EXECUTIVE SUMMARY – CLOSURE PLAN
EXIDE TECHNOLOGIES, VERNON, CALIFORNIA

BACKGROUND

Exide owns an inactive battery recycling facility situated at 2717 South Indiana Street in Vernon, California. The facility began operations in 1922. During the early 1980s, the facility was the subject of a major modernization and reconstruction that resulted in the current site configuration. The facility was granted Interim Status on December 12, 1981. The facility submitted its first Resource Conservation and Recovery Act (RCRA) hazardous waste permit ("Part B") application on November 8, 1988. Exide Technologies acquired the facility in September 2000 and last conducted recycling operations in March 2014. Exide withdrew its Part B application and provided notice of its intent to permanently close the facility on April 7, 2015. Exide is now proceeding with facility closure.

CLOSURE PLAN CONTENT

The Closure Plan addresses closure of former Interim Status (IS) hazardous waste management units (former IS units). Ninety-five (95) former IS units and their ancillary components at the facility will be closed. The former IS units include tanks, miscellaneous units, container storage areas, containment buildings, and a surface impoundment. The Closure Plan includes:

- Phase 1 (Closure): Phase 1 is a well-defined element that includes inventory removal; unit decontamination and removal; soil, soil gas and floor/pavement sampling; and decontamination and deconstruction of buildings containing former IS units to grade. Select units will remain operational through Phase 2 to manage and provide a location to clean closure-related vehicles exiting the Site.
- Phase 2 (Contingent Closure): Phase 2 addresses below grade impacts from former IS unit operations. The exact scope of Phase 2 is dependent on the sampling data generated during Phase 1 and may be influenced by data generated during the RFI and Corrective Action process. Phase 2 may include pavement removal, soil removal, restoration, capping, or some combination of measures. The Phase 2 activities described in this document (with five feet of soil removal beneath all former IS units) are assumed as a reasonable worst case scenario and have been developed in consultation with the Department of Toxic Substances Control (DTSC) to build the Contingent Closure cost estimate.
- Post-Closure: Occurs when hazardous soils have been remediated but remediation to residential standards (unrestricted clean closure) has not been achieved. If unrestricted clean closure is achieved, no post-closure care is necessary. ~~The post-closure period is 30 years.~~ Post-closure includes, but is not limited to, deed notices, inspections and reporting, maintaining a stabilized and secure site.
- Contingent Post-Closure: Occurs if closure performance standards (i.e., removal of hazardous waste) for IS units is not achieved. Contingent post-closure may

include boundary markers, deed notices, inspections, maintenance, and monitoring (groundwater, soil pore-water, soil gas, and/or surface water sampling). The Contingent Post-Closure activities described in this document are assumed as a reasonable worst case scenario and have been developed in consultation with DTSC to build the Contingent Post-Closure cost estimate. The exact scope of Contingent Post-Closure will be dependent upon the nature and extent of contamination remaining in-place after Contingent Closure.

CLOSURE COMPARED TO CORRECTIVE ACTION

The Closure Plan addresses potential impacts from ~~post-1981 former IS unit operations~~hazardous waste management units. The Closure Plan does not include ~~pre-1981~~ other areas of the facility with impacts ~~because these impacts are~~ being addressed under Corrective Action as set forth in the Corrective Action Consent Order (CACO) Docket No. P3-01/02-010 (February 25, 2002). The Closure and Corrective Action (CA) processes are occurring concurrently, and in the future CA may influence Phase 2; however, Closure and CA are separate projects proceeding on separate paths with separate regulatory and technical requirements.

PHASE 1 CLOSURE ELEMENTS

Construction permits from and notifications to SCAQMD, Water Resources Control Board, Los Angeles County, City of Vernon, and CalOSHA will be completed as required prior to the start of regulated work.

Air Pollution Control Equipment - Exide will continue to operate air pollution control equipment as necessary to maintain negative pressure in the former North Yard manufacturing area (Total Enclosure Building) through de-skinning of the former buildings. Temporary enclosures with negative pressure will be utilized during closure of features outside the Total Enclosure Building. These measures, and others, are designed to reduce fugitive emissions and maintain compliance with applicable air quality standards during closure.

Inventory Removal - Hazardous material and waste ("inventory") stored/contained in the former IS units which is solid will be removed and sent off-site for disposal at a landfill or recycling at a secondary lead smelter. Liquid remaining within units will be sent off-site for disposal or treated in the on-site Wastewater Treatment Plant (WWTP). Exide will remove lead from kettles containing more than 12 tons of lead with the preferred alternative identified in the Environmental Impact Report.~~Solidified lead greater than 12 tons within the kettles must be re-melted and cast into molds for off-site recycling at a secondary lead smelter~~.

Unit Cleaning and Removal – All former IS tanks and miscellaneous units will be cleaned and removed to grade by the completion of Phase 1, except for the Surface Impoundment/Stormwater Pond, Pump Sump and Stormwater Management System, and select sumps at topographic low points (maintained to collect stormwater runoff and excess water generated during the cleaning process) and the West Yard Truck Wash (maintained to clean vehicles before they leave the Site). The interior and exterior of units and ancillary equipment will be cleaned by HEPA vacuuming and/or pressure washing. Those former IS Units not removed during Phase 1 will be

cleaned at the end of Phase 1 to remove accumulated sediment, but will remain operational for Phase 2 (for environmental management purposes only). At the end of Phase 2, these units will be re-cleaned and removed. ~~If they will remain after Phase 2, the units shall be sampled and proven to be non-hazardous or closed within the limits of an area closed with a hazardous waste-in-place designation.~~

Disposition of Removed Units and Components – Removed units and ancillary components will be sent for re-use at another Exide facility, recycled (scrap metal), or disposed~~, or remain on-site.~~. Units and components destined for reuse at another Exide facility will be cleaned to remove ~~dust and dirt that could generate dust during handling~~all waste and waste residues. Units, equipment and scrap metal destined for recycling shall ~~attain a "Clean Debris Surface" as defined in the Alternative Cleaning Standards for Hazardous Debris (66268.45), or~~ be sampled and proven non-hazardous. Units and ancillary components destined for disposal shall be cleaned to remove ~~dust and dirt that could generate fugitive dust during handling~~waste and waste residues, characterized for disposal purposes and sent to an appropriately permitted disposal facility. ~~Units and ancillary equipment remaining on-site will be sampled to ensure they are non-hazardous.~~

Building Deconstruction - The areas and buildings containing units and the Finished Lead Building will be decontaminated by HEPA vacuuming and pressure washing. The interior and exterior roof, walls (both sides) and floor will be decontaminated. Concrete floors and at least five feet of soil beneath will be ~~sampled to assist in determining which floors will require removal during Phase 2 (i.e. those shown to be hazardous based on TTLC and STLC testing will be removed or closed within the limits of an area closed with a hazardous waste-in-place designation) and which may remain in-place~~removed. The Reverb Furnace Feed Room, Blast Furnace Feed Room, RMPS Building, Smelter Building, Baghouse Building, and Desulfurization Building will be gutted and deconstructed to five feet below grade. Concrete walls, non-metallic debris and equipment foundations will be characterized and disposed off-site. Metal debris will be ~~cleaned to a Clean Debris Surface~~sampled to confirm it is non-hazardous and recycled. The Container Storage Areas ~~are proposed to remain in-place~~will be removed to five feet below grade. ~~Sampling will be conducted on the Container Storage Area floors and structure to demonstrate that any components remaining in-place have wipe sample results below the Method Detection Limits (MDL) or are proven non-hazardous based on TTLC and STLC testing.~~

Air Monitoring - Ambient air monitoring will be performed daily (24 hrs/day) during closure for lead and arsenic. Real-time particulate (dust) monitoring will be conducted during working hours downwind and potentially upwind of the work area to track and gauge the trends in particulate dust generation as work progresses. The Contractor performing the decontamination and deconstruction activities will be required to conduct monitoring of their personnel and establish appropriate levels of personal protective equipment which comply with CalOSHA standards.

Water Management - Stormwater within the facility will be collected in the stormwater management system (manholes, piping, sumps, trench drains, pumps, Surface Impoundment and curbing) during Phase 1 and 2. Depending on the timing of CA and receipt of all required permits and approvals for direct discharge of stormwater, it may also be necessary to continue to

collect and treat stormwater after completion of Phase 2. Stormwater will be treated in the existing or temporary WWTP and discharged to the LA County Sanitation District until approval for direct discharge is received.

Wastewater generated during closure, including stormwater, will be treated in the on-site WWTP and discharged to the LA County Sanitation District. During the later portions of Phase 1 and Phase 2, a temporary WWTP will be used to treat wastewater prior to discharge as the existing WWTP will be closed.

PHASE 2 CLOSURE ELEMENTS

Phase 2 (Contingent Closure) Plan – The scope of Phase 2 is expected to involve the removal of ~~floors, pavement and secondary containment structures, and~~ underlying contaminated soil ~~at or above hazardous levels~~. The precise areas and depth of removal required will not be known until completion of Phase 1 Closure Sampling. For cost estimating purposes, a Contingent Closure scenario has been developed which assumes that removal of floors and pavement will be required beneath all secondary containment areas, containment buildings and Smelter Building units and that the removal depth will be 5 feet. The Phase 2 Closure also assumes that not all soils at or above hazardous levels can be removed with a 5 feet deep excavation and a RCRA cap will be required.

Using the results of the Phase 1 sampling, Exide will prepare a Phase 2 Contingent Closure Plan. The Phase 2 Contingent Closure Plan will identify the vertical and horizontal limits of removal, procedures for confirmatory sampling, erosion and sediment control measures, and Site restoration and stormwater management plan. The Phase 2 Contingent Closure Plan will be subject to DTSC, review and approval. If the Phase 2 Contingent Closure Plan includes closure with waste in-place, Exide will also be required to prepare and submit a post-closure permit application and assorted supporting documents, including water quality monitoring plan and inspection and maintenance plan. ~~Any~~ None of the former IS units ~~required to remain~~will remain on-site ~~and operational~~ following Phase 2 closure~~, including the Surface Impoundment liner system will be proven to be non-hazardous through sampling or it will be replaced~~.

SCHEDULE

Implementation of Phase 1 will begin within 30 days of approval of the Closure Plan. DTSC approval of the Closure Plan is required prior to implementation along with input from AQMD and City of Vernon. The estimated timeframe for Phase 1 Closure activities is approximately 5.75 years using standard work hours.

Phase 2 implementation is expected to begin 6 to 12 weeks following completion of Phase 1 Closure, depending on DTSC requirements and approval of the Phase 2 Contingent Closure Plan. Phase 2 will be established after the scope of the required work is known, and it is expected that it will be on the order of 12 to 24 months.

Date: ~~July~~ October 2015

CLOSURE PLAN

EXIDE TECHNOLOGIES
VERNON, CALIFORNIA
(EPA ID NO. CAD 097 854 541)

Prepared For:

EXIDE TECHNOLOGIES
Vernon, California

Prepared by:

ADVANCED GEOSERVICES
West Chester, Pennsylvania

Project No. 2013-2993-21
February 13, 2014
Revised August 18, 2014
Revised September 30, 2014
Revised May 15, 2015
Revised July 28, 2015
Suggested Revisions October 19, 2015 (DTSC)

C:\Users\wlorentz\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Outlook\VDQ78Y8Y\2015-10-15 DTSC Revised Closure Plan All Edits Final Red Line.docx~~F:\Projects\2013\20132993 - Exide Vernon Permitting Assistance\Sec Files\Reports\Closure Plan 6-15\Closure Plan 07-2015.docx~~

Date: ~~July~~ October 2015

Date: ~~July~~ October 2015

1.0 GENERAL

1.1 INTRODUCTION

This Closure Plan addresses the regulated Interim Status (IS) hazardous waste units (former IS units) at the Exide Technologies facility in Vernon, California. The closure information presented in this section is submitted under 22 CCR 66265.110, 66265.111 and 40 CFR 265 Subpart G, and applies to the former IS units shown on Table 1.1 of this Closure Plan. Detailed information regarding each unit can be found in Closure Plan Appendix D. This plan has been developed to meet the closure requirements of 22 CCR 66265.110 to .120, 66265.197, 66265.228, and 66265.1102 as applicable for closure of ~~RCRA~~ tank systems, ~~RCRA~~ container storage areas, ~~RCRA~~ surface impoundments, ~~RCRA~~ containment buildings, and miscellaneous units. This plan has also been developed in general accordance with California Department of Toxic Substances Control (DTSC) *Permit Writer Instructions for Closure of Storage and Treatment Facilities*. The closure and the post-closure care of all tank systems and containment buildings will also comply with CCR §66265.197 and §66265.1102, respectively.

Pursuant to the requirements of Title 22 CCR § 66265.111, the facility will close the units and appurtenant structures in a manner that:

(a) Minimizes the need for further maintenance.

(b) Controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste constituents, leachate, contaminated rainfall or waste decomposition products to the ground or surface waters or the atmosphere.

(c) Complies with the closure requirements of 22 CCR 66265.197 (Tank Systems), 22 CCR 66265.310 (Landfills), 22 CCR 66265.1102 (Containment Buildings), and 22 CCR 66265.228 (Surface Impoundments).

The methods to be used to ensure compliance with this performance standard are presented in the following sections.

Exide previously submitted a ~~RCRA~~ Part B Permit Application for the facility. On April 7, 2015, Exide withdrew the Part B Permit Application and provided DTSC with written notification of its intent to close the Vernon facility. This revised Closure Plan is submitted in accordance with 22 CCR 66265.112(d), and reflects the current status of facility inventory and additional detail for closure sequence, methods and performance standards. Upon approval of the Closure Plan by DTSC, Exide will have up to 30 days to begin implementation per the amended 2014 Stipulation and Order between DTSC and Exide. A copy of the approved plan and all revisions to the plan will be kept at the facility until closure is completed and certified in accordance with 22 CCR 66265.115.

1.2 CLOSURE AND CORRECTIVE ACTION

This Closure Plan includes the following:

- Phase 1 – Closure;
- Phase 2 – Contingent Closure;
- Post-Closure; and,
- Contingent Post-Closure.

Phase 1 generally includes inventory removal, unit decontamination and removal, soil and surface sampling, and decontamination and deconstruction of buildings containing former IS units to grade. Phase 2 generally includes addressing below-grade impacts from unit operations. The scope of Phase 2 is dependent on the sampling data generated during Phase 1 and may be

influenced by data generated during the RCRA Facility Investigation (RFI) and Corrective Action (CA) process. A range of Phase 2 options are described in this document. The Phase 2 option ~~developed for the purposes of the Contingent Closure Cost estimate and CEQA evaluation~~ is presumed to represent a "reasonable worst case" scenario. "Reasonable worst case" means that, based on the available information, it is expected to be the most expensive contingent closure option and will cause the greatest negative impact to community health and the environment. ~~For cost estimating and CEQA evaluation purposes only, the~~The reasonable worst case assumes up to 5 feet of soil excavation and removal will be performed beneath all former IS units, and that a multi-media cap with long-term care and maintenance requirements will be constructed over nearly all of the closed unit areas. "Reasonable worst case" for Phase 2 does not necessarily represent the contingent closure scenario that will in fact be implemented.

The Closure Plan addresses potential impacts from hazardous waste management units. The Closure Plan does not include other areas of the facility with impacts being addressed under Corrective Action (CA) as set forth in the Corrective Action Consent Order (CACO) Docket No. P3-01/02-010 (February 25, 2002). The facility Closure and ~~Corrective Action (~~CA~~)~~ processes are occurring concurrently, and as discussed in Section 3.2, 'Closure Performance Standards', Exide anticipates that ~~in the~~ future CA may inform ~~Phase 2 of~~ Closure; however, Closure and CA are separate projects proceeding on separate paths with separate regulatory and technical requirements. The Closure Plan addresses the former IS units and impacts associated with their operations. The Corrective Action (CA) process addresses impacts from historic facility operations and is not addressed in the Closure Plan. The Corrective Action process includes implementation of a RCRA Facility Investigation, a Corrective Measures Study (CMS), remedy selection and Corrective Measures Implementation. The CA is being conducted pursuant to a Corrective Action Consent Order (CACO) and other agreements between Exide and DTSC.

1.3 PROJECT MANAGEMENT

This section describes the project organization and identifies key parties for the closure process. Project organization is summarized in Figure 1.1.

1.3.1 OWNER

Exide Technologies is the owner of the Vernon facility. Exide has overall responsibility for planning and implementation of the closure and long-term maintenance and monitoring of the facility. Exide has the authority to accept or reject plans, work methods and the materials and workmanship of the Contractor. Exide will designate a key point of contact that will be able to mobilize additional Exide resources and facilitate critical decisions. The Exide key point of contact will be located in the Office Building.

1.3.2 PLAN PREPARER

Exide retained Advanced GeoServices to prepare the Closure Plan. The Plan Preparer will assist Exide and the Contractor in understanding and interpreting the Closure Plan. The Plan Preparer will assist Exide with obtaining state, county and local permits prior to closure task implementation. Exide may use additional consultants as needed.

1.3.3 CONTRACTOR

Exide will retain a Contractor to implement the Closure Plan. Different contractors may be used for Phase 1 and Phase 2. The Contractor will be an environmental remediation contractor experienced in projects of similar size and scope. The Contractor may use subcontractors to conduct specialized or specific tasks.

The Contractor is responsible for implementation of the Closure Plan in accordance with their contract with Exide. The Contractor will be responsible for:

- Retaining and overseeing subcontractors, as needed, to perform the specialized components of the work scope;
- Cooperate with and coordinate activities with regulatory agencies, Exide and the Resident Engineer;
- Submit reports, results, drawings as required for Exide and the Resident Engineer; and,
- Perform activities, as necessary, so that a final report signed and sealed by the Resident Engineer and a certificate of completion can be submitted at the completion of closure.

The Contractor will establish a construction office trailer at an on-site location designated by Exide.

1.3.4 SUBCONTRACTORS

Subcontractors to the Contractor will be responsible for their respective work in accordance with the Closure Plan.

1.3.5 OWNER OVERSIGHT

This section defines oversight roles retained by and conducted for Exide.

1.3.5.1 **Resident Engineer and Quality Assurance**

Exide has retained Advanced GeoServices to fulfill the roll of the Resident Engineer. The Resident Engineer, with the support of his/her designees, will be responsible for:

- Overseeing and documenting the Contractor's implementation of the Closure Plan;
- Performing confirmatory sampling required by the Closure Plan;

- Attending meetings and inspections;
- Reviewing and approving Contractor submittals;
- Assisting Exide with review of Contractor change orders which are contractual in nature and do not impact Closure Plan implementation;
- Coordinating agency review and approval of Closure Plan variations;
- Review of Contractor invoices; and,
- Preparation of the Closure Certification Report.

The designated Resident Engineer will be a professional civil engineer licensed in the State of California. The Resident Engineer will make periodic visits to the facility during closure activities. The Resident Engineer will designate field representatives to be present at the facility during the Closure Plan implementation. It is anticipate that two full-time personnel (one lead and one assistant) will be assigned to the project as field representatives for the Resident Engineer. Additional field personnel will be assigned as appropriate based on the Contractor's schedule and intensity of the work. The Resident Engineer's lead field representative will be the point of day to day contact during execution. Exide will provide office space in the former Engineering Building for Resident Engineer personnel and equipment.

1.3.5.2 **Air Monitoring Subcontractor**

Exide has retained Almega Environmental to implement the ambient air monitoring program at the facility.

1.3.6 Regulatory Agencies and Agency Oversight

Regulatory agencies associated with the Closure include:

- DTSC
- South Coast Air Quality Management District (SCAQMD)
- City of Vernon
- Los Angeles County Sanitation District

Additional agencies may become involved as permitting obligations are identified.

As a part of the Closure Plan, agency oversight of the work by regulatory agencies will be provided by a third party QA contractor (Dust Mitigation Oversight) hired by the regulatory agencies (DTSC and AQMD) and funded by Exide. The QA Contractor will provide oversight for implementation of the Closure Plan to ensure that the closure activities do not add additional

environmental impacts (that are not already identified in the Environmental Impact Report) to the surrounding neighborhoods. The QA Contractor will conduct the real-time air monitoring specified in Appendix G, section 3.6.2. The QA Contractor will also confirm compliance with truck loading procedures, truck decontamination procedures and transportation routes established in the Closure Plan. In addition each agency will provide a regular inspector to the oversight process to ensure the agencies are confident that all work is meeting the highest standards of performance related to environmental compliance.

1.3.6.1 **DTSC**

DTSC is the lead agency for the project. It is expected that the DTSC field representative will be one individual dedicated to the project who will be on-site on a full-time basis during start up and major work elements, and on a part-time basis during the balance of the work as appropriate to maintain communication and direct the Dust Mitigation Oversight representative. The DTSC field representative will maintain daily contact with the Dust Mitigation Oversight representative, participate in weekly progress meetings and complete other activities necessary to keep DTSC management informed on progress. Exide will provide a desk and chair in the former Engineering or Office Building for use by DTSC. DTSC inspectors will also be on-site to observe and document compliance with the terms of the approved Closure Plan and CCR, chapter 15 requirements.

1.3.6.2 **AQMD**

AQMD is the agency providing approval of engineering controls put in place to ensure there are no exceedances of the ambient air standards. It is expected that the AQMD field representative will be one individual dedicated to the project who will be on-site on a near full-time basis during start up and beginning of major work elements, and on a part-time basis during the balance of the work as appropriate to maintain communication and direct the Dust Mitigation Oversight representative. The AQMD field representative will maintain daily contact with the

Dust Mitigation Oversight representative, participate in weekly progress meetings and complete other activities necessary to keep AQMD management informed on progress. Exide will provide a desk and chair in the former Engineering or Office Building for use by AQMD.

1.3.6.3 **Dust Mitigation Oversight**

The Dust Mitigation Oversight Representative will be a third-party environmental consultant experienced in industrial site remediation hired by the agencies and funded by Exide to monitor work, confirmatory sampling and engineering controls for consistency with the Closure Plan, perform real-time air monitoring, and serve as the eyes and ears of DTSC and AQMD in the field on a daily basis. The Dust Mitigation Oversight will assign two full-time personnel to act as the lead and assistant with supplemental personnel as appropriate based on the Closure Contractor's schedule and intensity of work. Exide will provide office space in the former Engineering Building for the Dust Mitigation Oversight Representative.

1.4 MEETINGS

1.4.1 Pre-Construction Meeting

A pre-construction meeting will be held at the facility at the start of each phase of closure. Exide, the Contractor, and Resident Engineer will attend. DTSC, AQMD, and the City of Vernon will also be invited to attend. The meeting agenda will include, at a minimum:

- Designation of responsible personnel;
- Lines of communication;
- Construction schedule and work sequence;
- Fugitive dust mitigation and prevention;
- Working hours;
- Oversight and sampling procedures;
- Submittal procedures and requirements;
- Reporting;
- Facility security and safety procedures;
- Work area security and safety procedures; and,

- Procedures for processing field decisions and change orders.

A site walk will be conducted to verify that the approved Closure Plan is understood and to review material and equipment locations. Meeting minutes will be recorded by the Resident Engineer and submitted to all parties in attendance within three (3) business days of the meeting.

1.4.2 Progress Meetings

Progress meetings will be held at the facility weekly with Exide, the Contractor, and the Resident Engineer when field activities are occurring. DTSC, AQMD and the City of Vernon will be invited to attend. The meeting agenda will include the following:

- Work completed during the previous week;
- Health and safety summary;
- Concerns or areas of improvement with work completed during the previous week;
- Coordination or workmanship problems;
- Work planned for the upcoming two weeks;
- Notification to AQMD and DTSC of activities that have the potential to result in the release of fugitive-lead-containing dust;
- Potential problems and proposed solutions;
- Engineering controls for upcoming work; and,
- Staff levels necessary to provide oversight for upcoming work.

The Resident Engineer will prepare a meeting agenda, coordinate the meeting time and place, provide a conference call number, and moderate the meeting. The Resident Engineer will distribute meeting minutes to each party present and other parties who should have been present within five (5) business days. Comments on the minutes will be provided to the

Resident Engineer within three (3) business days of receipt of the meeting minutes, or prior to the following meeting, whichever is sooner.

Date: July 2015

2.0 FACILITY INFORMATION

2.1 FACILITY IDENTIFICATION

Exide Technologies provides the following facility identification information:

EPA/DHS I.D. Number:	CAD 097 854 541
Name:	Exide Technologies Lead Recycling Facility
Type of Facility:	A Lead Recycling Facility operated at this location from 1922 to 2014 for the recovery of lead from automotive batteries and other lead-bearing materials received from off site and generated on site. Supporting operations such as emission control and wastewater treatment continue.
Facility Mailing Address:	Exide Technologies Resource Recycling 2700 South Indiana Street Vernon, California 90058

2.2 FACILITY LOCATION

2717 South Indiana Street
Vernon, California 90058
Latitude: 34º 00’22” Longitude: 118º 11’48”
Section 12 of Township 2 South, Range 13 West (San Bernardino Base Meridian)
This location is not on Indian Lands.
See Figure 2.1 for Facility Location Map.

Telephone Number: (323) 262-1101

SIC Code: 3341

Date: July 2015

Date: July 2015

Operator Address: Exide Technologies
13000 Deerfield Parkway, Suite 200
Milton, GA 30004
(678) 566-9000

Owner Name and Address: Exide Technologies
13000 Deerfield Parkway, Suite 200
Milton, GA 30004
(678) 566-9000

Facility Contact: Nicolas Serieys
Interim Environmental Manager
Exide Technologies
2700 South Indiana Street
Vernon, California 90058
(323) 262-1101 x-259

Name of Persons Preparing Plan:

Advanced GeoServices
1055 Andrew Drive, Suite A
West Chester, Pennsylvania 19380
(610) 840-9100
Paul G. Stratman, P.E.

2.3 FACILITY DESCRIPTION

2.3.1 Facility Configuration

The facility encompasses approximately 15.5 acres which are generally referred to in three areas: North Yard, South Yard and West Yard. Topographic information to 1 mile beyond the facility boundaries is presented on the USGS topographic map shown on Figure 2.1. USGS topographic maps are also provided in Appendix M. A detailed topographic map of the facility and immediately adjacent areas (60 to 75 ft.) at a scale of 1 inch equals 20 ft. and 0.5 ft. contour interval based on a topographic survey performed in 2006 is presented in Appendix E. The USGS topographic map (Figure 2.1) provides additional information at a scale of 1"= 2000 ft. to

at least 2000 feet beyond the property. The current ~~topographic map in conjunction with the~~ 2006 topographic survey ~~are intended to satisfy~~will be replaced by a new survey to show all of the recent enhancements, well installations, upgrades and modifications added to the facility since 2006. The new survey shall follow all of the requirements of 22 CCR 66270.14(b)(18), and will be submitted to DTSC within 45 days of approval of the Closure Plan and before any deconstruction occurs. ~~the requirements of 22 CCR 66270(b)(18).~~

The USGS topographic map (Figure 2.1) includes legal boundaries of the facility and surface water bodies. Physical changes to the facility since the time of the topographic survey have been limited to enclosure of the baghouse, mud tank and RMPS plastic loading areas, construction of the truck wash and scale in the West Yard, and installation of the dual containment stormwater collection system. ~~The topographic survey is adequate for implementation of closure. A n~~New topographic surveys will be performed before and after building demolition.

The location of each existing hazardous waste treatment and storage unit is provided on Figure 2.2. The location of each sump which is ancillary to a former IS unit is provided on Figure 2.11. The as-built survey for the replacement stormwater system is provided in Appendix B. Design information for the installation of the stormwater system is also provided in Appendix B.

Figure 2.15 provides the information required by 22 CCR 66270.14(b)(18) on one figure. The requirements of 22 CCR 66270.14(b)(18) are addressed as follows:

> *(18) a topographic map showing a distance of 2000 feet around the facility at a scale of 2.5 centimeters (1 inch) equal to not more than 61.0 meters (200 feet). Contours shall be shown on the map. The contour interval shall be sufficient to clearly show the pattern of surface water flow in the vicinity of and from each operational unit of the facility. For example, contours with an interval of 1.5 meters (5 feet), if relief is greater than 6.1 meters (20 feet), or an interval of 0.6 meters (2 feet), if relief is less than 6.1 meters (20 feet). Owners and operators of hazardous waste management facilities located in*

mountainous areas should use larger contour intervals to adequately show topographic profiles of facilities.

Figure 2.15, Facility Topographic Map, has been provided at a scale of 1 inch equals 200 feet. Contours at 2 ft intervals are provided. As the figure is difficult to read at the required scale, a window of a portion of the facility has been provided at a scale of 1 inch equals 50 feet. As noted earlier, an updated topographic survey of the entire facility will be completed and submitted to DTSC within 45 days of DTSC approval of the Closure Plan.

The map shall clearly show the following:

(A) map scale and date;

The map is provided at a scale of 1 inch equals 200 feet and is dated July 2015.

(B) 100-year floodplain area;

The facility, which lies entirely within the incorporated City of Vernon, is outside the 100-year floodplain. The Flood Insurance Rate Map Index for the Los Angeles area and the Community Panel Number 065043 0935 B show that the City of Vernon is not included in the Federal Emergency Management Agency flood mapping system. A note has been provided on Figure 2.15 indicating this.

(C) surface waters including intermittent streams;

The facility is located near the Los Angeles River as shown on Figure 2.15. A portion of the flood control drainage system bisects the facility's property in the form of a covered box culvert and an adjacent open concrete drainage channel. The open concrete drainage channel is shown on the figure.

(D) surrounding land uses (residential, commercial, agricultural, recreational);

As shown on Figure 2.15, the facility and surrounding area is zoned General Industrial, Heavy Industrial and Commercial/Industrial.

(E) a wind rose (i.e., prevailing wind-speed and direction);

The wind rose provided in Appendix H has been provided on Figure 2.15.

(F) orientation of the map (north arrow);

Figure 2.15 has a north arrow.

(G) legal boundaries of the hazardous waste management facility site;

Property boundaries are provided on Figure 2.15.

(H) access control (fences, gates);

Fences and gates are provided on Figure 2.15.

(I) injection and withdrawal wells both onsite and offsite;

No injection wells are present at the facility. Monitoring wells and production wells are provided on Figure 2.15.

(J) buildings; transfer, treatment, storage or disposal operations; or other structure (recreation areas, run-off control systems, access and internal roads, storm, sanitary and process sewerage systems, loading and unloading areas, fire control facilities, etc.);

Buildings, operational areas, the on-site stormwater management system, paved areas, roadways, and loading and unloading areas are provided on Figure 2.15.

(K) barriers for drainage or flood control;

Figure 2.15 provides the facility perimeter curbing which maintains stormwater on-site.

(L) location of operational units within the hazardous waste management facility site, where hazardous waste is (or will be) transferred, treated, stored or disposed (include equipment cleanup areas);

Figure 2.15 provides the location of Units 1 through 3 and 5 through 103. Unit 4 was previously closed and is not shown.

2.3.2 Neighboring Wells

Figure 16, Comprehensive Water Quality Monitoring Plan – City of Vernon (City-1), provided in Appendix N shows the location of City of Vernon wells. On-site monitoring well locations are shown on Figure 2.3, with the exception of wells related to the Containment Building and RCRA Facility Investigation. These wells are not shown as installation is not complete and the wells have not yet been surveyed. None of the on-site wells are for untreated drinking water supply. A search of Los Angeles County Department of Public Works website identified six public water supply wells within one mile as shown on Figure 2.4. There is no indication in the City of Vernon and California Department of Water Resources records of any private use or residential drinking water wells in the area. One additional well (02S13W12P004) believed to be owned by Bobby Robertson has been identified in public records, but not field confirmed, at Central Valley Hide Company, 3768 Bandini Boulevard as shown on Figure 2.4.

An inactive production well is present at the Exide facility in the South Yard. The original log for the well has been located and provided to DTSC as part of the ongoing Corrective Action activities. The well was drilled in 1948 for potable/industrial water use. The original log indicates that it is on the order of 550 feet below the ground surface (bgs) and 12 inches in

diameter with the first perforations for the screen at 223 to 230 feet bgs. Additional perforated zones occur at 246 to 256 feet bgs, 420 to 428 feet bgs, 440 to 451 feet bgs, and 527 to 532 feet bgs. A geophysical evaluation, conducted in March 2015, revealed a "large monopole anomaly", which is a typical response for steel-cased water wells (Geophysical Evaluation, 2717 South Indiana Street, Vernon, California, prepared by Southwest Geophysics, Inc., dated March 31, 2015). On May 4, 2015, the well head and a single, 3-inch diameter, co-located sounding tube were successfully uncovered~~The well head has been located~~, and Exide is currently planning to assess the condition of the well, conduct sampling and then properly decommission it in accordance with local and state standards under the oversight of the City of Vernon. The approximate location is provided on Figure 2.3. Additional information is provided in the well investigation work plan being conducted under Corrective Action.

2.3.3 Surrounding Land Use

Figure 2.5 provides the zoning codes for the facility and surroundings. The facility location and surrounding properties are zoned for industry.

2.3.4 Hydrogeologic Conditions

2.3.4.1 **General**

The uppermost hydrogeologic unit beneath the facility is a perched zone of the Bellflower Aquiclude, which extends from the surface to depths in excess of 90 feet. The Bellflower Aquiclude is a unit of silts and sandy clays commonly containing perched groundwater. The Exposition Aquifer underlies the Bellflower Aquiclude and is reported to extend to a depth of about 175 feet in the area. The Lower Aquiclude and Gage Aquifer systems underlie the Exposition Aquifer.

Boring logs from existing monitoring wells at the facility confirm this general description of the Bellflower Aquiclude and Exposition Aquifer. Two geologic cross sections were developed using information from the existing monitor well boring logs and the results of test borings made prior to the construction of the current plant in 1982. Copies of these boring logs are provided in Appendix L. The cross sections and monitoring well locations are indicated in Figure 2.3, and an additional copy of the figures is provided in Appendix L. An updated figure showing all monitoring well locations will be provided to DTSC within 30 days of approval of the Closure Plan. Section A-A', shown in Figure 2.6, is an east/west section extending from monitoring well MW-15 to MW-8. Section B-B', shown in Figure 2.7, runs in the north/south direction along a line through the RMPS Building and the Stormwater Surface Impoundment. Revised sections reflecting the RFI lithologic data collected over the past several years will be provided to DTSC within 45 days of approval of the Closure Plan.

Additional hydrogeologic information is being gathered as part of the ongoing RCRA Facility Investigation (RFI). This includes groundwater investigations of any perched zones encountered during drilling, as well as deeper groundwater as it occurs beneath, and adjacent to, the facility. Recent drilling conducted as part of the RFI has identified a previously unknown, shallow, thin, discontinuous 'perched' zone occurring at depths from 17 feet to 20 feet bgs beneath some areas of the facility. For the purposes of the Closure Plan, this zone will be referred to as the 'upper perched zone', while the 'lower perched zone' refers to groundwater that occurs at depths ranging from 70 to 80 feet bgs. This zone has been extensively monitored and has groundwater data extending as far back as the mid-1980's. A new site-wide liquefaction study will be submitted to DTSC within 60 days of approval of the Closure Plan.

The aquifer below the lower perched zone, occurring at depths ranging from 140 to 150 feet bgs, is interpreted to be part of the regional Exposition Aquifer. For the purposes of this Closure Plan, this aquifer will be referred to as the Exposition Aquifer. Groundwater investigations are ongoing, however, several groundwater monitoring wells have recently been installed onsite in this zone (CB-3, MW-6D, MW-9D, MW-16D, MW-23D, MW-27D) with more wells proposed

for installation. The upper perched zone is not currently being monitored, therefore, the lateral extent of this zone is unknown, as is any indication that it is contaminated by releases from the facility, or if it extends offsite. The hydrostratigraphy, hydrogeology, and geochemistry of this upper zone will be further explored during the RFI.

Groundwater elevation measurements, mainly of the lower perched zone, have been periodically taken since July 1987. Table 2.1 summarizes the water level measurements taken from 1990 to ~~March 2015~~2014. The water level elevation within the lower perched zone beneath the facility showed a consistent declining trend from 1989 to 1994, and increase from 1994 to 1999, ~~and~~ a general declining trend from 1999 to the present, with a notable decrease in water-level elevations from 2013-2014 to present. This appears to have resulted in several monitoring wells (MW-9R, MW-11R, and MW-15) becoming dry over the past several months. ~~The~~ This overall declining trend ~~is probably the result of~~ could be the result of several conditions, both near and far-field; 1) the prolonged drought~~ conditions or perhaps~~, 2) pumping at an unidentified production or groundwater remediation well in the area, 3) improvements and upgrades to the surface impoundment liner and leak detection system, or 4) Exide's compliance with the associated Stipulation and Order between DTSC and Exide, Docket HWCA 2009-2208, for improved management of stormwater in the surface impoundment.

The relatively recent development of several wells becoming dry could be the result of the emergency removal that was implemented by Exide in 2014 to replace the compromised (i.e., leaking) subgrade stormwater system that extended across most of the facility. Top of casing in each well was resurveyed in April 2014. Figure 2.8 shows representative hydrographs from five of the existing monitor wells. These are typical of the overall conditions. A table summarizing well construction is provided as Table 2.7.

~~Additional hydrogeologic information is being gathered as part of the ongoing RCRA Facility Investigation.~~

Appendix C shows the water level contours interpreted from the ~~March 2015~~2nd Quarter 2015 measurements, and represents the most current groundwater elevation contour map. ~~The groundwater~~Groundwater in the lower perched zone beneath the east side of the facility appears to have a groundwater high trending east-west with groundwater flow to the north at a gradient of 0.016 feet per foot (ft/ft) and south at a gradient of 0.05 ft/ft. Groundwater flow beneath the West Yard is to the east-northeast with a hydraulic gradient of approximately 0.03 ft/ft; however, this gradient is difficult to calculate as MW-9R is dry. Groundwater flow direction(s) and gradient(s) in the upper perched zone is unknown at this time. Groundwater flow, based on both onsite and offsite well data, in the Exposition Aquifer is generally to the south-southwest.

Formatted: Superscript

2.3.4.2 **Groundwater Monitoring**

The groundwater monitoring program is described in the *Quarterly Groundwater Monitoring Report* for First Quarter 2015 provided in Appendix C and the *Quarterly Groundwater Sampling and Analysis Plan* provided in Appendix X. The Quarterly Groundwater Sampling and Analysis Plan is being implemented, but ~~has not yet been approved~~is still under review by DTSC.

As the RFI is not yet complete, adequate groundwater data is not available to define a plume. However, there is sufficient information to draw some initial conclusions regarding shallow groundwater impact. As noted earlier, r~~R~~ecent monitoring well installations across the facility indicate that there is more than one perched zone beneath the facility, that ~~the shallow,~~ perched groundwater is discontinuous across the site, and water levels cannot be used to define groundwater flow direction except on a very localized basis. Overall water levels in wells set in the lower perched zone have been decreasing, and, as noted above, some wells that previously held water have gone dry. There are several potential reasons for the decreasing water levels: the persistent drought~~ and~~, paving of previously unpaved areas in the vicinity~~ with the persistent drought likely being the significant reason for the water level decline~~, improved stormwater management practices for the surface impoundment, and replacement of the subsurface stormwater system.

There are areas of localized impact within the lower perched water zone at the facility:

- An area of reduced pH, dissolved metals above the MCLs and low levels of volatile organic compounds (benzene, 1,2 - dichloroethane, trichloroethane, cis - 1,2 dichloroethene) above their respective MCLs in the western portion of the West Yard. Wells are slated to be installed to the south and west of this area to identify the lateral extent of impact as well as determine whether it has impacted the deeper, regional Exposition aquifer.

- An area of dissolved metals (most notably cadmium, lead, nickel and zinc, with lesser levels of antimony, beryllium and ~~lead~~mercury) above the MCLs in the vicinity of the surface impoundment and in the ~~southwest~~ southeast corner of the South Yard. ~~Given the significant levels of zinc, and the fact that a zinc smelter was located over this portion of the site from the 1920s through 1970s, historic impacts are believed to be the primary source of impact.~~ The RCRA Facility Assessment also identified a historic pond in the south yard (Area of Concern M-29) that is believed to have been used until the 1950s or 60s. Impacts from the IS surface impoundment/stormwater pond are also possible. There are additional wells slated to be installed to the south of the impoundment to identify the lateral extent of impact as well as determine whether it has impacted the deeper, regional Exposition Aquifer.

- An area of trichloroethane (TCE) at concentrations above the MCL in the southeastern portion of the South Yard that appears to extend across South Indiana Street into the Exide office parking lot. Two of the shallow wells that have exhibited TCE concentrations above the MCL in the past, MW-11 and MW-15, are now dry. There are wells currently being installed to determine whether the deeper, regional Exposition Aquifer has been impacted.

In the 1st quarter of 2015, wells on the former Honeywell property to the east of the Exide office property that are screened in the Exposition Aquifer were sampled for the first time and found to have concentrations of TCE, cis-1,2-dichloroethene, tetrachloroethene and carbon tetrachloride above their respective MCLs. MW-17 located across Bandini Boulevard on Baker property, also screened in the Exposition Aquifer, ~~had~~ has reported concentrations of TCE and carbon tetrachloride above the MCLs. At this time, there is insufficient information to conclude whether ~~these~~ the off-site impacts above the MCLs are related to the Exide facility, particularly since tetrachlorethene and carbon tetrachloride have not been found at the facility or known to be associated with facility operations in previous investigations. As noted earlier, Exide has already installed several wells onsite to investigate the Exposition Aquifer, with a~~A~~dditional wells ~~are being~~slated to be installed ~~in the Exposition Aquifer~~ to determine conditions in this aquifer upgradient of Exide as well as downgradient of areas of known VOC impacts in the ~~shallow~~ lower perched groundwater as part of the RFI. Along with this, Exide is committed to install additional wells, if needed, to investigate the upper perched zone.

2.3.5 Weather Conditions

Appendix H presents a wind rose for Vernon, California. The predominant wind direction is from the west. The climate in Vernon, California is typically 70°F in the summer and 50 ^{o}F in the winter. The average annual precipitation is 15 inches. Rainfall is generally distributed evenly throughout the year.

2.4 OWNERSHIP HISTORY

In 1922, Morris P. Kirk & Sons, Inc. began secondary smelting and processing operations for aluminum, lead and zinc in a portion of the South Yard area of the Facility. NL Industries (NL) acquired Morris P. Kirk & Sons, Inc. in 1953. In 1979, Gould, Inc. (Gould) acquired the Facility from NL and maintained operations until 1983. In 1983, GNB Technologies bought the Facility

from Gould. In September 2000, Exide Technologies acquired GNB, including the Vernon facility. Exide has owned and operated the Facility since September 2000.

2.5 OPERATIONAL HISTORY

Morris P. Kirk & Son, Inc. began operations in 1922. During this time frame, the facility operations were limited to the South Yard area. The earliest facility operations recycled lead acid batteries in addition to aluminum, lead, zinc and scrap metal. By 1946, operations had expanded onto the West Yard. Waste materials (primarily slag associated with the various smelting and refining operations) and waste acid are reported to have been disposed in the West Yard Area.

During the early 1980s, the facility was the subject of a major modernization and reconstruction project that resulted in the cessation of handling and processing activities not related to lead recycling (i.e., aluminum smelting, zinc alloying and metals extrusion). The Raw Material Processing System (RMPS) and raw material storage building, new smelter building and baghouse area structures were all constructed on or about 1982 in the North Yard. Many of the original structures in the South Yard and West Yard were demolished after construction of the upgraded smelter and battery breaking operations in the North Yard. The lined rainwater retention pond in the South Yard was constructed in 1984.

Exide ceased recycling operations in March 2014 as part of a scheduled maintenance shut-down. From March 2014 to October 2014, no activities occurred at the facility. From October 2014 to May 2015, maintenance, housekeeping and improvement activities occurred, but recycling operations did not occur. Emission control equipment and wastewater treatment has remained active throughout these activities. Exide conducted a partial cleaning of the facility by HEPA vacuuming in 2014. Portions of the Containment Building not subject to the 2014 partial cleaning have dust and debris accumulated over years of operation.

2.6 ENVIRONMENTAL PERMITS

2.6.1 SCAQMD Permits

Air Quality Permit No. 124838 is a Title V permit issued by SCAQMD on June 24, 2009. The Title V Permit expires in March 2016.

2.6.2 Los Angeles County Sanitation District Waste Discharge Permit

Industrial Wastewater Discharge Permit No. 15725 was issued by the Los Angeles County Sanitation District on April 17, 2012 and has an expiration date of April 16, 2017. Exide submitted a permit revision to reflect the closure activities on May 7, 2015.

2.6.3 Other Permits Relating to Hazardous Waste Storage or Treatment

The City of Vernon issued Health Permits for a Waste Processing Facility (PT0000039), Aboveground Storage Tank Facility (PT0003217), Hazardous Materials Establishment – C (PT0000456), TSD Facility (PT0002264), and Hazardous Waste Generator – Large Quantity (PT0002693). These permits expire on June 30, 2015, except for the Waste Processing Facility permit which expires December 31, 2015.

A Weighmaster License No. 9758 was issued by the Department of Food and Agriculture, Division of Measurement Standards. The license expires December 1, 2015.

A State of California Permit to Operate Liquefied Petroleum Gas Tank, (L009110-02) was issued on April 15, 2013 and expires April 15, 2016.

State of California Permits to Operate Air Pressure Tanks (A044050-12, A044228-12, A044227-12, and A044226-12) were issued June 7, 2012 and expire June 6, 2017. State of California

Permits to Operate Air Pressure Tanks (A010505-02, A010507-02, A044050-12, A044226-12, A044227-12, and A044228-12) were issued June 7, 2012 and expire June 7, 2017. State of California Permits to Operate Air Pressure Tanks (A010054-05 and A010502-02) were issued August 30, 2012 and expire August 30, 2017.

A California Hazardous Materials Transportation License (55594) was issued March 19, 2013 and expires September 30, 2015.

All permits shall remain in effect and current as long as inventories and materials remain on-site and a closure letter is issued by the City of Vernon.

2.6.4 NPDES Permit

Even though facility stormwater runoff is collected for treatment and discharge to the Los Angeles County POTW, the Los Angeles Regional Water Control Board has required the facility to obtain a General NPDES permit for Stormwater Discharges Associated with Industrial Activity (NPDS No. CAS0000010). The Notice of Intent was submitted October 16, 2012. The facility's WDID number is 419I023878. The Stormwater Pollution Prevention Plan (SWPPP) is provided in Appendix Q. The SWPPP has been updated as required by the new Industrial Stormwater General Permit.

2.7 FACILITY DESIGN

2.7.1 Hazardous Waste Units

Hazardous wastes handled at the facility are managed either in containers, tanks, containment buildings, a surface impoundment, or miscellaneous units. The majority of the storage containers were spent lead-acid batteries which represented the primary feed material for the facility recycling process. The facility's permit application included 103 hazardous waste units, one of which was ~~fully closed~~removed (Unit 4). Proposed units which were not installed (Units 81 to 86 and 88) are discussed in Section 3.1.3. Unit 4, Canopied Container Storage Building, was ~~closed~~ removed as part of implementation of the Class 2 Permit Modification for expansion of the Reverb Furnace Feed Room (Unit 33) and construction of the Corridor (part of Unit 33) and Truck Wash Sump (Unit 51) approved by DTSC on December 13, 1999. Subsurface soil verification sampling will be conducted during closure for all hazardous waste management units at the facility, including the subsurface soil beneath former Unit 4.

Cleaning and removal of the above grade components of the former WWTP (Units 11, 15 to 23, 26 to 30, 38, and 39) was completed in November 2008 to January 2009. Subsurface soil sampling in the vicinity of Units 15 to 21, 38, and 39 in the South Yard was performed as part of the ongoing RFI. Subsurface soil sampling for Units 22, 23, 29, and 30 at the Baghouse Building was performed as part of the ongoing RFI. Subsurface soil sampling for Units 11 and 26 to 28 will be performed as part of closure sampling for the RMPS Building. Subsurface soil verification sampling will be conducted during closure for all hazardous waste management units at the facility.

Cleaning and removal of the above grade components of Units 64 and 65 was completed in October and November 2009. Subsurface soil sampling in the vicinity of Units 64 and 65 is being performed as part of closure sampling for the Desulfurization Building.

The location of each unit is provided on Figure 2.2. The location of ~~closed or~~ units which were removed ~~underwent preliminary closure~~ is shown on Figure 2.13, with the exception of Units 64 and 65. The location of Units 64 and 65 is provided in Appendix D. The as-built survey of the stormwater system is provided in Appendix B. The location of sumps which are ancillary to former IS units are provided in Figure 2.11. The process flow diagram for the facility is provided as Figure 2.12.

Table 1.1 summarizes the maximum inventory, worst case waste inventory (gross capacity), and actual inventory as of July 10, 2015. Table 1.1 also provides the unit name, unit type, location, contents, density of the contents, waste code, size, and methods for content removal, transport, treatment, storage, disposal, and the off-site disposal facility. In preparation for closure, Exide has removed waste inventory from select units, or is in the process of doing so. The status of inventory removal as of July 10, 2015 is provided in Table 1.1. Unit 12, Paste Thickening Unit, was replaced in late 2014 and was not used to manage waste materials. Unit 12 will be closed as a hazardous waste management unit.

Table 1.2 summarizes the waste and scrap metal generated during closure and provides the location/secondary containment area, unit name, unit type, materials of construction, size, quantities of decontamination water generated during closure, and quantities of concrete, soil and decontamination water generated during contingent closure. Table 1.3 summarizes the ancillary sumps, including the worst case inventory (gross capacity), wastes generated during closure, and wastes generated during contingent closure. Table 2.2 summarizes the unit name, contents, waste codes, unit size, materials of construction, maximum inventory, gross capacity, treatment rate, treatment type, overfill protection, secondary containment, structural certification and status. Table 5.1 summarizes the maximum quantities of waste generated during inventory removal, closure and contingent closure and their respective disposal method.

2.7.2 Containment Areas

Units requiring secondary containment are either double-lined with leak-detection, or are contained within one of nine secondary containment areas at the facility. The secondary containment areas, and the units within them, are as follows:

- Central Container Storage Building 1 (Unit 1);
- West Container Storage Building 1 (Unit 2);
- West Container Storage Building 2 (Unit 3);
- Desulfurization Area (Units 7, 8, 9, 10, 67);
- RMPS Area (Units 6, 12, 13, 14, 40, 41, 42, 43, 44, 45, 66, 79, 80);
- RMPS Lower Level (Units 5, 70);
- WWTP Area (Units 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 71, 72, 73, 74, 75, 76, 77);
- Drop Out System (Units 46, 47, 48, 49, 50); and,
- Oxidation Tank Area (Units 24, 25).

2.7.3 Buildings

The facility includes several buildings which are former IS units themselves, several buildings which contain former IS units, and several buildings which are not associated with former IS units.

2.7.3.1 **Buildings which are Units**

The following buildings at the facility are former IS units themselves:

- Reverb Furnace Feed Room (Unit 33), including Upper Feed Room, Lower Feed Room and Corridor; and,
- Blast Furnace Feed Room (Unit 34).

2.7.3.2 **Buildings which Contain Units**

The following buildings at the facility contain former IS units:

- Rotary Kiln Enclosure;
- RMPS Building;
- Desulfurization Building;
- Baghouse Building; and,
- Smelter Building.

The Rotary Kiln Enclosure is located within the Baghouse Building and contains Unit 69.

The RMPS area is enclosed within the RMPS Building. The RMPS Building consists of four sections: the unloading dock, the narrow section along the west side of the Reverb Furnace Feed Room, the main RMPS area, and the enclosed plastic trailer loading dock. The section along the west side of the Reverb Furnace Feed Room includes a main level, and a lower level which includes Unit 5, Battery Dump Bin Sump, and Unit 70, Oscillating Pan Feeder. The RMPS Building has two concrete secondary containment areas (the main area and the lower level), concrete floor, metal roof, and concrete and metal walls. Existing Units 5, 6, 12, 13, 14, 40, 41, 42, 43, 44, 45, 66, 68, 70, 79, and 80, and former Units 11, 26, 27, 28 are located within the RMPS Building.

The Desulfurization Area is enclosed within the Desulfurization Building. The building is also referred to as the Mud Tank Building. The Desulfurization Building has a concrete secondary containment area, metal roof and concrete and metal walls. Units 7, 8, 9, 10, former 64, former 65, and 67 and ancillary sump Mud Tank Area Sump 1 are located within the secondary containment area at the Desulfurization Building.

The Baghouse Building has a concrete floor, metal roof and metal walls. Units 31, 32, 88, former units 22, 23, 29, and 30, and ancillary sumps Baghouse Building Sump 1, Baghouse Building Sump 2, Baghouse Building Sump 3, Baghouse Building Tire Wash, and Neptune Scrubber Sump are located within the Baghouse Building.

The Smelter Building has a concrete floor, metal roof and concrete and metal walls. Units 36, 37, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102 are located on the main level of the Smelter Building. Ancillary sumps North Kettle Gallery Sump, South Kettle Gallery Sump and Cooling Tower Return Sump are located within the lower level of the Smelter Building.

Three cranes (15 tons maximum each) are present at the facility which may be used during closure: two in the Smelter Building, and one in the RMPS Building.

2.7.3.3 **Finished Lead Building**

The Finished Lead Building does not contain any hazardous waste units or ancillary sumps; however, it is proposed for use during closure activities. The Finished Lead Building has a concrete floor, metal roof and concrete and metal walls.

2.7.3.4 **Roof Repairs**

Exide conducted roof repairs from January 22 to March 31, 2015 at:

- Desulfurization Building;
- RMPS Building;
- Containment Building (Reverb Feed Room and Blast Feed Room);
- Baghouse Building;
- Smelter Building; and,
- Finished Lead Building.

Subsequent roof washing indicated that the roof repairs were successful.

2.7.4 Emission Control Equipment

Emission control equipment at the facility is regulated by the SCAQMD. Emission control equipment generally consists of baghouses with associated equipment including HEPA filters, scrubbers, duct work and dust conveyors. Emission control equipment that was installed at the facility, but did not operate, includes regenerative thermal oxidizers (RTOs).

Under requirements of SCAQMD Rule 1420.1, the RMPS Building, Reverb Furnace Feed Room (including Corridor), Blast Furnace Feed Room, Baghouse Building, Smelter Building, and Desulfurization Building must be maintained under negative pressure relative to the outdoor atmosphere. Operation of these structures under negative pressure ensures that airflow is inward through openings and doorways. Also per SCAQMD Rule 1420.1, the pressure differential between these building interiors and the outdoor atmosphere is continuously monitored and recorded to provide a measure of compliance with those requirements with records retained for documentation.

The facility operates six systems which maintain the required negative pressure:

- Soft Lead Baghouse system;
- Hard Lead Baghouse system;
- Material Handling Baghouse system;
- MAC Baghouse systems (East and West);
- MAPCO Scrubber; and,
- Torit Baghouse system.

Three systems are currently not operating:

- Reverb Furnace Baghouse system;
- Blast Furnace Baghouse system; and,

- Rotary Kiln Baghouse system.

The location of emission control equipment is provided on Figure 2.14. The operational status and service area for each baghouse is provided in Table 2.5. A process flow diagram and other supporting information for the emission control systems are provided in Appendix T. Please note that installation of select equipment shown on the process flow diagram was not completed as a consequence of Exide's decision to close the Vernon facility. The cartridge filter and associated RTO in the Smelter Building and the RTO in the Baghouse Building were installed but not operated. The second metallurgical process wet scrubber was not installed.

The Finished Lead Warehouse is not required to be maintained under negative pressure under local or federal rules; however, the building typically functions under negative pressure by virtue of the systems for the other buildings. There is no directly dedicated extraction ventilation system applied to the Baghouse Building. Rather, the Baghouse Building is maintained under negative pressure by air drawn from that enclosure into the adjoining enclosures (i.e., RMPS Building, Reverb Furnace Feed Room, Blast Furnace Feed Room, and Smelter Building) which do have dedicated negative pressure extraction ventilation, primarily the ventilation systems serving the Smelter Building and the Reverb Feed Room and Blast Feed Room containment building enclosures.

Emission control equipment that is currently operating will remain in operation to maintain negative pressure on the associated buildings until the equipment is removed from service as described in this Closure Plan. It is anticipated that maintenance and repair activities will be conducted prior to and during closure activities.

The stacks associated with the kiln dryer and metallurgical (Venturi Neptune) scrubber are currently capped.

2.7.5 Utilities

In addition to process piping and stormwater management features, the facility has several inactive and active utilities including:

- Potable water;
- Fire suppression water;
- Gas;
- Electric;
- Sanitary sewer; and,
- Communications.

The Contractor will field confirm all utilities prior to work in a particular area. Exide will also provide historic utility drawings for the facility to the Contractor.

2.8 DESCRIPTION OF HAZARDOUS WASTE CONSTITUENTS

The wastes handled by the facility included spent lead-acid batteries, lead-bearing material, spent acid, emission control dust, lead paste from spent batteries, wastewater treatment sludge and sludge cake, wastewater, reverb furnace slag, polypropylene, blast furnace slag, Stormwater Surface Impoundment sediment, and separator material. Waste codes included D002 (corrosive), D004 (arsenic), D005 (barium), D006 (cadmium), D007 (chromium), D008 (lead), D010 (selenium), and K069 (emission control dust/sludge from lead smelter). Descriptions of each type of waste from when the facility was in operation are provided below. Annual quantities handled during facility operation are summarized in Table 2.3.

In addition, the Reverb Furnace (Unit 36), Blast Furnace Feed Room (Unit 34), and Blast Furnace (Unit 37) may have managed by-products related to the incomplete combustion of feed material. The incomplete combustion process can produce polyaromatic hydrocarbons (PAHs)

and potentially dioxin/furans. The air emissions from the Reverb and Blast Furnaces are regulated by Title V permit issued by the SCAQMD.

The contaminants of concern for each unit are summarized in Table 2.4.

2.8.1 Raw Materials Received from Off-Site

Spent lead-acid batteries and lead-bearing material were the primary materials received from off-site. These materials were processed to reclaim lead and polypropylene.

2.8.1.1 **Spent Lead-Acid Batteries**

Spent lead-acid batteries are regulated under 22 CCR 66266.80-66266.81 and 40 CFR Part 266, Subpart G. Applicable California Waste Codes (CWC) include 181, 352, 724, and 792. While spent lead-acid batteries are not classified as a listed hazardous waste, these regulations require that spent lead-acid batteries be stored in a former IS container storage area. The regulations allow the use of a bill of lading or a hazardous waste manifest for transport of spent lead-acid batteries. Whole, undamaged batteries are viewed as individual containers. The contents of the containers may be classified as D002 (corrosive), D004 (arsenic toxicity), D005 (barium toxicity), D006 (cadmium toxicity), D007 (chromium toxicity), D008 (lead toxicity), and/or D010 (selenium toxicity) characteristic waste based upon their lead alloy and acid contents. Lead acid batteries made up approximately 85% of the incoming feed material.

2.8.1.2 **Lead-Bearing Material**

The balance of the facility's incoming feed material was composed of lead-bearing material obtained primarily from automotive and industrial lead-acid battery manufacturers. Classes of this material include reject plates and groups, wet and dry oxides, sump mud, pot dross, and baghouse dust. Applicable California Waste codes include 171, 172, 181, and 352. Applicable

federal waste codes include D002, D004, D005, D006, D007, D008, and D010 based upon metals toxicity. Typical lead contents (by weight) for these classes of material are presented below:

Battery Manufacturing Material	**Lead Content**
Auto plates and separators	72%
Industrial plates and separators	80%
Formed plates or groups	92%
Dry oxide	85%
Wet oxide	65%
Sump mud	50%
Pot dross	90%
Baghouse dust	60%

Lead bearing materials were typically received in 55 gallon drums. Drum weights can vary widely depending on contents and how full the drum is filled. Based on information provided by Exide's Muncie, Indiana facility, a typical drum of lead bearing material weighs 500 to 550 pounds. Supporting information is provided in Appendix I. All drums of lead bearing material received by the facility have been removed and sent for off-site recycling.

2.8.2 Material Generated On-Site and Recycled or Treated On-Site

The material generated on-site and recycled or treated on-site includes process intermediates and waste by-products. Materials in this category include:

- Spent acid
- Emission control dust (flue dust from on-site baghouses)
- Lead paste from spent batteries
- Wastewater treatment sludge

- Wastewater
- Reverbatory furnace slag
- Stormwater System and Surface Impoundment Sediment
- Sweepings

2.8.2.1 **Spent Acid**

Spent acid was used as a neutralizing agent in the Raw Material Preparation System (RMPS), to remove the sulfur from lead-containing material, and in the wastewater treatment system. Spent lead-acid battery electrolyte (Federal waste codes D002, D004, D005, D006, D007, D008, and D010, California Waste Codes 724 and 792) was released from whole batteries when they are initially dumped into the RMPS Oscillating Pan Feeder (Unit 70) and in greater quantities when the whole batteries are crushed in the former IS Hammer Mill (Unit 40). The electrolyte was an about 24% sulfuric acid solution with dissolved heavy metals. A typical automotive battery will contain between 0.5 and 1.0 gallon of electrolyte. The acid was collected in the Battery Dump Bin Sump (Unit 5) beneath the Oscillating Pan Feeder and the Paste Thickening Unit (Unit 12) beneath the Hammer Mill. The facility had the capacity to process up to 416,667 gallons per month of spent battery acid. Because the facility is no longer recycling batteries, spent acid is no longer being generated or stored on-site.

The acid, together with purchased virgin sulfuric and/or purchased spent lead-acid battery electrolyte, is used in the wastewater treatment system to adjust the influent pH in a multiple step metals precipitation sequence.

As described above, the management practices in place were sufficient to safely and effectively manage the spent acid. The collection sumps, tanks, piping, and pumps are constructed of corrosion resistant materials such as fiberglass, reinforced plastic or stainless steel.

2.8.2.2 **Emission Control Dust**

Air emissions from the facility are controlled by an extensive, state-of-the-art set of ventilation systems with filtration baghouses. The emissions control dust (flue dust) from the baghouses is a listed federal hazardous waste code K069 (California Waste Code 172). The flue dust has a high lead content and is continuously recycled for lead recovery upon generation. Annual flue dust generation was about 10,000 tons or 883 tons per month during recycling operations. Automated screw conveyors transferred the flue dust from the baghouses to the North and South Flue Dust Slurry Tanks (Units 31 and 32). Water was added to the flue dust in the tanks to produce a slurry. The slurry was then pumped to the former IS Mud Tanks (Units 7, 8 and 9). The contents of the mud tanks were processed through a filter press, and the resulting filter cake was processed through the furnaces to recover lead.

The handling of the flue dust at this facility is essentially a closed loop. The flue dust was not accumulated nor stored anywhere in its processing, and was transferred from the slurry tanks directly to the mud tanks upon collection. The baghouses have remained in operation since recycling operations ceased in March 2014; however, because the emission sources serviced by the baghouses (furnaces, refining kettles, etc.) have not been producing emissions, flue dust accumulation has all but ceased and creation of slurry high in lead content has stopped. Discharge from Units 31 and 32 continues to be sent to the former IS Mud Tanks (Units 7, 8 and 9) for settling prior to transfer of liquid to the WWTP for treatment. Solids are periodically removed from Units 7, 8 and 9 for off-site recycling or disposal.

2.8.2.3 **Lead Paste from Spent Batteries**

During the battery reclamation process, lead paste (lead oxide and lead sulfate) was separated from the other battery components. Typical lead paste contains 60 to 70 percent lead. The estimated annual volume generated at the facility was 64,070 tons during recycling operations. Lead paste (federal waste code of D002, D004, D005, D006, D007, D008, and D010 and

California Waste Code 181) from the battery plates was removed by the vibratory washing screen at Unit 40 and collected in the former IS Paste Thickening Unit (Unit 12). The paste was removed and transferred to the former IS Mud Tanks (Unit 7, 8 and 9). The contents of the mud tanks were processed through a filter press and the resulting filter cake was processed through the furnaces to recover lead. Since the facility has ceased recycling operations, lead paste from spent batteries is no longer being produced and paste within Units 7, 8 and 9 has been or will be removed prior to closure and sent for off-site recycling or disposal.

Unit 12 had been emptied, cleaned, disassembled and replaced when the decision to close the facility was made. The replacement Unit 12 has never held waste material.

2.8.2.4 **Wastewater Treatment Sludge and Sludge Cake**

A by-product of the on-site wastewater treatment system, sludge was generated at a rate of about 1,242 tons per month or 14,900 tons annually during recycling operations. Applicable federal waste codes include D004, D006, and D008 and California Waste Codes 132 and 171.

The sludge generated was from the former IS WWTP Filter Press (No. 44) and the RMPS Filter Press Unit B (No. 45), both of which are located in the RMPS building. The sludge was collected and transferred to the furnaces for lead recovery. Since the facility has ceased recycling operations, Unit 44 and 45 are not operating. Sludge has been limited to solids from WWTP operations and facility cleaning. Sludge is currently sent to the former IS Mud Tanks (Units 7, 8 and 9) for settling prior to transfer of liquid to the WWTP for treatment. Solids are periodically removed from Units 7, 8 and 9 for off-site recycling or disposal.

During closure activities, the WWTP sludge will be collected in Unit 54, Sludge Holding Tank, the Mud Tanks (Units 7, 8 and 9), and/or the temporary decontamination water storage feature and transferred to another recycling facility for lead recovery, or dewatered and disposed off-site.

2.8.2.5 **Wastewater**

Wastewater treated on-site at the facility included spent acid and process wastewater, plant wash down water, mobile equipment wash water, and stormwater. The wastewater contains metals. Federal waste codes include D002, D004, D005, D006, D007, D008, and D010. The applicable California waste codes are 132, 721, 722, 723, 724, 791, and 792. The estimated annual volume, excluding spent acid, is about 69.4 million gallons per year, or 5.78 million gallons per month during recycling operations. On-site treatment stages include neutralization, multiple stage metals precipitation, and filtration. Treated wastewater is discharged to the POTW. Since the facility has ceased recycling operations, the wastewater treated on-site has been limited to almost exclusively plant wash down water, mobile equipment wash water, and stormwater.

Wastewater (wash down water, decontamination water) is currently sent to the former IS Mud Tanks (Units 7, 8 and 9) for settling prior to transfer of liquid to the WWTP for treatment. Solids are periodically removed from Units 7, 8 and 9 for off-site recycling or disposal.

Wastewater treatment will be required throughout the closure process and until Exide receives regulatory approval for discharge of stormwater runoff to the municipal stormwater system and/or concrete drainage channel.

2.8.2.6 **Reverb Furnace Slag**

The alloying metals commonly found in batteries (antimony, tin and arsenic) are not reduced as readily as lead in the former IS Reverb Furnace. Along with other impurities, these metals form a floating slag layer on top of the molten lead bath within the furnace. The slag layer has poor heat transfer properties and, therefore, acts as an insulating layer. Because a heavy slag layer reduces the furnace efficiency, the slag was continuously tapped off to maintain about a half-inch thick slag layer. The slag from the Reverb Furnace was fed to the former IS Blast Furnace for further refining because of its high lead and alloy content. Reverb furnace slag, a by-product of

the Reverb Furnace lead recycling process, has applicable federal waste codes of D004, D005, D006, D007, D008, and D010 and a California Waste Code of 181. Reverb furnace slag was generated at an annual rate of 26,000 tons per year or an average rate of 2,167 tons per month.

Because the facility is no longer in operation, Reverb Furnace slag is no longer being produced. At the time of plan preparation, slag produced prior to idling the facility in March 2014 has been removed and sent for recycling at another facility.

2.8.3 Material Generated On-Site and Sent Off-Site for Reclamation, Disposal, or Purchase

The material generated on-site and sent off-site for reclamation, disposal, or customer purchase included polypropylene, blast furnace slag, separator material, and lead product. The polypropylene and separator material (including limited amounts of rubber from battery cases and separator envelopes) are recyclable by-products and the blast furnace slag is a waste by-product. All hazardous wastes shipped from the facility are required to comply with 22 CCR 66262.10 and 66263.10.

2.8.3.1 **Polypropylene**

The polypropylene battery case material was crushed and segregated from other battery components in the former IS Sink/Float Separator. The plastic chips were segregated from the rinse water in a centrifuge. The chips were pneumatically blown into trailers prior to temporary storage in the Trailer Staging Area and shipment off-site to a plastic reclamation facility. Annual polypropylene generation was about 9,200 tons or 767 tons per month during recycling operations. The applicable federal waste code is D008. The applicable California Waste Code is 181. These materials were shipped as hazardous waste. Because the facility is no longer recycling batteries, polypropylene battery case material is no longer being produced. Polypropylene battery case material stored in trailers has been removed from the facility.

2.8.3.2 **Blast Furnace Slag**

Blast furnace slag is solid in form and has the following typical composition: carbon, calcium oxide, sodium oxide, silicon dioxide, iron oxide, and minor quantities of lead and other metal compounds. A portion of the blast furnace slag was returned to the Blast Furnace Feed Room as a flux and the remainder was stored in the Corridor portion of the Reverb Furnace Feed Room prior to shipment for off-site disposal. Slag generation was on the order of 10,100 tons per year or about 842 tons per month during recycling operations. The Blast Furnace slag is a California hazardous waste only (not a federal hazardous waste) with a California Waste Code of 181. Blast furnace slag was sent off-site in covered dump trucks which are compatible with the waste. Because the facility is no longer recycling batteries, Blast Furnace slag is no longer produced. As of the time of plan preparation, all Blast Furnace slag material generated prior to cessation of operations in March 2014 has been removed from the facility.

2.8.3.3 **Stormwater System and Surface Impoundment Sediment**

The Stormwater System and Surface Impoundment accumulate sediment that has the potential to be hazardous under federal waste codes of D004, D005, D006, D007, D008, and D010 and a California Waste Code of 181. The sediment is removed and recycled or disposed off-site. The stormwater system was reconstructed and upgraded to improve operation and provide secondary containment in late 2013 and early 2014. Facility decontamination during Phase 1 Closure will eliminate the potential for the former IS Units to directly contribute lead and other metals to surface sediment. However, anticipated Phase 2 Closure activities and Corrective Action activities, such as soil excavation, subsurface demolition activities and site capping will represent a potential source of contaminated sediment that must be anticipated. Therefore, stormwater system and surface impoundment (as well as Unit 46 (Pump Sump)) closure will be conducted in a stepped process.

- **Step 1** - Near the end of Phase 1 Closure, the stormwater system piping and structures, Unit 46 and surface impoundment will be flushed and cleaned to remove accumulated sediment (Step 1). The stormwater system configuration will remain unchanged following Step 1 and Exide will continue to collect and treat stormwater, and discharge treated stormwater to the sanitary sewer system in accordance with the existing industrial discharge permit. Wipe samples will be collected from the flow line at the down-slope end of each HDPE pipe run, at the bottom of each HDPE manhole and within Unit 46. Samples of the surface impoundment liner system will be collected during completion of soil sampling at 25% of proposed soil sample locations. Sample results will be utilized to evaluate the effectiveness of cleaning methods and provide initial information to determine if closure performance standards can be achieved, or if complete removal or closure with hazardous waste-in-place will be required during Phase 2 Closure activities.

- **Step 2** – Phase 2 Closure is expected to involve removal of ~~floors, pavement,~~ subsurface soils~~, foundations~~ and utilities. The extent of the Phase 2 activities will be dictated by the results of sampling conducted during Phase 1 Closure and, to the extent possible, are also expected to be completed concurrent with Corrective Action activities. Because of the expectation for Phase 2 Closure and Corrective Action activities to generate sediment, the stormwater system inlets will be retrofitted with erosion and sediment control measures to capture sediment before it enters the piping system. The specific types of controls will be a function of the scope of the Phase 2 Closure activities, the extent of storm water system removal and/or reconfiguration, and will be determined in consultation with DTSC during preparation of the detailed Phase 2 Contingent Closure Plan and Corrective Action remedy selection. Despite the implementation of erosion and sediment control measures during Phase 2 Closure, some limited amount of sediment will enter the system and, therefore, Exide will continue to collect and treat stormwater, and discharge treated stormwater to the sanitary sewer system in accordance with the existing industrial discharge permit. At the end of Phase 2, those components of the stormwater collection

system HDPE pipes and manhole ~~to remain in place, Unit 46 (if it will remain), and surface impoundment (if it will remain) will be cleaned and tested for Closure~~will be removed. As described in Section 3.2.4, If, after removing structures, foundations and subsoil down to 5-feet below surface and making all reasonable efforts to effect removal or decontamination of subsoils beneath 5-feet below surface, Exide demonstrates and DTSC concurs that not all contaminated subsoils can be practicably removed or decontaminated, Exide will submit an application to modify the Closure Plan to include creation of a new solid waste management unit as part of closure in accordance with 22 CCR 66270.42(c). ~~closure requirements for those components remaining in place will be the method detection limit for wipe samples, or TTLC and STLC results below their corresponding regulatory limits.~~

Formatted: Highlight

- **Step 3** – The Post Phase 2 Closure configuration will be dictated by the extent of soil removal activities and limits of capping required to complete Closure and Corrective Action. It is expected that majority significant portion of the existing stormwater system will be removed near the end of Phase 2 Closure~~, although some sections may ultimately be retained~~. Exide will be required to collect and treat stormwater until sampling can demonstrate that runoff meets requirements for discharge. DTSC review and approval will be required for the Phase 2 Closure and Corrective Action.

2.8.3.4 **Battery Chips/Separator Material**

As the batteries were processed through the RMPS, the case material was crushed and separated out. Battery cases are typically polypropylene. A small volume of battery cases are constructed of hard rubber. In addition, the separator which insulates the plates was crushed and separated out in the Sink/Float Separator (Unit 13). The battery chips and separator material were then separated from the rinse water in a centrifuge (Unit 80). Automotive battery separator material is typically polyethylene. Industrial battery separators vary from glass wool or cellulose paper to PVC (infrequent).

Once separated from the feed material, both the battery chips and separator material were stored temporarily in trailers in the Trailer Staging Area and sent off-site for recycling. The box trailers were loaded at the plastics loading area at the RMPS Building shown on Figure 2.2. Battery chips/separator material which cannot be separated from the feed material were charged into the Reverb Furnace. The applicable federal waste codes of D002, and D008; California Waste Code of 181; and recycle code H039 apply to the battery chips/separator material. Battery chips/separator material was generated at about 2,600 tons per year or an average rate of 217 tons per month during recycling operations.

Because the facility is no longer operating, battery case or separator material is no longer produced. Battery case and separator material stored in trailers have been removed from the facility.

2.8.3.5 **Lead Product**

When Exide was operating, lead from the furnaces was refined in the refining and receiving kettles to meet customer specifications. The refined lead was pumped into molds where it was allowed to harden prior to shipment. The lead product is not a hazardous waste and was shipped under a bill of lading. Lead product was shipped off-site in covered van trailers. The facility is no longer producing lead; however, when Exide ceased operations in 2014, solidified lead remained within the refining and receiving kettles. As part of closure, Exide must remove the lead in the kettles before it can decommission the kettles. ~~Exide has diligently assessed various potential methods for removing the lead, and has concluded that the only viable option for those kettles with over 12 tons of lead is tore-melt the lead and cast it into molds for transport to an off-site recycling facility. Loose pieces of solidified lead within the refining and receiving kettles will be removed by hand for transport to an off-site recycling facility during closure. Lead in kettles that is less than 12 tons will be removed with a crane without re-melting.~~Exide

will remove lead from kettles containing more than 12 tons of lead with the preferred alternative identified in the Environmental Impact Report.

~~As explained in Section 5.2.2.5, for kettles with over 12 tons of lead, re-melting the lead is the most efficient, safest and most environmentally protective method to remove lead from the kettles. Exide emphasizes that: (i) re-melting of lead would be a temporary decommissioning closure process conducted over the course of just a few weeks, with all associated environmental controls (including air emission controls) in place; (ii) Exide would not be producing or refining lead during this time – Exide would simply be re-melting existing lead for the sole purpose of taking it out of the kettles so it can be cast and taken to another recycling facility. This is a core closure activity; (iii) Exide carefully assessed other potential methods to remove the lead from the kettles. Each of the alternative methods were either much less efficient (resulting in delay), less safe to personnel, or created potentially significant environmental problems. Given the high unit weight of lead, the need to ensure safety, the need to conduct closure efficiently without delay, and the need to be environmentally protective during the closure process, re-melting of lead in the kettles represents the best and safest available closure process.~~

Date: July 2015

2.9 CLOSURE PLAN CERTIFICATION

Authorization from a responsible corporate officer for a duly authorized representative to complete the certification is provided in Appendix Y.

The following certification complies with CCR 66270.11(d):

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature:_____

Name:_____

Company:_____

Title:_____

Date: July 2015

3.0 GENERAL CLOSURE APPROACH

3.1 CLOSURE APPROACH

Formatted: Normal, Line spacing: single

Formatted: Justified, Line spacing: 1.5 lines

Closure of the site will be conducted in two phases. Phase 1 includes inventory removal; unit decontamination and removal; soil, soil gas and floor/pavement sampling; and decontamination and deconstruction of buildings containing former Interim Status units to grade. Interim Closure Performance Standards are presented for Phase 1. Phase 2 addresses below grade impacts from former Interim Status unit operations. Final Closure Performance Standards for Phase 2 closure are to be developed to be protective of human health and the environment as demonstrated by a site wide DTSC approved Health Risk Assessment.

Formatted: Normal, Justified

At some point it will become prudent to integrate the closure and corrective action processes as the closure and clean-up performance standards are similar for each process. The closure and corrective action processes are respectively required to close the Interim Status units and appurtenant structures and to clean up the facility fence line to fence line in a manner that controls, minimizes, or eliminates, to the extent necessary to protect human health and the environment, post closure/clean-up escape of hazardous waste constituents, chemicals of concern, leachate, contaminated rainfall or waste decomposition products to the ground or surface water or the atmosphere. The Phase 2 closure activities will be coordinated with the on-going site-wide corrective action. In Phase 2, integrated clean-up goals and closure performance standards will be developed and engineering and institutional controls will be designed. These measures will be tailored to mitigate adverse risk to human health and the environment posed by the site-wide nature and extent of any remaining hazardous waste constituents or chemicals of concern. A site-wide Health and Ecological Risk Assessment will be conducted to estimate the cumulative cancer risk, non-cancer hazard and adverse effects of lead remaining at the site, to potential future receptors, prior to and after the appropriate engineering and institutional controls have been implemented at the site. Cumulative cancer risks to potential future receptors at the site shall not exceed a level determined to be acceptable by DTSC management, which is within the risk management range (10-6 -to 10-4), and a non-cancer hazard of 1. The 95% UCL of the

mean of lead levels in dust/soils available for exposure at the site should not exceed 80 ppm -for a potential residential (onsite or off-site receptor) and 320 ppm for a commercial/industrial worker. Contaminants left in place should be monitored using the appropriate operation and management (O&M) controls -to ensure that human health or the environment are not adversely affected.

3.1.1 General

Closure activities at the Exide facility will meet the ~~general~~ Federal and State of California Closure and Post-Closure requirements in California Code of Regulations, title 22, division 4.5, chapter 15, article 7. To meet these standards Exide will close and provide post-closure care in accordance with the following Closure Performance Standards in ~~(~~22 CCR 66265.111~~)~~.

(a) M~~m~~inimizes the need for further maintenance, and

(b) C~~c~~ontrols, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated rainfall or run-off, or waste decomposition products to the ground or surface waters or to the atmosphere, and

(c) C~~c~~omplies with the closure requirements of this chapter 15. including, but not limited to, the requirements of sections:

66265.197 Closure and Post-Closure Care for Tank Systems,
66265.228 Closure and Post-Closure Care for Surface Impoundments,
66265.258 Closure and Post-Closure Care for Waste Piles,
66265.310 Closure and Post-Closure Care for Landfills,
66265.351 Closure of Incinerators,
66265.381 Closure of Thermal Treatment Units,
66265.404 Closure of Chemical, Physical, Biological Treatment, and
66265.1102 Closure and Post-Closure Care of Containment Buildings.

The closure activities will minimize the need for further maintenance by removal of all contaminated equipment, structures, or buildings and all hazardous waste and residues to the maximum extent practical as determined by DTSC. Exide will maintain a log of everything that

is removed from the facility. The log will include the date of removal, description of material, identification of area removed from, results of decontamination confirmation sampling, waste characterization, destination and truck identification. If DTSC determines not all hazardous waste and residues can be removed, Exide will; control, minimize or eliminate to the extent necessary to protect human health and the environment the post-closure escape of:

- -hazardous waste,
- hazardous and related constituents,
- leachate,
- contaminated rainfall or run-off, and
- waste decomposition products

to the ground, surface water, groundwater or atmosphere.; and ensure that any equipment, structures or buildings left in place contain no hazardous waste. Those areas not achieving performance standards must be closed with a hazardous waste in place designation and managed as a landfill pursuant to the requirements of 22 CCR 66265.310.

Formatted: List Paragraph, Bulleted + Level: 1 + Aligned at: 0.3" + Indent at: 0.55"

The general process for closure will occur in two phases. Phase 1 represents those activities necessary to close the former IS units (Closure) and Phase 2 represents those activities selected to address impacts to soil and groundwater caused by the former IS units (Contingent Closure). As described in greater detail herein, Phase 1 (Closure) is well known and easily quantified. Phase 2 (Contingent Closure) activities cannot will be further defined until based on subsurface sampling activities areresults completed during Phase 1. For the purposes of generating the Phase 2 portion of this plan, establishing financial assurance requirements and facilitating the CEQA process, certain assumptionsappropriate corrective measures have been made that are believed to represent a reasonable worst case scenariodetermined.

The general steps for Phase 1 (Closure) and Phase 2 (Contingent Closure) are as follows:

PHASE 1 - CLOSURE

- Removal and management of ~~regulated~~ all hazardous waste (inventory) and residuals at the facility at the time of closure (Section 5.2)
- Unit decontamination to meet specified performance standards (Section 6.0)
- Confirmatory sampling of each unit; both former and historic (Section 7.1 to 7.7)
- Removal of units (Section 7.8)
- Containment Area and building decontamination (Section 8.0)
- Confirmatory sampling of containment area and building (Section 9.0)
- Soil and soil gas sampling (Section 10.0)
- Building deconstruction (roof and walls to grade) (Section 11.0)
- Decontamination of unregulated areas (Section 12.0)
- Stormwater system decontamination (Section 6.7)

PHASE 2 - CONTINGENT CLOSURE

- Concrete floor and pavement removal and management (Section 16.3)
- Soil removal and disposal (Section 16.3)
- Excavation of stormwater pipe (Section 16.3)
- Confirmatory soil sampling (Section 16.4)
- Restoration (Section 16.5)
- ~~Hazardous~~ Contaminated soil boundary markers (Section 16.9)
- Treatment and ~~C~~capping ~~hazardous~~ waste in-place (Section 16.11)

General procedures for each activity are provided in Sections 5 through 16. Detailed information for each unit and a work breakdown structure (WBS) for closure and an assumed contingent closure of each unit are provided in Appendix D. ~~Deconstruction of buildings is above and beyond typical RCRA closure requirements.~~

Post-Closure is addressed in Section 21.0. Contingent Post-Closure is addressed in Section 22.0.

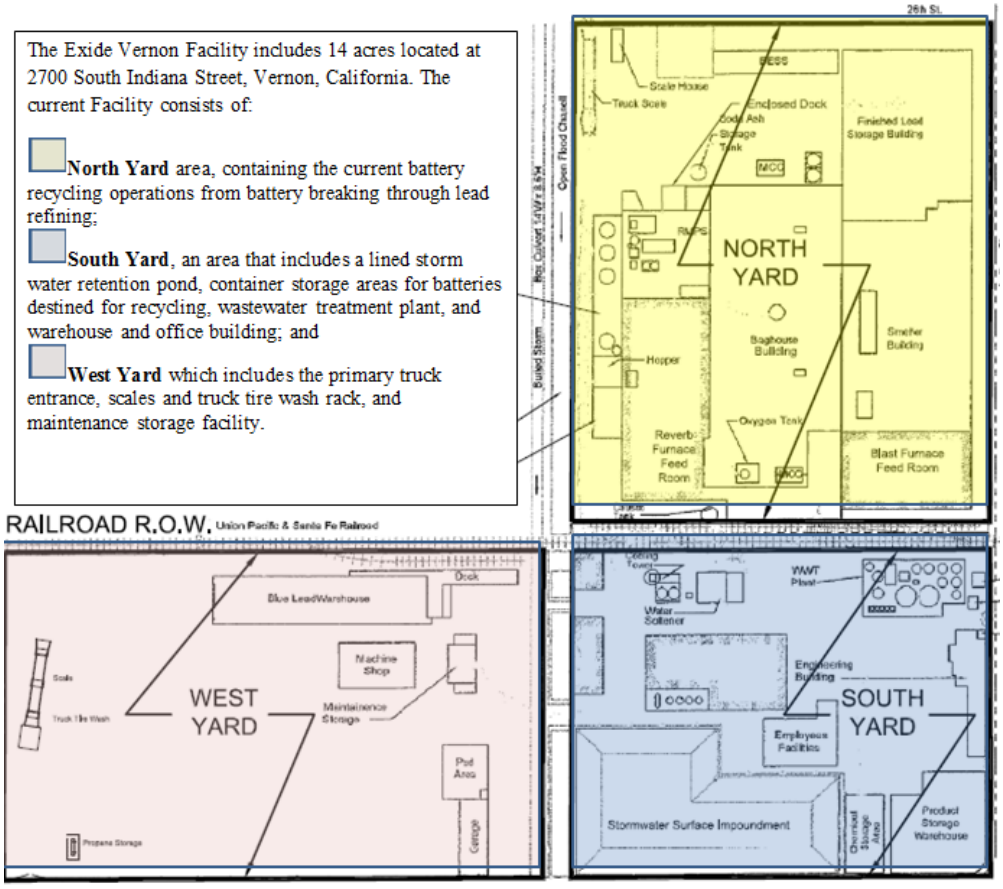
The sequence of Phase 1 closure activities is addressed on a unit by unit basis in Section 4.0.

3.1.2 Contingent Closure (Phase 2) Excavation Rationale

The facility has been in operation since 1922 and is known to have impacts to soil and groundwater caused by historic operations and pursuant to RCRA regulations; those historic impacts are being addressed through the Corrective Action (CA) process. The CA is in the RCRA Facility Investigation (RFI) stage, which will be followed by a Corrective Measures Study (CMS), remedy selection and Corrective Measures Implementation. The CA is being conducted pursuant to the February 25, 2002 Corrective Action Consent Order (CACO) between Exide and DTSC. The following text provides a summary of current and historical conditions and identifies areas of contamination that will be addressed by Exide under the Corrective Action Order and Health and Safety Code 25200.10~~The CA is presently a different project on a separate path than Closure~~.

3.1.2.1 Recent Operations

This Section is based on information from the 2012 Current Conditions Report for the Exide Facility. The Exide Facility has ceased operations and is currently in the closure process. During the early 1980s, the Facility was the subject of a major modernization and reconstruction project that resulted in the cessation of handling and processing activities not related to lead recycling (i.e., secondary aluminum smelting, zinc alloying and metals extrusion). The Raw Material Processing System (RMPS) and raw material storage building, new smelter building and baghouse area structures were all constructed during 1981 and 1982 in the North Yard. The lined "Storm Water Retention Pond" (SWMU A-24 and IS Unit 78) in the South Yard was constructed in 1984. The figure below provides a map of the recent facility layout.



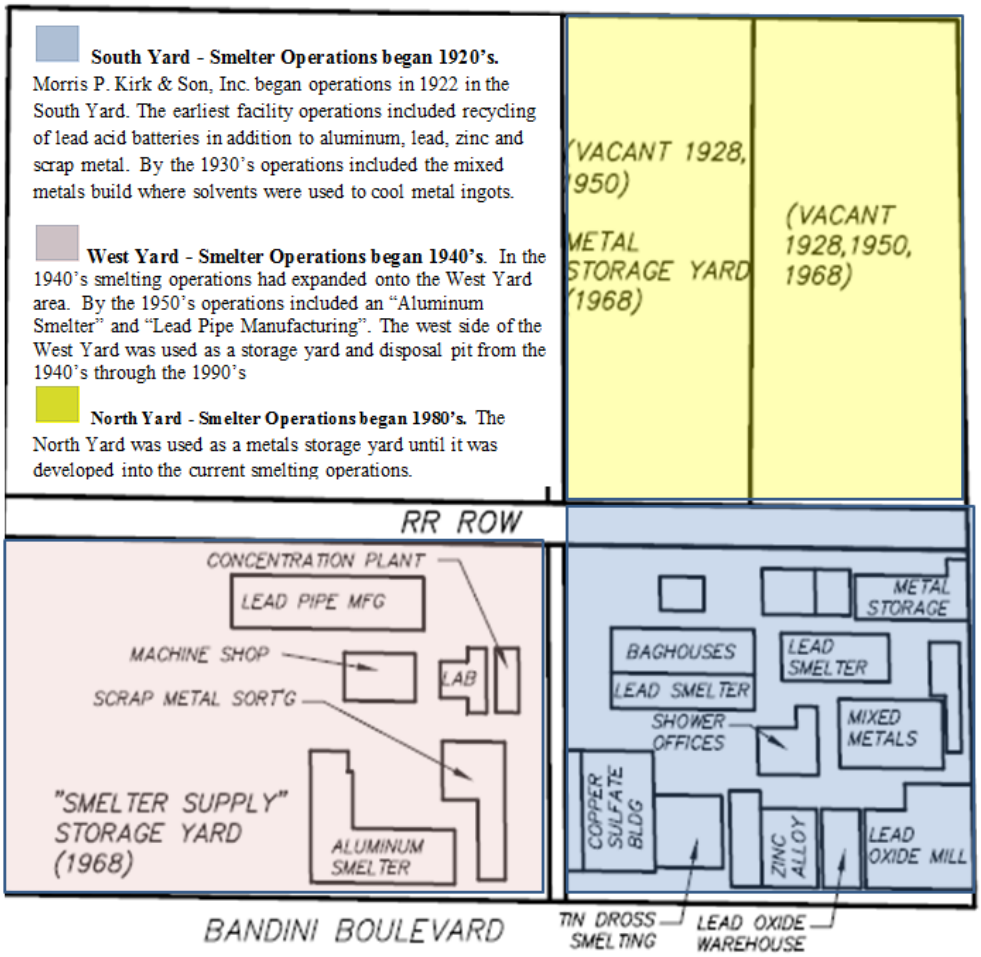
Recent Facility Layout

The Exide facility was a resource recovery operation. Since 1979 operations have been limited to recycling lead-bearing scrap materials obtained from spent lead-acid batteries and lead bearing scrap primarily associated with battery manufacturing related operations. The reclaimed lead is used to produce marketable lead and lead alloys. The metal recovery process used at the Facility is commonly referred to as secondary lead smelting and refining. The Facility received spent used) lead-acid batteries and other lead-bearing materials and recycled them to recover lead and

polypropylene. The sulfuric acid in the batteries was recycled and used in the wastewater treatment system. The Facility had an average production of 100,000 to 120,000 tons of lead per year of batteries.

3.1.2.2. Historical Operations

Morris P. Kirk & Son, Inc. began operations in 1922. Based on a 1928 Sanborn Map during this time frame, the Facility operations were limited to just the South Yard area and consisted of four labeled structures, identified as "Metal Storage", "Smelter", "Oxide Plant" and "Office". No specific information is known about the earliest facility operations except that the Facility recycled lead acid batteries in addition to aluminum, lead, zinc and scrap metal. Those portions of the South Yard not covered by buildings in a 1928 aerial appear to be utilized for material stockpiling and related operations. See the figure below for the historical facility layout.



Based on a 1938 aerial photograph, Facility operations grew since 1928 to include buildings covering nearly the entire South Yard. A 1946 aerial photograph shows that operations had expanded onto the West Yard area and includes buildings identified in a 1950 Sanborn Map as "Aluminum Smelter" and "Lead Pipe Manufacturing". A review of the 1946 Standard Metal Directory identifies that the Facility included an aluminum smelter; battery lead smelter; babbitt (Babbitt metal is a type of metal historically used for bearings (such as in rail road car wheels)

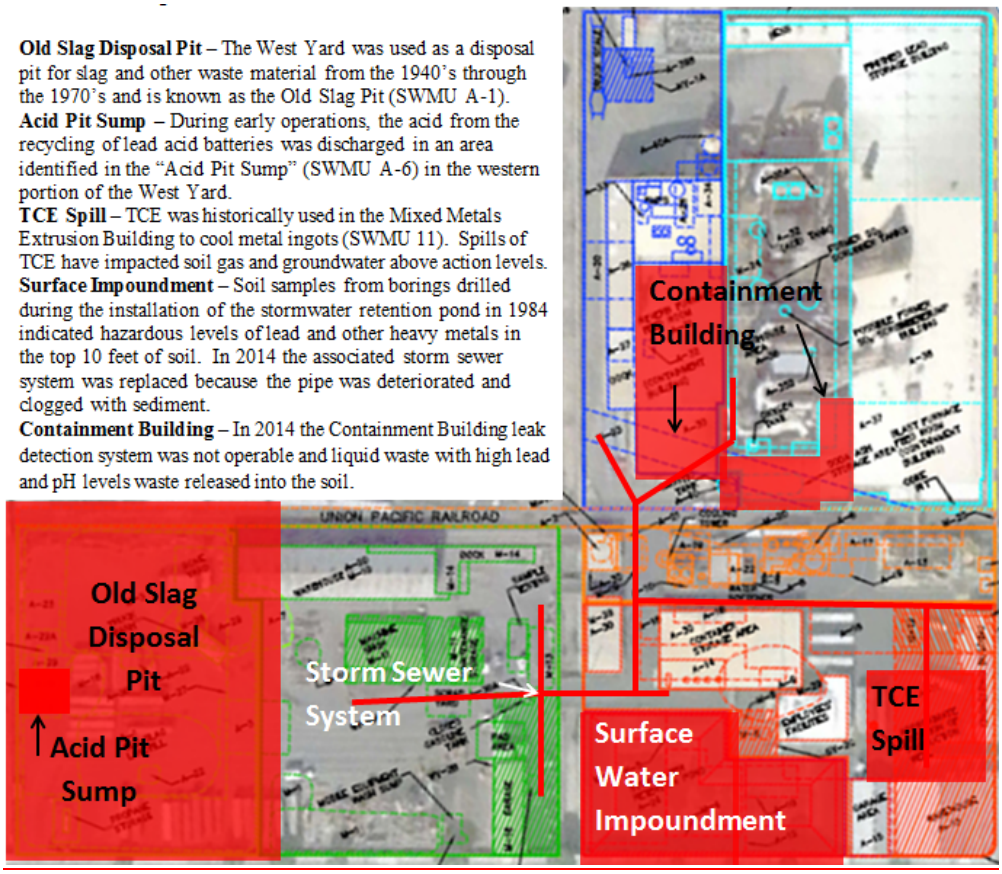
that contains lead, tin, antimony and other metals) and solder manufacturing processes; scrap iron and metal dealership; and zinc smelter. The lead acid battery recycling operations would have included an operation that involved the separation of the lead, acid and casing components.

During early operations, the acid is reported to have been discharged in an area identified in the RCRA Facility Assessment (RFA) (DTSC, 1990) as the "Acid Pit Sump" (SWMU A-6) in the West Yard. As stated in the Phase 2 RFI Report (AGC and E2, 2006a and 2006b), the earliest aerial photographs (1928 through 1946) indicate that areas from 0.5 acres to 1.5 acres in the extreme portions of the West Yard are disturbed – these are identified in the RCRA Facility Assessment (RFA) (DTSC, 1990) as the "Old Slag Pit" (SWMU A-1). A 1940's photographic record appears to limit the filled area to the West Yard and within property boundaries. The Facility is clearly bounded by roadways to the south and east, by a railroad to the north and by a distinct property limit to the west. These boundaries have been confirmed to be within fenced or controlled limits. By 1952, some areas of disturbance still appear in the West Yard but by 1968 only two small areas totaling 0.3 acres appear to be disturbed. By 1976, the entire West Yard appears to be paved.

3.1.2.3 Past Investigations

In 1990 A RCRA Facility Assessment (RFA) was conducted by DTSC staff. The RFA identified 38 Solid Waste Management Units (SWMUs) and two Areas of Concern (AOCs) and determined that a number of units at the Vernon Facility had evidence, or a high likelihood, of a release of hazardous substances while in operation. During subsequent RCRA Facility Investigations DTSC also determined that hazardous waste or constituents had migrated or threatened to migrate, from the Vernon Facility into the environment through soil, surface water, groundwater, and air pathways. Major areas with hazardous levels of soil contamination are shown on the figure below.

Old Slag Disposal Pit – The West Yard was used as a disposal pit for slag and other waste material from the 1940's through the 1970's and is known as the Old Slag Pit (SWMU A-1).
Acid Pit Sump – During early operations, the acid from the recycling of lead acid batteries was discharged in an area identified in the "Acid Pit Sump" (SWMU A-6) in the western portion of the West Yard.
TCE Spill – TCE was historically used in the Mixed Metals Extrusion Building to cool metal ingots (SWMU 11). Spills of TCE have impacted soil gas and groundwater above action levels.
Surface Impoundment – Soil samples from borings drilled during the installation of the stormwater retention pond in 1984 indicated hazardous levels of lead and other heavy metals in the top 10 feet of soil. In 2014 the associated storm sewer system was replaced because the pipe was deteriorated and clogged with sediment.
Containment Building – In 2014 the Containment Building leak detection system was not operable and liquid waste with high lead and pH levels waste released into the soil.



The significant areas of soil and groundwater contamination were identified in the:

- 1990 RCRA Facility Assessment (RFA),
- 2002 Corrective Actions Consent Order (CACO),
- 2012 Current Conditions Report that summarizes six Phases of RCRA Facility Investigations (RFIs),
- Interim Corrective Measures for the Surface Water, TCE Spill, and Storm Sewer Replacement, and

- Current reports from Exide staff regarding failed leak detection and liner systems in the Surface Impoundment and Containment Buildings.

Major areas of significant soil contamination were described in the 2012 Current Conditions report as follows:

Earthen Disposal Pit (Old Slag Landfill) – SWMU A-1 (West Yard)

Formatted: Font: Bold

Located in the southwest section of the West Yard, the Old Slag Landfill (pit) was used by previous operators of the Facility for disposal of blast furnace slag from secondary smelting of lead, aluminum and zinc. The pit consists of an earthen disposal pit located in the southwest section of west yard. The pit was filled and paved over as facility operations expanded over the years. Information contained in the RFA from plant personnel estimated the size of the pit to be approximately 50 feet in diameter and 20 feet deep. Based on a more detailed review of historic aerial photographs and subsurface investigation activities during the Phase 2 RFI, the footprint of the pit is over 1.5 acres and maximum depths were greater than 40 feet. The estimated quantity of slag within the pit on-site is estimated to be 60,000 to 80,000 cubic yards. Boring logs indicate slag and metal ingots were recovered from the borehole drillings. According to former facility personnel, pit operations were discontinued in approximately 1973. However the area continued to be used as a waste pile for slag material as noted in the 1990 RFA.

Earthen Acid Dump Pit – SWMU A-6 (West Yard)

Formatted: Font: Bold

The pit was located near the middle of the property at the western fence line. The pit was used by previous operators of the Facility for the disposal of acid from spent batteries. The pit has been filled and is presently covered with asphalt pavement. The acid dump pit consisted of an earthen pit where spent acid and other unidentified wastes were deposited. There are no existing records of the type or quantity of wastes placed in the pit. Similarly, the exact size of the pit is unknown. Use of the pit was discontinued prior to 1979 when Gould/GNB began operation of the Facility.

Old Mixed Metals Extrusion Building SWMU A-11 (South Yard)

Formatted: Font: Bold

The old mixed metals extrusion building was situated to the west of the engineering building. The building was approximately 10,000 square feet in size. The process performed in this area included the extrusion of metal bars and stock into various shapes (ingots). The building has been removed, and the area is now paved with asphalt. The 1968 Sanborn Map identifies a production well in the southwest corner of the mixed metals extrusion building. It is unknown exactly when operations were started in this location; however, the mixed metal operations were ceased in approximately 1978. During the operation of this unit, TCE was applied to metal bars as a cooling medium in the extrusion process. Existing monitor wells in the vicinity of the mixed metal extrusion building (MW-11, MW-14, MW-15 and PW-2) have detected elevated TCE since the time of their installation in 1986 (MW-11) and 1987 (MW-14, MW-15 and P-2).

Stormwater Surface Impoundment – SWMU A-24 (South Yard)

Formatted: Font: Bold

The Stormwater Surface Impoundment was used as rainwater retention pond and secondary containment system for several units. It is located on the southern boundary fence at the location of the old zinc alloy production area. The pond was constructed in 1984 and was proposed for permitting as a hazardous waste Surface Impoundment in the RCRA Hazardous Waste Permit application. Historic Sanborn Maps (1950, 1968 and 1976) indicate that in the footprint of the pond, former Facility operations included not just zinc alloying operations, but also areas identified as “tin dross smelting”, “copper sulfate building” and “ball mill”, as well as, fuel dispenser and sulfuric acid tanks. Results of soil sampling conducted prior to construction of the pond indicate that soil remediation was conducted to depths typically 6 to 8 feet deep within the footprint of the pond. Subsequent to remediation, the pond was excavated to its final depths (approximately 14 feet) and lined with geomembrane liners and leak detection system. The pond liner and leak detection system were upgraded in 2000 to the existing 60 mil HDPE liner system.

Sediment samples collected from within the rainwater retention pond since operation of the pond began in late 1984/early 1985 have indicated hazardous concentrations of lead. DTSC has also expressed concern that the rainwater retention pond functioned as secondary containment for some of the interim status hazardous waste tanks during the 1980s and into 1990s. The rainwater

retention pond no longer serves as secondary containment, although sediment in the pond can still test as TTLC or STLC hazardous.

Currently the Surface Impoundment does not meet the design standards for hazardous waste surface impoundments, because it cannot accommodate the drainage from a 1000 year 24 hour storm event, does not have an adequate factor of safety for slope stability, and does not have an operable leak detection system.

Stormwater Management System- (Site Wide Storm Sewer Pipe)

Formatted: Font: Bold

In March of 2013 an inspection of the Facility wide storm sewer found significant blockage of the sewer system with sediment. The sediment contained hazardous levels of lead in excess of 100,000 mg/kg. This prompted an Emergency Response Interim Measure Work Plan (ERIMWP) for the Storm Sewer Management System Removal. Implementation of the ERIMWP was required by the Memo of Understanding and Stipulation and Order (Docket HWCA:P3-12/13-010) between the California Department of Toxic Substances Control (DTSC) and Exide. ERIMWP implementation included removal of approximately 3,100 linear feet of original stormwater system piping and 33 structures and abandonment in-place of approximately 600 linear feet of original stormwater system piping. Excavation depths ranged from 2.5 to 14.5 feet in depth. Removal activities were substantially complete by March 2014.

Shallow Soil Contamination (Site Wide)

Formatted: Font: Bold

The ERIM Completion Report April 2014 contained pre and post excavation sampling that showed hazardous levels of lead exceeding 100,000 km/kg or 10% lead by weight in the upper 10 feet throughout the South and West Yards. Post excavation sampling in the storm drain trench indicated hazardous levels of lead still remain in the soil below the storm drain. Significant contamination was found in the northwest portion of the South yard adjacent to the drainage channel, because the storm drain was sloped in the wrong direction allowing standing water and sediment accumulation in the storm drains. Significant deterioration of the original storm drain pipe was also found in this area. Additional fill material was identified in the North

Yard. The borings identified a thin (1 to 3 feet thick) layer of fill over the North Yard Area. The fill was described as a brown silty sand with wire, metal, trash, wood and brick. No metals analysis was performed on the boring samples, but based on the description; it does not appear to be slag fill. Information obtained during the City of Vernon file review on September 17, 2012 included a summary of hand written soil lead concentrations apparently from soil being remediated in the North Yard in June 1980. The information indicates total lead concentrations up to 150,000 mg/kg.

Containment Building (North Yard)

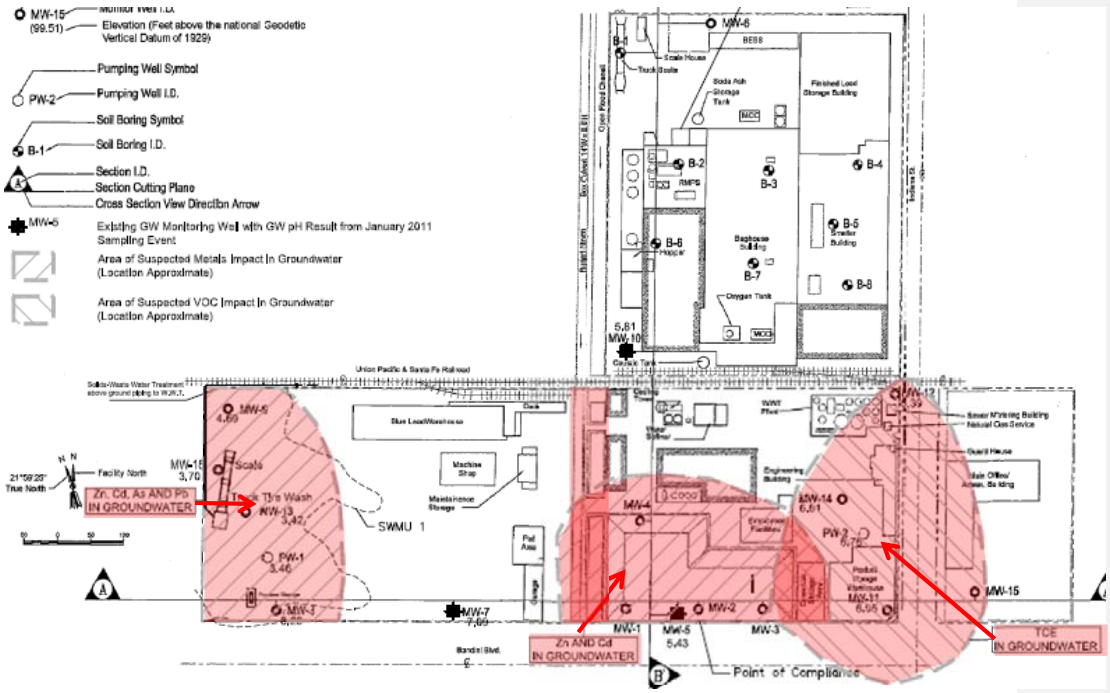
Formatted: Font: Bold

In November 2014, the leak detection system for the Containment Building in the North Yard was determined by Exide staff to be inoperable. Further investigation found that the primary and secondary liner systems in the containment building had been breached and hazardous levels of lead were found in the underlying soil. Investigation of this area is ongoing.

Groundwater Contamination (South and West Yards)

Formatted: Font: Bold

With the exception of the containment building the areas of major soil contamination have also impacted groundwater. Soil and groundwater impacts due to the liner system failure under the Containment Building are currently under investigation. Areas of groundwater impacts from heavy metals, acid, and VOCs are shown on the following Figure.



3.1.2.4 Areas of Contamination to be addressed under Corrective Actions

Formatted: Font: Bold

Based on previous investigation dating back to the 1980's and recent documented releases, the following Areas of Contamination were identified by DTSC staff to be addressed under the Corrective Action process:

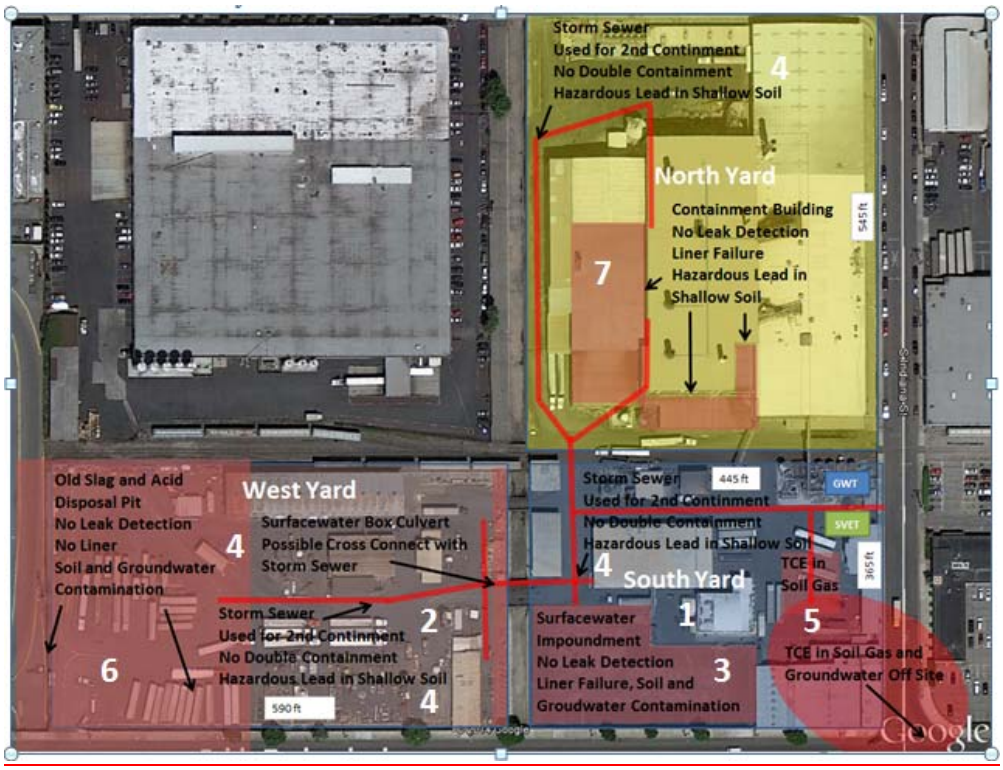
1. The shallow soil in the South Yard is heavily contaminated with heavy metals from smelter operations starting in the 1920's.
2. The shallow soil in the West Yard is heavily contaminated with heavy metals from smelter operations starting in the 1930's.
3. Deep soil and groundwater are contaminated with heavy metals under the stormwater surface impoundment installed in the 1980's in the South Yard. In the early 1980's the surface impoundment was rebuilt due to a failed liner system. Currently the leak detection system is not functioning and the surface impoundment does not meet the regulatory standards.

4. The associated stormwater pipe system was used for secondary containment for many units. In 2013 it was found to be clogged with sediment containing hazardous levels of lead and replaced. Cross connections with the storm sewer and other Units were also found. Hazardous levels of lead and other metals deposited due to leaks in the sewer pipe were left in place after the Storm Sewer System Interim Corrective Measures competed in 2014.

5. Soil gas and ground water were contaminated from solvents used between the 1930's to 1980's in the mixed metals extrusion process in the east side of the South Yard.

6. Battery acid disposed of in the Old Slag Disposal Pit has mobilized heavy metals in the waste and contaminated soil and groundwater. The disposal pit in the western portion of the west yard contains approximately 71,700 cubic yards of fill including hazardous slag material at depths up to 40 feet below the ground surface.

7. Shallow soil in the North Yard was contaminated from a historical metals storage yard. Current operations have contaminated shallow soil and may have contaminated deeper soil and groundwater due to a failure of the leak detection and liner system in the Feed Material Containment Building.



3.1.2.5 Phase 2 Contingent Closure

Formatted: Font: Bold

~~Initial findings of the RFI and information obtained during the RCRA Facility Assessment (RFA) have determined that the majority of the historic facility operations were conducted in the South Yard and eastern portions of the West Yard, while on-site disposal of slag and other waste materials occurred across the Site with significant amounts of material (up to 45 +/- feet) placed in a former quarry pit in the western portions of the West Yard. Operations in the North Yard appear to have been limited to shallow (generally <3 feet) filling with slag and battery breaking activities until the early 1980s when battery recycling operations were moved from the South Yard to the North Yard. RCRA regulated activities in the South Yard since the early 1980s have been limited essentially to container storage, wastewater treatment and stormwater management.~~

~~Subsurface conditions in the South and West Yards reflect the intensive historic use in these areas and the former IS units within these areas are known or suspected to be underlain and surrounded by historic contamination subject to the CACO. In addition, subsurface impacts (if any) from the former IS units situated in these areas would be indistinguishable from the pre-RCRA impacts when all or most of the site was unpaved and waste management activities were performed directly on the ground surface and without secondary containment, and waste was disposed on site. (Examples of this are the excavation of the stormwater surface impoundment in the early 1980s when lead impacted soil above hazardous levels was encountered to depths 6 to 8 feet below the ground surface, and the management of waste piles on the ground surface at multiple locations throughout the site).~~

The Phase 2 (Contingent Closure) scenario presented herein has been developed based on the assumption that the concrete floor (nominal thickness 0.8 feet) and 5 feet of underlying soil beneath all former IS units will be excavated and sent for off-site disposal. (In the Reverb Feed Room, two layers of concrete floor were assumed.) ~~Actual~~ Phase 2 (Contingent Closure) activities will be further defined ~~established between the Phase 1 and Phase 2 Closure~~ based on ~~the results of Phase 1 soil~~subsurface sampling results completed during Phase 1 and after appropriate corrective action goals have been determined~~and the closure performance standard for soil~~. This Phase 2 (Contingent Closure) further assumes that hazardous waste cannot be removed beneath most former IS units following 5 feet of soil removal and therefore, assumes that a RCRA Cap must be installed over portions of the North and South Yard. Phase 2 (Contingent Closure) is expected to be modified, with DTSC approval, to accommodate the relationship between the selected Corrective Action measures and subsurface impacts from the former IS units. Clean up levels and ~~R~~remedy selection under the Corrective Action process includes an opportunity for public review and comment that is separate from the Closure process.

3.1.3 Proposed Units and Ancillary Sumps

Centrifuge No. 2 (Unit 81), RMPS Acid Storage Tank (Unit 82), Shredder (Unit 83), Vibrating Screen (Unit 84), Industrial Cell Extraction (Unit 85), Industrial Cell Shredder (Unit 86), Neptune Scrubber Tank (Unit 88), Mud Tank Area Sump 2 and Oxidation Tank Area Sump were proposed as part of the Part B Permit Application and/or a Class 2 Interim Status Permit Modification, but were not installed. These units are not included in the Closure Plan as they were never installed.

3.2 CLOSURE PERFORMANCE STANDARDS

Closure performance standards will comply with 22 CCR 66265.111 as discussed in Section 3.1. Pursuant to 22 CCR 66265.114, all hazardous residue, equipment, ancillary equipment, secondary containment areas, structures and soil associated with former IS Units shall be properly disposed of, or decontaminated by removing all hazardous waste and hazardous waste residues. To confirm that equipment, structures, and buildings have not been or are no longer contaminated with hazardous constituents, a surface sample must be taken. Procedures will vary depending on the type of contamination. The following document will be used for guidance: Compendium of Waste Sampling Procedures, EPA/540/P-91/008, as well as Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Office of Solid Waste and Emergency Response. When no SW-846 methods or 22 CCR Chapter 11 methods are available, then other methods approved by reputable organizations (e.g., ASTM, AOAC) may be used. Exide may propose an alternative method which should be reviewed and approved by the Department. Non-detect is used as the clean-up standard. It is recognized that for small pieces of equipment (e.g., pumps and filters that have been in contact with hazardous wastes, it is very difficult to gain access to interior surfaces. The use of wipe samples to confirm decontamination is inappropriate. The analysis of the rinsewaters or other rinse solvents to non-detect levels is acceptable proof that small equipment has been decontaminated and historic IS Units shall be properly disposed of, or decontaminated by removing all hazardous waste and residues to background concentrations.

Closure of the site will be conducted in two phases. Phase 1 includes inventory removal; unit decontamination and removal; soil, soil gas and floor/pavement sampling; and decontamination and deconstruction of buildings containing former Interim Status units to grade. Interim Closure Performance Standards are presented for Phase 1. Phase 2 addresses below grade impacts from former Interim Status unit operations. Final Closure Performance Standards for Phase 2 closure are to be developed to be protective of human health and the environment as demonstrated by a site wide DTSC approved Health Risk Assessment.

The Closure Plan will achieve the performance standards through a combination of requirements as described in the following subsections. In most instances, the former Interim Status Unit (IS Unit) and its ancillary equipment will be removed during Phase 1 Closure. Several IS Units, including the West Yard Truck Wash (Unit 87), Pump Sump (Unit 46) and stormwater system, surface impoundment (Unit 78), and a few key floor tanks/sumps will be partially removed and cleaned, but must remain operational through Phase 2 to manage stormwater runoff and provide a location to clean vehicles exiting the Site. Similarly, secondary containment area and building floors must remain in-place to prevent erosion of subsurface soils until Phase 2 soil excavation activities are completed. All hazardous waste and residues will be removed in accordance with the closure performance standards or incorporated~~ion~~ into areas being closed with a ~~hazardous~~ waste-in-place designation or managed as part of the site-wide Corrective Action.

The specific scope of the Phase 2 Closure activities will be determined based on the results of Phase 1 Closure sampling results for those former IS Units (and ancillary equipment/component) not removed as part of Phase 1 Closure and underlying soils. Phase 2 Closure is expected to include soil excavation to clean-up levels and Closure Performance Standards, demolition of secondary containment areas and foundations remaining from Phase 1 and exhibiting hazardous characteristics, or required for removal to access underlying hazardous soils, site grading and reconfiguration or removal of the

stormwater collection and management system. Stormwater runoff from the entire Site, including any of the former IS Units or their ancillary components and equipment remaining in-place after Phase 1, must still be collected and treated until they are addressed under Phase 2 Closure and achieve the Closure Performance Standards.

While Closure of a specific former IS Unit will be deemed complete when the Phase 2 Closure Performance Standards are achieved, additional cleaning, excavation, demolition or other remedial measures may be warranted as part of site-wide Corrective Action. The specific clean-up levels required under Corrective Action will utilize default levels approved by DTSC, background levels established through a site-specific or regional study approved by DTSC, and/or be established based on the results of a site-specific risk assessment. Establishing and implementing Corrective Action clean-up levels is not part of the Closure process and is not covered in the Closure Plan.

The facility subsurface, as a whole, is significantly contaminated. Initial findings of the RFI and information obtained during the RCRA Facility Assessment (RFA) have determined that the majority of the historic facility operations were conducted in the South Yard and eastern portions of the West Yard, while on-site disposal of slag and other waste materials occurred across the Site with significant amounts of material (up to 45 +/- feet) placed in a former quarry pit in the western portions of the West Yard. Operations in the North Yard appear to have been limited to shallow (generally <3 feet) filling with slag and battery breaking activities until the early 1980s when battery recycling operations were moved from the South Yard to the North Yard. RCRA regulated activities in the South Yard since the early 1980s have been limited essentially to container storage, wastewater treatment and stormwater management.

Subsurface conditions in the South and West Yards reflect the intensive historic use in these areas and the former IS units within these areas are known or suspected to be underlain and surrounded by historic contamination subject to the CACO. Furthermore,

DTSC has notified Exide that releases from the Containment Building in the North Yard have also occurred. Subsurface impacts (if any) from the former IS units situated in these areas would be indistinguishable from the pre-RCRA impacts when all or most of the site was unpaved and waste management activities were performed directly on the ground surface and without secondary containment, and waste was disposed on-site (Examples of this are the excavation of the stormwater surface impoundment in the early 1980s when lead impacted soil above hazardous levels was encountered to depths 6 to 8 feet below the ground surface, and the management of waste piles on the ground surface at multiple locations throughout the site). Efforts to discern between recent releases from former IS units and historic releases from historic units would likely be inconclusive and a relative waste of resources. Instead, Exide recommends using data collected as part of the CA program to develop sample screening and/or clean-up levels with the goal of achieving 1) clean closure for the facility as a whole (no restrictions), 2) closure with restrictions (industrial land use only), or 3) closure as a RCRA-hazardous-waste landfill.

The clean-up levels, despite having been developed under the CA program, would then be identified and used as Closure Performance Standards for implementation of the Closure Plan. This may result in a significant modification to Exide's Closure Plan, once approved by DTSC, and would require the appropriate steps to complete (i.e., notifications, document submittals, fees, public comment period, etc.).

Management of tanks, equipment and deconstruction material is summarized in Table 3.1. Phase 1 Performance standards for each unit are summarized in Table 3.2.

3.2.1 Closure Performance Standard for Former IS Tanks and Ancillary Equipment

The former IS Units regulated as tanks are constructed from steel, plastic or concrete and had ancillary components consisting of piping, controls, ladders and platforms, and miscellaneous pieces of equipment, as described in greater detail in Appendix D. The tanks are supported on

concrete pedestals or supports and secured using anchors (bolts, brackets and tie downs). The majority of the tanks are located within secondary containment areas constructed from concrete with chemical resistant coating and sump(s) for collecting liquid.

Table 3.2 provides a detailed list of each former IS Unit, the unit type, material of construction, cleaning techniques and disposition at the end of Phase 1 Closure, and Closure Performance Standards. As shown on Table 3.2, former IS Tanks can be removed and sent for reuse at another Exide facility; removed and sent for off-site recycling; removed and sent for off-site disposal, or remain in-place. The Closure Performance Standard for each is provided below.

3.2.1.1 **Closure Performance Standards for Removal and Reuse**

The Closure Performance Standards in 66265.111(c) require Exide to close tank systems in a manner that complies with the closure and post-closure requirements in 66265.197. Section 66265.197 (c) requires Exide to remove or decontaminate all waste residuals, contaminated equipment components (liners, etc), contaminated soil, and structures and equipment contaminated with waste, and manage them as hazardous waste, unless 66261.3(d) applies. The closure plan, closure activities, a cost estimates for closure, and financial responsibility for tank systems will meet all of the requirements specified in articles 7 and 8 of chapter 15.

Three tanks (former IS Units 12, 55 and 79) ~~will~~ may be salvaged and sent to Exide facilities in Canon Hollow, Missouri or Muncie, Indiana for reuse if sampling analysis results confirm concentrations of potential contaminants are non-detect. Former IS Unit 12, Santa Maria Paste Thickening Unit, has never been used. Former IS Units 55 (WWTP Flocculation Tank) and 79 (RMPS Surge Tank) have nearly all of their design life remaining. ~~Salvaged equipment is not discarded and therefore does not meet the definition of waste under 22 CCR 66261.2.~~In accordance with 22 CCR 66265.197, all waste residues, contaminated containment system components, contaminated soils, and structures and equipment contaminated with waste will be removed, and managed as hazardous waste unless 22 CCR 66261.3(d) applies. ~~Although not a~~

waste, Exide will pressure wash the tanks and non-electrical components in an effort to remove visible accumulations of waste residue ("visibly clean") and wrap the cleaned equipment in plastic before removal from the Site. Electrical components will be dry vacuumed using a vacuum equipped with a HEPA filter. No sampling is required on tanks and ancillary equipment proposed for removal and reuseTanks and ancillary equipment proposed for removal and reuse will be sampled using methods described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846 and required under California Code of Regulations, title 22, division 4.5, chapter 11, article 3. If sampling indicates that the waste residues, contaminated containment system components, contaminated soils, or structures and equipment contaminated with waste exhibit characteristics of hazardous waste identified in California Code of Regulations, title 22, division 4.5, chapter 11, article 3, they will be removed and managed as a hazardous waste, or decontaminated.

3.2.1.2 **Closure Performance Standard for Recycling**

Steel tanks and metallic ancillary equipment and components (i.e. scrap metal) will be segregated, cleaned to remove visible contamination and sized for recyclingremoved or decontaminated, and managed as a hazardous waste, unless 22 CCR 66261.3(d) applies. Scrap metal that is not contaminated with a hazardous waste, such that the metal does not exhibit any characteristic of a hazardous waste under California Code of Regulations, division 4.5, chapter 11, article 3, does not meet the definition of hazardous waste under 22 CCR 66261.23, and therefore is not a hazardous waste per 22 CCR 66261 66265.197. Although not a wasteIn accordance with 22 CCR 66265.197, Exide will manage the scrap metaltanks and ancillary equipment as hazardous debris waste, unless 22 CCR 66261.3(d) applies. and perform cleaning to achieve a Clean Debris Surface. The term "Clean Debris Surface" is defined in footnote 3 of Table 1 "Alternative Treatment Standards for Hazardous Debris" as *"The surface, when viewed without magnification, shall be free of all visible contaminated soil and hazardous waste except that residual staining from soil and waste consisting of light shadows, slight streaks, or minor discoloration, and soil and waste in crevices, cracks and pits shall be limited to no more than*

~~*5% of each square inch of surface area*". Water washing and spraying (i.e. pressure washing) is one of the technologies recognized in 22 CCR 66268.45 as appropriate for removing site COCs and as stated in the Federal Register (August 8, 1992) "it should not allow toxic contaminants to remain at a level that could pose a hazard to human health and the environment absent Subtitle C regulation", meaning that following cleaning to a Clean Debris Surface, the tank or piece of equipment will be non-hazardous.~~ Tanks and ancillary equipment proposed for designation as Scrap Metal will be sampled using methods described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846 and required under California Code of Regulations, title 22, division 4.5, chapter 11, article 3. If sampling indicates that the waste residues, contaminated containment system components, contaminated soils, or structures and equipment contaminated with waste exhibit characteristics of hazardous waste identified in California Code of Regulations, title 22, division 4.5, chapter 11, article 3, they will be removed and managed as a hazardous waste, or decontaminated. ~~No sampling is required for scrap metal achieving a Clean Debris Surface.~~

~~If a Clean Debris Surface is not achieved, Exide may elect to 1) conduct non-destructive sampling (e.g. wipe samples) to demonstrate that the testing does not detect inorganic (CAM 17 metals) constituents above the Method Detection Limit (MDL); 2) conduct destructive testing to demonstrate that results for CAM 17 metals TTLC and STLC analysis are below limits for hazardous waste. STLC testing will not be required for constituents in samples with TTLC results less than 10 times STLC limits; 3) send the material for reuse at a permitted hazardous waste facility; or 4) send the material for disposal at an appropriately permitted disposal facility. Scrap metal painted with lead based paint may produce testing results above the MDL (wipe samples) or above TTLC/STLC levels even after achieving a visibly clean surface. If lead based paint is suspected, Exide may conduct additional testing using XRF or paint chip analysis and if proven to be positive for lead based paint, will send such materials for recycling.~~

3.2.1.3 **Closure Performance Standards for Off-Site Disposal**

Tanks and ancillary equipment (including piping) and components not retained for reuse, recycling or remaining in operation after Closure will be removed and disposed off-site. The Closure Performance Standard for tanks and equipment destined for off-site disposal will be management as a hazardous waste and having residual contents removed and be sufficiently clean of residue that could create dust during sizing, loading/unloading and transportation, or be wrapped in plastic. Tanks and equipment intended for disposal shall be characterized per receiving facility requirements. In accordance with 22 CCR 66265.197, Exide will manage the tanks and ancillary equipment as hazardous waste, unless 22 CCR 66261.3(d) applies. Tanks and ancillary equipment proposed for designation as 'non-hazardous' will be sampled using methods described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846 and required under California Code of Regulations, title 22, division 4.5, chapter 11, article 3. If sampling indicates that the tanks and equipment contaminated with waste exhibit characteristics of hazardous waste identified in California Code of Regulations, title 22, division 4.5, chapter 11, article 3, they will be managed as a hazardous waste. ~~Tanks and equipment intended for non-hazardous disposal shall be less than TTLC and STLC (within California), or TCLP (for wastes being disposed out of state).~~ STLC testing will not be required for constituents in samples with TTLC results less than 10 times STLC limits.

Tanks and equipment must meet CalTrans and DTSC requirements for transportation and recordkeeping. Large pieces of equipment destined for disposal that are not fully contained in a covered roll-off shall be wrapped in plastic before leaving the facility.

3.2.1.4 **Closure Performance Standards for Remaining Tanks and Equipment**

The Pump Sump (former Unit 46) and ancillary stormwater piping system, and the West Yard Truck Wash (former Unit 87) will remain intact and fully operational into Phase 2. Additional discussion is provided in Section 3.2.4 regarding Closure Performance Standards for the stormwater management system. The West Yard Truck Wash concrete pad and sump will be the subject of chip sampling after completion of initial (Phase 1) cleaning. The Closure Performance

Standard for the West Yard Truck Wash concrete pad and sump ~~chip samples, if the West Yard Truck Wash will remain beyond Phase 2,~~ will be removal, and management as a hazardous waste unless 22 CCR 66261.3(d) applies~~results below TTLC and STLC hazardous waste thresholds~~. STLC testing will not be required for constituents in samples with TTLC results less than 10 times STLC limits. Concrete pads and sumps proposed for designation as 'non-hazardous' will be sampled using methods described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846 and required under California Code of Regulations, title 22, division 4.5, chapter 11, article 3. If sampling indicates that the concrete pads or sumps exhibit characteristics of hazardous waste identified in California Code of Regulations, title 22, division 4.5, chapter 11, article 3, they will be managed as a hazardous waste. ~~Results of the chip sampling will provide information regarding the effectiveness of cleaning efforts on the concrete pad and sump. Phase 1 Closure chip sample results failing to achieve the Closure Performance Standards will indicate that more aggressive cleaning is required for portions of the system that may remain in place following completion of Phase 2 Closure.~~ Exide will already be required to collect and treat all wash water and sediment accumulating in the West Yard Truck Wash through completion of Phase 2 Closure.

The remaining tanks staying in operation after Phase 1 (Battery Dump Bin Sump (former Unit 5), RMPS Floor Sump (former Unit 6), Containment Building Truck Wash Sump (former Unit 51), and WWTP Sump (former Unit 62)) will have had stainless steel liners, pumps, piping and other ancillary equipment removed during Phase 1 and the concrete walls and bottom of the sump will be pressure washed and chip sampled. These former IS units, along with the other ancillary sumps summarized in Table 1.3 (which will also be cleaned and chipped sampled), situated at low points and former basement areas (see Figure 2.11), are required for capturing and removing stormwater runoff, and water generated during dust suppression and wash down during Phase 2 Closure. The Closure Performance Standard for these tanks will be removal, and management as a hazardous waste unless 22 CCR 66261.3(d) applies. Tanks and sumps proposed for designation as 'non-hazardous' will be sampled using methods described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846

and required under California Code of Regulations, title 22, division 4.5, chapter 11, article 3. If sampling indicates that the tanks or sumps exhibit characteristics of hazardous waste identified in California Code of Regulations, title 22, division 4.5, chapter 11, article 3, they will be managed as a hazardous waste. ~~Results of the initial chip sampling will be compared against the TTLC and STLC levels and provide information regarding the effectiveness of cleaning efforts on the sump. Phase 1 Closure chip sample results failing to achieve the Closure Performance Standards will indicate that more aggressive cleaning is required for portions of the system that may remain in place following completion of Phase 2 Closure, or the feature will be addressed during Phase 2. If they will remain, the Closure Performance Standard for concrete sumps (tanks) to remain in place are non-hazardous TTLC and STLC (where necessary) test results for chip or core samples pursuant to 22 CCR 66261.24.~~ STLC testing will not be required for constituents in samples with TTLC results less than 10 times STLC limits.

3.2.2 Closure Performance Standard for Former IS Miscellaneous Units

As identified on Table 3.2, miscellaneous units and their ancillary equipment and components may be salvaged for reuse at another Exide facility, sent for recycling (e.g. steel) or sent for disposal (e.g. plastic and general debris). No former IS Miscellaneous Units are proposed to remain on-site after Phase 1 Closure. The performance standards for miscellaneous units shall be management as a hazardous waste unless 22 CCR 66261.3(d) applies~~the same as those with a similar final disposition described for tanks and ancillary equipment in Section 3.2.1~~.

The former IS Miscellaneous Units planned to be sent for reuse at another Exide facility are the RMPS Hammer Mill (former Unit 40); Rotary Kiln (former Unit 69); brick, burners and feed screws from the Reverb Furnace (former Unit 36); Blast Furnace crucible (former Unit 37), and twelve (12) kettles (former Units 89-91, 93-98 and 100-102). The kettles may also be recycled off-site. These former units or former unit components have all or most of their useful design life remaining. In accordance with 22 CCR 66265.114, Exide will remove all hazardous waste and residues from the IS Miscellaneous Units. IS Miscellaneous Units proposed for reuse at another facility will be sampled using methods described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846 and required under California Code of Regulations, title 22, division 4.5, chapter 11, article 3. If sampling indicates that the IS Miscellaneous Units exhibit characteristics of hazardous waste identified in California Code of Regulations, title 22, division 4.5, chapter 11, article 3, they will be managed as a hazardous waste.

3.2.3 Closure Performance Standard for Former IS Containment Building and Containment Areas

The Closure performance standard for secondary containment areas and containment building walls and floors ("containment areas") ~~to remain in place are~~ is removal, and management as a hazardous waste unless 22 CCR 66261.3(d) applies~~non-hazardous TTLC and STLC (where~~

~~necessary) test results for concrete or asphalt chip/core samples pursuant to 22 CCR 66261.24~~. STLC testing will not be required for constituents in samples with TTLC results less than 10 times STLC limits. Containment areas failing non-detect sampling results will be managed as hazardous waste.

In accordance with 22 CCR 66265.1102, Exide will remove the containment building components and containment areas, and manage them as hazardous waste unless 22 CCR 66261.3(d) applies. Waste residues, contaminated containment system components, contaminated subsoils, and structures and equipment contaminated with waste and leachate proposed for designation as 'non-hazardous' will be sampled using methods described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846 and required under California Code of Regulations, title 22, division 4.5, chapter 11, article 3. If sampling indicates that the containment building components and containment areas exhibit characteristics of hazardous waste identified in California Code of Regulations, title 22, division 4.5, chapter 11, article 3, they will be managed as a hazardous waste.

If, after removing structures, foundations and subsoil down to 5-feet below surface and making all reasonable efforts to effect removal or decontamination of subsoils beneath 5-feet below surface, Exide demonstrates and DTSC concurs that not all contaminated subsoils can be practicably removed or decontaminated, Exide will submit an application to modify the Closure Plan to include creation of a new solid waste management unit as part of closure in accordance with 22 CCR 66270.42(c).

~~Containment areas failing TTLC and STLC (where necessary) sampling results will be managed as hazardous waste during Phase 2 or closed with a hazardous waste in-place designation. However, pursuant to previous discussions between Exide and DTSC, and as discussed in greater detail elsewhere in the Closure Plan, the decision for requiring concrete or asphalt removal at this facility is complicated by the fact that the majority of the site is underlain by materials and soil impacted at or above hazardous levels from operations prior to promulgation of the RCRA~~

~~regulations (historic impacts) and decisions related to Phase 2 Closure (including asphalt or concrete removal) will be made in conjunction with decisions for site-wide Corrective Action.~~

3.2.4 Closure Performance Standard for Former IS Stormwater System and Surface Impoundment

As described in Section 2.8.3.3, the stormwater management system is integral to the continued collection and removal of stormwater, dust suppression water and wash water now and during Phase 1 and 2 Closure. Depending on timing with site-wide Corrective Action and receipt of all required permits and approvals for direct discharge of site stormwater, it may also be necessary to continue to collect and treat stormwater runoff after completion of the Phase 2 Closure. The Closure Performance Standard for the stormwater system including ~~(~~pipes, manholes~~,~~ and pump sumps ~~and stormwater surface impoundment)~~ is removal, and management as a hazardous waste unless 22 CCR 66261.3(d) applies~~removal (with off-site disposal or recycling), cleaning to remove hazardous waste and hazardous waste residue, or closure with hazardous waste in place~~. Closure Performance Standards for the stormwater management system must be achieved by the end of Phase 2 Closure or before Exide may discontinue collection and treatment of stormwater (whichever occurs first). ~~Closure with hazardous waste in place may only be performed with DTSC approval.~~

In accordance with 22 CCR 66265.197, Exide will manage the stormwater system as hazardous waste, unless 22 CCR 66261.3(d) applies. Waste residues, contaminated containment system components, contaminated soils, and structures and equipment contaminated with waste proposed for designation as 'non-hazardous' will be sampled using methods described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846 and required under California Code of Regulations, title 22, division 4.5, chapter 11, article 3. If sampling indicates that the stormwater system components exhibit characteristics of hazardous waste identified in California Code of Regulations, title 22, division 4.5, chapter 11, article 3, they will be managed as a hazardous waste.

If, after removing structures, foundations and subsoil down to 5-feet below surface and making all reasonable efforts to effect removal or decontamination of subsoils beneath 5-feet below surface, Exide demonstrates and DTSC concurs that not all contaminated subsoils can be practicably removed or decontaminated, Exide will submit an application to modify the Closure Plan to include creation of a new solid waste management unit as part of closure in accordance with 22 CCR 66270.42(c).

Near the end of Phase 1 Closure, the stormwater system piping and structures, Unit 46 and surface impoundment will be flushed and cleaned to remove accumulated sediment (initial cleaning). Wipe Appropriate samples will be collected in accordance with "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846 and required under California Code of Regulations, title 22, division 4.5, chapter 11, article 3.from the flow line at the down slope end of each HDPE pipe run, at the bottom of each HDPE manhole and within the Unit 46 stainless steel insert. Destructive samples of the surface impoundment liner system will be collected at 25% of proposed locations during soil sampling. Results of the Phase 1 sampling will provide information regarding the effectiveness of cleaning efforts on the system, indicate if more aggressive cleaning is required to achieve Closure Performance Standards for portions of the system that may remain in-place following completion of Phase 2 Closure, and will be considered while developing Phase 2 plans for removal and reconfiguration of the stormwater system. Regardless of wipe sample results that may exceed the MDLsclosure performance standards, the stormwater system will remain operational into Phase 2; however, Exide must continue to collect and treat all stormwater through the temporary WWTP.

At the end of Phase 2, those components of the stormwater collection system to remain in place (if any), including the Unit 46 primary concrete tank (if it will remain), and surface impoundment (if it will remain) will be cleaned removedand tested for Closure. Wipe samples will be collected to demonstrate the performance standards (22 CCR 66265.197) for the

stormwater management system to remain in place have been achieved. If the wipe sample result is less than the method detection limit, then the performance standard has been achieved and the portion of the system represented by the sample can remain in place. If the wipe sample result is greater than the method detection limit, then a sample of the stormwater system component represented by the sample (i.e., destructive sample) will be collected and analyzed. If a sample of the stormwater system structure is collected, the performance standards for the stormwater system to remain in place are non-hazardous TTLC and STLC (where necessary) test results pursuant to 22 CCR 66261.24. STLC testing will not be required for constituents in samples with TTLC results less than 10 times STLC limits.

For the secondary containment of the stormwater system (EPDM layer and concrete manhole), the performance standard for the stormwater system components and 5 feet of soil beneath the components is removal, and management as a hazardous waste unless 22 CCR 66261.3(d) applies to remain in place will be passing pressure testing of the primary pipe and hydrostatic testing of the primary manhole as discussed in Section 10.2.2.2. If the pressure testing does not pass, then soil sampling must be performed along the alignment of the pipe as described in Section 10.2.2.2.

Samples of the primary and secondary liner system at the surface impoundment will be collected to demonstrate the performance standards to remain in place have been achieved. The Closure Performance Standard for the stormwater surface impoundment is removal or decontamination of all waste residues, contaminated containment system components, contaminated subsoils, and structures and equipment contaminated with waste and leachate,management as a hazardous waste unless 22 CCR 66261.3(d) applies, and minimization of the need for further maintenance. The performance standards for the stormwater system to remain in place are non-hazardous TTLC and STLC (where necessary) test results pursuant to 22 CCR 66261.24. STLC testing will not be required for constituents in samples with TTLC results less than 10 times STLC limits.

In accordance with 22 CCR 66265.228, Exide will remove or decontaminate all waste residues, comtaminated containment system components, contaminated subsoils, and structures and equipment contaminated with waste and leachate, and manage them as hazardous waste, unless 22 CCR 66261.3(d) applies. Waste residues, contaminated containment system components, contaminated subsoils, and structures and equipment contaminated with waste and leachate proposed for designation as 'non-hazardous' will be sampled using methods described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846 and required under California Code of Regulations, title 22, division 4.5, chapter 11, article 3. If sampling indicates that the surface impoundment components exhibit characteristics of hazardous waste identified in California Code of Regulations, title 22, division 4.5, chapter 11, article 3, they will be removed and managed as a hazardous waste, or decontaminated.

If, after removing structures, foundations and subsoil down to 5-feet below surface and making all reasonable efforts to effect removal or decontamination of subsoils beneath 5-feet below surface, Exide demonstrates and DTSC concurs that not all contaminated subsoils can be practicably removed or decontaminated, Exide will submit an application to modify the Closure Plan to include creation of a new soild waste management unit as part of closure in accordance with 22 CCR 66270.42(c).

3.2.5 Closure Performance Standards for Concrete Demolition Debris

Concrete building components not covered by Section 3.2.3 designated for deconstruction will be removed and disposed off-site. The performance standard for concrete destined for disposal is management as a hazardous waste unless 22 CCR 66261.3(d) applies~~will be visually clean of residue that could generate fugitive lead dust during demolition and handling~~. Characterization sampling will be performed as required by the disposal facility.

The Closure Performance Standard for concrete not associated with hazardous waste management units to remain in-place is non-detect sampling analysis results. If the test results

fail, the concrete will be removed and disposed at the appropriate disposal facility. Contaminated concrete will be managed as hazardous waste if the appropriate sample results indicate the material exhibits characteristics of hazardous waste identified in California Code of Regulations, title 22, division 4.5, chapter 11, article 3.~~are non hazardous TTLC and STLC (where necessary) test results for chip/core samples pursuant to 22 CCR 66261.24~~. STLC testing will not be required for constituents in samples with TTLC results less than 10 times STLC limits.

~~Contaminated concrete will be managed as hazardous waste during Phase 2 if the chip/core samples exhibit hazardous waste characteristics.~~

3.2.6 Closure Performance Standards for Steel Structures and Steel Debris

The Reverb Furnace Feed Room, Blast Furnace Feed Room, RMPS Building, Smelter Building, Baghouse Building, former Finished Lead Warehouse, ~~and~~ Desulfurization Building, and Container Storage Areas 1, 2 and 3 ~~are all proposed for deconstruction~~will be deconstructed and removed. ~~Steel proposed for recycling as scrap metal is not discarded pursuant to 22 CCR 66261.2(b) and not a waste, and therefore not a hazardous waste per 22 CCR 66261.197.~~ In accordance with 22 CCR 66265.1102, at closure of a containment building, all waste residues, contaminated containment system components, contaminated subsoils, and structures and equipment contaminated with waste and leachate must be managed as a hazardous waste unless 22 CCR 66261.3(d) applies. The effectiveness of decontamination on metal building components, and structural steel proposed for deconstruction and intended for off-site scrap metal recycling will be determined by the Closure Performance Standard. The Closure Performance Standard for metal building components and structural steel proposed for deconstruction and intended for off-site scrap metal recycling is management as a hazardous waste unless 22 CCR 66261.3(d) applies. ~~visual inspection (i.e., will have a Clean Debris Surface as defined in the Alternate Treatment Standards for Hazardous Debris (USEPA Debris Rule (40 CFR 268.45))).~~ The materials intended for off-site recycling will also meet waste

stream characterization requirements for the facility receiving the materials. Steel proposed for recycling that does not ~~achieve a Clean Debris Surface~~meet the Closure Performance Standard ~~may~~ will be sent to a hazardous waste recycling facility~~, disposed, or subject to testing to demonstrate it is not a hazardous waste.~~.

~~The former Finished Lead Warehouse, and Container Storage Areas 1, 2 and 3 are proposed to remain on-site and are not intended for deconstruction. In an abundance of caution, the effectiveness of decontamination on these structures, even after achieving a Clean Debris Surface, will be determined by collecting wipe samples. The performance standard for unpainted metal components of the buildings will be the method detection limit (MDL) for wipe samples. Wipe sample results below the MDL identified for wipe samples will be considered absent of hazardous constituents and deemed clean. If wipe sample results are above the MDLs, Exide will have the choice of re-cleaning and re-testing or deconstruction and disposal. Additionally, if the metal components achieved a Clean Debris Surface as defined in the Alternate Treatment Standards for Hazardous Debris (e.g. the USEPA Debris Rule), Exide may choose to repaint the surfaces using a lead-free primer/paint. For existing painted metal surfaces on these structures, Exide will test the paint using XRF techniques or paint chip testing and if the paint is shown to contain lead or other inorganic constituents, wipe sampling will not be required.~~

3.2.7 Closure Performance Standards for Equipment

Ancillary equipment and electrical equipment will be removed and may be salvaged, sent for recycling (e.g. scrap metal), or sent for disposal~~, or remain on-site for reuse (such as storm water pumps and controls)~~. The Closure Performance Standard for ancillary equipment and electrical equipment is the method detection limit (MDL) for wipe samples and/or rinseate or cleaning solution samples. Equipment that will be re-used on-site after Phase 2 Closure shall have sample results below the MDL for the equipment to be considered absent of hazardous constituents and deemed clean. If sample results are above the MDLs, Exide will have the choice of re-cleaning

and re-testing or deconstruction and disposal. Contaminated equipment will be treated as hazardous waste and sent to an appropriately-permitted hazardous waste facility if the confirmation samples still exhibit hazardous waste characteristics even after decontamination. Ancillary equipment proposed for designation as 'non-hazardous' will be sampled using methods described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846 and required under California Code of Regulations, title 22, division 4.5, chapter 11, article 3. If sampling indicates that the ancillary equipment exhibits characteristics of hazardous waste identified in California Code of Regulations, title 22, division 4.5, chapter 11, article 3, they will be managed as a hazardous waste. ~~The performance standards for ancillary equipment shall be the same as those described for tanks and ancillary equipment in Section 3.2.1.~~

~~Equipment that is salvaged for reuse at another Exide facility or proposed for disposal shall be visually clean. Equipment that will be re-used on-site after Phase 2 Closure will be wipe sampled, or analyzed based on rinse waters or cleaning solution that have passed through the equipment. The performance standard will be the method detection limit. If wipe or rinsate samples do not meet cleanup levels, Exide may elect to re-clean and retest the equipment until passing results are received, salvage the item for use at another Exide facility, recycle, or dispose of equipment. Electrical equipment that cannot be washed, such as motors and switches shall be vacuumed using a vacuum equipped with HEPA filter and wiped with damp or dry rags until visually clean.~~

3.2.8 Closure Performance Standard for Soils

The Closure Performance Standards for soil up to five feet beneath a unit is removal, and management as a hazardous waste unless 22 CCR 66261.3(d) applies.~~are non-hazardous Total Threshold Limit Concentrations (TTLC) and Soluble Threshold Limit Concentrations (STLC) (where necessary) test results pursuant to 22 CCR 66261.24, and non-corrosive test results based on pH testing per 22 CCR 66261.22~~. The Closure Performance Standard for contaminated soil

below five feet beneath a unit is background for inorganics; non-detect for organics; or health-based risk assessment levels. STLC testing will not be required for constituents in samples with TTLC results less than 10 times STLC limits. Contaminated soil with hazardous characteristics, proposed for remediation during the Phase 2 Closure, will be managed as hazardous waste.

If, after removing structures, foundations and subsoil down to 5-feet below surface and making all reasonable efforts to effect removal or decontamination of subsoils beneath 5-feet below surface, Exide demonstrates and DTSC concurs that not all contaminated subsoils can be practicably removed or decontaminated, Exide will submit an application to modify the Closure Plan to include creation of a new solid waste management unit as part of closure in accordance with 22 CCR 66270.42(c). A site-wide Health and Ecological Risk Assessment will be conducted to estimate the cumulative cancer risk, non-cancer hazard and adverse effects of lead remaining at the site, to potential future receptors, prior to and after the appropriate engineering and institutional controls have been implemented at the site. Cumulative cancer risks to potential future receptors at the site shall not exceed a level determined to be acceptable by DTSC management, which is within the risk management range (10-6 to 10-4), and a non-cancer hazard of 1. The 95% UCL of the mean of lead levels in dust/soils available for exposure at the site should not exceed 80 ppm for a potential residential (onsite or off-site receptor) and 320 ppm for a commercial/industrial worker. Contaminants left in place should be monitored using the appropriate operation and management (O&M) controls to ensure that human health or the environment are not adversely affected.

~~Pursuant to previous discussions between Exide and DTSC, and as discussed in greater detail elsewhere in the Closure Plan, the decision for requiring soil removal at this facility is complicated by the fact that the majority of the site is underlain by materials and soils containing contamination at or above TTLC and/or STLC levels. These impacts are associated with operations prior to promulgation of RCRA regulations (historic impacts) and decisions related to Phase 2 Closure (including soil remediation) will be made in conjunction with decisions for site-wide Corrective Action. As a result, final decisions regarding Phase 2 Closure requirements~~

~~within those areas with significant historic impacts, especially the South and West Yards, will be influenced by the remedy selected during the Corrective Action process. Similarly, decisions regarding depth and extent of soil removal being performed as part of Phase 2 Closure in areas less heavily impacted by historic operations (e.g. North Yard) may choose to be overly conservative (e.g. excavate more soil than just the amount to remove hazardous soil) in an effort to ensure that completed excavation areas will also meet reasonably anticipated Corrective Action clean-up levels.~~

3.3 NOT USED

3.4 PERMITTING AND REGULATORY REQUIREMENTS

This section discusses state, county and local permits necessary to conduct the closure activities. Depending on the nature of the permit, the permit may apply to Phase 1 or Phase 2, or both phases.

3.4.1 DTSC

Although the facility will no longer be an Interim Status RCRA hazardous waste treatment, storage and disposal (TSD) facility, operation of facility environmental systems and the closure activities themselves continue to generate hazardous waste. Therefore, the facility will be subject to regulation as a large quantity hazardous waste generator under Title 22 CCR ~~66260~~66262.10. Exide remains subject to applicable requirements under the Hazardous Waste Control Law and requirements for interim status, including, but not limited to closure and post-closure requirements in accordance with Title 22 CCR 66265.1. Exide is required to comply with all of the minimum standards in CCR, title 22, division 4.5, chapter 15, that establish the minimum standards that define the acceptable management of hazardous waste until certification of final closure or, if the facility is subject to post-closure requirements, until post-closure responsibilities are fulfilled. The facility already possesses and will continue to use its federal identification number. Exide will prepare an inventory of the former IS units and ancillary equipment that will remain in operation during and after Phase 1. All former IS units will be subject to inspection and maintenance requirements until the time of unit closure, and those units remaining in operation during/after closure shall be subject to the requirements contained in 22 CCR ~~66260~~66262.10 and chapter 15. Exide shall also modify existing waste analysis and emergency procedures/contingency plans to reflect changes in operations as needed.

3.4.2 SCAQMD

3.4.2.1 **General**

The following SCAQMD Rules presently apply to the closure activities (certain rules may no longer apply as closure progresses depending on the rule and the nature of the activities conducted):

- Rule 1150 Excavation
- Rule 1403 Asbestos Emissions from Demolition/Renovation Activities
- Rule 1166 VOC Emissions from Decontamination of Soil
- Rule 1420 Emissions Standard for Lead
- Rule 1420.1 Emission Standards for Lead and Other Toxic Air Contaminants from Large Lead-Acid Battery Recycling Facilities
- Rule 403 Fugitive Dust
- Rule 402 Nuisance
- Rule 401 Visible Emissions
- Rule 1150.2 Control of Gaseous Emissions from Inactive Landfills

The information provided in this section is intended to be a summary of the activities to be conducted and is not intended to represent the complete requirements of the SCAQMD rules.

Exide and its consultants and contractors shall fully comply with all applicable air quality Rules and Regulations, Compliance Plans, Permit Conditions, Orders for Abatement and any other applicable federal, state and local air quality related requirements, including, but not limited to, Rule 1420.1 and any subsequent revisions.

If during closure the ambient air concentrations of lead or arsenic exceed the limits in paragraphs (d)(1) or (d)(5) of AQMD Rule 1420.1, Exide shall submit a written report assessing the root

cause of the exceedance and, if closure-related activities are determined to have contributed to the exceedance, Exide shall temporarily suspend the closure-related activities that contributed to the exceedance and provide a mitigation plan designed to avoid additional exceedances. The closure-related activities that contributed to the exceedance shall not re-commence until the Executive Officer, in consultation with DTSC, approves the mitigation plan and the mitigation measures are implemented.

3.4.2.2 **Notification (Rule 1420.1)**

The closure activities are considered maintenance activities in accordance with Rule 1420.1. Notification will be provided to AQMD 10 days prior to start of closure activities in accordance with Rule 1420.1. Notification in accordance with Rule 1420.1 will be made to the public 10 days prior to building gutting and deconstruction or removal of pavement, if conducted outside of a total enclosure. A sign will be installed at facility with the phone number for a facility contact or pre-recorded notification center in accordance with Rule 1420.1.

3.4.2.3 **Asbestos Abatement (Rule 1403)**

An asbestos survey will be prepared prior to building decontamination and deconstruction. The survey will include:

- Inspection, identification, and quantification of all friable, and Class I and Class II non-friable asbestos-containing material;
- Physical sampling of materials;
- Identification of all affected materials at the facility, including but not limited to all layers of flooring materials to the joist level, and all material in wall or ceiling cavities;
- Name, address, phone number of person conducting the survey;

- Written statement of qualifications of personnel, including demonstrating certification by Cal/OSHA pursuant to regulations required by subdivision (b) of Section 9021.5 of the Labor Code, and passing an EPA-approved Building Inspector Course;
- Date survey was conducted;
- List of all suspected materials containing asbestos, list of samples collected, and sketch of sample locations;
- Laboratory name, address, and phone number; and,
- Statement of qualification for the laboratory showing compliance with 40 CFR Part 763.86, SCAQMD Method 300-91; Appendix A, Subpart F, 40 CFR Part 763, Section 1, Polarized Light Microscopy; accreditation by the National Voluntary Laboratory Accreditation Program.

Notification in accordance with Rule 1403(d)(B)(ii) will be provided to AQMD and the City of Vernon 10 days prior to building decontamination, gutting and deconstruction per 1403 (d)(B)(ii). A copy of the notice will be kept on-site.

3.4.2.4 **Temporary Equipment**

A permit to operate will be obtained from AQMD prior to mobilization and use of temporary equipment such as a temporary filter press, wastewater treatment plant, soil stabilization equipment, and temporary generators (if used). A concrete crusher will not be used during Phase 1 ~~but may be used during~~or Phase 2. Separate permits will be obtained for each piece of equipment.

3.4.2.5 **Excavation (Rule 1150)**

Phase 1 (Closure) activities are proposed to be limited to work occurring above the existing floors and pavement (i.e. cleaning, gutting, sampling, equipment removal and deconstruction).

No excavation is expected during Phase 1, except limited excavation required for exposing and disconnecting/removing existing utilities. Any such excavation completed during Phase 1 will be completed inside existing structures or temporary enclosures operated under negative pressure. ~~The resulting excavation will be backfilled with clean fill and resurfaced with pavement.~~ The enclosure shall remain in-place and operational until the excavation is backfilled to the pavement subgrade and covered with a geotextile filter fabric. Pavement will be placed within 3 working days after removal of the temporary enclosure. If more significant excavations are necessary under Phase 1, then an Excavation Management Plan shall be prepared and submitted for AQMD review and approval as described below.

Phase 2 (Contingent Closure) activities are assumed to include large scale soil excavation to depths ~~up to~~beyond 5 feet below the ground surface. Prior to the start of Phase 2, an Excavation Management Plan will be prepared in accordance with Rule 1150 and submitted to AQMD. The Excavation Management Plan will include:

- Quantity and characteristics of material to be excavated and transported;
- Mitigation measures necessary during excavation to ensure a public nuisance condition does not occur;
- The requirement to immediately cease excavation when notified a public nuisance has occurred; and,
- Ambient air monitoring procedures.

AQMD has 30 days to respond to the plan, or state that additional time is needed. Fees for filing, engineering and operating will be submitted to AQMD.

3.4.2.6 **VOC Emissions During Excavation (Rule 1166)**

Prior to the start of Phase 2, a Mitigation Plan for VOC emissions during excavation of VOC contaminated soil will be prepared in accordance with Rule 1166 and submitted to AQMD.

VOC-contaminated soil registers a concentration of 50 ppm or greater of VOCs above background as measured before suppression materials have been applied and at a distance of no more than three inches from the surface of the excavated soil with an organic vapor analyzed calibrated with hexane. Depending on the scope of excavation in Phase 2, the Contractor's Various Location Plan will be used, or a site-specific plan will be developed. A Various Location Plan applies to excavation of 2,000 cy or less of VOC contaminated soil in any consecutive 12-month period at the same site. A Site Specific Plan applies to excavation of greater than 2,000 cy of VOC contaminated soil and is issued for period of not more than 2 years. If used, the Site Specific Plan will include:

- Reason for excavation or grading;
- Cause of VOC soil contamination and history of site;
- Description of tanks or piping associated with soil contamination;
- Estimate of amount of contaminated soil;
- Operating schedule for excavation and removal;
- Description of how excavation and grading will be conducted;
- Description of mitigation measures for dust, odors and VOC;
- Details of disposal of VOC contaminated soil, including destination facility;
- Description of monitoring equipment and techniques;
- Map showing facility layout, property line, and surrounding area up to 2,500 feet away, and including any schools, residential areas or other sensitive receptors such as hospitals or locations where children or elderly people live or work; and,
- Designation of a person who can conduct a site inspection with AQMD prior to issuance of the plan.

Notification, including start date, will be provided to AQMD 24 hours in advance. A copy of the mitigation plan will be maintained on-site. The VOC Soil Mitigation Plan will include:

- Segregation of VOC-contaminated stockpiles from non-VOC stockpiles;

- Spraying piles with water and/or approved vapor suppressant, and covering with plastic sheeting for periods of inactivity lasting more than one hour;
- Daily visual inspection of all covered piles, and maintain records;
- Treatment or removal of soil within 30 days from the time of excavation; and,
- Maintaining records of identification and business address of generator, transporter and disposal facility.

Equipment associated with decontamination and remediation of VOC-contaminated soil may also require permits from AQMD.

3.4.3 Water Resources Control Board

Although the facility has an Industrial Stormwater NPDES Permit, under its current configuration the facility collects and treats all stormwater runoff and then discharges the treated effluent under an Industrial discharge permit to the Los Angeles County sanitary sewer system. No runoff directly discharges from the facility, except from the office and employee parking areas east of South Indiana Street. Exide intends to maintain and operate the stormwater collection and treatment system (including the surface impoundment), through Phase 1 and as long as possible during Phase 2. As Phase 1 will be above-grade activities only with no earth disturbance (besides small limited excavations for terminating/disconnecting utilities), and all stormwater runoff will continue to be collected and treated as part of the Industrial Stormwater NPDES Permit, a General Construction Stormwater NPDES Permit does not apply to Phase 1.

The Phase 2 Contingent Closure scenario developed for cost estimating purposes anticipates the excavation and off-site disposal of ~~up to~~ 5 feet of soil and capping. The actual Phase 2 remedy will not be determined until after completion of Phase 1 subsurface sampling activities and may integrate with site-wide Corrective Action (CA remedy not yet developed or known). As part of Phase 2, the stormwater collection system and site surface grading will be modified to collect and discharge stormwater runoff directly to the open concrete channel and/or storm sewer system

in South Indiana Street and Bandini Boulevard. The Phase 2 activities are expected to require a General Construction Stormwater NPDES Permit. The Water Resources Control Board may also require that Exide modify and maintain the Industrial Stormwater NPDES Permit following completion of Phase 2 activities, until sufficient information can be generated to demonstrate that stormwater runoff from the restored site can consistently meet standards for direct discharge.

3.4.5 Los Angeles County

The existing Los Angeles County Sanitation District (LACSD) industrial discharge permit will be maintained through Phase 1 and Phase 2 of closure for discharge of treated wastewater and stormwater. The permit will be revised when required by LACSD to reflect changes in the WWTP.

As described above, prior to Phase 2 Exide will submit to the Water Resources Control Board a modification to the existing Industrial Stormwater NPDES Permit for direct discharge of facility stormwater from the site into the storm sewer system or adjacent stormwater drainage channel. Exide will continue to collect, treat and discharge stormwater through the LA County industrial discharge permit until Phase 2 activities are complete and the untreated stormwater meets discharge requirements.

3.4.6 City

3.4.6.1 **Clarifier and Sump Removal**

A City of Vernon permit will be obtained to close Unit 5, Battery Dump Bin Sump; Unit 6, RMPS Floor Sump; Unit 46, Pump Sump; Unit 51, Truck Wash Sump; Unit 62, WWTP Sump; Unit 56, WWTP Clarifier; and ancillary sumps. The requirements of the application are included in this Closure Plan.

3.4.6.2 **Asbestos Abatement**

A permit will be obtained from the City of Vernon Health & Environmental Control Department for asbestos abatement.

3.4.6.3 **Utility Termination**

If applicable, a permit will be obtained to cap the sewer at the property line. Permits will be obtained to abandon fire sprinkler service and terminate electrical services to the work area.

3.4.6.4 **Building Deconstruction**

A Building Demolition permit will be obtained from the City of Vernon Public Works, Water & Development Department and Health & Environmental Control Department. The Building Demolition permit application requires a SWPPP, which is provided in Appendix Q, and a Soil Management Plan. Earth disturbance is not anticipated during Phase 1 building deconstruction as work will occur above grade only (besides small limited excavations for terminating/disconnecting utilities); therefore, a Soil Management Plan may not apply. The application will include the estimated total disposal and diversion amounts in tons (including materials to be recycled on-site and any universal waste) for all construction and demolition wastes generated. A rodent control survey will be conducted to certify the project area is free of vectors, or a rodent control plan will be implemented prior to, during and after completion of work. A site inspection will be conducted at least 5 days prior to deconstruction.

3.4.6.5 **Soil Borings**

A City of Vernon Health & Environmental Control Department permit will be obtained for any established/proposed monitoring well, any soil boring exceeding 50 feet below grade, and any groundwater monitoring well.

3.4.6.6 **Erosion and Sediment Control**

For Phase 2 activities involving soil disturbance, a Statement of Intent to Comply with Minimum Requirements of the Stormwater Permit will be submitted, along with proof of coverage under the General Construction Stormwater NPDES Permit from the State Water Resources Control Board and a site-specific Stormwater Pollution Prevention Plan or Erosion & Sediment Control Plan. The SWPPP and ESCP will be certified by a Qualified SWPPP Developer. Soil disturbance is not expected during Phase 1 (besides small limited excavations for terminating/disconnecting utilities), but is expected during Phase 2.

The City of Vernon Erosion & Sediment Control Plan, if needed, will include:

- Elements of a Stormwater Pollution Prevention Plan;
- Methods to minimize the footprint of the disturbed area and to prevent soil compaction outside of the disturbed area;
- Methods used to protect native vegetation and trees;
- Sediment/Erosion Controls;
- Controls to prevent tracking on and off the site;
- Non-stormwater controls (e.g., vehicle washing, dewatering, etc.);
- Materials management (delivery and storage);
- Spill prevention and control.
- Waste management (e.g., concrete washout/waste management; sanitary waste management);
- Identification of site Risk Level as identified per the requirements in Appendix 1 of the General Construction Activities Stormwater NPDES Permit.
- Rationale for selection and design of the proposed BMPs, including quantifying the expected soil loss from different BMPs;
- Certification by Qualified SWPPP Developer;

- BMPs designed, constructed and operated in a manner to prevent the breeding and harborage of vectors, nuisance pests, or any other vermin;
- Structural BMPs designed by a licensed California Engineer;
- Certification statement signed by landowner; and,
- Documentation of existing coverage under applicable permits, including but not limited to the State Water Board's General Construction Activities Stormwater NPDES Permit, and State Water Board 401 Water Quality Certification.

3.4.6.7 **Monitoring Wells**

City of Vernon Health & Environmental Control Department permits will be obtained prior to installation of proposed monitoring wells.

3.4.7 CALOSHA

Applicable CalOSHA permits and registrations associated with the work will be obtained and notifications will be conducted. These may include a permit with project specific plan for deconstruction of buildings greater than 30 feet high, an annual permit for excavation greater than 5 feet in depth, and an annual permit for scaffolding greater than 35 feet in height. The Notifications and registrations may include a Lead Work Pre-job Notification and Asbestos Contractor Registration.

3.5 ENGINEERING CONTROLS

Engineering controls for water and air management, including dust mitigation procedures, are discussed in Appendix G.

3.6 CONTINGENCY PLAN

The Crisis Management Plan / Contingency Plan for the facility will remain in effect during the Closure and is provided in Appendix S.

In the event of a power outage during closure, work activities occurring within/requiring maintenance of negative pressure will cease until power to the air control systems for the area where the work is occurring is restored. An existing backup power system is present at the perimeter ambient air monitors to maintain their operation during a facility power outage.

If a planned power outage will occur, portable generators will be used to maintain negative pressure on the work areas.

3.7 AIR MONITORING

Air monitoring during closure activities is provided in Appendix H.

3.8 STORMWATER MANAGEMENT

3.8.1 General Operations

The existing stormwater management system maintains stormwater within the facility boundaries and transfers the stormwater for on-site treatment prior to discharge to the LA County Sanitation District. The stormwater management system includes manholes, piping, perimeter sumps and trench drains, pumps, the Surface Impoundment, and perimeter curbing. As the stormwater system is ancillary to Unit 46, Pump Sump, the manholes and piping were replaced in 2013/2014 and have secondary containment and leak detection.

The stormwater management system will be operated during Phase 1 and 2 closure in accordance with the Replacement Stormwater Management System Installation Certification Report (provided in Appendix B), including daily leak detection monitoring by manual or electronic methods and transfer of liquid in the leak detection zone to the on-site WWTP within 24 hours of detection, until the point at which these features need to be closed themselves using the procedures described in the Closure Plan. Following completion of the Phase 2 activities, and provided the closure performance standards in Section 3.2.4 are met, portions of the stormwater system will remain active as a traditional stormwater management system to manage non-hazardous stormwater at the facility as discussed in Section 2.8.3.3. Leak detection system monitoring will be discontinued after completion of required pipe and inlet cleaning.

Exide will submit a modification to the Industrial Stormwater NPDES Permit to allow discontinuation of stormwater collection at the perimeter sumps west of the West Yard truck scale and north of the Blue Lead Warehouse after completion of Phase 1 activities (including final pavement cleaning). While the Blue Lead Warehouse sump is still in operation, Exide will continue to utilize the current piping system to convey stormwater from the perimeter sump north of the Blue Lead Warehouse to Inlet H. This will include running the temporary hose across the west approach to the northern vehicle bridge when storm events are forecasted.

3.8.2 Surface Impoundment Operations

Until the time that the Surface Impoundment is decontaminated during Phase 2 and will no longer manage hazardous waste, Exide will continue to operate the Surface Impoundment in compliance with the associated Stipulation and Order between DTSC and Exide, Docket HWCA 2009-2208. Operational requirements from the Stipulation and Order generally include:

- Measuring the water level daily when the impoundment contains measurable quantities of water above the upper level of the sumps (3 inches or greater from the bottom of the impoundment);

- Recording all rain events, including start and end;
- Recording pumping, including start and end;
- Repair or replace pumps within 48 hours of failure;
- Withdraw a minimum volume of 80,000 gpd of water until levels are 3 inches or less;
- Within one hour of reaching 3 inches from bottom of impoundment, initiate removal of lead-containing material, including sludge, from entire surface area of impoundment. Complete removal within 6 calendar days and as soon as possible; and,
- Provide notices to DTSC.

3.8.3 CL-14 Trench Drain

A trench drain conveys stormwater to Inlet CL-14 from the south. The trench drain is double contained with a leak detection layer and is encased in concrete. Despite several repair attempts during and since installation, a limited amount of water reaches the trench drain leak detection layer and flows to the leak detection zone at CL-14. The precise pathway that the water is taking to enter the trench drain leak detection layer is uncertain and cannot be pinpointed without significant destructive testing. Testing of samples collected from the CL-14 leak detection zone has demonstrated that while the water is non-hazardous, it contains lead, antimony and arsenic at concentrations that well exceed their respective drinking water Maximum Contaminant Levels (MCLs).

In an effort to demonstrate to DTSC's satisfaction that releases have not occurred to the subsurface, Exide will collect soil samples (and liquid samples if detected during the drilling) at multiple locations in the immediate vicinity of CL-14, including along both sides of the trench drain. In addition, Exide will attempt to complete an angled boring directly beneath the inlet. Additional groundwater monitoring wells may be needed to determine if groundwater has been

impacted by this release. Details regarding this investigation will be provided to DTSC in a workplan within 30 days of DTSC approval of the Closure Plan.

In the meantime, Exide will continue to monitor liquid levels in CL-14 and collect and remove accumulating liquid in accordance with the Temporary Leak Detection System Operating Procedure dated January 24, 2014 provided in Appendix B (when manual leak detection methods are used) or in accordance with the Replacement Stormwater Management System Installation Certification Report provided in Appendix B (when electronic leak detection methods are used). Exide will analyze the liquid at CL-14 prior to the start of each removal when the Temporary Leak Detection Operating Procedure is used. Additional information is provided in Appendix U. Exide may conduct these activities prior to implementation of the Closure Plan.

3.9 WASTEWATER TREATMENT

3.9.1 Existing WWTP

The existing Wastewater Treatment Plant (WWTP) is currently operating, and will continue to operate to the extent possible during Phase 1. It is anticipated that maintenance and repair activities will be necessary prior to and during closure activities. The permit for discharge of treated effluent to the LA County Sanitation District will be maintained.

It is anticipated that the temporary filter press discussed in Section 3.9.2 will be installed early in Phase 1 to allow for removal of Unit 79, Surge Tank and Unit 44, WWTP Filter Press.

Alternatively, installation of Unit 79, Surge Tank in the RMPS Building may be completed and a Tank Assessment Report would be submitted to DTSC. Modifications may be made to infrastructure near Unit 44, WWTP Filter Press, in the RMPS Building to allow for a temporary water-tight container (i.e., a roll-off or similar) to be placed beneath the WWTP Filter Press to collect filter cake, or modifications may be made to the Unit 44 screw conveyors to discharge to

a temporary water-tight container located east of Unit 44 in the Baghouse Building. Units 79 and 44 would be operated as long as possible during Phase 1 to dewater sludges from the existing WWTP. Filter cake from Unit 44 will be disposed off-site or sent to a secondary lead smelter for recycling. Filtrate will be returned to the WWTP. When the temporary container is full, the container will be removed, covered, and the exterior decontaminated in accordance with the container shipping procedures in Section 3.13. An empty container will be put in its place. Unit 44 has not operated for a significant amount of time, and minor repairs and maintenance will likely be required during the start-up/shake down process.

3.9.2 Temporary Filter Press and Water Storage

A temporary filter press will be mobilized early in Phase 1 to replace Unit 79 and Unit 44. A temporary decontamination water storage feature will be mobilized early in Phase 1 to replace Units 7, 8, and 9. The temporary filter press and temporary decontamination water storage feature will be sized based on expected wastewater volume and quality. Additional details regarding the temporary filter press and temporary decontamination water storage feature will be provided to DTSC, AQMD and the City of Vernon following equipment selection. It is anticipated that the temporary filter press and temporary decontamination water storage feature will be located at Unit 1, and will be operated in conjunction with the existing WWTP and the temporary WWTP.

3.9.3 Temporary WWTP

A temporary WWTP will be mobilized to manage decontamination water generated during the later portions of Phase 1 and during Phase 2. The temporary WWTP will be mobilized and placed into service prior to taking the existing WWTP out of service for closure. The temporary WWTP will be designed based on wastewater volume and quality observed during the early portions of Phase 1 and is expected to include:

- Frac Tank(s);
- Primary Bag Filters (100 gpm);
- Secondary Bag Filters (100 gpm);
- Sand Filter;
- Pump; and,
- Hoses and piping.

The size and configuration of the temporary system is expected to be smaller and simpler than the existing WWTP. Additional detail regarding the temporary WWTP will be provided to DTSC, AQMD and the City of Vernon following equipment selection.

It is anticipated that the temporary WWTP will be located at Unit 1, Central Container Storage Area. Temporary above-grade piping and hoses will be used to transfer liquid to and from the temporary WWTP. Treated liquid will continue to discharge at the existing discharge point to the LA County Sanitation District.

3.10 1420.1 ACTIVITIES

Exide will continue to implement housekeeping activities required by SCAQMD Rule 1420.1 to the extent possible during Phase 1 of closure, including:

- Apply water to outdoor on-site paved areas twice per shift and as necessary;
- Sweep on-site paved areas (excluding east of the Smelter Building) and inside the North Yard buildings under negative pressure with a PM10-compliant sweeper three times every calendar day, at least once per operating shift. Sweeping is not required on rainy days;
- Sweep sidewalks adjacent to the facility with a PM10-compliant sweeper twice per day. Sweeping is not required on rainy days;
- Wash roofs less than 45 feet in height twice per month; and,
- Wash roofs greater than 45 feet in height once per quarter.

1420.1 activities will be conducted by Exide or their designated contractor. 1420.1 activities will cease as closure activities progress. Roof washing will cease once building decontamination is completed during Phase 1. Water application and sweeping of paved areas and sidewalks will cease after completion of decontamination of site-wide unregulated areas during Phase 1.

3.11 EROSION AND SEDIMENT CONTROLS

Earth disturbance is not expected during Phase 1 as activities will be above grade (besides small limited excavations for terminating/disconnecting utilities). The existing perimeter curb and site grading which maintains stormwater runoff on-site will be maintained.

An Erosion and Sediment Control Plan will be prepared for Phase 2 activities once the scope of Phase 2 is known. Erosion and sediment controls will be conducted in accordance with the Stormwater BMP Construction Handbook sheets developed by the California Stormwater Quality Association. As discussed in Section 3.8.3, stormwater system inlets will be retrofitted with erosion and sediment control measures during Phase 2.

3.12 MAINTENANCE

Regular maintenance and housekeeping activities will be performed prior to and during implementation of the Closure Plan.

3.13 SHIPPING PROCEDURES

Prior to exiting its loading area, each truck, trailer and shipping container will be adequately tarped and placarded. The loaded materials shall not extend above the sides or rear of the truck, trailer or shipping container. The truck and trailer exterior and tires will be pressure washed to remove visible material prior to leaving the facility.

All vehicles exiting the facility will be decontaminated in the West Yard Truck Wash prior to exit. Appropriate shipping manifests or bills of lading will be completed. Additional information is provided in Section 5.2.1.

Additional detail regarding shipment procedures, including pre-loading and decon checklists, is provided in Appendix G. Decon checklists will confirm that trucks are dry before exiting the facility.

3.14 TRANSPORTATION

Transportation will be conducted in accordance with DOT requirements. Empty roll-offs and trailers will be staged at the facility prior to loading. Roll-offs and trailers which have been loaded using the procedures discussed in Section 3.13 will be staged on-site while awaiting transport.

A summary of locations receiving materials during closure is provided in Table 3.4. Transportation routes are provided in Appendix Z. All routes will proceed from the facility directly toward Bandini Boulevard, turn left onto Bandini Boulevard and merge onto I-710. Directions to 2801 N Madera Road will be revised to proceed to I-710 using this route. Please note that transportation routes may change due to planned and unplanned road closures. The Contractor will ensure that drivers understand the approved truck routes and will provide a written statement confirming that the transportation routes have been provided and reviewed by the truck driver(s), and the route will be followed, except to the extent that road closures require an alternate route. Any change from the Bandini to I-710 portion of routes will require DTSC approval. Trucks using alternate routes will be documented on a transportation log that includes the date, time, truck identification, manifest number, route taken and contents of load. The Transportation Log will be submitted to DTSC daily when there are entries.

Alternate facilities and routes may be proposed by the Contractor for approval by Exide and DTSC.

All trucks leaving the facility will be marked with a yellow flag having a visible area of at least 1 square foot, attached to the high rear end of the trailer in a location visible to pedestrians.

Date: July 2015

4.0 PHASE 1 CLOSURE SEQUENCE

4.1 NOTIFICATION

On April 7, 2015, Exide withdrew the Part B Permit Application for the facility and provided DTSC and the City of Vernon with written notification of its intent to close the Vernon facility.

Implementation of the Closure Plan shall commence within 30 days of DTSC final approval of the Closure Plan. DTSC, AQMD and the City of Vernon will be notified at least 10 business days prior to commencement of field work.

4.2 PREPARATION ACTIVITIES

4.2.1 Support Zone

The Contractor will establish an on-site support zone for field offices, temporary facilities, equipment and material staging. The support zone is anticipated to be in the West Yard near the Mobile Equipment Maintenance Building.

Health and safety procedures and personal protective equipment are discussed in Section 18.0.

4.2.2 Implementation Plan

The Contractor shall prepare an Implementation Plan for Phase 1 activities that is consistent with requirements of this Closure Plan and provides detailed information regarding execution of each work element. The Contractor shall be responsible for developing means and methods, although ultimately the approved Closure Plan will be the standard applied to determine adequacy and compliance. The Implementation Plan shall be submitted for review and comment by Exide and the Resident Engineer. Deviations from the approved Closure Plan must be approved by DTSC

prior to execution. Following incorporation of Exide and Resident Engineer comments, the Implementation Plan will be submitted to DTSC at least 30 calendar days prior to the start of work. Work shall not begin until DTSC approval of the Implementation Plan is received in writing. To expedite preparation, review and approval of the Implementation Plan, the Contractor may submit separate plans for decontamination and deconstruction.

The Implementation Plan shall include the following:

- Scope of work;
- Sequence;
- Schedule;
- Supplemental Dust Mitigation Measures;
- Work hours;
- Procedures, sequence and techniques for:
  - Asbestos abatement
  - Air monitoring and dust control;
  - Removal of hazardous materials;
  - Draining and cleaning of piping;
  - Decontamination of units, equipment, areas and buildings;
  - Removal of units and equipment;
  - Utility termination;
  - Water management;
  - Waste management, disposal and transportation, including characterization sampling procedures and frequency;
  - Building deconstruction;
  - Installing temporary fencing at low areas; and,
  - Staging and storage areas.
- Site-specific Health and Safety Plan; and,
- Demolition Engineering Survey.

4.2.3 Utilities

The Contractor will retain a utility locator and conduct an inspection of the facility prior to the start of closure to identify active and inactive utilities and safety concerns. The Contractor will include the procedures and sequence of utility termination in the Implementation Plan for review by Exide and the Resident Engineer prior to submission to DTSC, AQMD and the City of Vernon. The Implementation Plan will include the sequence of utility termination with respect to building decontamination, gutting and deconstruction activities and maintaining utilities during activities which need them.

The plan will include contacting the City of Vernon Utilities Customer Service Department to remove electrical, gas, or water meters upon termination of services and capping sewer laterals, if any, prior to building deconstruction.

The Contractor shall clear each decontamination and deconstruction area for utilities in accordance with the procedures developed in the Implementation Plan. In certain cases, and depending on the needs and requirements of the specific utility company, some of the utilities that are removed will need to be capped in the manner specified by the utility company. Any such work shall be identified in advance and considered in the Contractors bid price.

If excavations or sub-surface activities are conducted, the Contractor shall notify Regional Notification Centers a minimum of 2 working days prior to the initiation of sub-surface activities per 8 CCR 1541(b)(2). The contact information is "811".

If encountered during deconstruction, transformers that are no longer required shall be de-energized and removed. Removal will require testing transformers for PCBs and taking those steps required by federal, state and local regulations for proper handling and disposal. If any transformers are found to contain PCB fluids, concrete and soil samples beneath the transformer

will be analyzed for PCBs. Please note that PCB analysis is not used to evaluate whether or not a material is hazardous and whether or not the closure performance standards in Section 3.2 have been met.

The Contractor shall also provide alternate/backup electrical services for its own use as well as alternate power necessary to operate the WWTP during the period when the primary electrical service is disrupted by relocation/deconstruction activity.

4.2.4 Environmental Survey

A survey of all facility buildings, RCRA regulated and non-regulated, will be performed by an environmental consultant retained by Exide prior to closure to determine the presence of the following environmental concerns:

- Asbestos containing material (ACM) including friable, and Class I and Class II non-friable;
- Lead-based paint;
- Lighting lamps;
- Non-PCB ballasts and transformers;
- Batteries; and,
- PCB-containing ballasts and transformers.

These devices may include fluorescent type, mercury vapor lamps, metal halide lamps, sodium vapor lamps, and batteries from exit signs and emergency lights and smoke detectors.

The survey will be available to the Contractor for use in Phase 1 building decontamination, gutting and deconstruction.

4.3 PHASE 1 SEQUENCE

4.3.1 General

Former IS units at the facility were grouped by their secondary containment/area of drainage to develop areas to be addressed during Phase 1 closure. Existing piping and systems will be used to process stored liquids and residuals to the extent possible, otherwise temporary piping and pumps will be used. The general sequence of closure is provided in the sections below and corresponds to the sequence of work presented in the Phase 1 schedule in Appendix F. The sequence of closure was selected to prioritize critical path items such as engineering controls set-up for building deconstruction, deconstruction of the Baghouse Building, and building deconstruction engineering controls removal while maintaining operation of the West Yard Truck Wash (Unit 87), emission control equipment, stormwater system (including drop-out system and surface impoundment) and the WWTP as long as possible.

The West Yard Truck Wash is required to decontaminate vehicles prior to leaving the Bandini Boulevard entrance per SCAQMD. Operation of emission control equipment is required until completion of decontamination and initial steps of building deconstruction at the Containment Buildings (Reverb Feed Room and Blast Feed Room), Desulfurization Building, RMPS Building, Smelter Building and Finished Lead Building (decontamination only). It is anticipated that the Torits and MAC Baghouses will be the emission control equipment used during a majority of the work. Maintaining the WWTP will allow for treatment of decontamination water with existing equipment to the extent possible. The Corridor portion (north-south and west-east sections) of Unit 33 will be used as a decontamination area for vehicles, equipment and materials.

The Contractor may propose an alternate sequence for review and approval by Exide and DTSC.

Units within a closure area will be closed from upstream to downstream in process and physical location. The order in which the units are presented is the general order in which they will be closed. The closure contractor may opt to close units concurrently or modify the order in which units are closed provided the sequencing requirements are met.

General procedures for closure of each unit are discussed in Sections 5.0 through 11.0. Closure activities specific to each closure area are summarized in Table 3.2.

Please note that the location of a unit does not always correspond to the process within which the unit is used. For example, the WWTP Filter Press (Unit 44) is used in the WWTP process, but is located in RMPS.

Phase 2 activities are discussed in Section 16.0.

4.3.2 Existing Unit Operations

As noted in Section 3.9.1, operations may be resumed at Unit 79, Surge Tank and Unit 44, WWTP Filter Press to support the existing WWTP until closure of the WWTP in the later stages of Phase 1. Units 7 and 8, North and Center Mud Tanks may be used for storage of decontamination liquid prior to treatment in the WWTP. Unit 9, South Mud Tank may also be used for storage of decontamination liquid prior to treatment in the WWTP if additional capacity is needed. Alternatively, a temporary filter press and temporary decontamination water storage feature will be used as discussed in Section 3.9.2.

Unit 87, West Yard Truck Wash, will be used for vehicle decontamination prior to exiting the facility as discussed in Section 3.13.

4.3.3 Container Storage Areas

Prior to the start of and during Phase 1, the Container Storage Areas (CSAs) will be used for storage of drums of waste materials from the RFI investigation or facility housekeeping prior to shipment for off-site disposal. During Phase 1, the CSAs may also be used for storage of containers of deconstruction materials awaiting shipment. Such material shall be dry (i.e. no free liquids) and containers shall be sealed when placed in the CSA.

The Central Container Storage Building (Unit 1) is a former IS regulated container storage area and was used for storage of spent lead acid batteries and drums of plant scrap. The containers represent primary containment and the floor of Unit 1 functions as secondary containment for the containers (batteries and drums of battery plant scrap) awaiting processing. Unit 1 has a concrete floor which slopes to spill collection sumps (Acid Collection Sumps 1 and 2) and piping, metal roof, and partial concrete walls on two sides. Unit 1 will be closed by decontaminating the secondary containment area floor, sumps, walls and roof as discussed in Section 8.0, removing the stainless steel liner as discussed in Section 8.2, and performing wipe, concrete, soil and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Additional information regarding Unit 1 is provided in Appendix D. It is anticipated that Unit 1 will be used as the location for temporary equipment during closure such as a temporary filter press and/or temporary WWTP.

The West Container Storage Building #1 (Unit 2) is a former IS regulated container storage area and was used for storage of spent lead acid batteries and drums of plant scrap. Unit 2 is empty. Unit 2 provided secondary containment for the containers stored therein. Unit 2 has a concrete floor which slopes to spill collection sumps (Acid Collection Sumps 5 and 6) and piping, metal roof and partial concrete walls on three sides. Unit 2 will be closed by decontaminating the secondary containment area floor, walls and roof as discussed in Section 8.0, removing the stainless steel sump liner as discussed in Section 8.2, and performing wipe, concrete, soil and

soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Additional information regarding Unit 2 is provided in Appendix D.

The West Container Storage Building #2 (Unit 3) is a former IS regulated container storage area and was used for storage of spent lead acid batteries and drums of plant scrap. Unit 3 is empty. Unit 3 provides secondary containment area for the containers stored therein. Unit 3 has a concrete floor which slopes to a spill collection sump (Acid Collection Sump 4) and piping, metal roof and partial concrete walls on three sides. Unit 3 will be closed by decontaminating the secondary containment area floor, walls and roof as discussed in Section 8.0, removing the stainless steel sump liner as discussed in Section 8.2, and performing wipe, concrete, soil and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Additional information regarding Unit 3 is provided in Appendix D.

Ancillary sump Acid Collection Sump 3 is ancillary to former IS Units 1, 2, and 3 and is used for management of acid spills and wash down water. Acid Collection Sumps 1, 2, 4, 5, and 6 at Units 1, 2 and 3 drain to Acid Collection Sump 3. A pump at Acid Collection Sump 3 transfers collected liquid via above ground piping to the Water Softener Building Sump, and then to the on-site Wastewater Treatment Plant. The Acid Collection Sumps 1 through 6 are concrete sumps with stainless steel liners. The Acid Collection Sumps 1 through 6 will be closed by removing any standing liquid as discussed in Section 5.2, decontaminating the sumps concurrent with Unit 1, 2 and 3 floor decontamination as discussed in Section 8.0, removing the stainless steel liner as discussed in Section 8.2, and performing concrete, soil, and soil gas sampling concurrent with Unit 1, 2 and 3 sampling as discussed in Sections 9.0 and 10.0, respectively. Additional information regarding Acid Collection Sumps 1 through 6 is provided in Table 1.3.

4.3.4 Oxidation Tank Area

The Oxidation Tank Area is a secondary containment area with concrete floor and walls. The Oxidation Tank Area does not have a roof. Units 24, 25 are located within the secondary containment area at the Oxidation Tank Area.

Date: July 2015

North Oxidation Tank (Unit 24) is a former IS unit and was used for storage of wastewater and sodium sulfate solution. Unit 24 will be emptied by Exide prior to the start of closure. Unit 24 is a fiberglass, closed top tank located within the Oxidation Tank Area secondary containment. Unit 24 will be closed by decontaminating the interior and exterior of the tank as discussed in Section 6.0, and disposing the tank off-site as discussed in Section 7.8. Additional information regarding Unit 24 is provided in Appendix D.

South Oxidation Tank (Unit 25) is a former IS unit and was used for storage of wastewater and sodium sulfate solution. Unit 25 will be emptied by Exide prior to the start of closure. Unit 25 is a fiberglass, closed top tank located within the Oxidation Tank Area secondary containment. Unit 25 will be closed by decontaminating the interior and exterior of the tank as discussed in Section 6.0, and disposing the tank off-site as discussed in Section 7.8. Additional information regarding Unit 25 is provided in Appendix D.

Ancillary sump Neptune Scrubber Sump is located in the Baghouse Building, is ancillary to former IS units 24 and 25, and is used for management of wastewater. Neptune Scrubber Sump is a concrete sump. Neptune Scrubber Sump will be closed by removing inventory/scrubber slurry as discussed in Section 5.2, decontaminating the sump as discussed in Section 8.0, and performing concrete, soil, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Additional information regarding Neptune Scrubber Sump is provided in Table 1.3.

The Oxidation Tank Area will be closed by decontaminating the floor and walls discussed in Section 8.0, and performing concrete, soil, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Tank pedestals will be deconstructed as discussed in Section 11.2. Additional information regarding the Oxidation Tank Area is provided in Table 1.2 and the Closure Cost Estimate (Appendix I).

4.3.5 Mobile Equipment Wash Station

Mobile Equipment Wash Station (Unit 35) is a former IS tank and is used for collection of wash water. Unit 35 is a stainless steel and concrete sump. Unit 35 is currently empty. Unit 35 will be closed by decontaminating the sump as discussed in Section 8.0, removing the stainless steel liner, and performing concrete, soil, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Additional information regarding Unit 35 is provided in Appendix D.

4.3.6 Blast Furnace Feed Room

The Blast Furnace Feed Room (Unit 34) is a former IS containment building and was used for storage of blast furnace feed. Unit 34 contents will be removed prior to closure. Unit 34 has a reinforced concrete floor (with sacrificial asphalt layer), metal roof, and concrete and metal walls. A coke railcar unloading system, partially below grade is located beneath the southeast corner of the Blast Furnace Feed Room building. Unit 34 will be closed by decontaminating the floor, walls and roof as discussed in Section 8.0, and performing concrete, soil, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Additional information regarding Unit 34 is provided in Appendix D.

A structural evaluation will be conducted for the Blast Furnace Feed Room. The Blast Furnace Feed Room building will be deconstructed to grade as discussed in Section 11.0.

4.3.7 Rotary Kiln

Rotary Kiln (Unit 69) is a former IS miscellaneous unit which processed reverb furnace feed material. The rotating drum portion of Unit 69 contains an estimated 4 cy of dry feed material that was in-process when plant operations were suspended. The conveyors into and out of the rotating drum portion of Unit 69 have already been cleaned to remove feed material that was in-process when plant operations were suspended. Unit 69 is constructed of steel and is located in

the Rotary Kiln enclosure within the Baghouse Building. Unit 69 will be closed by removing inventory in the rotating drum as discussed in Section 5.2, decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and based on the results of the sampling, either ~~and~~ re-using the unit at an alternate facility as discussed in Section 7.8., or shipping the unit to an appropriate disposal facility. Additional information regarding Unit 69 is provided in Appendix D.

The Rotary Kiln enclosure will be closed by decontaminating the floor, walls and roof as discussed in Section 8.0, and performing concrete, soil, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. The Rotary Kiln enclosure will be deconstructed to grade as discussed in Section 11.0. Additional information regarding the Rotary Kiln enclosure is provided in Table 1.2 and the Closure Cost Estimate (Appendix I). All or part of the enclosure will require deconstruction in concert with cleaning and removal of the Rotary Kiln equipment.

The Dryer Baghouse (used to collect and manage air emissions from the Rotary Kiln) and associated equipment will be decontaminated as discussed in Section 6.10 and deconstructed as discussed in Section 7.8.

4.3.8 Baghouse Building Units

The Baghouse Building has a concrete floor, metal roof and metal walls. Former IS units 31 and 32, former units 22, 23, 29, and 30 which underwent preliminary closure, and ancillary sumps Baghouse Building Sump 1, Baghouse Building Sump 2, Baghouse Building Sump 3, Baghouse Building Tire Wash, and Neptune Scrubber Sump are located within the Baghouse Building.

North Flue Dust Slurry Tank (Unit 31) is a former IS tank and is used for storage of lead dust slurry. Unit 31 is a stainless steel, double walled, open top tank. Unit 31 will be closed by removing remaining contents as discussed in Section 5.2, decontaminating the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and based on

the results of the sampling, recycling the tank off-site as discussed in Section 7.8. or shipping the unit to an appropriate disposal facility. Additional information regarding Unit 31 is provided in Appendix D.

South Flue Dust Slurry Tank (Unit 32) is a former IS tank and is used for storage of lead dust slurry. Unit 32 is a stainless steel, double walled, open top tank. Unit 32 will be closed by removing remaining contents as discussed in Section 5.2, decontaminating the interior and exterior of the tank as discussed in Section 6.0, conduct confirmation sampling, and, based on the results, recycling the tank off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 32 is provided in Appendix D.

4.3.9 Emission Control Equipment Decontamination and Deconstruction

Operation of the Soft Lead Baghouse, Hard Lead Baghouse, Material Handling Baghouse, the portion of the East and West MAC Baghouses not retained in service, the portion of the Torit Dust Collector not retained in service, and MAPCO Scrubber will cease. This equipment, the Reverb Baghouse, and the Blast Baghouse will be decontaminated as discussed in Section 6.10 and deconstructed as discussed in Section 7.8.

4.3.10 Baghouse Building Decontamination

The Baghouse Building will be closed by decontaminating the floor, walls and roof as discussed in Section 8.0, and performing wipe, concrete, soil, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Surface wipe samples will be performed on all walls and the roof of the building. Concrete, soil and soil gas sampling will be performed in the footprint of active former IS units only. Additional information regarding the Baghouse Building is provided in Table 1.2 and the Closure Cost Estimate (Appendix I).

Ancillary sumps Baghouse Building Sump 1, Baghouse Building Sump 2, Baghouse Building Sump 3 and Baghouse Building Tire Wash Sump are ancillary to former IS units and are used for management of wash down water. Baghouse Building Sump 1, Baghouse Building Sump 2, Baghouse Building Sump 3 and Baghouse Building Tire Wash Sump are concrete sumps.

Baghouse Building Sump 1, Baghouse Building Sump 2, Baghouse Building Sump 3 and Baghouse Building Tire Wash Sump will be closed by removing sump contents as discussed in Section 5.2, decontaminating the sumps concurrent with Baghouse Building floor decontamination as discussed in Section 8.0, and performing concrete, soil, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Additional information regarding Baghouse Building Sump 1, Baghouse Building Sump 2, Baghouse Building Sump 3 and Baghouse Building Tire Wash Sump are provided in Table 1.3.

East Equalization Tank (Unit 22) was previously decontaminated and demolished. Closure of Unit 22 will be completed as part of floor decontamination for the Baghouse Building.

West Equalization Tank (Unit 23) was previously decontaminated and demolished. Closure of Unit 23 will be completed as part of floor decontamination for the Baghouse Building.

Process Tank (Unit 29) was previously decontaminated and demolished. Closure of Unit 29 will be completed as part of floor decontamination for the Baghouse Building.

Filtrate Tank (Unit 30) was previously decontaminated and demolished. Closure of Unit 30 will be completed as part of floor decontamination for the Baghouse Building.

4.3.11 Baghouse Building Deconstruction

A structural evaluation will be conducted for the Reverb Feed Room Building, RMPS Building, Baghouse Building and Smelter Building. The deconstruction sequence will be determined by the structural evaluation. The Baghouse Building will likely be deconstructed first as it is structurally dependent on the RMPS Building, Reverb Feed Room Building, and Smelter Building.

The lower levels of the Smelter, Blast Furnace Feed Room, Baghouse Building and RMPS Buildings and sumps will not be backfilled during Phase 1. A temporary fence will be installed at the perimeter of lower levels and sumps as needed due to health and safety concerns with fall hazards. The Corridor portion (north-south and west-east sections) of the Reverb Feed Room will remain in use as a decontamination area for equipment and building components that cannot be decontaminated in-place during these activities.

4.3.12 Desulfurization Area Units

The Desulfurization Area is enclosed within the Desulfurization Building. The building is also referred to as the Mud Tank Building. The Desulfurization Building has a concrete secondary containment area, metal roof and concrete and metal walls. Units 7, 8, 9, 10, former 64, former 65, and 67 and ancillary sump Mud Tank Area Sump 1 are located within the secondary containment area at the Desulfurization Building.

The discharge for the MAPCO Scrubber currently discharges to Units 7, 8, 9 or 10 and will be changed to discharge to Unit 6, RMPS Floor Sump in preparation for removing the Desulfurization units.

A temporary decontamination water storage feature will be mobilized to the facility as the Mud Tanks will be closed.

North Mud Tank (Unit 7) is a former IS tank and was used for storage of lead sulfate paste. Paste will be removed by Exide prior to closure. Unit 7 will be used for decontamination water storage prior to closure and may be used during closure. Unit 7 is a stainless steel, closed top tank. Unit 7 will be closed by removing inventory as discussed in Section 5.2, decontaminating the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycling the tank off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 7 is provided in Appendix D.

Center Mud Tank (Unit 8) is a former IS tank and was used for storage of lead sulfate paste. Paste will be removed by Exide prior to closure. Unit 8 will be used for decontamination water storage prior to closure and may be used during closure. Unit 8 is a stainless steel, closed top tank. Unit 8 will be closed by removing inventory as discussed in Section 5.2, decontaminating the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycling the tank off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 8 is provided in Appendix D.

South Mud Tank (Unit 9) is a former IS tank and was used for storage of lead sulfate paste. The paste will be removed by Exide prior to closure. Unit 9 may be used for decontamination water storage prior to and during closure. Unit 9 is a stainless steel, closed top tank. Unit 9 will be closed by removing inventory as discussed in Section 5.2, decontaminating the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycling the tank off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 9 is provided in Appendix D.

South Acid Storage Tank (Unit 10) is a former IS tank and was used for storage of sulfuric acid. Unit 10 currently contains discharge from the MAPCO Scrubber, which will be removed by Exide prior to closure. Unit 10 is a polyethylene, closed top tank. Unit 10 will be closed by cleaning the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycling the tank off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and disposing the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 10 is provided in Appendix D.

Acid Overflow Tank B (Unit 67) is a former IS tank and was used for storage of sulfuric acid. Unit 67 contains solid residue. The stand for Unit 67 has failed. Unit 67 is a polyethylene,

closed top tank. Unit 67 will be closed by removing inventory as discussed in Section 5.2, cleaning the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycling the tank off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and disposing the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 67 is provided in Appendix D.

4.3.13 Desulfurization Building

The Desulfurization Building will be closed by decontaminating the floor, walls and roof as discussed in Section 8.0, and performing wipe, concrete, soil, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Surface wipe samples will be performed on all walls and the roof of the building. Additional information regarding the Desulfurization Building is provided in Table 1.2 and the Closure Cost Estimate (Appendix I).

North Acid Storage Tank 2 (Unit 64) was previously decontaminated and demolished. Closure of Unit 64 will be completed as part of floor decontamination, and concrete, soil and soil gas sampling for the Desulfurization Building.

North Acid Storage Tank (Unit 65) was previously decontaminated and demolished. Closure of Unit 65 will be completed as part of floor decontamination, and concrete, soil and soil gas sampling for the Desulfurization Building.

Ancillary sump Mud Tank Area Sump 1 was ancillary to former IS units and used for management of wash down water. Mud Tank Area Sump 1 is a concrete sump. Mud Tank Area Sump 1 will be closed by removing standing liquid as discussed in Section 5.2, decontaminating the sump concurrent with Desulfurization Building floor decontamination as discussed in Section 8.0, and performing concrete, soil, and soil gas sampling concurrent with Desulfurization Building sampling as discussed in Sections 9.0 and 10.0, respectively. Additional information regarding Mud Tank Area Sump 1 is provided in Table 1.3.

A structural evaluation will be conducted for the Desulfurization Building. The Desulfurization Building will be deconstructed to 5 feet below grade as discussed in Section 11.0.

4.3.14 RMPS Units

The RMPS area is enclosed within the RMPS Building. The RMPS Building consists of four sections: the unloading dock, the narrow section along the west side of the Reverb Furnace Feed Room, the main RMPS area, and the enclosed plastic trailer loading dock. The section along the west side of the Reverb Furnace Feed Room includes a main level, and a lower level which includes Unit 5, Battery Dump Bin Sump, and Unit 70, Oscillating Pan Feeder. The RMPS Building has two concrete secondary containment areas (the main area and the lower level), concrete floor, metal roof and concrete and metal walls. Former IS units 5, 6, 12, 13, 14, 40, 41, 42, 43, 44, 45, 66, 68, 70, 79, and 80, and former IS units 11, 26, 27, and 28 which underwent preliminary closure are located within the RMPS Building.

Battery Processing Units

Oscillating Pan Feeder (Unit 70) is a former IS miscellaneous unit which processed spent batteries and lead-bearing plant scrap. Materials in Unit 70 will be removed by Exide prior to the start of closure. Unit 70 is constructed of stainless steel and is located above the lower level secondary containment area at the RMPS Building. Unit 70 will be closed by decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the unit off-site as discussed in Section 7.8~~. Additional information regarding Unit 70 is provided in Appendix D.

RMPS Hammer Mill (Unit 40) is a former IS miscellaneous unit which processed spent batteries. Materials in Unit 40 will be removed by Exide prior to the start of closure. Unit 40 is constructed of stainless steel and is located in the main secondary containment area at the RMPS

Building. Unit 40 will be closed by cleaning the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and re-using the unit at an alternate facility as discussed in Section 7.8~~. Additional information regarding Unit 40 is provided in Appendix D.

Paste/Acid Processing Units

Paste Thickening Unit (Santa Maria) (Unit 12) is a former IS regulated tank intended to contain lead sulfate paste. Unit 12 was reconstructed during the facility shutdown in the fall of 2014 and was never used to handle waste materials. Unit 12 is empty. Unit 12 is a stainless steel, open top tank located in the main secondary containment area at the RMPS Building. Unit 12 will be closed by cleaning the interior (single rinse) and exterior (single rinse) of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and re-using the tank at an alternate facility as discussed in Section 7.8~~. Additional information regarding Unit 12 is provided in Appendix D. Closure Performance Standards are discussed in Section 3.2.1.1 for equipment that is being removed and reused.

Acid Overflow Tank A (Unit 66) is a former IS regulated tank and was used for storage of sulfuric acid. Unit 66 is empty. Unit 66 is a polyethylene, closed top tank and is located in the main secondary containment area at the RMPS Building. Unit 66 will be closed by cleaning the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and disposing the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 66 is provided in Appendix D.

Waste Acid Circulation Tank (Unit 41) is a former IS tank and contained sodium sulfate solution and dilute sulfuric acid. The tank contains solid residue which will be removed by Exide prior to closure. Unit 41 is a stainless steel, open top tank located in the main secondary containment area at the RMPS Building. Unit 41 will be closed by decontaminating the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 41 is provided in Appendix D.

Clarifying Acid Filter Press (Unit 68) is a former IS miscellaneous unit which processed sulfuric acid. Unit 68 is empty. Unit 68 is constructed of cast iron coated with acid resistant paint and is located in the main secondary containment area at the RMPS Building. Unit 68 will be closed by decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the unit off-site as discussed in Section 7.8~~. Additional information regarding Unit 68 is provided in Appendix D.

Plastic Processing Units

East Elutriation Column (Unit 42) is a former IS miscellaneous unit which processed dilute sulfuric acid, plastic, rubber and lead metal. Unit 42 is empty. Unit 42 is constructed of stainless

steel and is located in the main secondary containment area at the RMPS Building. Piping discharge to Unit 42 from the WWTP has been disconnected by Exide. Unit 42 will be closed by decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the unit off-site as discussed in Section 7.8~~. Additional information regarding Unit 42 is provided in Appendix D.

West Elutriation Column (Unit 43) is a former IS miscellaneous unit which processed dilute sulfuric acid, plastic, rubber and lead metal. Unit 43 is empty. Unit 43 is constructed of stainless steel and is located in the main secondary containment area at the RMPS Building. Unit 43 will be closed by decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the unit off-site as discussed in Section 7.8~~. Additional information regarding Unit 43 is provided in Appendix D.

Sink/Float Separator (Unit 13) is a former IS tank and contained plastic and dilute sulfuric acid. Unit 13 is empty. Unit 13 is a stainless steel, open top tank located in the main secondary containment area at the RMPS Building. Unit 13 will be closed by decontaminating the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 13 is provided in Appendix D.

Recycle Tank (Unit 14) is a former IS tank and contained dilute sulfuric acid. Unit 14 is empty. Unit 14 is a stainless steel, open top tank located in the main secondary containment area at the RMPS Building. Unit 14 will be closed by decontaminating the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 14 is provided in Appendix D.

Plastic Centrifuge #1 (Unit 80) is a former IS miscellaneous unit which separated plastic chips and rinse water. Unit 80 is empty. Unit 80 is constructed of stainless steel and is located in the main secondary containment area at the RMPS Building. Unit 80 will be closed by decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an

appropriate disposal facility~~and recycling the unit off-site as discussed in Section 7.8~~. Additional information regarding Unit 80 is provided in Appendix D.

RMPS Filter Press

RMPS Filter Press Unit B (Unit 45) is a former IS miscellaneous unit which processed lead carbonate paste. Unit 45 is empty. Unit 45 was partially decontaminated and deconstructed in preparation for replacement of the filter press when the decision to pursue closure occurred. Unit 45 is constructed of cast iron coated with acid resistant paint and is located in the main secondary containment area at the RMPS Building. Unit 45 will be closed by decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the unit off-site as discussed in Section 7.8~~. Additional information regarding Unit 45 is provided in Appendix D.

WWTP Filter Press

A temporary filter press will be mobilized to replace Unit 44. It is anticipated that the temporary filter press will be located at Unit 1.

Surge Tank (Unit 79) is a former IS tank that may be used during closure for storage of wastewater in conjunction with Unit 44 operations. Unit 79 is a polyethylene, closed top tank and located in the main secondary containment area at the RMPS Building. Unit 79 will be closed by removing inventory as discussed in Section 5.2, cleaning the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and re-using the tank at an alternate facility as discussed in Section 7.8~~. Additional information regarding Unit 79 is provided in Appendix D.

WWTP Filter Press (Unit 44) is a former IS miscellaneous unit which processed lead carbonate paste and WWTP sludge and which may be used for WWTP sludge processing during closure. Unit 44 is constructed of cast iron coated with acid resistant paint and is located in the main secondary containment area at the RMPS Building. Unit 44 will be closed by decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the unit off-site as discussed in Section 7.8~~. Additional information regarding Unit 44 is provided in Appendix D.

If used, the temporary container associated with Unit 44 will be decontaminated as discussed in Section 6.0, sampled and demobilized from the facility.

4.3.15 RMPS Building/Upper Feed Room Building

The discharge from Unit 87, West Yard Truck Wash, will be rerouted from Unit 5 to the WWTP.

RMPS Floor Sump (Unit 6) is a former IS tank used to collect sodium sulfate solution and wash water. Unit 6 is a double-walled stainless steel sump located in the main secondary containment area at the RMPS Building. Unit 6 will be closed by removing standing liquid as discussed in Section 5.2, removing the stainless steel liner as discussed in Section 8.2, decontaminating the sump concurrent with RMPS Building floor decontamination as discussed in Section 8.0, and conducting wipe, concrete, soil and soil gas sampling as discussed in Section 9.0. Additional information regarding Unit 6 is provided in Appendix D.

Battery Dump Bin Sump (Unit 5) is a former IS tank used to collect acid and wash water. Unit 5 is a double-walled stainless steel sump located in the lower level secondary containment area at the RMPS Building. Unit 5 will be closed by removing inventory as discussed in Section 5.2, removing the stainless steel liner as discussed in Section 8.2, decontaminating the sump concurrent with RMPS Building floor decontamination as discussed in Section 8.0, and conducting wipe, concrete, soil and soil gas sampling as discussed in Section 9.0. Additional information regarding Unit 5 is provided in Appendix D.

The RMPS Building and Upper Feed Room portion of the Reverb Feed Room will be closed by decontaminating the floor, secondary containment areas, walls and roof as discussed in Section 8.0, and performing wipe, concrete, soil, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Surface wipe samples will be performed on all walls and roof of the RMPS and Reverb Feed Room. Additional information regarding the RMPS Building and Reverb Feed Room are provided in Table 1.2 and the Closure Cost Estimate (Appendix I).

Overflow Tank (Unit 11) was previously decontaminated and demolished. Closure sampling (chip, soil, and soil gas) of Unit 11 will be completed as part of floor decontamination, and concrete, soil and soil gas sampling for the RMPS Building.

pH Adjustment Tank #1 (Unit 26) was previously decontaminated and demolished. Closure sampling (chip, soil, and soil gas) of Unit 26 will be completed as part of floor decontamination, and concrete, soil and soil gas sampling for the RMPS Building.

pH Adjustment Tank #2 (Unit 27) was previously decontaminated and demolished. Closure sampling (chip, soil, and soil gas) of Unit 27 will be completed as part of floor decontamination, and concrete, soil and soil gas sampling for the RMPS Building.

pH Adjustment Tank #2 (Unit 28) was previously decontaminated and demolished. Closure sampling (chip, soil, and soil gas) of Unit 28 will be completed as part of floor decontamination, and concrete, soil and soil gas sampling for the RMPS Building.

The RMPS Building and Upper Feed Room portion of the Reverb Feed Room will be deconstructed to grade as discussed in Section 11.0.

4.3.16 Smelter Building Units and Equipment

Negative pressure for the Smelter Building and Corridor will be provided by re-ducting a portion of the capacity of the existing Torit and/or MAC Baghouses or using temporary emission control equipment.

The Smelter Building has a concrete floor, metal roof and concrete and metal walls. Units 36 and 37 are located on the main level of the Smelter Building. Receiving and refining kettles (Units 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102) are accessed from the main level of the Smelter Building and extend below the main level floor into a lower level referred to as

the kettle gallery. Ancillary sumps North Kettle Gallery Sump, South Kettle Gallery Sump and Cooling Tower Return Sump are located within the lower level of the Smelter Building.

Receiving Kettle A (Unit 89) is a former IS miscellaneous unit which processed lead product. Unit 89 is constructed of steel and is located in the Smelter Building. Unit 89 will be closed by removing inventory as discussed in Section 5.2.2.5, decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and re-using or recycling the unit off-site as discussed in Section 7.8~~. The kettle housing and brick will also be decontaminated, sampled and recycled or disposed off-site. Additional information regarding Unit 89 is provided in Appendix D.

Receiving Kettle B (Unit 90) is a former IS miscellaneous unit which processed lead product. Unit 90 is constructed of steel and is located in the Smelter Building. Unit 90 will be closed by removing inventory as discussed in Section 5.2.2.5, decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and re-using or recycling the unit off-site as discussed in Section 7.8~~. The kettle housing and brick will also be decontaminated, sampled and recycled or disposed off-site. Additional information regarding Unit 90 is provided in Appendix D.

Receiving Kettle E (Unit 91) is a former IS miscellaneous unit which processed lead product. Unit 91 is constructed of steel and is located in the Smelter Building. Unit 91 will be closed by removing inventory as discussed in Section 5.2.2.5, decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and re-using or recycling the unit off-site as discussed in Section 7.8~~. The kettle housing and brick will also be

decontaminated, sampled and recycled or disposed off-site. Additional information regarding Unit 91 is provided in Appendix D.

Receiving Kettle F (Unit 92) is a former IS miscellaneous unit which processed lead product. Unit 92 is constructed of steel and is located in the Smelter Building. Unit 92 will be closed by removing inventory as discussed in Section 5.2.2.5, decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and re-using or recycling the unit off-site as discussed in Section 7.8~~. The kettle housing and brick will also be decontaminated, sampled and recycled or disposed off-site. Additional information regarding Unit 92 is provided in Appendix D.

Receiving Kettle G (Unit 93) is a former IS miscellaneous unit which processed lead product. Unit 93 is constructed of steel and is located in the Smelter Building. Unit 93 will be closed by removing inventory as discussed in Section 5.2.2.5, decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and reusing or recycling the unit off-site as discussed in Section 7.8~~. The kettle housing and brick will also be decontaminated, sampled and recycled or disposed off-site. Additional information regarding Unit 93 is provided in Appendix D.

Refining Kettle 1 (Unit 94) is a former IS miscellaneous unit which processed lead product. Unit 94 is constructed of steel and is located in the Smelter Building. Unit 94 will be closed by removing inventory as discussed in Section 5.2.2.5, decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and re-using or recycling the unit off-site as discussed in Section 7.8~~. The kettle housing and brick will also be decontaminated, sampled and recycled or disposed off-site. Additional information regarding Unit 94 is provided in Appendix D.

Refining Kettle 2 (Unit 95) is a former IS miscellaneous unit which processed lead product. Unit 95 is constructed of steel and is located in the Smelter Building. Unit 95 will be closed by removing inventory as discussed in Section 5.2.2.5, decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and re-using or recycling the unit off-site as discussed in Section 7.8~~. The kettle housing and brick will also be decontaminated, sampled and recycled or disposed off-site. Additional information regarding Unit 95 is provided in Appendix D.

Refining Kettle 3 (Unit 96) is a former IS miscellaneous unit which processed lead product. Unit 96 is constructed of steel and is located in the Smelter Building. Unit 96 will be closed by

removing inventory as discussed in Section 5.2.2.5, decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and re-using or recycling the unit off-site as discussed in Section 7.8~~. The kettle housing and brick will also be decontaminated, sampled and recycled or disposed off-site. Additional information regarding Unit 96 is provided in Appendix D.

Refining Kettle 4 (Unit 97) is a former IS miscellaneous unit which processed lead product. Unit 97 is constructed of steel and is located in the Smelter Building. Unit 97 will be closed by removing inventory as discussed in Section 5.2.2.5, decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and re-using or recycling the unit off-site as discussed in Section 7.8~~. The kettle housing and brick will also be decontaminated, sampled and recycled or disposed off-site. Additional information regarding Unit 97 is provided in Appendix D.

Refining Kettle 5 (Unit 98) is a former IS miscellaneous unit which processed lead product. Unit 98 is constructed of steel and is located in the Smelter Building. Unit 98 will be closed by removing inventory as discussed in Section 5.2.2.5, decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and re-using or recycling the unit off-site as discussed in Section 7.8~~. The kettle housing and brick will also be decontaminated, sampled and recycled or disposed off-site. Additional information regarding Unit 98 is provided in Appendix D.

Refining Kettle 6 (Unit 99) is a former IS miscellaneous unit which processed lead product. Unit 99 is located in the Smelter Building. The kettle is no longer present at Unit 99; however, the kettle housing remains. The kettle housing and brick will be decontaminated as discussed in Section 6.0, confirmation sampling will be conducted, and, based on the results, the unit will be recycled off-site as discussed in Section 7.8 or shipped to an appropriate disposal facility~~and recycled or disposed off-site as discussed in Section 7.8~~. Additional information regarding Unit 99 is provided in Appendix D.

Refining Kettle 7 (Unit 100) is a former IS miscellaneous unit which processed lead product. Unit 100 is constructed of steel and is located in the Smelter Building. Unit 100 will be closed by removing inventory as discussed in Section 5.2.2.5, decontaminating the unit as discussed in

Section 6.0, sampled, and re-using or recycling the unit off-site as discussed in Section 7.8 or shipped to an appropriate disposal facility. The kettle housing and brick will also be decontaminated, sampled and recycled or disposed off-site. Additional information regarding Unit 100 is provided in Appendix D.

Refining Kettle 8 (Unit 101) is a former IS miscellaneous unit which processed lead product. Unit 101 is constructed of steel and is located in the Smelter Building. Unit 101 will be closed by removing inventory as discussed in Section 5.2.2.5, decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and re-using or recycling the unit off-site as discussed in Section 7.8~~. The kettle housing and brick will also be decontaminated, sampled and recycled or disposed off-site. Additional information regarding Unit 101 is provided in Appendix D.

Refining Kettle 9 (Unit 102) is a former IS miscellaneous unit which processed lead product. Unit 102 is constructed of steel and is located in the Smelter Building. Unit 102 will be closed by removing inventory as discussed in Section 5.2.2.5, decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and re-using or recycling the unit off-site as discussed in Section 7.8~~. The kettle housing and brick will also be decontaminated, sampled and recycled or disposed off-site. Additional information regarding Unit 102 is provided in Appendix D.

Reverb Furnace (Unit 36) is a former IS miscellaneous unit which processed reverb furnace feed material. Unit 36 is constructed of brick and steel and is located in the Smelter Building. Unit 36 is empty. However, lead and slag can accumulate between the steel frame forming the bottom of reverb-style furnaces. Therefore lead and slag should be anticipated beneath this unit during deconstruction. The brick was replaced in 2014 in anticipation of the facility restarting but the furnace was not used for material processing following brick replacement. The burner and feed

screw portions of the furnace were previously removed and are in an on-site warehouse. Unit 36 will be closed by removing brick for re-use at an alternate facility as discussed in Section 7.8, removing lead and slag from beneath the unit, decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~re-using the burners and feed screws at an alternate facility as discussed in Section 7.8, and recycling the remaining unit off-site as discussed in Section 7.8~~. Additional information regarding Unit 36 is provided in Appendix D.

Blast Furnace (Unit 37) is a former IS miscellaneous unit which processed blast furnace feed material. Unit 37 is empty. Unit 37 is constructed of brick and steel and is located in the Smelter Building. Unit 37 will be closed by removing brick as discussed in Section 5.2, decontaminating the unit as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~re-using the crucible at an alternate facility as discussed in Section 7.8, and recycling the remainder of the unit off-site as discussed in Section 7.8~~. Additional information regarding Unit 37 is provided in Appendix D.

4.3.17 Smelter Building

Ancillary sump North Kettle Gallery Sump and South Kettle Gallery Sump are ancillary to former IS units and are used for management of wash down water. North Kettle Gallery Sump and South Kettle Gallery Sump are concrete sumps. North Kettle Gallery Sump and South Kettle Gallery Sump will be closed by removing inventory as discussed in Section 5.2, decontaminating the sumps concurrent with Smelter Building floor decontamination as discussed in Section 8.0, and performing concrete, soil, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Additional information regarding North Kettle Gallery Sump and South Kettle Gallery Sump is provided in Table 1.3.

Ancillary sump Cooling Tower Return Sump is used for management of cooling water. Cooling Tower Return Sump is a concrete sump. Cooling Tower Return Sump will be closed by removing inventory as discussed in Section 5.2, decontaminating the sump concurrent with Smelter Building floor decontamination as discussed in Section 8.0, and performing concrete, soil, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Additional information regarding Cooling Tower Return Sump is provided in Table 1.3.

The Smelter Building, including the Lower Level, will be closed by decontaminating the floor, walls and roof as discussed in Section 8.0, and performing wipe, concrete, soil, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Surface wipe samples will be performed for all walls and the ceiling of the building. Concrete, soil and soil gas sampling will be performed in the footprint of former IS units only. Additional information regarding the Smelter Building is provided in Table 1.2 and the Closure Cost Estimate (Appendix I).

The Smelter Building will be deconstructed to grade as discussed in Section 11.0.

4.3.18 Containment Building Decontamination

The Reverb Furnace Feed Room (Unit 33) is a former IS containment building and was used for storage of reverb furnace feed. Unit 33 is empty. Unit 33 has a reinforced concrete floor and double-lined containment system with leak detection, metal roof, and concrete and metals walls. Unit 33 will be closed by decontaminating the floor, walls and roof as discussed in Section 8.0, and performing wipe, concrete, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Surface wipe samples will be performed on all walls and ceiling of the building. Soil sampling was performed prior to closure. Additional information regarding Unit 33 is provided in Appendix D.

The Truck Wash Sump (Unit 51) is a former IS tank (concrete sump) used to collect wash water within the Reverb Furnace Feed Room (Unit 33). Unit 51 contents will be removed prior to closure. Unit 51 will be closed by decontaminating the sump concurrent with Unit 33 floor decontamination as discussed in Section 8.0, and performing concrete, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Soil sampling was performed prior to closure. Additional information regarding Unit 51 is provided in Appendix D.

The Corridor portion (north-south and west-east sections) of Unit 33 will remain in use as a decontamination area during closure. Negative pressure for the Corridor will be provided by re-ducting a portion of the capacity of the existing Torit and/or MAC Baghouses or using temporary emission control equipment.

The Lower Feed Room and then the Corridor portions of the Reverb Feed Room will be deconstructed to grade as discussed in Section 11.0.

4.3.19 Finished Lead Building

The Finished Lead Building will be closed as a containment building by decontaminating the floor, walls and roof as discussed in Section 8.0. Wipe sampling will be performed as discussed in Section 9.2. Additional information regarding the Finished Lead Building is provided in Table 1.2 and the Closure Cost Estimate (Appendix I). The building will be deconstructed to remove all structures, foundations and 5 feet of soils.

4.3.20 WWTP Units

The Wastewater Treatment Plant will be one of the final areas to be decontaminated so that stormwater and decontamination water generated during Phase 1 can be processed on-site to the extent possible. A temporary WWTP will be mobilized as discussed in Section 3.9.3. The temporary WWTP is anticipated to be located at Unit 1. The temporary WWTP will treat Phase 1 liquids generated after decontamination of the Wastewater Treatment Plant and stormwater through the Phase 2 Closure and Corrective Action activities, and until Exide is permitted to direct discharge surface water runoff.

The WWTP is a secondary containment area with concrete floor and walls. Units 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 71, 72, 73, 74, 75, 76 and 77 are located within the secondary containment area at the WWTP.

WWTP Acid Storage Tank (Unit 63) is a former IS tank and was used for storage of acid. Unit 63 is empty. Unit 63 is a polyethylene, closed top tank located in the secondary containment area at the WWTP. Unit 63 will be closed by decontaminating the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, shipping the unit to an appropriate disposal facility~~and disposing the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 63 is provided in Appendix D.

WWTP Recycled Acid Tank (Unit 76) is a former IS tank and was used for storage of wastewater. Unit 76 is empty. Unit 76 is a polyethylene, open top tank located in the secondary containment area at the WWTP. Unit 76 will be closed by cleaning the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, shipping the unit to an appropriate disposal facility~~and disposing the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 76 is provided in Appendix D.

Equalization Tank 1 (Unit 52) is a former IS tank and is used for storage of wastewater. Unit 52 is a stainless steel, open top tank located in the secondary containment area at the WWTP. Unit 52 will be closed by removing remaining liquid as discussed in Section 5.2, decontaminating the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 52 is provided in Appendix D.

Equalization Tank 2 (Unit 53) is a former IS tank and is used for storage of wastewater. Unit 53 is a stainless steel, open top tank located in the secondary containment area at the WWTP. Unit 53 will be closed by removing remaining liquid as discussed in Section 5.2, decontaminating the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 53 is provided in Appendix D.

Reaction Tank 1 (Unit 57) is a former IS tank and is used for storage of wastewater. Unit 57 is a polyethylene, open top tank located in the secondary containment area at the WWTP. Unit 57 will be closed by removing remaining liquid as discussed in Section 5.2, cleaning the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, shipping the unit to an appropriate disposal facility~~and disposing the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 57 is provided in Appendix D.

Reaction Tank 2 (Unit 58) is a former IS tank and is used for storage of wastewater. Unit 58 is a polyethylene, open top tank located in the secondary containment area at the WWTP. Unit 58 will be closed by removing remaining liquid as discussed in Section 5.2, cleaning the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, shipping the unit to an appropriate disposal facility~~and disposing the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 58 is provided in Appendix D.

Reaction Tank 3 (Unit 59) is a former IS tank and is used for storage of wastewater. Unit 59 is a polyethylene, open top tank located in the secondary containment area at the WWTP. Unit 59 will be closed by removing remaining liquid as discussed in Section 5.2, cleaning the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, shipping the unit to an appropriate disposal facility~~and disposing the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 59 is provided in Appendix D.

Reaction Tank 4 (Unit 60) is a former IS tank and is used for storage of wastewater. Unit 60 is a polyethylene, open top tank located in the secondary containment area at the WWTP. Unit 60 will be closed by removing remaining liquid as discussed in Section 5.2, cleaning the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, shipping the unit to an appropriate disposal facility~~and disposing the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 60 is provided in Appendix D.

Reaction Tank 5 (Unit 61) is a former IS tank and is used for storage of wastewater. Unit 61 is a polyethylene, open top tank located in the secondary containment area at the WWTP. Unit 61 will be closed by removing remaining liquid as discussed in Section 5.2, cleaning the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, shipping the unit to an appropriate disposal facility~~and disposing the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 61 is provided in Appendix D.

Flocculation Tank (Unit 55) is a former IS tank and is used for storage of wastewater. Unit 55 is a steel, closed top tank located in the secondary containment area at the WWTP. Unit 55 will be closed by removing remaining liquid as discussed in Section 5.2, cleaning the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and re-using the tank at an alternate facility as discussed in Section 7.8~~. Additional information regarding Unit 55 is provided in Appendix D.

WWTP Clarifier (Unit 56) is a former IS tank and is used for storage of wastewater. Unit 56 is a stainless steel, open top tank located in the secondary containment area at the WWTP. Unit 56 will be closed by removing remaining liquid as discussed in Section 5.2, decontaminating the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 56 is provided in Appendix D.

Sand Filter Feed Tank (Unit 77) is a former IS tank and is used for storage of wastewater. Unit 77 is a polyethylene, open top tank located in the secondary containment area at the WWTP. Unit 77 will be closed by removing remaining liquid as discussed in Section 5.2, cleaning the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, shipping the unit to an appropriate disposal facility~~and disposing the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 77 is provided in Appendix D.

Sand Filter #1 (Unit 71) is a former IS tank and is used for storage of wastewater. Unit 71 is a stainless steel, closed top tank located in the secondary containment area at the WWTP. Unit 71 will be closed by removing remaining liquid and filter media as discussed in Section 5.2, decontaminating the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section

7.8 or shipping the unit to an appropriate disposal facility~~and recycling the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 71 is provided in Appendix D.

Sand Filter #2 (Unit 72) is a former IS tank and is used for storage of wastewater. Unit 72 is a stainless steel, closed top tank located in the secondary containment area at the WWTP. Unit 72 will be closed by removing remaining liquid and filter media as discussed in Section 5.2, decontaminating the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 72 is provided in Appendix D.

Sand Filter #3 (Unit 73) is a former IS tank and is used for storage of wastewater. Unit 73 is a stainless steel, closed top tank located in the secondary containment area at the WWTP. Unit 73 will be closed by removing remaining liquid and filter media as discussed in Section 5.2, decontaminating the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 73 is provided in Appendix D.

Sand Filter #4 (Unit 74) is a former IS tank and is used for storage of wastewater. Unit 74 is a stainless steel, closed top tank located in the secondary containment area at the WWTP. Unit 74 will be closed by removing remaining liquid and filter media as discussed in Section 5.2, decontaminating the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 74 is provided in Appendix D.

Sand Filter #5 (Unit 75) is a former IS tank and is used for storage of wastewater. Unit 75 is a stainless steel, closed top tank located in the secondary containment area at the WWTP. Unit 75

will be closed by removing remaining liquid and filter media as discussed in Section 5.2, decontaminating the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, recycle the unit off-site as discussed in Section 7.8 or shipping the unit to an appropriate disposal facility~~and recycling the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 75 is provided in Appendix D.

Sludge Holding Tank (Unit 54) is a former IS tank and is used for storage of clarified sludge. Unit 54 is a polyethylene, closed top tank located in the secondary containment area at the WWTP. Unit 54 will be closed by removing contents as discussed in Section 5.2, decontaminating the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, shipping the unit to an appropriate disposal facility~~and disposing the tank off-site as discussed in Section 7.8~~. Additional information regarding Unit 54 is provided in Appendix D.

The temporary filter press and temporary decontamination water storage feature will be decontaminated and demobilized.

4.3.24 WWTP Decontamination and Deconstruction

The WWTP area will be closed by decontaminating the floor and walls discussed in Section 8.0, and performing wipe, concrete, soil, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Tank pedestals will be deconstructed as discussed in Section 11.2. Additional information regarding the WWTP area is provided in Table 1.2 and the Closure Cost Estimate (Appendix I).

WWTP Sump (Unit 62) is a former IS tank and is used for collection of wastewater. Unit 62 is a double-walled stainless steel sump located in the secondary containment area at the WWTP. Unit 62 will be closed by removing liquid as discussed in Section 5.2, decontaminating the sump concurrent with WWTP floor decontamination as discussed in Section 8.0, and conducting wipe,

concrete, soil and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Additional information regarding Unit 62 is provided in Appendix D.

4.3.21 Non-Permitted Building Roofs

Non-permitted building roofs will be decontaminated as discussed in Section 12.0.

4.3.22 Trailer Staging Area

The Trailer Staging Area (Unit 103) is a former IS container storage area and was used for storage of trailers containing dry plastic chips. Unit 103 is empty. Unit 103 has asphalt paving. Unit 103 will be closed by decontaminating the asphalt surface as discussed in Section 8.0, and performing asphalt, soil, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Additional information regarding Unit 103 is provided in Appendix D.

4.3.23 Concrete Yard System (Former WWTP)

The Concrete Yard System is the location of the former WWTP. Units 15, 16, 17, 18, 19, 20, 21, 38 and 39 underwent preliminary closure and were located within the Concrete Yard System. The Concrete Yard System will be closed by ~~decontaminating the existing ground surface as discussed in Section 8.0.~~ removing the asphalt paving and soils beneath the paving to a depth of 5 feet.

50K Tank (Unit 15) was previously decontaminated and demolished. Closure of Unit 15 will be completed as part of existing ground surface decontamination for the Concrete Yard System.

West Reaction Tank (Unit 16) was previously decontaminated and demolished. Closure of Unit 16 will be completed as part of existing ground surface decontamination for the Concrete Yard System.

East Reaction Tank (Unit 17) was previously decontaminated and demolished. Closure of Unit 17 will be completed as part of existing ground surface decontamination for the Concrete Yard System.

Pump Tank (Unit 18) was previously decontaminated and demolished. Closure of Unit 18 will be completed as part of existing ground surface decontamination for the Concrete Yard System.

Sludge Tank (Unit 19) was previously decontaminated and demolished. Closure of Unit 19 will be completed as part of existing ground surface decontamination for the Concrete Yard System.

Delta Stack Clarifier (Unit 20) was previously decontaminated and demolished. Closure of Unit 20 will be completed as part of existing ground surface decontamination for the Concrete Yard System.

WWTP Area Sump (Unit 38) was previously decontaminated and demolished. Closure of Unit 38 will be completed as part of existing ground surface decontamination for the Concrete Yard System.

WWTP Filter Press Sump (Unit 39) was previously decontaminated and demolished. Closure of Unit 39 will be completed as part of existing ground surface decontamination for the Concrete Yard System.

Additional information regarding the Concrete Yard System is provided in Table 1.2 and the Closure Cost Estimate (Appendix I).

4.3.24 Unregulated Area Decontamination

Site-wide unregulated areas which were not decontaminated during the aforementioned activities will be decontaminated as discussed in Section 12.0.

Water Softener Building Sump is an ancillary sump used for management of wash down water. Water Softener Building Sump is a concrete sump. Water Softener Building Sump will be closed by removing inventory as discussed in Section 5.2, decontaminating the sump as discussed in Section 8.0 concurrent with unregulated area decontamination, and performing concrete, soil, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Additional information regarding Water Softener Building Sump is provided in Table 1.3.

Caustic Tank Sump is an ancillary sump used for management of wash down water. Caustic Tank Sump is a concrete sump with stainless steel liner. Caustic Tank Sump will be closed by removing inventory as discussed in Section 5.2, removing the stainless steel liner as discussed in Section 8.2, decontaminating the sump as discussed in Section 8.0 concurrent with unregulated area decontamination, and performing concrete, soil, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Additional information regarding Caustic Tank Sump is provided in Table 1.3.

Ancillary sump Railroad Sump is ancillary to former IS units and is used for management of storm water. Railroad Sump is a concrete sump. Railroad Sump will be closed by removing accumulated liquid as discussed in Section 5.2, decontaminating the sump as discussed in Section 8.0 concurrent with unregulated area decontamination, and performing concrete, soil, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Additional information regarding Railroad Sump is provided in Table 1.3.

4.3.25 Stormwater System

DTSC has indicated that the stormwater system is ancillary to Unit 46. As discussed in Section 6.7, the stormwater system will be cleaned prior to final closure of the Drop Out System. Wipe sampling and structure sampling (if needed) will be conducted as discussed in Section 7.4. Soil sampling along the pipe alignment and pressure testing of the stormwater system will be conducted as discussed in Section 10.2.2.

4.3.26 Drop Out System

The Drop Out System is a secondary containment area with concrete floor and walls within the Central Container Storage Building (Unit 1). Units 46, 47, 48, 49 and 50 are located within the secondary containment area at the Drop Out System.

Pump Sump (Unit 46) is a former IS tank and is used for storage of stormwater and wash down water. Unit 46 is a double-walled stainless steel sump located in the secondary containment area at the Drop Out System. Unit 46 must remain operational for management of stormwater runoff. Unit 46 will be initially cleaned by removing remaining contents as discussed in Section 5.2, concurrent with Drop Out System floor decontamination as discussed in Section 8.0, and conducting wipe sampling of the exposed surfaces as discussed in Section 9.0. The Unit 46 stainless steel liner will not be removed until Phase 2 Closure. Additional information regarding Unit 46 is provided in Appendix D. Unit 46 will continue to operate after closure to continue management of stormwater after Phase 1 as discussed in Section 2.8.3.3.

Settling Tank No. 1 (Unit 47) is a former IS tank and is used for storage of stormwater and wash down water. Unit 47 is a polyethylene, open top tank located in the secondary containment area at the Drop Out System. Unit 47 will be closed by removing remaining contents as discussed in Section 5.2, cleaning the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, shipping the unit to an appropriate disposal

facilityand disposing the tank off-site as discussed in Section 7.8. Additional information regarding Unit 47 is provided in Appendix D.

Settling Tank No. 2 (Unit 48) is a former IS tank and is used for storage of stormwater and wash down water. Unit 48 is a polyethylene, open top tank located in the secondary containment area at the Drop Out System. Unit 48 will be closed by removing remaining contents as discussed in Section 5.2, cleaning the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, shipping the unit to an appropriate disposal facilityand disposing the tank off-site as discussed in Section 7.8. Additional information regarding Unit 48 is provided in Appendix D.

Settling Tank No. 3 (Unit 49) is a former IS tank and is used for storage of stormwater and wash down water. Unit 49 is a polyethylene, open top tank located in the secondary containment area at the Drop Out System. Unit 49 will be closed by removing remaining contents as discussed in Section 5.2, cleaning the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, shipping the unit to an appropriate disposal facilityand disposing the tank off-site as discussed in Section 7.8. Additional information regarding Unit 49 is provided in Appendix D.

Settling Tank No. 4 (Unit 50) is a former IS tank and is used for storage of stormwater and wash down water. Unit 50 is a polyethylene, open top tank located in the secondary containment area at the Drop Out System. Unit 50 will be closed by removing remaining contents as discussed in Section 5.2, cleaning the interior and exterior of the tank as discussed in Section 6.0, conducting confirmation sampling, and, based on the results, shipping the unit to an appropriate disposal facilityand disposing the tank off-site as discussed in Section 7.8. Additional information regarding Unit 50 is provided in Appendix D.

The Drop Out System area will be closed by decontaminating the secondary containment area floor and walls as discussed in Section 8.0, and performing concrete, soil, and soil gas sampling

as discussed in Sections 9.0 and 10.0, respectively. Additional information regarding the Drop Out System area is provided in Table 1.2 and the Closure Cost Estimate (Appendix I).

4.3.27 Surface Impoundment

The Stormwater Surface Impoundment (Unit 78) is a lined surface impoundment with three sumps. The surface impoundment is constructed with a double-liner and leak detection system. The liner system is made up of (from top to bottom) a 60-MIL HDPE geomembrane over-liner, a 110-MIL geotextile fabric, a 40-MIL HDPE geomembrane under-liner, and a 110-MIL geotextile fabric. Unit 78 will be closed by removing and treating stormwater contained therein as discussed in Section 5.2, decontaminating the impoundment as discussed in Section 6.6, performing geomembrane sampling as discussed in Section 7.4.2, and performing soil, and soil gas sampling as discussed in Section 10.0. The surface impoundment will be inspected by a Professional Engineer, and the geosynthetic liner system repaired as discussed in Section 10.2.3. Unit 78 will continue to operate for stormwater management after Phase 1 as discussed in Section 2.8.3.3. Additional information regarding Unit 78 is provided in Appendix D.

4.3.28 West Yard Truck Wash

West Yard Truck Wash (Unit 87) is a former IS tank and is used for collection of wash water. Unit 87 is a concrete sump. Unit 87 will be closed by removing inventory as discussed in Section 5.2, decontaminating the sump as discussed in Section 8.0, and performing concrete, soil, and soil gas sampling as discussed in Sections 9.0 and 10.0, respectively. Additional information regarding Unit 87 is provided in Appendix D. The West Yard Truck Wash will remain operational into Phase 2.

4.3.29 Temporary WWTP Decontamination

The temporary WWTP will be decontaminated at the end of Phase 1. The temporary WWTP will remain on-site for treatment of stormwater prior to and during Phase 2 and decontamination water during Phase 2.

4.4 CLOSURE OF FORMER UNITS

Decontamination and demolition of the former WWTP (Units 11, 15, 16, 17, 18, 19, 20, 21, 22, 23, 26, 27, 28, 29, 30, 38, and 39) was completed on February 11, 2009 in accordance with the approved Decommissioning Plan. A Preliminary Closure Report was submitted on February 17, 2009. A copy of the report is provided as Appendix O. As summarized in the Preliminary Closure Report, sampling of the former concrete containment area and underlying soils was not completed at the time of unit removal to determine if the concrete has been adequately cleaned or if operations associated with the former WWTP have impacted underlying and surrounding soils. Soil sampling has been performed at former WWTP Units 15 to 21, 38 and 39 in the South Yard as part of the ongoing RFI. Soil sampling at former WWTP Units 22, 23, 29 and 30 at the Baghouse Building was performed as part of the ongoing RFI. Soil sampling at former WWTP Units 11 and 26 to 28 will be performed as part of closure sampling for the RMPS Building as shown on Figure 9.1. Remediation of the former WWTP units, if needed, will be conducted under Corrective Action. A post-closure permit application will be submitted if closure performance standards are not achieved.

While the Original Flue Dust Slurry Sumps were previously decontaminated and demolished, the concrete and soil sampling at these features will be conducted as part of the Closure Plan as shown on Figure 9.1 as these units are located beneath the current North and South Flue Dust Slurry Tanks (Units 31 and 32).

Cleaning and removal of Units 64 and 65 was completed between October 16,2009 and November 9, 2009. Exide determined the tanks were not required for current operations and made the decision to close them. The tanks were decontaminated and demolished. The report for these activities is provided as Appendix P. Soil and concrete sampling has not yet been conducted. The sampling for these units ~~is~~ will be~~ing~~ performed during Phase 1 Closure as shown on Figure 9.1 and removal of concrete and soil as appropriate to achieve the Closure Performance Standards will be completed in accordance with Section 3.2.3 and 3.2.8.

4.5 EQUIPMENT

As noted in Section 4.3, the following existing units are proposed for use during and, in some cases, after Phase 1:

Unit 1, Central Container Storage Building
Unit 87, West Yard Truck Wash
Units 7, 8 and 9, Mud Tanks (if needed)
Unit 79, Surge Tank (if needed)
Unit 44, WWTP Filter Press (if needed)
WWTP (Units 52 to 63, and 71 to 77)
Unit 33, Reverb Furnace Feed Room, Corridor portion (north-south and west-east sections)
Unit 46, Pump Sump (including stormwater collection system)
Unit 78, Surface Impoundment

As noted in Section 4.3, the following equipment (excluding conventional construction equipment) is proposed for use during Phase 1:

Temporary container to collect filter cake from Unit 44, WWTP Filter Press (if needed)
Temporary filter press
Temporary decontamination water storage feature(s)
Temporary wastewater treatment plant (WWTP)
Temporary baghouse
Re-ducting of Torit and/or MAC baghouses

Additional detail for each proposed feature will be provided to DTSC, AQMD and the City of Vernon prior to mobilization of the equipment.

Date: July 2015

Date: July 2015

5.0 ESTIMATE AND MANAGEMENT OF MAXIMUM INVENTORY

Management of waste inventory will occur during Phase 1.

5.1 MAXIMUM INVENTORY OF HAZARDOUS WASTE

Waste addressed during closure includes two types: inventory within the unit and waste generated during closure. Table 1.1 summarizes the maximum operating waste inventory, and worst case (gross) inventory, actual inventory as of July 10, 2015 and provides the unit name, unit type, location, contents, density of the contents, waste code, size, and methods for content removal, transport, treatment, storage, disposal, and the off-site disposal facility. Alternate disposal facilities may be proposed by the Contractor for approval by Exide and DTSC. Table 1.2 summarizes the waste generated during closure and provides the unit name, unit type, materials of construction, size, quantities of decontamination water generated during closure, and quantities of concrete, scrap metal, soil and decontamination water generated during contingent closure. Table 1.3 summarizes the ancillary sumps, including the maximum operating waste inventory and worst case (gross) inventory, wastes generated during closure, and wastes generated during contingent closure. Table 2.2 summarizes the unit name, contents, waste codes, unit size, materials of construction, maximum inventory, gross capacity, treatment rate, treatment type, overfill protection, secondary containment, structural certification and status. Table 5.1 summarizes the maximum quantities of waste generated during inventory removal, closure and contingent closure and their respective disposal method. The quantities include waste generated by sampling activities and facility decontamination. It is expected that the facility will be closed in an orderly fashion and the amount of waste will be minimized. The maximum quantities include wastes in each unit as well as process areas.

The nature of the facility's battery recycling operations is such that no organic or other material susceptible to decomposition are accepted, processed, or generated at the facility. No waste decomposition products are known to occur at this facility.

5.2 REMOVAL AND MANAGEMENT OF MAXIMUM INVENTORY

5.2.1 General

Prior to shipping waste, the Contractor will provide copies of the disposal or recycling facility's permits and information on any outstanding permit violations for the receiving facility to Exide and the Resident Engineer. Exide and the Resident Engineer will also review permit and violation information on DTSC's website. The Contractor will also provide the receiving facility's requirements for analytical data or paperwork. The receiving facility will provide an approved waste profile or waste acceptance prior to shipment of waste. The receiving facility, by virtue of its existing permits, will comply with local, state and federal regulations. Waste shipment will be conducted by the Contractor with shipping paperwork signed by Exide. A summary of locations receiving materials during closure is provided in Table 3.4.

Copies of all manifests and shipping papers will be retained for inclusion in closure documentation. The Contractor will provide legible electronic copies of all manifests and shipping papers, including signature by the receiving facility, to the Resident Engineer. The Contractor will also provide the Resident Engineer with a summary table of disposal and recycling shipments, including manifest number, shipping date, truck number, contents, weight, destination facility, and other pertinent information. The manifests and summary table shall be provided daily.

Any shipment of materials to a foreign country will comply with the requirements specified in California Code of Regulations, Chapter 12, Article 5.

Solids will be managed as hazardous wastes until characterization sampling indicates they are non-hazardous. Characterization sampling will be conducted in accordance with the Waste

Characterization Plan provided in Appendix V. Additional sampling may be conducted as required by the receiving facility at the time of closure.

Reclaimable material (batteries and containers of lead bearing scrap/materials, reverb and blast furnace feed material (including reverb furnace slag), battery chips, desulfurization sludge, scrubber slurry, air emission control dust slurry, in process/partially smelted unrefined and refined lead) has been or will be removed from the facility prior to closure, except as noted in Table 1.1.

The order of presentation does not represent the sequence of closure. Sequence of Phase 1 closure is discussed in Section 4.

5.2.2 Removal and Management

Each unit will be inspected and its condition documented. Solid and liquid waste levels will be documented. Units will be accessed using scaffolding, manlifts or cranes as needed. Where liquids and solids are both present in a particular unit, liquids will be removed by pumping and managed as noted below. Where possible, liquids will be transferred through existing piping. Piping will be flushed and liquids removed by pumping and managed as noted below. Plumbing and utilities will be disconnected. Ancillary equipment such as pumps and mixers will be removed. The unit will be entered using hazardous confined space entry procedures (where applicable) and the contents removed by hand or equipment. For tanks, an opening will be cut into the tank sidewall with a hand saw for access if needed.

Additional detail for removal and management of each waste type is provided below.

5.2.2.1 **Batteries and Lead Scrap**

The Container Storage Areas (Units 1, 2 and 3) stored spent batteries and containers of lead scrap. Palletized batteries and containers of lead scrap from Units 1, 2 and 3 have been removed.

5.2.2.2 **Plastic Chips**

No trailer loads or stockpiles of plastic chips are present at the Site. Small amounts of plastic chips may be encountered while decontaminating processing equipment. Plastic chips will be managed with other waste materials and sent for disposal or recycling.

5.2.2.3 **Feed Material**

Reverb furnace feed material from the Reverb Furnace Feed Room (Unit 33) has been removed. Blast furnace feed material from the Blast Furnace Feed Room (Unit 34) will be removed from the facility prior to closure.

Battery components in the Recycle Tank (Unit 14), Waste Acid Circulation Tank (Unit 41), Acid Overflow Tank A (Unit 66) have been removed. Battery components remaining in processing equipment will be removed from the respective equipment by hand. The battery components will be loaded into appropriately permitted watertight roll-offs with covers or enclosed watertight trucks using a front-end loader. Battery components will be transported in accordance with 22 CCR 66261.6 requirements to a secondary lead smelter for recycling or disposed at an appropriately licensed disposal facility.

5.2.2.4 **Paste and Slurry**

Paste from the Mud Tanks (Units 7, 8 and 9) will be removed from the facility prior to closure. Unit 12, Paste Thickening Unit, was recently replaced and has not been used to manage paste. Any remaining residual paste will be processed in the WWTP Filter Press (Unit 44) or temporary filter press to remove excess liquids. The resulting liquids will be processed in the WWTP. The filter cake will be loaded into water tight roll-offs or water tight trucks with a front end loader. Filter cake will be transported in accordance with 22 CCR 66261.6 to a secondary lead smelter for recycling or disposed at an appropriately licensed disposal facility.

Slurry from the Flue Dust Slurry Tanks (Units 31 and 32), if any, will be removed from the tank by hand and processed in the WWTP Filter Press (Unit 44) or temporary filter press. The filter cake will be loaded into the roll-offs or trucks with a front end loader. Filter cake will be transported in accordance with 22 CCR 66261.6 to a secondary lead smelter for recycling or disposed at an appropriately licensed disposal facility.

5.2.2.5 **Lead Product**

Exide will remove lead product and drosses from the receiving and refining kettles (Units 89 to 98 and 100 to 102) during closure. Loose pieces of solidified lead will be removed by hand. Some sizing may be required to facilitate removal and shipment. The remaining solidified lead and drosses (i.e., heel) will be evaluated to determine if it can be removed by lifting with a crane or similar equipment. When the heel is less than 12 tons, the heel will be removed with a crane or similar equipment. The refinery overhead crane has a lifting capacity of 15 tons. Larger capacity cranes (i.e., mobile cranes) cannot operate in the kettle area because of the floor's limited allowable weight capacity. Thus, when the heel is greater than 12 tons, the lead product and drosses will be ~~re-melted and the product cast into molds for off-site recycling~~removed using procedures associated with the preferred alternative identified in the Environmental Impact Report. No refining will be performed. At the time of Closure Plan preparation, Exide was unable to determine which heels can be lifted versus melted as DTSC indicated that loose lead removal could not be performed prior to closure. The surface of the lead in the kettle and the surrounding area will be cleaned using a HEPA vacuum prior to and during the removal process. ~~As explained in Section 2.8.3.5, for lead over 12 tons, re-melting and casting the lead is the safest, most efficient, and environmentally protective option available. Re-melting would be a temporary decommissioning closure process not involving lead production.~~

Several heel removal options were evaluated during preparation of the Closure Plan as follows:

- Manual demolition: This method uses air demolition units and/or backhoe equipment with spade shaped tool to cut small pieces of lead from the larger mass. Lead is malleable and must be sliced as it will not break. This method is time consuming as cutting a 1-ton piece of lead would require 8 working hours; cutting lead within Unit 92 containing an approximately 100 ton lead heel would require approximately 100 8-hour shifts, or 20 weeks to remove the 100 ton lead heel. This method would also require personnel to conduct confined space entry into the kettle to manually move the pieces into a skip or barrel to lift the pieces out of the kettle. ~~This method was not selected due to the slow production rate and safety risk to personnel.~~
- Cutting with water cutting equipment: This method uses high pressure water to cut small pieces of lead from the larger mass. Vendors providing this service do not have experience using water cutting methods to cut a mass which is inside a kettle. A specialized robotic device with high pressure spray heads would need to be designed and built over a period of several months. A major safety concern for this approach is the ability to control the cutting to keep the kettle structurally sound and not have the lead mass and kettle suddenly collapse inside of the kettle housing. Another substantial concern for this method is management of the water used in the cutting process. A typical water cutting system uses approximately 150 gpm of water with a pump capacity designed at 20,000 to 40,000 psi. Water containing lead grit particles resulting from the cutting process must be controlled and collected for treatment. The amount of water to be collected and treated is approximately 9,000 gallons per hour (or 72,000 gallons per day or 360,000 gallons per week). The water management system necessary for this task would be significant. This method is also time consuming; water cutting would require approximately 50 8-hour shifts, or 10 weeks to implement, plus mobilization and demobilization. ~~This method was not selected due to the inavailability of equipment, vendor inexperience, safety concerns with stability of the kettle and its~~

~~housing, slow production rate, and water management/environmental control and treatment concerns.~~

- Remelting: This method uses natural gas to heat the lead until molten, and the lead is pumped out of the kettle into molds. A temporary natural gas line will be installed to service the kettles. The existing natural gas burner on the kettle setting would be started to heat the lead to about 900 degrees F in about 24 hours. The combustion products from the burner are vented from the kettle setting by the existing MAC Baghouses and associated HEPA secondary filtration. The Blast Furnace kettles are vented by the Hard Lead Baghouse and associated HEPA secondary filtration. The Reverb Furnace kettles are vented by the Soft Lead baghouse and associated HEPA secondary filtration. The molten lead will be pumped out of the kettle via a submerged lead pump. The molten lead will be pumped into 1-ton molds and allowed to solidify into blocks that will be taken out of the molds. All of the lead within the kettle will be pumped out, except for about 5 tons of lead remaining at the bottom of the kettle below the bottom of the lead pump. The pump will be removed from the kettle and a steel beam will be lowered into the remaining molten lead. The lead will be allowed to solidify around the steel beam. The remaining solidified lead and steel beam will be lifted out of the kettle using the refinery overhead crane. The total time for this process from starting to reheat the lead and to pulling the final lead out of the kettle would take approximately 50 hours for a full (100 ton) kettle. ~~This method was selected as the required equipment for lead management and air emission controls are present at the facility, and the work can be conducted within a reasonable amount of time using experienced personnel and safe procedures.~~

Any residual lead product encountered during closure will be removed by hand or equipment and will be loaded into roll-off containers or trucks approved for hazardous waste transportation with a front end loader or forklift. Lead is anticipated to be present beneath the Reverb Furnace and

in the lower level (refining kettle basement) of the Smelter Building. The lead product will be transported in accordance with 22 CCR 66261.6 to a secondary lead smelter for recycling.

5.2.2.6 **Blast Furnace Slag**

Slag from the Blast Furnace (Unit 37) has been removed. Any residual amounts of slag encountered during closure will be removed by hand and/or mechanical equipment and loaded into transport vehicles meeting the requirements of 22 CCR 66263.10. Blast Furnace slag will be disposed off-site in accordance with 22 CCR 66262.10 as California-hazardous waste at a US Ecology landfill in Beatty, Nevada or alternate appropriately licensed disposal facility. If available at the time of closure, a closer facility may be utilized. Characterization sampling will be conducted in accordance with the Waste Characterization Plan in Appendix V. Additional sampling may be conducted as required by the receiving facility at the time of closure.

5.2.2.7 **Furnace Brick**

The reverb furnace was in the process of being rebuilt when the decision to close the facility waste made. New/unused brick will be removed, rinsed to remove dust, wrapped in plastic and transported for re-use at another facility or segregated from used brick for separate characterization and appropriate disposal. Following decontamination, Exide will collect one surface wipe sample per 20 new/unused bricks, or a sample rate of 5%, will be performed to determine the effectiveness of the decontamination. If hazardous, the bricks will be disposed off-site as RCRA or California hazardous waste (as appropriate based on characterization testing) at an appropriately licensed disposal facility. All bricks in contact with the brick that exceeded the MDL will be similarly tested. Used brick and any brick that did not pass the Closure Performance Standard~~Used brick~~ from the reverb and blast furnaces will be removed by hand and loaded into transport vehicles meeting the requirements of 22 CCR 66263.10. The used furnace brick will be transported under hazardous waste manifest in accordance with 22 CCR 66262.10 to US Ecology in Beatty, Nevada or alternate appropriately licensed disposal

facility for treatment and disposal. The transportation of this material will be handled in accordance with all applicable State and Federal Department of Transportation hazardous waste transportation requirements and will meet all applicable federal land ban requirements for lead contaminated material.

Furnace and kettle brick does not contain asbestos. Manufacturer's information for the brick is provided in Appendix AA.

5.2.2.8 **Wastewater**

Wastewater within the Truck Wash Sump (Unit 51), Pump Sump (Unit 46), Settling Tanks (Units 47 through 50), Battery Dump Bin Sump (Unit 5), RMPS Floor Sump (Unit 6), Surge Tank (Unit 79), Surface Impoundment (Unit 78), West Yard Truck Wash (Unit 87), Equalization Tank 1 (Unit 52), Equalization Tank 2 (Unit 53), Flocculation Tank (Unit 55), WWTP Clarifier (Unit 56), Reaction Tanks (Units 57 to 61), WWTP Sump (Unit 62), Sand Filter Feed Tank (Unit 77) and ancillary sumps will be removed by pumping and transferred to the WWTP for processing. If the existing WWTP is not operating then the wastewater will be transferred and processed through the temporary WWTP mobilized for closure. Treated effluent shall be discharged to the City of Los Angeles wastewater system through the facility industrial discharge permit.

The Mobile Equipment Wash Station (Unit 35), North Oxidation Tank (Unit 24), South Oxidation Tank (Unit 25), Sink/Float Separator (Unit 13), Recycle Tank (Unit 14), Waste Acid Circulation Tank (Unit 41), Acid Overflow Tank A (Unit 66), WWTP Acid Storage Tank (Unit 63), and WWTP Recycled Acid Tank (Unit 76) are empty except for solid residue.

5.2.2.9 **Sand Filter Media**

Media from the sand filters (Units 71 to 75) will be removed by cutting open the tank, and removing the media by hand. The media will be loaded into transport vehicles meeting the requirements of 22 CCR 66263.10 and transported in accordance with 22 CCR 66261.6 to a secondary lead smelter for recycling or sent for stabilization and disposal at a hazardous waste landfill.

5.2.2.10 **WWTP Sludge**

Sludge in the Sludge Holding Tank (Unit 54) at the WWTP will be decanted to remove standing liquid. The sludge will be removed by hand and loaded into water-tight roll-offs (meeting the requirements of 22 CCR 66263.10) with a front end loader. The sludge will be transported to a secondary lead smelter in accordance with 22 CCR 66261.6 for recycling.

5.2.2.11 **Surface Impoundment Sediment**

Liquid in the surface impoundment and leachate within the surface impoundment liner system will be removed by pumping and transferred to the WWTP for processing. Sediment remaining in the surface impoundment will be removed by hand, characterized, stabilized if necessary to absorb free liquid, and loaded into transport vehicles meeting the requirements of 22 CCR 66263.10. If hazardous, the sediment will be disposed off-site as RCRA or California hazardous waste (as appropriate based on characterization testing) at US Ecology landfill in Beatty, Nevada or alternate appropriately licensed disposal facility. Characterization sampling will be conducted in accordance with the Waste Characterization Plan in Appendix V. Additional sampling may be conducted as required by the receiving facility at the time of closure.

5.2.2.12 **Acid**

Acid from the South Acid Storage Tank (Unit 10) and Acid Overflow Tank B (Unit 67) has been removed. Unit 67 contains solid residue. Exide will remove scrubber water from Unit 10 prior to closure. If residual amounts of acid are encountered when removing equipment, the acid will be placed in drums and the drums will be placed either manually or mechanically onto pallets, secured and loaded on trucks using forklifts. Drums of acid will be disposed off-site as a hazardous waste or recyclable hazardous waste at Evoqua in Los Angeles, California or alternate appropriately licensed disposal facility.

5.3 LAND DISPOSAL RESTRICTIONS

The facility will determine which wastes are subject to land disposal restrictions prior to off-site disposal. If the waste is a restricted waste that is prohibited from land disposal, the facility will notify the receiving facility in writing of the treatment standards and prohibition of land disposal. If the facility determines that a restricted waste can be land disposed without further treatment, a notice and certification that the waste meets all applicable treatment standards will be provided to the receiving facility for each shipment of waste. The facility will comply with all land disposal restriction requirements when shipping hazardous wastes to off-site waste management facilities.

5.4 CHANGES IN MAXIMUM INVENTORY

Not applicable.

5.5 HAZARDOUS MATERIALS

As part of normal operations, Exide maintains materials which are hazardous, but which are not hazardous wastes, at the facility. The Hazardous Materials Inventory includes the identity and quantity of the materials and is provided in Appendix K. Exide will remove these materials from the facility as closure activities allow. For example, materials needed for existing WWTP operations will remain on-site until the existing WWTP is closed. Exide will maintain the Hazardous Materials Inventory until all hazardous materials are off-site.

Date: July 2015

6.0 DECONTAMINATION PROCEDURES FOR UNITS AND EQUIPMENT

Decontamination of units and equipment will occur in Phase 1.

6.1 GENERAL

Prior to decontamination of units, equipment, areas or buildings, engineering controls for liquids provided in Appendix G will be implemented.

Following removal of the waste inventory, former IS units and equipment will be decontaminated to meet required closure performance standards provided in Section 3.2. Decontamination water will be collected at existing sumps and low points, removed with a pump, and transferred to the WWTP or temporary WWTP for processing. Hoses outside of the containment area will be double contained. A shop vac may also be used to collect small quantities of liquids for transfer to the WWTP or temporary WWTP.

This section provides general procedures. Specific procedures for units are provided in the Work Breakdown Structure in Appendix D.

6.2 TANK DECONTAMINATION

Plastic tanks will be visually inspected at the time of closure and a decision will be made based on condition of the tank regarding cleaning and non-hazardous disposal versus removal of gross solids and hazardous disposal.

The interior of each plastic former IS tank, not destined for disposal as a hazardous waste, and all steel tanks will be triple rinsed with a pressure washer from top to bottom. If needed, a stiff bristle broom and water will be used on surfaces to remove sediment after the first rinse. The exterior of each former IS tank will be rinsed one time from top to bottom with a pressure

washer. The goal for pressure washing for tanks not destined for disposal as a hazardous waste is provided in Section 3.2.1. Piping, pumps, valves, and ancillary equipment will also be triple rinsed with a pressure washer from upstream to downstream. Rinse water will be collected in the bottom of the tank and the secondary containment area within which the tank is located. Plastic tanks being sent directly for disposal as a hazardous waste shall be cleaned inside and out with a single wash using a pressure washer to achieve the goal discussed in Section 3.2.1.

The West Yard Truck Wash Sump (Unit 87) and Mobile Equipment Wash Station (Unit 35) will be cleaned by vacuuming with a HEPA vacuum and washing using a pressure washer.

The forklift or front end loader used during equipment removal will also be decontaminated.

6.3 MISCELLANEOUS UNIT DECONTAMINATION

Each former IS miscellaneous unit will also be pressure washed from top to bottom. The housing at each kettle will also be pressure washed. The goal for pressure washing is provided in Section 3.2.2. Piping, pumps, valves and ancillary equipment will also be pressure washed from upstream to downstream.

6.4 TRAILER STAGING AREA

The Trailer Staging Area (Unit 103) is paved with asphalt. The area will be vacuumed with a HEPA vacuum and washed with a pressure washer.

6.5 FORMER UNITS

The footprint of previously closed units which are not located within building footprints will be cleaned to remove hazardous waste constituents by vacuuming with a HEPA vacuum and

washing using a pressure washer. These units are included in the Concrete Yard System (Former WWTP).

Previously closed units which are located within building footprints will be cleaned concurrently with the building floor as discussed in Section 8.3.

6.6 SURFACE IMPOUNDMENT

The surface impoundment will be cleaned by pressure washing from the top of slope to bottom of slope. Soft bristle brooms may be used to loosen sediment as needed. Decontamination water will be collected at the existing low points.

6.7 STORMWATER MANAGEMENT SYSTEM DECONTAMINATION

The replacement stormwater management system piping and manholes are proposed to remain in-place following completion of Phase 1 and possibly Phase 2 Closure activities as discussed in Section 2.8.3.3. DTSC has indicated that the stormwater management system is ancillary to Unit 46. The 3,100 lf of piping and manholes will be cleaned ~~until visually clean~~ using jetting techniques as determined by direct visual examination or color video inspection. Any sediment removed from the stormwater system will be placed in drums or dump trucks for off-site disposal at a hazardous waste facility as discussed in Section 5.2.2.11.

Stormwater management system closure performance standards are provided in Section 3.2.4.

After completion of stormwater system cleaning, stormwater treatment will be required until sampling can demonstrate that runoff meets the requirements for discharge.

Pressure testing of the stormwater system is discussed in Section 10.2.2.

6.8 CLOSURE EQUIPMENT CLEANING

Equipment such as fork lifts, front end loaders, and pumps used during inventory removal and cleaning activities will also be triple rinsed with a pressure washer. The goal for cleaning is visually clean.

6.9 RESIDUE MANAGEMENT

Any remaining lead residue following decontamination activities will be drummed and transported, as a reclaimable material, to a RCRA regulated secondary lead recycler for lead reclamation or sent for treatment (as appropriate) and disposal as a hazardous waste.

6.10 EMISSION CONTROL EQUIPMENT

The Contractor is required to determine the most appropriate means and methods for completing emission control equipment decontamination and deconstruction in a manner that is safe for all personnel on or in the facility, meets all applicable regulations, and is protective of human health and the environment. Those means and methods shall be described in the Contractor's Implementation Plan. The approach described below is provided as a general approach for regulatory review. Significant variation will require review and approval by the DTSC and/or AQMD.

Emission Control Equipment decontamination and removal shall be performed when gutting and interior cleaning of a building under negative pressure is substantially complete, except for those portions of the emission control equipment needed to maintain negative pressure. To the extent possible the exterior of emission control equipment (including duct work) shall be cleaned as part of the building interior cleaning. Work will commence at the most distant air intake hood and progress in the direction of air flow, towards the baghouse. To the extent possible, the Contractor will be required to perform gross cleaning of duct work before removal and with the

emission control equipment still active. This is expected to require section by section removal while working on manlifts or similar equipment, and the use of HEPA vacuums to remove accumulated dust inside each section and accumulated dust on the outside of each section not accessible during building interior cleaning prior to removal of each section. After gross cleaning of a particular section, the cleaned section shall be disconnected (cold cutting or breaking at connections), both ends covered with plastic sheeting and secured with duct tape, and lowered to the ground in a horizontal fashion using appropriate techniques and equipment to prevent generation of dust. Once on the ground, the plastic covering the ends shall be removed and the interior will be scraped and pressure washed to remove dust and dirt that can become mobilized during subsequent handling (for duct work proposed for reuse at another Exide facility or being sent for disposal) and until a clean debris surface is achieved and confirmation wipe samples indicate that the metal ducts can be sent off-site as discussed in Section 7.8 or shipped to a disposal facility~~for metal ducts being sent for recycling~~.

If needed, a portion of the duct work may remain in-place during deconstruction to provide negative pressure to the area.

Once the duct work has been removed all the way back to the emission control equipment, the duct shall be blinded and the interior of the equipment cleaned following manufacturer's operating procedures. This is expected to include removal of bags and cartridges, emptying dust hoppers, bins and conveyance equipment, vacuum cleaning and pressure washing all interior and exterior surfaces, and surface wipe sampling to confirm decontamination.

Date: July 2015

7.0 CONFIRMATION SAMPLING AND MANAGEMENT OF DECONTAMINATED TANKS AND EQUIPMENT

Confirmation sampling and management of tanks and equipment will occur during Phase 1.

7.1 SAMPLING OBJECTIVES/PURPOSE

Confirmation sampling will be conducted after decontamination of units and equipment intended to remain on-site and/or shipped off-site for re-use or recycling to confirm decontamination is ~~adequate~~achieved. The locations and boundaries of each unit are provided on Figure 2.2. Additional detail for each unit is provided in Appendix D.

All samples collected during closure will be collected by or under supervision of a California registered Civil Engineer or Geologist and in accordance with the Sampling and Analysis Plan provided in Appendix A. Confirmation sampling will ~~not~~ be required for tanks and equipment destined for re-use at an alternate facility, off-site use as furnace flux material at a secondary lead smelter~~,~~ or for scrap metal recycling~~ or off-site disposal~~. Characterization sampling (TTLC/STLC for wastes being disposed of in California, and TCLP for wastes being disposed out of state) will be required for materials and equipment destined for disposal.

7.2 WIPE SAMPLES

The effectiveness of decontamination on steel tanks, ancillary equipment and miscellaneous units ~~which will remain on-site for re-use~~ will be determined by collecting wipe samples. For large areas, wipe samples will be collected using a random grid, or otherwise biased towards areas where waste was managed or came into contact with the surface. Methods for collection and analysis of wipe samples are provided in Appendix A, Sampling and Analysis Plan.

Steel Tanks – ~~If the tank is intended to remain on site, w~~Wipe samples will be collected every 300 sf of tank interior, and a minimum of three samples per covered tank (one each from interior top, bottom and side) and two samples per open top tank (one each from interior bottom and side).

Steel Miscellaneous units ~~If the miscellaneous unit is intended to remain on site, w~~Wipe samples will be collected every 300 sf of interior surface. A minimum of three wipe samples will be collected from the interior of each miscellaneous unit ~~intended to remain on site~~.

Wipe samples may not be appropriate for every surface (e.g., porous surfaces). Chip samples discussed in Section 9.3 may be required for any other surfaces other than metal tanks, epoxy-coated surfaces, vinyl liners etc.

The performance standard for steel tanks, equipment and piping which will remain on-site is provided in Section 3.2.1.4.

7.3 EQUIPMENT RINSATE SAMPLING

Decontamination of equipment ~~intended to be re-used on site~~ that cannot be wipe sampled, if any, will be conducted by analyzing rinse water that has passed through the equipment. A summary of anticipated equipment at the time of closure is provided in Table 7.1. The determination that equipment cannot be wipe sampled will be made by visual evaluation by the Contractor and Resident Engineer. Following decontamination of the equipment by rinsing three times with a pressure washer as discussed in Section 6.0, laboratory-supplied deionized water will be passed through the equipment and collected in the sample jar. A minimum of one sample will be collected for equipment associated with each particular unit.

~~Rinsate sampling will not be conducted for equipment that cannot be wipe sampled intended to be re-used at another Exide facility, disposed off-site, or recycled as scrap metal.~~

7.4 STORMWATER SYSTEM SAMPLES

7.4.1 Stormwater Piping and Manholes

Near the end of Phase 1 Closure, the stormwater system piping and structures, Unit 46 and surface impoundment will be flushed and cleaned to remove accumulated sediment. Wipe samples will be collected from the flow line at the down-slope end of each HDPE pipe run, at the bottom of each HDPE manhole and within the Unit 46 stainless steel insert. Results of the Phase 1 sampling will provide information regarding the effectiveness of cleaning efforts on the system, indicate if more aggressive cleaning is required for portions of the system that may remain in-place following completion of Phase 2 Closure, and will be considered while developing Phase 2 plans for removal and reconfiguration of the stormwater system. Regardless of wipe sample results that may exceed the MDLs, the stormwater system will remain operational into Phase 2, and Exide will continue to collect and treat all stormwater through the temporary WWTP.

At the end of Phase 2, ~~those components of~~ the stormwater collection system ~~to remain in-place~~will be removed, including the Unit 46 primary concrete tank ~~(if it will remain) will be cleaned and tested for Closure~~. Wipe samples will be collected to demonstrate the performance standards (22 CCR 66265.197) for the stormwater management system piping and manholes ~~to remain in-place~~ have been achieved. ~~If the wipe sample result is less than the method detection limit, then the performance standard has been achieved and the portion of the system represented by the sample can remain in-place.~~ If the wipe sample result is greater than the method detection limit, then ~~a destructive sample of the stormwater system structure (i.e., destructive sample) will be collected and analyzed~~that portion will be decontaminated or managed as a waste. ~~If a sample of the stormwater system structure is collected, the performance standards for the stormwater system to remain in-place are non-hazardous TTLC and STLC (where necessary) test results pursuant to 22 CCR 66261.24.~~

~~For the secondary containment at the stormwater management system (EPDM layer and concrete manhole), the performance standard for the stormwater management system to remain in place will be passing pressure testing of the primary pipe and manhole as discussed in Section 10.2.2.2. If the pressure testing does not pass, then~~S~~s~~oil sampling must be performed along the alignment of the pipe as described in Section 10.2.2.2.

Wipe samples will be analyzed for CAM-17 total metals. HDPE pipe samples will be sampled at the downstream end of the pipe on the interior bottom surface, approximately 1 foot upstream from the end of the pipe. HDPE manhole samples will be collected at the bottom of the manhole.

If needed, HDPE destructive samples will be collected at HDPE pipe and manhole locations where wipe samples did not meet the performance standard. HDPE samples will be collected by scraping, grinding or cutting adequate sample volume from the HDPE surface to a depth of 0.2 +/- inches. HDPE pipe and manhole samples will be at the same location as the wipe sample; however, the sample area may be expanded to obtain adequate volume for lab analysis. ~~The cleanup level for stormwater system HDPE pipe and manholes to remain in place (as determined from HDPE samples) without restrictions will be CAM-17 total metals results below ten times STLC levels or CAM-17 total metals results below TTLC limits and WET results below STLC limits.~~

Waste Extraction Test (WET) will be performed when the concentration for a contaminant of concern (COC) in a solid, as determined through TTLC testing, is below the TTLC level (22 CCR 66261.24) but greater than 10 times (by rule of thumb) the STLC. If the WET result is greater than the STLC, the item/media sampled is considered hazardous, even if the TTLC result is less than the TTLC level.

If the TTLC result is above the TTLC level, then the item/media sampled is considered hazardous waste, even without the STLC result. If the TTLC result is less than 10 times the STLC level in 22 CCR 66261.24, then the item/media sampled is considered non-hazardous, even without the STLC result.

~~Sections of t~~The stormwater management system ~~which did not meet cleanup standards~~ will be removed as part of Phase 2. If sections not meeting the cleanup standards are located within areas of the site approved by DTSC for closure with hazardous waste in-place, Exide may seek DTSC approval to abandon (via in-place grouting or similar techniques) said components and manage as part of the hazardous waste-in-place closure designation.

7.4.2 Surface Impoundment

Following decontamination of the Surface Impoundment liner system in Phase 1, initial samples of the primary and secondary geomembranes will be collected at 25% of proposed sample locations concurrent with soil sampling. The geomembrane samples will be analyzed at a frequency of one sample every 2,600 sf. Results of the initial sampling will provide information regarding the effectiveness of cleaning efforts on the geomembranes, indicate if more aggressive cleaning is required for portions of the geomembrane that may remain in-place following completion of Phase 2 Closure, and will be considered while developing the portion of the Phase 2 Contingent Closure Plan related to removal and/or replacement of the geomembrane. Regardless of wipe sample results that may exceed the MDLs, the existing stormwater pond geomembrane will remain until the completion of Phase 2. Exide will continue to collect and treat all stormwater through the temporary WWTP.

~~The cleanup level for the surface impoundment liner system to remain in-place (as determined from HDPE samples) without restrictions will be CAM 17 total metals results below ten times STLC levels or CAM 17 total metals results below TTLC limits and WET results below STLC limits.~~

Waste Extraction Test (WET) will be performed when the concentration for a contaminant of concern (COC) in a solid, as determined through TTLC testing, is below the TTLC level (22 CCR 66261.24) but greater than 10 times (by rule of thumb) the STLC. If the WET result is greater than the STLC, the item/media sampled is considered hazardous, even if the TTLC result is less than the TTLC level.

If the TTLC result is above the TTLC level, then the item/media sampled is considered hazardous waste, even without the STLC result. If the TTLC result is less than 10 times the STLC level in 22 CCR 66261.24, then ~~the item/media sampled is considered non-hazardous, even without the STLC result~~STLC analysis is not necessary.

Geomembranes will be removed. If ~~geomembrane and~~ underlying soil sample results indicate contaminant concentrations are at or below background~~non-hazardous~~ concentrations based on complete sampling (1 sample/650 sf) performed in the end of Phase 2, then the Surface Impoundment meets the closure performance standards~~ to remain in place~~. If the ~~geomembranes and/or~~ underlying soil sample results indicate contaminant concentrations are above background concentrations~~ are hazardous~~, then the data will be used to make decisions about removal as discussed in Section 16. ~~If the Surface Impoundment is proposed to remain in place after Phase 2, then geomembrane samples will be collected at a rate of 1 sample per 650 sf concurrent with soil sampling at 100% of the proposed locations.~~

As previously noted in Section 3.2, remediation of contaminated material below hazardous-waste levels but above the Closure Performance Standards developed as clean-up levels during CA is anticipated to occur during closure to meet the performance goals for closure of the facility.

7.5 QUALITY CONTROL PROCEDURES

Quality control procedures including field duplicates, trip blanks, equipment blanks, matrix spike and matrix spike duplicates (as appropriate); chain of custody procedures; sample labeling, packaging and transportation; and documentation will be conducted as discussed in Section 14.0.

7.6 ANALYTICAL TEST METHODS

Wipe samples, and equipment rinsate samples will be analyzed for total metals as indicated in Table 10.1.

All sample analyses will be performed in accordance with the latest versions of 40 CFR Part 261, Appendix III and EPA publication SW-846 entitled "Test Methods for Evaluating Solid Waste." Additional information regarding analytical methods is provided in Appendix A, Sampling and Analysis Plan. Upon completion of the analyses, the laboratory will complete a report and submit to the project engineer. The report will include the sample identification code, reporting limits, date sampled, date analyzed, analytical method used, and the analytical results.

7.7 EVALUATION OF RESULTS

~~As stated above, the adequacy of decontamination activities is a function of the proposed final disposition of the unit or equipment represented by the sample.~~ Method detection limits and reporting limits are summarized in Appendix A.

7.7.1 Rinsate Samples

If equipment rinsate sample results are less than the method detection limit, decontamination will be determined to be adequate and the representative surface/unit adequately cleaned.

If equipment rinsate results exceed the performance standard, the equipment ~~may be re-cleaned and re-tested, re-used at an Exide facility, characterized and sent for appropriate disposal, or recycled~~will be managed as a waste.

7.7.2 Wipe Samples

The cleanup level for steel tanks and equipment intended to remain on-site for re-use will be the method detection limit (MDL) for wipe samples. Wipe sample results below the MDL identified for wipe samples will be considered absent of hazardous constituents and deemed clean. If wipe sample results are above the MDLs, Exide will have the choice of re-cleaning and re-testing; destructively testing to demonstrate performance standard are met; or address the feature in Phase 2. For painted surfaces, Exide may conduct a lead base paint analysis using an XRF or paint chip samples. If the wipe sample fails for lead, the surface is coated with paint containing lead, and the surface is visibly free of dirt and residuals, Exide ~~may~~ will request DTSC approval for the equipment to remain on-site.

7.8 REMOVAL OF DECONTAMINATED UNITS

7.8.1 Tanks and Miscellaneous Units

Decontaminated (confirmation sample results indicate non-detect concentrations of contaminants of concern) former IS tanks and miscellaneous units and kettle housings will be removed for off-site re-use at an alternate facility, off-site use as furnace flux material (steel), scrap metal recycling (steel), or disposal (used brick, plastic or fiberglass).

Equipment intended for re-use at an alternate facility is summarized as follows:

- Unit 12, Paste Thickening Unit (Exide Muncie, Indiana);

- Unit 36, Reverb Furnace (brick, burners, feed screws) (Exide Canon Hollow, Missouri);
- Unit 37, Blast Furnace (crucible) (Exide Muncie, Indiana);
- Unit 40, Hammer Mill with hydraulic system (Exide Muncie, Indiana);
- Unit 55, Flocculation Tank (Exide Canon Hollow, Missouri);
- Unit 69, Rotary Kiln (Exide Muncie, Indiana);
- Unit 79, Surge Tank (Exide Muncie, Indiana); and,
- Units 89 to 102, Kettles (Exide Muncie, Indiana).

Exide will review the kettles and identify kettles eligible for re-use. Remaining kettles will be cut up and recycled as scrap metal.

Decontaminated ~~S~~steel tanks and miscellaneous units will be cut up and loaded for recycling as scrap metal. The cost estimate assumes a scrap metal recycler within 15 miles would be used. Scrap metal will be decontaminated to meet the receiving recycling facility's requirements, and ~~will have a "clean debris surface" pursuant to the requirements of the USEPA Debris Rule (40 CFR 268.45).~~confirmation samples will confirm non-detect concentrations of contaminants of concern.

In the event that steel does not meet the performance standards, the steel will be subject to a wipe test or destructive testing will be performed to indicate performance standards have been met, or the steel will be ~~re-used at a hazardous waste facility or~~ disposed off-site.

Plastic tanks will be sized to facilitate handling, characterized for disposal purposes, loaded for disposal at an appropriately licensed disposal facility. The cost estimate assumes disposal of non-hazardous debris at a facility in Los Angeles, California; however, an alternate facility may be used.

7.8.2 Emission Control Equipment

Following gross cleaning with a HEPA vacuum, emission control equipment will be unbolted and dismantled. Equipment intended for reuse will be decontaminated with a pressure washer and shipped off-site.

Date: July 2015

8.0 DECONTAMINATION PROCEDURES FOR CONTAINMENT STRUCTURES AND BUILDINGS

Decontamination of containment structures and buildings will occur during Phase 1.

8.1 GENERAL

Following removal of the inventory, tanks, miscellaneous units and equipment, secondary containment structures and building interiors will be decontaminated. Structures and buildings will be decontaminated starting at the highest point (ceiling/rafters) and working down. Decontamination water will be collected for processing in the temporary WWTP.

Building and containment structure decontamination adequacy is discussed in Sections 3.2.3 and 3.2.5. Structural steel and metal siding intended for off-site recycling will also meet DOT rules for shipment, and meet requirements imposed by the recycling facility.

Concrete walls, tank pedestals and equipment foundations deconstructed during Phase 1 will not be crushed and re-used as backfill. These materials will be disposed off-site.

This section provides general procedures. Specific procedures for units are provided in the Work Breakdown Structure in Appendix D.

The controlling employer per Article 4.5, Multi-Employer Worksites, will ensure that all pits, vaults, sumps, and floor-openings which previously held process equipment (e.g. kettles, etc.) are guarded in a manner consistent with provisions found within 8 CCR 3212 (Floor Openings, Floor Holes and Roofs).

8.2 SECONDARY CONTAINMENT AREA DECONTAMINATION

Following decontamination, sampling, and disposal of units within a particular secondary containment area, the secondary containment area floor and curbing will be cleaned by vacuuming with a HEPA vacuum and pressure washing with a pressure washer. Concrete surfaces in high-use areas, or areas with extensive operations may have higher levels of contamination or corrosion. These areas may also be cleaned using hydro-demolition or abrasion techniques that pulverize or grind away a pre-determined surface depth. The goal of cleaning will be to achieve a visually clean surface with no visible waste prior to conductive chip/core sampling. Secondary containment areas located within structures operated under negative pressure will be decontaminated while the building is still under negative pressure.

Secondary containment areas at the facility are the Container Storage Buildings (Units 1, 2 and 3), Desulfurization (Mud Tank) Area, RMPS Area, RMPS lower level, WWTP area, Drop Out System, and Oxidation Tank area. Additional detail regarding secondary containment areas and the units within each area is provided in the unit information in Appendix D. Former IS tanks and ancillary sumps within the secondary containment areas will be cleaned concurrent with cleaning of the secondary containment area floor.

Cleaning will occur from upslope to downslope, working towards a collection point for decontamination water. Sediment accumulations will be removed using hand tools, HEPA vacuums, and appropriately sized equipment and containerized in drums for transport to a secondary lead recycler for reclamation or sent for off-site stabilization and disposal as RCRA hazardous waste. The sumps (containment area low points) will be the last area cleaned. The sumps are cast-in-place concrete, a stainless steel primary liner set in a concrete secondary liner, or primary and secondary stainless steel liners. Some sumps also have leak detection between the primary and secondary liners. Except where embedded into the cast-in-place concrete, the stainless steel liner(s) shall be removed to provide access to the concrete for the purposes of decontamination and to facilitate soil and soil gas sampling. If the containment area will

continue to be used during Phase 2, the stainless steel liner(s) will be re-installed or the remaining concrete sump will be seal coated as required in Appendix G.

Following completion of decontamination, access to the decontaminated area will be restricted to prevent cross-contamination by blocking doorways and posting signs.

8.3 BUILDING DECONTAMINATION

The interior and exterior roof, interior and exterior walls, floor or footprint of each building housing hazardous waste units will be cleaned to remove hazardous waste constituents by vacuuming with a HEPA vacuum and washing using a pressure washer. Work will progress from top to bottom. Horizontal surfaces shall be vacuum cleaned with a HEPA vacuum before the start of pressure washing. Exterior walls are expected to have a lesser amount of dust accumulation as they have been exposed to the elements. The exterior walls will be decontaminated using a HEPA vacuum and pressure washer with a focus on visible dust accumulations. The buildings subject to decontamination are the Reverb Furnace Feed Room and Blast Furnace Feed Room Containment Buildings, RMPS building (the portion that was not already decontaminated during secondary containment area cleaning), Desulfurization Building, Rotary Kiln enclosure within the Baghouse Building, Smelter Building, Baghouse Building and Finished Lead building.

Former IS units and ancillary sumps will be cleaned with a HEPA vacuum and washed with a pressure washer concurrent with and at the end of floor cleaning.

The ceiling will be cleaned first, followed by the interior walls from top to bottom. The floor will be cleaned next from upslope to downslope, working towards a collection point for decontamination water. Sediment accumulations will be removed ~~by~~ using hand tools and containerized in drums for transport to a secondary lead recycler for reclamation or sent for off-site stabilization and disposal as RCRA hazardous waste.

Lower levels will also be decontaminated using these procedures after decontaminating the upper levels.

The exterior roof of all buildings at the facility will also be cleaned by vacuuming with a HEPA vacuum and washing with a pressure washer, including buildings which do not contain former IS units. A detailed list of buildings which do not contain former IS units is provided in Section 12.0.

Additional detail regarding building dimensions is provided in Table 1.2.

Following completion of decontamination, access to the area will be restricted to prevent cross-contamination by blocking doorways and posting signs.

8.4 BUILDING GUTTING

Building gutting refers to the removal of non-regulated units and ancillary equipment, and non-structural building elements such as equipment, utilities, piping, control rooms, insulation, wiring and fixtures. Building gutting will occur concurrent with decontamination activities. Hazardous and TSCA waste material identified in the environmental survey (bulbs, ballasts, PCB transformers, batteries, miscellaneous chemicals, petroleum products, etc.) will be removed, sorted and containerized for off-site disposal or recycling. If the respective component is not damaged or leaking, the Contractor shall place the component in a sealable, suitable container (i.e., boxes for lamps, metal drums for ballasts). If the component is damaged to the extent that potentially hazardous materials could be released or are leaking, the Contractor will place the entire device in an appropriately labeled, sealable, water tight drum. Following the removal of all light lamps, ballasts, batteries, and transformers, the Contractor shall remove the remaining fixture, conduct a final cleaning, crush the fixture and place the fixture in a DOT-approved roll-off for subsequent recycling or disposal. All PCB-contaminated materials shall be properly

containerized and labeled in compliance with TSCA and all applicable local, state and federal regulations.

Non-structural components which cannot be removed without affecting building integrity will be decontaminated with a HEPA vacuum and pressure washer and wrapped with plastic for subsequent removal during building dismantlement.

Lower levels will be also gutted using these procedures.

8.5 UTILITY TERMINATION

Utility termination will be conducted in conjunction with building decontamination, gutting and deconstruction as discussed in Section 4.2.3.

8.6 ASBESTOS ABATEMENT

Asbestos abatement will be conducted prior to decontamination activities (i.e., HEPA vacuuming and pressure washing) if the decontamination activities could damage the asbestos.

8.6.1 Preparation and Training

The Contractor will review the Asbestos Survey Report and locate the friable and Class I and II non-friable asbestos. The Contractor will develop sequences and procedures for the removal of friable and Class I and Class II non-friable asbestos containing material (ACM) that account for protection of the workers, the public, the environment and that control the transmission of dust and cross-contamination of surrounding areas and is compliant with applicable federal, state and local regulations.

As part of the Implementation Plan, the Contractor shall prepare an ACM Removal Plan for review by Exide, the Resident Engineer, and DTSC prior to implementation and for inclusion in required permits and authorizations. The ACM Removal Plan shall summarize the types and location of ACM to be removed and the methods for removal.

At least one on-site representative for the Contractor will have successfully completed the Asbestos Abatement Contractor/Supervisor course pursuant to Asbestos Hazard Emergency Response Act (AHERA), and maintain accreditation as a AHERA Asbestos Abatement Contractor/Supervisor. Workers will have successfully completed the Abatement Worker course per AHERA. Supervisor and workers trained in provisions of SCAQMD Rule 1403, 40 CFR Part 61.145, 61.146, 61.147 and 61.152 and Part 763 shall be present during stripping, removing, handling or disturbing of ACM.

8.6.2 Asbestos Removal

All asbestos containing material (ACM) will be removed in conjunction with building decontamination and gutting and prior to building deconstruction. Asbestos abatement will be conducted in accordance with SCAQMD Rule 1403 and City of Vernon requirements. ACM removal will be conducted using one of the methods provided in Rule 1403 (d)(1)(D), including HEPA Filtration, glovebag, adequate wetting, dry removal and/or approved alternatives. ACM identified after the deconstruction begins will also be removed pursuant to Rule 1403 (d)(1)(D).

ACM will be placed in transparent, leak-tight, labeled containers or wrapping. The container will be kept in a locked enclosed storage area when not in use. The ACM will be disposed off-site at an appropriately licensed facility.

All surfaces in the isolated work area will be cleaned with a vacuum system using HEPA filtration, or wet mopping and wipe down with water prior to dismantling of plastic barriers or sealed openings.

Date: July 2015

8.6.3 Documentation

The following documentation will be maintained on-site:

- California State Contractor's License certification number;
- Cal/OSHA Registration Number;
- Copies of surveys; and,
- Copies of notifications.

Records will be maintained for not less than 3 years, including:

- Survey-related documents;
- Notifications;
- Written approvals;
- Waste shipment records;
- Employee Training materials; and,
- Training and accreditation certificates.

.

Date: July 2015

9.0 CONFIRMATION SAMPLING OF DECONTAMINATED CONTAINMENT STRUCTURES AND BUILDINGS

Confirmation sampling of decontaminated containment structures and buildings will occur during Phase 1.

9.1 SAMPLING OBJECTIVES/PURPOSE

Confirmation sampling will be conducted after decontamination to confirm that floors, metal surfaces, concrete secondary containment areas, container storage buildings, building walls, and lower levels intended to remain in-place have been decontaminated properly. Concrete walls proposed for demolition will also be sampled for disposal characterization purposes. The locations and boundaries of each unit are provided on Figure 2.2. Additional detail for each unit is provided in Appendix D.

All samples collected during closure will be collected by or under supervision of a California registered Civil Engineer or Geologist and in accordance with the Sampling and Analysis Plan provided in Appendix A. Sample locations must be approved by and collected under the oversight of DTSC.

9.2 METAL SURFACES

9.2.1 Steel – Recycled Off-Site

~~As steel proposed for recycling as scrap metal is not a waste, and therefore not a hazardous waste per 22 CCR 66261.197, t~~The effectiveness of decontamination on decontaminated metal building walls and ceilings, and structural steel proposed for deconstruction and intended for off-site scrap metal recycling or disposal will be determined by the requirements of the closure performance standard. All scrap metal will be sampled and analyzed to ensure that all waste residues have

been removed, or cleaned to non-detect. ~~determined by visual inspection (will have a Clean Debris Surface as defined in the Alternate Treatment Standards for Hazardous Debris (USEPA Debris Rule (40 CFR 268.45))).~~ The materials intended for off-site recycling or disposal will also meet waste stream characterization requirements for the facility receiving the materials and shipping requirements. ~~Materials achieving a Clean Debris Surface will be deemed non-hazardous and will not be subject to hazardous shipping requirements.~~

9.2.2 Steel – Remain On-Site

The effectiveness of decontamination on decontaminated metal building walls (both sides) and interior and exterior roofs, and structural steel proposed to remain on-site and not intended for deconstruction will be determined by collecting wipe samples. For large areas, wipe samples will be collected using a random grid, or otherwise biased towards areas where waste was managed or came into contact with the surface. Methods for collection and analysis of wipe samples are provided in Appendix A, Sampling and Analysis Plan.

Building walls – A wipe sample will be collected every 300 sf per each wall intended to remain in-place. A minimum of ~~one~~ three (~~1~~3) samples per wall will be taken.

Building roofs – A wipe sample will be collected every 500 sf per each roof intended to remain in-place. A minimum of ~~one~~ three (~~1~~3) samples per roof will be taken.

Wipe samples may not be appropriate for every surface (e.g., porous surfaces). Chip samples discussed in Section 9.3 may be required for any other surfaces other than metal siding, epoxy-coated surfaces, vinyl liners etc.

9.3 CHIP SAMPLES

Concrete or asphalt "chip" samples will be collected once per 1,000 sf of concrete or asphalt floor ~~intended to remain in place~~, and a minimum of 5 locations per secondary containment area, plus one additional sample for each additional unit and ancillary sump in secondary containment areas containing multiple units. Chip samples will be collected at sumps. Chip samples will be collected once per 1,000 sf of concrete for both sides of walls ~~which will remain in place and are not designated for deconstruction~~ to evaluate whether closure performance standards have been met. Chip samples will be collected one per 1,000 sf of concrete wall (both sides) and pedestals for disposal characterization purposes and to determine whether a temporary enclosure is needed during demolition. Samples will be co-located with confirmatory soil samples collected on the aforementioned locations and co-located with preferential confirmatory soil samples selected because of damaged and/or degraded, stained or cracked concrete or asphalt as described in Section 10.0. Sample locations are provided on Figure 9.1.

The effectiveness of secondary containment area and floor decontamination ~~for areas and floors intended to remain in place~~ will be determined by collecting chip samples. Chip samples will be collected in accordance with Sampling and Analysis Plan provided in Appendix A.

9.4 CORE SAMPLES

Concrete or asphalt core samples will be completed within those areas where multiple layers of flooring are identified during the soil sampling activities, where extensive surficial degradation may be present that may not be accurately characterized by chip sampling alone as determined in the field between Exide and DTSC, or where chip sampling techniques are inefficient or ineffective. Core samples will be taken in accordance with Sampling and Analysis Plan provided in Appendix A.

9.5 QUALITY CONTROL PROCEDURES

Quality control procedures including field duplicates, trip blanks, equipment blanks, matrix spike and matrix spike duplicates; chain of custody procedures; sample labeling, packaging and transportation; and documentation will be conducted as discussed in Section 14.0.

9.6 ANALYTICAL TEST METHODS

Samples collected from building interiors and secondary containment areas will be analyzed for ~~total and STLC~~ metals using the methods provided in Table 10.1. Chip samples collected from concrete sumps will be analyzed for ~~total and STLC~~ metals, ~~and total and STLC~~ VOCs, PAHs and dioxins/furans using the methods provided in Table 10.1. Four chip samples from each of the Reverb Furnace, Blast Furnace and Blast Furnace Feed Room floor areas will be analyzed for ~~total and STLC~~ metals, ~~total and STLC~~ VOCs, ~~total and STLC~~ PAHs, and ~~total and STLC~~ dioxins and furans using the methods provided in Table 10.1.

As previously noted in Section 3.2, the final Closure Performance Standards will need to be modified as determined by the clean-up levels developed during CA. Table 10.1 will likely need to be modified during the closure process as a result.

All sample analyses will be performed in accordance with the latest versions of ~~40 CFR Part 261~~22 CCR, chapter 11, Appendices~~x~~ I, II, III, XI and EPA publication SW-846 entitled "Test Methods for Evaluating Solid Waste." Additional information regarding analytical methods is provided in Appendix A, Sampling and Analysis Plan. Upon completion of the analyses, the laboratory will complete a report and submit to the project engineer. The report will include the sample identification code, reporting limits, date sampled, date analyzed, analytical method used, and the analytical results.

9.7 EVALUATION OF RESULTS

Method detection limits and reporting limits are summarized in Appendix A.

9.7.1 Containment Areas and Sump

The cleanup level for concrete and asphalt containment areas (secondary containment areas and containment buildings walls and floors (unlined floors)) and concrete sumps (tanks) to remain in-

place (as determined from concrete or asphalt chip or core samples) will be ~~CAM 17 total metals results below ten times STLC levels or CAM 17 total metals results below TTLC limits and WET results below STLC limits~~non-detect.

Waste Extraction Test (WET) for waste characterization will be performed when the concentration for a contaminant of concern (COC) in a solid, as determined through TTLC testing, is below the TTLC level (22 CCR 66261.24) but greater than 10 times (by rule of thumb) the STLC. If the WET result is greater than the STLC, the item/media sampled is considered hazardous, even if the TTLC result is less than the TTLC level.

If the TTLC result for waste characterization is above the TTLC level, then the item/media sampled is considered hazardous waste, even without the STLC result. If the TTLC result is less than 10 times the STLC level in 22 CCR 66261.24, then the item/media sampled is considered non-hazardous, even without the STLC result.

If sample analysis results for surfaces remaining in-place indicate concentrations ~~are~~ less than the performance standards established in Section 3.2, decontamination will be determined to be adequate and the representative surface/unit adequately cleaned for the purposes of Closure.

If sample results exceed the performance standard, additional cleaning measures can be performed or Exide may designate the area represented by the failing result for deconstruction and removal during Phase 2 Closure. The cleaning technique will be dictated by the surface type, surface condition, and apparent effectiveness of previous cleaning efforts and professional judgment of the Resident Engineer. After re-cleaning, the sampling will be repeated in the areas of re-cleaning. If, after attempting to clean a containment area or sump three times, the sample concentrations are still above the performance standard, the surface represented by the sample will be removed and disposed at an authorized disposal facility as part of contingent (Phase 2) closure activities. ~~Depending on the location and size of the areas failing to meet the~~

~~performance goals, Exide may also propose for DTSC consideration alternate techniques such as encapsulation or capping in conjunction with site-wide Corrective Action.~~

As previously noted in Section 3.2, remediation of contaminated material below hazardous-waste levels but above the Closure Performance Standards developed as clean-up levels during CA is anticipated to occur during closure to meet the performance goals for closure of the facility. Appendix A may need to be modified during the closure process as a result.

9.7.2 Metal Surfaces

The performance standard for steel building walls (both sides) and interior and exterior roof ~~intended to remain in place for re-use~~ will be the method detection limit (MDL) for wipe samples. The cleanup levels for wipe samples for steel tanks and ancillary equipment ~~remaining on site~~ are wipe sample results below the MDL identified for wipe samples. If wipe sample results are below the MDL, the metal will be considered absent of hazardous constituents and deemed clean ~~and the structure may remain in place~~. For painted surfaces, Exide may conduct a lead base paint analysis using an XRF or paint chip samples. ~~If the wipe sample fails for lead, the surface is coated with paint containing lead, and the surface is visibly free of dirt and residuals, Exide may request DTSC approval for the equipment to remain on site.~~

If wipe sample results are above the MDLs, Exide will have the choice of re-cleaning and re-testing using non-destructive testing or~~;~~ disposing~~; or if cleaned to a Clean Debris Surface as defined in the Alternate Treatment Standards for Hazardous Debris (e.g. the USEPA Debris Rule), applying paint~~. Debris not achieving closure performance standards, as described above, must be characterized and transported ~~as a California Hazardous Waste~~appropriately.

9.7.3 Concrete Walls

The cleanup level for concrete walls to remain in-place (as determined from chip or core samples samples) will be ~~CAM 17 total metals results below ten times STLC levels or CAM 17 total metals results below TTLC limits and WET results below STLC limits~~non-detect.

Waste Extraction Test (WET) for characterization will be performed when the concentration for a contaminant of concern (COC) in a solid, as determined through TTLC testing, is below the TTLC level (22 CCR 66261.24) but greater than 10 times (by rule of thumb) the STLC. If the WET result is greater than the STLC, the item/media sampled is considered hazardous, even if the TTLC result is less than the TTLC level.

If the TTLC result for characterization is above the TTLC level, then the item/media sampled is considered hazardous waste, even without the STLC result. If the TTLC result is less than 10 times the STLC level in 22 CCR 66261.24, then the item/media sampled is considered non-hazardous, even without the STLC result.

If sample analysis results for surfaces remaining in-place indicate concentrations ~~are~~ less than the performance standards, ~~Closure~~ decontamination will be determined to be adequate and the representative surface/unit adequately cleaned.

If sample results exceed the performance standard, additional cleaning measures can be performed. The cleaning technique will be dictated by the surface type, surface condition, and apparent effectiveness of previous cleaning efforts and professional judgment of the Resident Engineer. After re-cleaning, the sampling will be repeated in the areas of re-cleaning. If, after following this procedure three times, the sample concentrations are still above the performance standard, the surface represented by the sample will be removed and disposed at an authorized disposal facility as part of contingent (Phase 2) closure activities. ~~Depending on the location and size of the areas failing to meet the performance goals, Exide may also propose for DTSC consideration alternate techniques such as encapsulation or capping in conjunction with site-wide Corrective Action.~~

As previously noted in Section 3.2, remediation of contaminated material below hazardous-waste levels but above the Closure Performance Standards developed as clean-up levels during CA is anticipated to occur during closure to meet the performance goals for closure of the facility.

Date: July 2015

10.0 CONFIRMATION SOIL AND SOIL GAS SAMPLING PLAN

Confirmatory soil and soil gas sampling will be performed in Phase 1. The data collected will be used in the Corrective Action process.

10.1 GENERAL

To confirm that no releases of hazardous wastes or constituents have occurred through the floor system or Stormwater Surface Impoundment liner system, soil and soil gas samples will be conducted beneath and adjacent to hazardous waste management units during Phase 1 Closure. Confirmation sampling will be used to determine whether spills, leaks, overtopping, or other releases of hazardous wastes or constituents from waste management units have occurred. The horizontal and vertical extent of the investigation will characterize the extent of releases of hazardous waste or constituents that have occurred from a former IS unit. When evaluating impacts caused by former IS units, consideration regarding historic impacts associated with non-HWMUs will be required in many areas. Soils exceeding hazardous waste levels based on TTLC and STLC testing as discussed in Section 3.2, and not situated within areas known to be impacted by historic (pre-RCRA) operations requiring Corrective Action will be excavated, or removed, during Phase 2. Adequacy of remediation will be documented using confirmatory sampling. The extent of the Phase 2 Closure soil remediation is defined when the sample results indicate that the COCs are detected below the performance standards in Section 3.2. If soil performance standards are exceeded to depths greater than 5 feet (and are not the result of historic impacts), Exide may propose for DTSC review and approval alternate excavation depths, closure with hazardous waste-in-place, or an alternate closure technique appropriate for the conditions identified.

10.2 CONFIRMATION SAMPLING LOCATIONS AND DEPTHS

10.2.1 Unit and Containment Area Soil Sample Locations

During Phase 1 Closure, soil samples will be collected using hand augers, direct-push, roto-sonic or hollow stem auger soil sampling, as appropriate based on depth and accessibility, once every 1,000 sf of floor, or a minimum of five locations per containment area plus one additional soil boring for each additional IS unit contained therein (whichever is greater). Soil borings will be placed at the mid-points of all four sides of the secondary containment system, and at the center of the former IS unit. If several units occupy the same secondary containment system, additional boring locations will be situated directly below each tank, miscellaneous unit and sump within the containment system. A soil sample location will also be conducted below or immediately adjacent to the secondary containment sumps associated with the Container Storage Areas. Where possible, sampling locations will be biased towards areas of cracked pavement, if present. Prior to sampling, all liners/floors will be inspected for cracks, holes, staining, odors etc., to determine targeted sampling locations in addition to grid sampling. Proposed sample locations are provided on Figure 9.1. Sample locations shown on Figure 9.1 for the Reverb Feed Room are for chip sample locations. Soil sample locations have already been completed in accordance with the letter regarding Containment Building Supplemental Sampling dated November 20, 2014 and Supplemental Sampling Work Plan, Reverb Furnace Feed Room dated March 26, 2015.

Soil samples at boring locations other than those within the Surface Impoundment and stormwater system piping will be collected in one foot intervals to a depth of 7 feet below the bottom of the secondary containment floor. Samples collected from the 0 to 1 ft, 1 to 2 ft, 2 to 3 ft, and 4 to 5 ft intervals will be analyzed with remaining samples being archived. Sample depths may be adjusted based on specific site conditions.

See Appendix A (Sampling and Analysis Plan) for more information regarding soil sampling activities. Any additional sampling plans will be submitted for DTSC's approval if additional soil sampling is required.

10.2.2 Stormwater System Sampling and Testing

10.2.2.1 Stormwater System Soil Samples

Soil samples will be collected at locations where subsoils were visually impacted (staining or wet) by pipe leakage along the bottom of the excavation during removal of original stormwater system piping during the 2013/2014 upgrades. The locations of visually impacted subsoils caused by stormwater pipe leakage are identified in Appendix B as occurring at the following locations:

- Deterioration in the bottom of metal pipe at ED+0+10 (invert elevation 7 feet bgs) extended approximately three feet towards Structure D. Soil beneath the deteriorated pipe section was moist, but not wet, fill which indicated that leakage was not actively occurring.
- Deterioration in the bottom of the metal pipe at ED+0+50 to Structure D (approximately 20 feet long, invert elevation 5 feet bgs). Sporadic staining was observed. Soil beneath the pipe was moist, but not wet, fill which indicated that leakage was not actively occurring.
- Deterioration in the bottom of the metal pipe from MH-1 to NORTHCL-3 (approximately 50 feet long, invert elevation 27 inches bgs).
- Localized staining and odor beneath pipe with concrete encasement at HG+0+43 (invert elevation 8 feet bgs).

Sample locations are provided in Figure 10.1. Soil samples will be collected at each location from 0 to 1 ft, 1 to 2 ft and 2 to 3 ft, below the pipeline. Samples will be analyzed for pH, total metals and moisture content. Sample depths may be adjusted based on specific site conditions. If impacts from the stormwater system are identified at the 2 to 3 ft. depth, then additional sampling will be necessary at greater depth. The techniques and frequency of such sampling will be subject to DTSC approval, before implementation.

10.2.2.2 **Stormwater System Testing**

At the time of closure, the HDPE piping system will be pressure tested to document piping system integrity. The HDPE manholes will be hydrostatically tested to document manhole integrity. Test procedures are the same as those used during installation of the replacement stormwater system in 2013/2014.

Pipe Testing

Gravity flow sewer systems shall be tested for leakage by a low pressure air test. The test procedure shall be, in general, as recommended by the Bay Area Committee on Air Testing, Berkeley, California. The test procedure shall be as follows:

1. The inside of the pipe shall be thoroughly cleaned, removing all debris and mortar. The pipe shall be thoroughly flushed with water to clean and wet the pipe.
2. The pipe shall be plugged at the upper and lower manholes by the use of inflatable air-tight plugs, one of which shall be equipped with an air hose to the pipe interior.
3. The test equipment shall consist of a compressor with an air bleed valve, a throttling valve, and a sensitive air pressure test gage with a gage cock. This equipment shall be connected with the air hose connection to the pipe.

4. If the pipe is laid in groundwater, the elevation of groundwater level shall be determined and compensations will be made in the test pressures at the direction of the Resident Engineer.
5. Determine the test duration based on the table below (for sizes not listed, use next larger size):

Pipe Diameter (inches)	Test Period Duration (minutes)
8	4.0
10	5.0
12	6.0
16	7.0
18	8.5
24	11.5
30	14.0
36	17.0

6. Air shall be slowly added to the pipe until the pressure reaches 4.0 psi in excess of the groundwater head. After 5 minutes stabilization time, air shall be added as required. Plugs shall be checked for leaks. Pressure in the system should not exceed 5.0 psi.
7. When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi, commence the test. Record the drop in pressure for the test period. The test may be discontinued when the prescribed test time has been completed, even though 1.0 psi drop has not occurred.
8. If the groundwater level at the time of testing is above the pipe invert, add 0.43 psi of air per foot of water above the invert to the test air pressure range of 2.5 psi to 3.5 psi stated above.
9. If the pressure drop exceeds 1.0 psi during the test period, the test will be considered to have failed.

Manhole Testing

Drainage structures (i.e., HDPE manholes) located along the pipeline shall be tested for leakage by a low pressure hydrostatic test. The test procedure shall be as follows:

1. The inside of the drainage structure shall be thoroughly cleaned of foreign material.
2. The drainage structure shall be plugged by the use of inflatable water-tight plugs at all pipe penetrations.
3. Fill structure with water to the bottom of the concrete lid.
4. Measure loss over a 4-hour period.
5. A loss of ¼" or more during the test period shall be considered a failure.

If the piping and manholes pass the testing, no sampling along the alignment of the pipe and manholes will be necessary. If the HDPE pipe fails the pressure testing or HDPE manholes fail hydrostatic testing, additional soil borings shall be conducted in the area of the test failure every 20 feet adjacent (within 18-inches) to the alignment of the pipe. Soil samples will be collected at depths corresponding to 0 to 1 ft., 1 to 2 ft., and 2 to 3 ft. below the invert of the pipe. Trench drain sections that cannot be pressure tested will be sampled using soil borings every 40 feet along the alignment of the trench drain pipe. Manholes failing testing will be sampled at four locations around the structure and samples collected at depths corresponding to 0 to 1 ft, 1 to 2 ft, and 2 to 3 ft below the invert of the deepest incoming pipe.

10.2.3 Surface Impoundment Soil Samples

At the Stormwater Surface Impoundment, the liner system will be removed at the sample location to allow access to underlying soils and liner samples will be collected as discussed in Section 7.4.2. Soil borings shall be collected at the locations shown on Figure 9.1. Bottom

samples shall extend to 7 feet below the liner system of the surface impoundment. Soil samples at every 12 inches should be collected to a depth of 3 feet on the side-slopes of the impoundment. Bottom samples from 0-1 ft, 1-2 ft, 2-3 ft and 4-5 ft will be analyzed and the remaining samples (3-4 ft, 5-6 ft and 6-7 ft (bottom samples only)) will be archived for later analysis, if needed.

Side slope samples will be collected at one foot increments to 3 feet below the liner surface and all three samples at each location analyzed. Archived samples may be submitted for analysis if appropriate for refining vertical delineation.

Damage to the primary and secondary liner system geomembrane layers will be repaired by patching the geosynthetic layers and inspected by a licensed Professional Engineer. Sample frequency is provided above. Analytes are provided in Section 10.5.

10.2.4 Former Unit Sampling

Sampling for closed Units 11, 26, 27, 28, 64 and 65 will be conducted as shown on Figure 9.1 and as indicated in Appendix A.

Concrete and soil sampling at other historic closed units is proposed as part of the RFI as discussed in Section 4.4.

10.2.5 Soil Gas Sample Locations

Soil gas sampling will be completed at each of the three Surface Impoundment sumps and at one boring beneath or adjacent to each former IS unit. Soil gas samples will be collected at approximately 5 feet and 15 feet below grade using temporary soil gas sampling probes.

10.3 SAMPLE COLLECTION

Sample collection is described in the Sampling and Analysis Plan provided in Appendix A. Sampling equipment will be decontaminated prior to use and between each location. Decontamination procedures are provided in the Sampling and Analysis Plan (Appendix A)

10.3.1 Soil Sample Collection

Discrete samples will be placed in a laboratory-supplied sample jar. Samples will not be homogenized. Soil samples collected for VOC analysis will be collected using a TerraCore sampler or similar DTSC-approved technique as described in the Sampling and Analysis Plan provided in Appendix A. A record of the sampling will be made by field personnel in a dedicated log book. Sample locations will be documented by measuring from existing features.

Direct-push soil borings completed to 20 feet bgs or less will be abandoned using granular bentonite. Bentonite will be placed by hand into the boring from grade and hydrated in place with potable water. The following day, the borings will be topped off should the cement within the borings settle overnight.

10.3.2 Soil Gas Sample Collection

Soil gas sampling will be performed at approximately 5 and 15 feet deep in one boring beneath each former IS hazardous waste management unit and at three locations beneath the Surface Impoundment, one at each Surface Impoundment sump. The deeper sample depth may vary based on field conditions encountered during drilling. Soil gas samples will be co-located with a soil sample selected for VOC analysis.

10.4 QUALITY CONTROL SAMPLES

Quality control procedures including field duplicates, trip blanks, equipment blanks, matrix spike and matrix spike duplicates; chain of custody procedures; sample labeling, packaging and transportation; and documentation will be conducted as discussed in the Sampling and Analysis Plan (Appendix A).

10.5 ANALYTICAL TEST METHODS

Each sample will be analyzed for the compounds indicated in Table 10.1. Sample concentrations will be reported on a dry-weight basis.

10.6 EVALUATION OF RESULTS

The cleanup level for soil up to five feet below a unit to remain in-place without restrictions will be CAM-17 total metals results below ten times STLC levels or CAM-17 total metals results below TTLC limits and WET results below STLC limits.

Waste Extraction Test (WET) will be performed when the concentration for a contaminant of concern (COC) in a solid, as determined through TTLC testing, is below the TTLC level (22 CCR 66261.24) but greater than 10 times (by rule of thumb) the STLC. If the WET result is greater than the STLC, the item/media sampled is considered hazardous, even if the TTLC result is less than the TTLC level.

If the TTLC result is above the TTLC level, then the item/media sampled is considered hazardous waste, even without the STLC result. If the TTLC result is less than 10 times the STLC level in 22 CCR 66261.24, then the item/media sampled is considered non-hazardous, even without the STLC result.

Although determinations regarding whether or not soils are hazardous do not require soil gas sampling, Exide has agreed to perform the soil gas sampling as part of the Phase 1 Closure sampling. The results of soil gas sampling, in conjunction with relevant soil sampling results will be reviewed to determine if volatile organic compounds (VOCs) have been released from any of the former IS units and if such a release has occurred, will allow comparison against screening levels to determine if vapors are present in the soils at concentrations that warrant further evaluation as part of the ongoing Corrective Action.

10.7 SOIL PARAMETERS

Site-specific soil parameters from a minimum of three soil samples will be collected from major lithologic types underlying the Facility. Physical properties of the Facility's soil (i.e., density, moisture, total porosity, organic carbon content, soil type, and effective permeability or hydraulic conductivity) will be obtained in the field or through testing of soil parameter samples by a geo-technical laboratory.

Date: July 2015

11.0 BUILDING DECONSTRUCTION

Building deconstruction will be conducted during Phase 1. Deconstruction of buildings is above and beyond typical RCRA closure requirements. Engineering controls are presented in Appendix G.

11.1 CONCRETE SURFACE REMOVAL

Following completion of gutting, initial cleaning of metal walls and ceiling to visibly clean surfaces, and cleaning and chip sampling concrete building walls (for characterization purposes and to determine whether or not a temporary enclosure is needed during deconstruction), the uppermost surface of the concrete floor in the Reverb Furnace Feed Room Containment Building (Unit 33) will be removed by milling, hydroblasting, or similar techniques. The depth of surface removal is expected to vary between 0.5 and 1.5 inches depending on overall condition of the floor. The resulting millings/sediment will be removed using a HEPA vacuum truck or HEPA vacuum truck equipped with a vacuum box, characterized and disposed off-site at an appropriate disposal facility consistent with the results of the characterization testing. After surface removal activities, the ceiling, walls and floor will be re-cleaned using a HEPA vacuum and/or pressure washing techniques to remove residual dust remaining from the surface removal activities. Confirmatory sampling will then be performed. Concrete surface removal is not required at other closure areas, but may be performed at the discretion of the Resident Engineer if visual observations and/or chip samples indicate that the concrete will likely fail to achieve performance standards. To the extent possible for the purposes of controlling fugitive dust, surface removal shall be performed while the air emission controls remain in operation and the building is under negative pressure. If the air emission controls are no longer operable or surface removal is performed outside of buildings with negative pressure, a temporary enclosure with negative pressure shall be erected over the work zone to control fugitive dust.

11.2 TANK FOUNDATIONS

Tank and miscellaneous unit foundations and pedestals which project above the floor elevation will be pressure washed to remove visible residual waste on the finished surface and then deconstructed to match surrounding floor, including tank foundations at the Wastewater Treatment Plant and Oxidation Tank Area. Concrete characterization chip samples will be collected and the foundation managed as discussed in Section 11.3.7.2. To the extent possible for the purposes of controlling fugitive dust, foundation deconstruction in the RMPS Building, Desulfurization Building, Containment Buildings, Baghouse Building and Smelter Building will be performed while the air controls remain in operation. Tank and miscellaneous units not within a structure maintained under negative pressure and with total lead concentrations above the California Human Health Screening Level (CHHSL) for industrial soil (320 mg/kg), as determined through chip sampling, or untested shall be covered by a temporary enclosure operated under negative pressure until completion of foundation and pedestal deconstruction. The chip samples will be used for characterization for disposal and to determine whether or not a temporary enclosure will be used and will not be used for determination of whether or not a closure performance standard has been met.

11.3 BUILDING DECONSTRUCTION

11.3.1 Preparation

Following completion of decontamination, gutting, and sampling, the Reverb Furnace Feed Room and Blast Furnace Feed Room Containment Buildings, RMPS Building, Smelter Building, Baghouse Building and Desulfurization Building will be deconstructed to 5 feet below surrounding grade as part of closure activities. The buildings proposed for deconstruction are shown on Figure 11.1. All non-structural components and equipment will be removed and disposed or recycled off-site, and all interior decontamination shall be completed prior to the start of building deconstruction.

Prior to the start of deconstruction activity, an environmental sweep of all buildings will be performed to confirm that all wastes and/or regulated materials (such as asbestos, insulation, electrical fixtures containing PCBs or mercury, transformers, loose or chipping lead based paint and emission control equipment not required to maintain negative pressure on remaining structures) are removed. The inspection will also verify that all utilities associated with the buildings have been disconnected and deenergized. The deconstruction area will be demarcated to secure the work area and protect workers and other personnel onsite. Access to the work area will be restricted to Contractor personnel and other approved visitors and support staff.

Existing floor sumps will be used for water management during deconstruction. Precipitation and dust control water are expected to require management during deconstruction. Any floor sumps (including trenches, floor drains and lower levels) remaining after completion of Phase 2 Closure will have achieved the Closure Performance Standards or be approved by DTSC for closure with hazardous waste-in-place.

11.3.2 Deconstruction Engineering Survey

A Deconstruction Engineering Survey will be prepared by a Structural Engineer with demolition/deconstruction experience licensed in the State of California in accordance with CalOSHA provisions (8 CCR Subchapter 4, Construction Safety Orders, Article 31 – Demolition). The engineering survey shall be utilized to determine safe decontamination and deconstruction procedures and shall adequately assess the condition of framing, floors, walls and roofs. Project safety is solely the responsibility of the Contractor. Worker and public safety must be a paramount concern of the Contractor.

The Contractor will submit the Deconstruction Engineering Survey to Exide and the Resident Engineer for review. Following incorporation of Exide and Resident Engineer comments, the Deconstruction Engineering Survey will be submitted to DTSC and AQMD at least 30 calendar

days prior to start of deconstruction. The Deconstruction Engineering Survey must be approved by DTSC in writing prior to implementation.

As it was built last, the Baghouse Building is structurally inter-connected with the Reverb Feed Room, RMPS Building and Smelter Building and is anticipated to be the first deconstructed of these four buildings.

11.3.3 Deskinning

De-skinning shall not be performed until interior decontamination is fully completed. Negative pressure will be maintained on the building while de-skinning (i.e., removing wall and roof panels). A temporary enclosure with negative pressure will be constructed on outside walls by securing plastic sheeting on scaffolding or supported by structural building elements. The temporary enclosure with negative pressure shall be adequately secured at ground level, along the roof line, at the ends and along adjacent panels to allow the windbreak to be sufficiently impermeable such that negative pressure can be maintained inside the building as wall panels are removed. The building skin will be removed panel by panel beginning with the walls and ending with the roof using the following methods:

- Spray panel to be removed with water to control dust expected at panel overlaps.
- Cut the fasteners and maintain panel in its original position.
- HEPA vacuum dust accumulations within panel overlaps and between panel and structural steel.
- While separating the panel, wipe the overlaps and face of structural members with a damp rag or pressure wash the overlap to remove dust accumulations.
- Remove the panel and lower to the ground in a controlled fashion.

Following wall skin removal, the roof skin will be removed panel by panel using the following methods:

- Within an approximately 10 ft by 10 ft by 10 ft mobile negative pressure tent on top of the roof, remove 50% of the roof panel screws while vacuuming with a SCAQMD permitted HEPA vacuum. Seal holes with silicone as the screws are removed.
- Cover roof panels with 11 mil plastic sheeting and seal to the perimeter scaffolding and structures. Use rope or sand bags to hold the plastic sheeting in place as needed. This procedure will completely enclose the section of the roof to be removed with plastic sheeting.
- Use standoff supports with rounded ends to separate the plastic sheeting from roof panels without damaging the plastic sheeting. The standoff supports will be approximately 4 to 6 inches tall.
- Remove roof panels in small sections by cold cutting from inside the building while ensuring the 11-mil plastic sheeting is not damaged. Remove the cut section and lower to the ground in a controlled fashion. It is anticipated that the roof panels will be removed in a row along the peak of the roof, parallel to the girt line, and then downwards row by row towards the roof/wall interface.
- As roof panels are removed, remove remaining screws connecting the roof panel to the structural steel from above or below the roof.
- As panels are removed, allow plastic sheeting to lay on structural steel. Use rope or cables between structural girts and trusses to create a grid to support the plastic sheeting.

Panels will be sorted by material type, and containerized for off-site recycling or disposal. The negative pressure will be turn off and the temporary enclosure will be partially removed to leave a windbreak at the concrete walls proposed for deconstruction. Once the work is complete, the scaffolding and plastic will be cleaned using SCAQMD permitted HEPA-equipped vacuums to remove any dust prior to removal. The interior of the temporary enclosure/windbreak will be wiped down and sprayed with an encapsulant such as Fiberlock or similar before dismantling the temporary enclosure/windbreak or removing plastic sheeting.

Negative pressure equipment will be shut down.
Throughout these activities, water sprays, floor sweeping and vacuuming of dust accumulations with a HEPA vacuum will be performed.

The sequence of removing emission control equipment which penetrates the roof and the building walls will be determined using the Deconstruction Engineering Survey.

The windbreak will remain in-place until the building is completely de-skinned.

11.3.4 Structural Steel

Structural steel for the walls and roof will be removed to the top of concrete wall using cold cutting and conventional equipment.

The structural steel frames of the buildings will be systematically dismantled from the roof level down to the ground level in accordance with the sequence recommended by the Contractor's Structural Engineer. It is anticipated that steel frame deconstruction will be performed using large tracked excavators (operating weight greater than 50,000 lbs) equipped with rotating shear or grapple attachments to cut and remove structural members down to the concrete slab/foundation level.

11.3.5 Concrete

Hydraulic hammers will be used to break up concrete and masonry debris to surrounding grade.

11.3.6 Material Segregation

During deconstruction, materials will be placed on cleared sections of concrete slabs. The materials will be sorted using excavators, skid steer loaders (Bobcat), and manual labor and either direct loaded for shipment off-site or moved into one of the remaining structures with operating air emission controls (until deconstruction of the final structure) for sizing or supplemental cleaning, if required. Torches will be used to cut and size metal debris. It is anticipated that materials will be sorted into three basic categories: concrete/masonry, scrap metals, construction and deconstruction debris (wood, plastics, etc.). These materials may be further segregated as needed based on recycler/disposal facility requirements (example: ferrous metals separated from non-ferrous metals).

11.3.7 Material Management

11.3.7.1 **Scrap Metal**

Structural steel will be recycled off-site. The Closure Cost Estimate assumes recycling at a facility within 15 miles of the facility. Transportation costs are included in the Closure Cost Estimate. No credit is assumed for the value of the scrap.

11.3.7.2 **Concrete**

Walls and equipment foundations intended for deconstruction will be visually clean prior to deconstruction. Walls and equipment foundations will be removed, sized as needed for transport and disposal, and disposed off-site. Wall and equipment foundation chip samples will be used for disposal characterization and to determine whether or not deconstruction should occur within an enclosure. Characterization sampling will be performed as required by the disposal facility. The materials will be stored in sealed, leak-proof containers unless located within a total enclosure.

Concrete walls (except for portions of the Reverb Feed Room) are assumed to be non-hazardous in the Closure Cost Estimate as all concrete pavement removed during the 2013/2014 Stormwater System Replacement project was characterized as non-hazardous. Characterization results from the Stormwater System Replacement project are provided in Appendix B.

Date: July 2015

12.0 DECONTAMINATION OF UNREGULATED AREAS

Based upon the potential for dust or residue to be present on ancillary equipment and structures, decontamination will be performed to minimize exposure and protect human health and environment. Non-regulated building roofs and site-wide paved areas that were not cleaned during the initial closure activities will be decontaminated. The non-regulated building roofs to be decontaminated are shown on Figure 12.1 and are as follows:

- BESS;
- Engineering;
- Product Storage;
- Chemical Storage;
- Employee Facilities;
- Water Softener;
- Garage;
- Machine Shop;
- Maintenance Storage;
- Blue Lead Warehouse;
- Scale House; and,
- Cooling Tower.

During Phase 1, the non-regulated areas will be decontaminated by HEPA vacuum and pressure wash, and the resulting rinsate collected for processing in the Wastewater Treatment Plant. All equipment used in the decontamination activity will be triple rinsed.

The Water Softener Building Sump, Caustic Tank Sump, and Railroad Sump will be cleaned concurrent with decontamination of unregulated areas by vacuuming with a HEPA vacuum and washing using a pressure washer.

Date: July 2015

13.0 GROUNDWATER SAMPLING

The contents of this section have been moved to Section 22.

The Sampling and Analysis Plan (SAP) included as Appendix A does not discuss satisfying clean-up levels that are anticipated to be included as part of Closure (i.e., clean closure or closure with land-use restrictions for an industrial-type scenario) and are not yet known. Exide will submit an additional SAP to DTSC to address this issue within 60 days of approval of the Closure Plan.

Date: July 2015

14.0 QUALITY CONTROL PROCEDURES

14.1 LABORATORY ANALYSIS

Analysis will be conducted at a laboratory certified by the California Environmental Laboratory Accreditation/Certification Program (ELAP).

The EPA analytical methods will be used for waste analysis as shown in Table 10.1.

14.1.1 Quality Control Samples

The use of control samples will maintain quality for all sampling. Field duplicates will be collected at a rate of 5% (or one duplicate for every 20 samples collected) of the samples collected per sampling event. Field duplicates will be collected, preserved, packaged, labeled and sealed in a manner identical to the other samples being collected. Duplicate samples will be used as a check for consistency in analytical procedures.

Field and laboratory quality control procedures are provided in the Sampling and Analysis Plan in Appendix A.

14.1.2 Decontamination of Sampling Equipment

All non-disposable field sampling equipment will be cleaned and decontaminated in accordance with the Sampling and Analysis Plan (Appendix A).

14.2 CHAIN-OF-CUSTODY PROCEDURES

Handling and custody transfer of samples will be completed in accordance with the protocol contained in the Sampling and Analysis Plan (Appendix A).

15.0 PARTIAL CLOSURE

Not used.

Date: July 2015

16.0 PHASE 2 - CONTINGENT CLOSURE PLAN

The contingent closure plan was prepared in the event there are unforeseen circumstances that arise during closure or additional activities are required to complete and certify the facility closure. These additional activities will be conducted during Phase 2 and may require the removal of hazardous soil beneath the concrete floor at the closure areas; installation of boundary markers where hazardous soils are left in-place; and development of a deed notice/land use covenant. The scope of Phase 2 will be determined using data generated during Phase 1 and may be influenced by data generated during the RFI and Corrective Action process. The scope of Phase 2 could range from the worst case presented in this section (excavation and capping) to a best case of no excavation with all Phase 1 samples meeting the performance standards. It is likely that the scope of Phase 2 will be a variety of activities with no excavation in some areas, excavation only in some areas, and capping in some areas.

16.1 PLANNING

The soil, soil gas and chip data generated during Phase 1 will be used to prepare a Phase 2 Contingent Closure Plan. The Phase 2 Contingent Closure Plan will identify the vertical and horizontal limits of removal, procedures for confirmatory sampling, erosion and sediment control measures, and Site restoration and stormwater management plan. The Phase 2 Contingent Closure Plan will include a conceptual site model that illustrates the physical, chemical and biological processes that control the transport, migration and potential impacts of contamination identified in soil, air, groundwater, surface water and sediments. The Phase 2 Contingent Closure Plan will be subject to DTSC review and approval.

Planning activities also include obtaining permits from state and local agencies (which may include an erosion and sediment control permit, and a stormwater discharge permit) as discussed in Section 3 and retaining a contractor to conduct the work.

16.2 PROPOSED EQUIPMENT

The following former IS units and equipment are proposed for use during Phase 2:

- Unit 1 – Central Container Storage Building;
- Unit 87 – West Yard Truck Wash;
- Unit 46 – Pump Sump;
- Unit 78 – Stormwater Surface Impoundment;
- Temporary WWTP;
- Soil stabilization equipment, if needed;
- ~~Concrete crusher;~~
- Torit Baghouses;
- Temporary emission control equipment, if needed; and,
- Finished Lead Building.

The former IS units will have been cleaned during Phase 1 to remove accumulated sediment that has the potential test hazardous. The Torit Baghouses, located in the Finished Lead Building, are proposed to remain on-site and in operational condition after cleaning during Phase 1. The Finished Lead Building is expected to be an ideal location for treating excavated soil ~~or crushing concrete~~ during Phase 2. The Torits will provide the ability to maintain negative pressure in the Finished Lead Building during material handling.

16.3 SOIL REMOVAL PROCEDURES

16.3.1 General

The location of former IS units is provided on Figure 2.2. The extent of contamination and required excavation at these units (if any) will be determined based on the results of closure soil sampling discussed in Section 10.0, and the relationship with the corrective measures alternative

selected through the Corrective Action process. For the purposes of the contingent closure cost estimate provided in Appendix I, floor removal, soil excavation and restoration is assumed to occur at 100% of the footprint of the following locations to the depth from the bottom of 0.8 ft thick (nominal) pavement and building concrete floor as noted below and as shown on Figure 16.2. Excavation will occur below both pavement and building floor slabs. The actual thickness of pavement and floor slabs is not known and is anticipated to be variable. 0.8 feet thick was selected as the nominal thickness for preparation of the Contingent Closure Cost Estimate provided in Appendix I.

- RMPS Building, including unloading dock, and oscillating pan feeder (Unit 70) (5 ft depth);
- RMPS Plastic Trailer Loading area (5 ft depth);
- Desulfurization Building/Secondary Containment Area (5 ft depth);
- Reverb Furnace Feed Room Containment Building (5 ft depth);
- Blast Furnace Feed Room Containment Building (5 ft depth);
- Oxidation Tank secondary containment area (5 ft depth);
- Mobile Equipment Wash station (Unit 35) (5 ft depth);
- Units 31 and 32 at the Baghouse Building (5 ft depth);
- Other current and former IS unit footprints and ancillary sumps at the Baghouse Building (5 ft depth), including Rotary Kiln enclosure;
- Furnace and kettle footprints at the Smelter Building (5 ft depth);
- Caustic Tank Sump (5 ft depth);
- West Yard Truck Wash (Unit 87) (5 ft depth);
- Container Storage Areas (Units 1, 2 and 3) (5 ft depth);
- Drop Out System (5 ft depth);
- Concrete Yard Area (Former WWTP) (5 ft depth);
- Wastewater Treatment Plant (5 ft depth);
- Railroad Sump (5 ft depth);

- Water Softener Sump (5 ft depth); and,
- Acid Collection Sump 3 (5 ft depth).

No excavation is assumed for the contingent closure cost estimate for the following:

- Surface Impoundment ~~due to physical constraints~~because this area has both historic and more recent impacts and will be addressed during Corrective Action.
- Trailer Staging Area (Unit 103) because this historic metals processing area will be addressed during Corrective Action.

16.3.2 Concrete Floor Removal and Management

If soil sampling conducted during Phase 1 closure activities (discussed in Section 10.0) indicates that soils are present which exceed the cleanup levels discussed in Section 3.2 and those impacts are not associated with historic operations, the concrete or asphalt floor and/or liner system above the hazardous soil will be removed using a concrete saw, jackhammer, front-end loader and/or hand tools as appropriate. Concrete removal and soil excavation will be performed in temporary enclosures using water spray to control dust.

The concrete or asphalt pavement and building floors will be removed during Phase 2 and, based on results of sampling and visual appearance, will be ~~crushed and saved for use as on-site fill (at or below the performance criteria) or~~ disposed off-site at an appropriate disposal facility ~~(above the performance criteria)~~. ~~If conducted during Phase 2, concrete floors to be crushed and recycled as on-site backfill shall have chip sample results meeting the DTSC screening levels for non-residential exposure scenarios.~~ Concrete which does not have chip sample results meeting the performance standard will be visually clean and be characterized and disposed off-site.

~~If conducted, concrete will be crushed to 3-inch (max.) size in a concrete crusher located in the Finished Lead Building and retained on-site for re-use as backfill. 500 cy (1,000 ton) stockpiles~~

~~of crushed concrete will be created in the Finished Lead Building until the stockpile can be sampled again. Composite characterization samples will be collected as discussed in the Sampling and Analysis Plan (Appendix A) to confirm the crushed concrete can be re-used on-site. Determination for reuse will be based on the characterization results being equal to or less than the Corrective Action standards. Piles passing confirmation sampling will be immediately use for backfilling excavations that have been completed or placed in a stockpile in the West Yard. Stockpiles will be placed on and covered with plastic sheeting.~~

~~Concrete crushing will be performed in the Finished Lead Building or temporary enclosure operated under negative pressure.~~ Hazardous floors, pavement and building foundations being shipped for off-site disposal may be treated on-site prior to shipment or treated at the landfill. The Closure Cost Estimate in Appendix I assumes concrete floor removal and disposal will occur at 100% of the locations noted in Section 16.3.1.

16.3.3 Soil Removal and Management

After removing the pavement, the ~~hazardous~~ contaminated soil will be removed using a front-end loader, excavator or a dozer. Confirmation samples will be collected from the walls and floor of the excavation area; excavation areas will not be backfilled until confirmation sample results indicate the soils within the excavation meet applicable clean-up levels. Upon receipt of clean confirmation sample results, the excavation will be backfilled with clean fill and resurfaced with pavement.

The contingent closure Cost Estimate assumes excavation of soil to 5 feet depth from the bottom of an approximate 0.8 ft thick Portland cement and asphalt concrete pavement, as well as below concrete floor slabs at the locations noted in Section 16.3.1. ~~For e~~Excavations are expected to occur after or during building demolition. ~~near structural building foundations, the excavation may be required to slope away from the foundation to avoid compromising the structural integrity of the building.~~ In the event that excavations near structural building foundations are

performed prior to building demolition, then ~~O~~options for excavation up to the foundation, including shoring or slot cutting, will be considered based on depth and soil conditions.

The remediated soil will be stabilized ex-situ on-site (as required based on characterization testing) prior to off-site disposal as non-hazardous waste or transported by hazardous waste manifest to a certified treatment, storage, and disposal facility for treatment prior to disposal. On-site treatment is anticipated to occur using soil stabilization equipment within the Finished Lead Building. For the purposes of preparing the Closure Cost Estimate, 100% of the soil is assumed to be disposed off-site as RCRA hazardous waste at a facility in Beatty, Nevada.
Dust control measures such as temporary enclosures and water will be used during floor removal and excavation activities. The temporary enclosure will remain in-place until the excavation is complete and/or any areas remaining over the performance standards are covered with plastic sheeting or geotextile fabric.

The City of Vernon requires removal or deconstruction of footings and similar obstructions up to 10 feet below grade to avoid conflicts for future land users, unless an alternate approach is approved. Based on the 90+ year operating history of the facility, most of which pre-dates the former IS units, it is expected that the most appropriate alternative for Corrective Action will involve ~~capping and~~restoration of the facility to clean-up levels and placing deed restrictions on the property~~ that restrict excavation~~. All existing foundations as well as any other similar obstructions within ten feet of existing or final grade, whichever is greater, shall be removed in accordance with City of Vernon requirements. ~~If deed restrictions are put in place as discussed in Section 16.10 which restrict excavation, then footing removal would not be warranted. As-built drawings will be prepared to document foundations left in place and included in the deed restrictions. Exide will work with the City of Vernon when finalizing the Phase 2 Contingent Closure Plan and Corrective Action Plans to limit impacts to future development. Removal or deconstruction of footings not removed as part of the soil remediation activities will be performed, if needed, after an excavation area has achieved the performance standards.~~

16.3.4 Removal of VOC-Contaminated Soils

VOC-contaminated soils are not expected during the Phase 2 Closure activities; however, measures will be taken to implement SCAQMD Rule 1166 procedures for soil excavation. VOC-contaminated soils register a concentration of 50 ppm or greater of VOCs as measured before suppression materials have been applied and at a distance of no more than three inches from the surface of the excavated soil with an organic vapor analyzed calibrated with hexane.

VOC readings will be taken by the Contractor every 15 minutes using the following procedures:

- Calibrate organic vapor analyzer with hexane;
- Place probe inlet at a distance of no more than 3 inches from the surface of the excavated soil;
- Slowly move probe across soil surface which observing the instrument reading;
- If increased meter reading is observed, continue to screen the excavated soil until maximum reading is obtained;
- Leave probe inlet at maximum reading location for approximately double the instrument response time; and,
- If maximum observed reading is greater than 50 ppm, record and report results.

All readings and instrument calibrations will be recorded.

If VOC-contaminated soil is detected, the following actions will be taken:

- Implement the VOC-contaminated Soil Mitigation Plan;
- Notify AQMD within 24 hrs of detection;
- Continue to monitor and record VOC readings; and,
- Maintain calibration records onsite.

If VOC-contaminated soil greater than 1,000 ppm is detected, the following actions will be taken:

- Spray soil with water or vapor suppressant; and,
- Place soil in sealed containers as soon as possible and within 15 minutes, or,
- Place soil in trucks, moisten with additional water and cover within 15 minutes and transport off-site as soon as possible.

General shipping procedures are provided in Section 3.13.

16.3.5 Abandoned Stormwater Piping Removal

Sections of stormwater piping which could not be removed during the 2013/2014 stormwater system replacement were abandoned in-place by cleaning using jetting methods and grouting in their entirety. All abandoned-in-place piping within ten feet of existing or final grade, whichever is lower, shall be removed as required by the City of Vernon requirements. ~~If compatible with the selected Corrective Action alternative, or if occurring in an area destined for closure with a hazardous waste in-place designation, these sections of pipe will be allowed to remain in place. If occurring in an area that is expected to achieve the closure performance standards, t~~The abandoned-in-place ~~section of~~ piping~~e~~ will be excavated ~~during Phase 2~~ to a depth of the pipe invert plus 6 inches. Sidewalls and bottom of excavation shall be demonstrated to achieve the closure performance standards in Section 3.2 using confirmatory sampling. The excavated material will be characterized and disposal/managed as appropriate.

The Closure Cost Estimate assumes excavation of all the abandoned stormwater piping in the North Yard. The excavation volume is 779 cy in the North Yard. The Closure Cost Estimate also assumes that original/abandoned stormwater piping in the South Yard will remain in-place and be capped as part of the South Yard Corrective Action activities.

As presented in the Stormwater Management System Removal completion report in Appendix B, the abandoned piping are:

- MH-1 to MH-2, beneath the Soda Ash Silo and east to MH-1 (MH-2MH-1+0+85 to MH-1)(approximately 180 feet);
- Inlet D-1 to MH-6 (approximately 90 feet);
- 12-inch diameter corrugated HDPE pipe from DC+0+30 to DC+1+13 (approximately 83 feet);
- 18-inch diameter HDPE pipe with invert 11 feet bgs, (ECHANNEL+0+23 to ECHANNEL+0+65) (approximately 42 feet);
- CL-8 to MH-6 beneath the Reverb Furnace Feed Room (approximately 77 feet); and,
- MH-7 to MH-6 beneath the RMPS Building, Reverb Furnace Feed Room, RMPS Loading Dock area and existing ramp (approximately 125 feet).

16.4 CONFIRMATORY SOIL SAMPLING

Confirmatory soil sampling will be conducted after soil remediation from 0 to 1 ft depth from the bottom of excavation in accordance with Section 10.0 to verify that all soil which exceeds the performance standards has been removed. Samples will be analyzed as discussed in Section 10.5. ~~Confirmatory soil sampling will not be required beneath areas to be capped.~~

16.5 RESTORATION

The void left after removal will be backfilled using ~~the crushed concrete from Phase 2 concrete removal,~~ imported clean fill, as recommended by the DTSC's Information Advisory, or imported clean crushed stone. Finished grades will be determined during development of the detailed Phase 2 design, but are expected to be designed to promote surface water drainage, minimize the volume of backfill material required and accommodate the selected Corrective Action

alternative. Backfill material will be placed in compacted lifts and graded with appropriate construction equipment to surrounding grade. The uppermost 6-inch layer will be crushed stone.

16.6 SURFACE IMPOUNDMENT RESTORATION

Any soil and surface impoundment material that exceeds the Closure Performance Standards (i.e., clean-up levels established as part of CA), will be excavated and removed from the Surface Impoundment. Confirmatory soil sampling will be conducted after soil remediation from 0 to 1 ft depth from the bottom of excavation in accordance with Section 10.0 to verify that all soil which exceeds the Closure Performance Standards has been removed. Samples will be analyzed as discussed in Section 10.5. Backfilling will be performed as described above in Section 16.5. A Soil Management Plan (SMP) will be submitted to DTSC for review within 30 days of approval of the Closure Plan.

If impacts to soil-gas are detected above Closure Performance Standards for soil-gas, soil-vapor-extraction (SVE) may be implemented during the closure and/or CA process to restore soil-gas to risk-based levels. Groundwater beneath the Surface Impoundment is long-known to be contaminated; therefore, groundwater monitoring followed by remediation to Closure Performance Standards (e.g., drinking water MCLs) will be implemented as part of CA.

Article 6 groundwater monitoring is required for this unit. Exide will submit a Sampling and Analysis Plan for Article 6 groundwater monitoring for the surface impoundment within 30 days of approval of the Closure Plan.

In the event that soil above the performance standard remains in-place beneath the Stormwater Surface Impoundment, or that Exide cannot feasibly meet any of the conditions for clean closure or closure with restrictions as discussed in Section 3.2.1, 'Contingent Closure (Phase 2) Excavation Rationale', the Stormwater Surface Impoundment will be closed with a hazardous

waste in-place designation. The liner systems will be removed and disposed off-site and the impoundment will be backfilled as appropriate based on future use of the area and the area where waste remains shall be capped. A discharge pipe will be designed and installed to allow gravity drainage from the Stormwater Surface Impoundment into the storm sewer system or adjacent stormwater drainage channel. If applicable, a National Pollutant Discharge Elimination System (NPDES) permit shall be obtained from the State Water Resources Control Board (SWRCB) before discharging stormwater from the facility.

If waste is left in-place ~~that exceeds the Closure Performance Standard~~, the impoundment will be re-lined to create a cap over the hazardous waste remaining in-place. The cap will consist of, from bottom to top, two feet of low permeability clay layer or geosynthetic clay liner, 60-mil HDPE geomembrane, single-sided geocomposite drainage layer, and 6 inches of reinforced concrete pavement or similar protective hardscape. The cap shall be in compliance with California Code of Regulations Section 66264.228 (e) through (r). The side-slopes will be graded for a shallower slope to allow for cap installation on the slopes. The cap design will be submitted to DTSC. For conservatism, the contingent closure cost estimate assumes that the Stormwater Surface Impoundment will be closed with hazardous waste in-place.

16.7 CONTINGENT POST-CLOSURE SUBMITTALS -

If Closure Performance Standards cannot be achieved, 22 CCR 66265.197, 66265.228 and 66265.1102 respectively state that the operator shall close the tank systems, surface impoundments and containment buildings and perform post-closure care in accordance with the closure and post-closure requirements that apply to landfills (22 CCR 66265.310). If soil greater than the Closure Performance Standard remains in-place at the completion of Phase 2, a RCRA cap design conforming to 22 CCR 66265.310 will be submitted for DTSC review and approval prior to installation.

The cap will be designed to:

- Prevent the downward entry of water into the closed unit for a period of at least 100 years.
- Function with minimum maintenance.
- Promote drainage and minimize erosion or abrasion of the final cover.
- Accommodate settling and subsidence so that the cover's integrity is maintained.
- Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.
- Accommodate lateral and vertical shear forces generated by the maximum credible earthquake so that the integrity of the cover is maintained.
- Preclude ponding of rainfall and surface run-on over the closed area.

Upon completion of RCRA cap installation, a post-closure permit application will be submitted for DTSC's review as required by 22 CCR 66264.310 or Exide will enter into an Enforceable Agreement covering both the former IS unit post-closure and the Corrective Action. The post-closure permit application or Enforceable Agreement will include the post-closure care as specified in California Code of Regulations, Section 66264.118 and Water Quality Monitoring and Response Programs for Permitted Facilities as specified in California Code of Regulations, Chapter 14, Article 6. The post-closure application/Enforceable Agreement design details will include surface water run-on and run-off controls.

The Post-Closure Permit Application will include a Post Closure Plan addressing the following requirements:

- Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion or other events;

- Maintain and monitor the leachate collection and removal system which also serves as a leak detection system;

- Maintain and monitor the groundwater monitoring system and comply with all other applicable requirements of Article 6 of Chapter 14 of Division 4.5 of Title 22 of the California Code of Regulations;

- Prevent run-on and run-off from eroding or otherwise damaging the final cover; and,

- Maintain and monitor the leak detection system in accordance with 22 CCR 66264.221(c)(2)(D) and (c)(3) and 66264.226(d) and comply with all other applicable leak detection system requirements of Chapter 14 of Division 4.5 of Title 22 of the California Code of Regulations.

The application will include:

(1) A description of the planned monitoring activities and the frequencies at which the monitoring will be performed to comply with Articles 6, 11, 12, 13, and 14 of this chapter during the post-closure care period.

(2) A detailed description of the maintenance and monitoring activities, and frequencies at which they will be performed, to ensure:

   a. The integrity of the cap and final cover and other containment systems in accordance with the requirements of Articles 11, 12, 13 and 14 of this chapter; and,

   b. The function of the monitoring equipment in accordance with the requirements of Articles 6, 11, 12, 13, and 14 of this chapter.

(3) A description of how the performance standards and post-closure requirements for any remaining hazardous soil will be met is included to comply with Articles 6, 11, 12, 14 and 16 of Chapter 14 of the California Code of Regulations, Title 22, during the post-closure care period.

(4) A detailed description of steps needed to protect and maintain the waste management area surveyed benchmarks.

(5) A detailed description of the steps necessary to collect, transport, and discharge collected stormwater.

(6) The name, address, and phone number of the person or office to contact concerning the hazardous waste management unit and facility during post-closure care.

(7) all information necessary to enable the Department to prepare an Initial Study for the post-closure plan, which meets the requirements of Title 14,California Code of Regulations section 15063, unless the Department has determined that the post-closure plan is exempt from the requirements of the California Environmental Quality Act pursuant to Title 14, CCR section 15061.

(8) Water Quality Monitoring and Response Program.

16.8 EQUIPMENT DECONTAMINATION

Equipment used during Phase 2 will be decontaminated. The resulting rinsate will be treated in the temporary WWTP prior to being discharged to the local sewer. The resulting lead residue will be drummed and transported, as a reclaimable material, to a secondary lead recycler for reclamation or sent for off-site stabilization and disposal.

16.9 ~~HAZARDOUS~~ CONTAMINATED SOIL BOUNDARY MARKERS

If hazardous soil remains in-place at the completion of Phase 2, bollards or posts shall consist of at least 42-inch high above surrounding grade, 4-inch diameter, schedule 40 steel pipes, painted traffic yellow, and set or anchored in concrete foundations ~~posts~~ or similar boundary markers will be installed to mark the boundaries of each area of soil remaining in-place. Post locations will be documented by a licensed surveyor. Boundary marker details will be determined based on the corrective action scope and will be submitted to DTSC for approval. The Closure Cost

Estimate in Appendix I assumes seventeen areas with hazardous waste remaining in-place, and eight markers per area for a total of 136 fence posts.

No later than the submission of the certification of closure of the former IS units, the facility will submit to the local zoning authority and DTSC, a survey indicating the location and dimensions of any hazardous soil with respect to permanently surveyed vertical and horizontal benchmarks as specified under 22 CCR 66264.116. The survey will be prepared and certified by a Professional Land Surveyor licensed in California. The survey filed with the local zoning authority will contain a statement or notation, prominently displayed, which states the facility's obligation to restrict disturbance of the hazardous soil.

16.10 DEED NOTICE

No later than 60 days after certification of closure, if any hazardous waste remains, the facility will submit to DTSC and to the authority with jurisdiction over local land use, a record of the type, location, and quantity of hazardous waste remaining at the facility as required under 22 CCR 66264.119. The facility will record, in accordance with state law, a notation on the deed / land use covenant to the facility property that will notify any potential purchaser that: 1) the land was used to manage hazardous wastes; 2) its use is restricted under closure and post-closure regulatory requirements; and 3) the survey and record of the type, location, and quantity of hazardous waste within the area of the facility has been filed with the local zoning authority and DTSC.

The facility will submit to DTSC a signed certification stating that the location has been recorded. The submittal will include a copy of the document(s) in which the notification has been placed. If at any time the facility wishes to remove underlying contamination or surrounding soil, the facility will request a modification to the post-closure plan. The facility will demonstrate that the removal of the hazardous soil will satisfy 22 CCR 66264.117(d) which states:

> "Post-closure use of property on or in which hazardous waste remains after partial or final closure will never be allowed to disturb the integrity of the final cover, liners or any

other component(s) of the containment system, or the function of the facility's monitoring systems, unless the Department of Toxic Substances Control (DTSC) find that the disturbance: 1) is necessary to the proposed use of the property, and 2) is necessary to reduce a threat to human health or the environment."

If DTSC grants a permit modification or otherwise grants approval to conduct such a removal activity, and removal activities are completed to the satisfaction of DTSC, the facility may request the approval of either the removal of the notation on the deed of the facility property or include an additional notation on the deed indicating the removal of the hazardous soil.

16.11 CAPPING

The Closure Cost Estimate in Appendix I assumes that caps will be installed in the North Yard and South Yard where hazardous waste is closed in-place as shown in Figure 16.1. The North Yard cap area is assumed to be 1.26 acres, and the South Yard cap area is assumed to be 3.11 acres. The assumed cap is an asphaltic concrete section that will consist of, from top to bottom:

- 4 inch thick asphalt concrete wearing course;
- ~~4 inch thick asphalt binder course;~~
- 6 inch thick ~~crushed stone~~aggregate base;
- 12 inch thick structural soil fill;
- Single-sided geocomposite drainage layer;
- 60-mil HDPE geomembrane;
- Geosynthetic Clay Liner;~~ and,~~
- Geocomposite drainage layer, and
- 4 inch thick sand layer.

The cap design is for Contingent Closure assumptions only and is presented for use in developing the Closure Cost Estimate. If it is determined that an IS unit will be closed with

~~hazardous~~ waste in-place, a cap design will be submitted to DTSC for approval prior to installation.

Date: July 2015

17.0 CLOSURE IMPLEMENTATION SCHEDULE

17.1 GENERAL

Though subject to modification based on the regulatory process, the overall closure schedule is provided in Microsoft Project format in Appendix F. The overall closure schedule is summarized as follows:

DTSC Notice to Start Closure	January 2016
Phase 1 Implementation	March 2016 – December 2021
Phase 2 Planning	July 2021 – January 2022
Phase 2 Implementation	February 2022 – January 2024
Post-Closure	February 2024 – February 2053

The schedule for Phase 2 Planning and Implementation may also depend on the schedule for Soil Corrective Measures implementation in the Corrective Action process.

17.2 DURATION

22 CCR 66265.113(a) requires that all hazardous wastes be treated, removed from the unit or facility, or disposed on-site within 90 days of approval of the Closure Plan, unless DTSC approves a longer period. Exide, with DTSC approval, has shown good faith by initiating removal of hazardous wastes prior to approval of the Closure Plan to the extent possible without affecting units that remain in operation (e.g. WWTP, Mud Tanks and West Yard Truck Wash). Removal of the remaining hazardous wastes will require longer than 90 days from approval of

the Closure Plan as the units storing the remaining hazardous wastes must remain in operation to implement the Closure Plan (e.g. WWTP, Mud Tanks and West Yard Truck Wash) or inventory removal at the particular unit is sequenced to occur at a time after the 90 day period due to the magnitude of the Closure. The Closure Plan addresses 95 former IS units, each of which must be addressed individually to remove waste inventory and decontaminate the unit. The sequential nature of the facility process also requires that units and areas be handled in sequence, with only select areas being able to be addressed concurrently. The schedule provided in Appendix F indicates that Phase 1 will require over 5 years to complete using standard work hours. It would not be physically possible to complete inventory removal and unit decontamination activities in a manner which does not pose a threat to human health or the environment within 90 days from approval of the Closure Plan due to the magnitude of the project, the number of units which must be addressed and necessity to conduct every step in a deliberate and controlled manner to help prevent exceedances of ambient air standards at the property boundary. Work is required to be performed in accordance with DTSC, AQMD and City of Vernon requirements, including significant measures for engineering controls. Exide will continue to take all steps to comply with all applicable interim status requirements. The longer period will not pose a threat to human health and the environment and will allow Exide the time needed to complete inventory removal and unit decontamination in an environmentally responsible manner.

22 CCR 66265.113(b) requires that closure activities be completed within 180 days after approval of the Closure Plan, unless DTSC approves a longer period. The Closure Plan addresses 95 former IS units, each of which must be addressed individually to remove waste inventory and decontaminate the unit. The sequential nature of the facility process also requires that units and areas be handed in sequence, with only select areas being able to be addressed concurrently. In addition, the structural inter-relationship of the buildings proposed for deconstruction requires that the buildings be removed in sequence, with only select buildings being able to be addressed concurrently. The schedule provided in Appendix F indicates that Phase 1 (inventory removal, unit removal, confirmatory sampling, building decontamination and deconstruction) will require over 5 years to complete using standard work hours, with Phase 2

(possible excavation and capping in-place) requiring additional time. It would not be physically possible to complete the Phase 1 and 2 activities in a manner which does not pose a threat to human health or the environment within 180 days from approval of the Closure Plan due to the magnitude of the project. Work is required to be performed in accordance with DTSC, AQMD and City of Vernon requirements, including significant measures for engineering controls. Exide will continue to take all steps to prevent threats to human health and the environment from the unclosed, but not operating units or facilities, including compliance with all applicable interim status requirements. The longer period will not pose a threat to human health and the environment and will allow Exide the time needed to complete inventory removal and unit decontamination in an environmentally responsible manner.

17.3 PHASE 1 SCHEDULE

Appendix F presents the proposed Phase 1 closure schedule in Microsoft Project format and includes a schedule for final closure, the total time required to close the facility, and the time required for intervening closure activities, which allow tracking of the progress of closure. The Phase 1 closure schedule was prepared during a constructability review and includes the extensive efforts necessary to construct and remove windbreaks (i.e., scaffolding with plastic sheeting) at each building proposed for deconstruction as required by Appendix G. The sequence of building deconstruction is tentative and will be finalized in consultation with the Contractor during Phase 1 following receipt of the Deconstruction Engineering Survey. The sequence for deconstruction proposed in the Phase 1 schedule is based on the knowledge that the Baghouse Building is structurally dependent on the RMPS Building, Reverb Feed Room (Upper Feed Room), and Smelter Building, and must be deconstructed first.

The Phase 1 schedule in Attachment F provides work tasks conducted by the Contractor, existing and temporary WWTP operation, and sampling crews. The schedule does not include laboratory analysis of samples.

The schedule does not anticipate work stoppages or production rate reductions in response to agency requirements.

The actual schedule for Phase 1 activities will be provided in the Contractor's Implementation Plan. The Contractor's Implementation Plan is a submittal prepared by the selected Contractor that details his proposed means and methods and incorporates the requirements of the Closure Plan and results of the Deconstruction Engineering Survey.

17.4 PHASE 2 SCHEDULE

The schedule for Phase 2 is dependent on the scope for Phase 2, which is currently unknown as the scope for Phase 2 will be determined using data developed in Phase 1 and may be performed concurrently with and the site-wide Corrective Action. As shown in the overall schedule provided in Appendix F, Phase 2 is assumed to require approximately two years. The schedule for Phase 2 will be refined once with scope for Phase 2 is known.

17.5 SCHEDULE MODIFICATIONS

A Closure Plan revision in accordance with California Code of Regulations, §66270.42 will be submitted to DTSC if a longer period for closure as specified in California Code of Regulations, §66265.111 and §66265.113 is required.

17.6 WORK HOURS

Work hours will generally be Monday to Friday, 8 hours per day; however, the Contractor may propose an increased number of days per week or hours per day for approval by Exide and the DTSC. Exact work hours may be modified as work progresses to accommodate weather delays and subcontractor schedules.

Date: July 2015

The Phase 1 schedule contained in this version of the Closure Plan is presented with two assumptions for work hours:

- Standard Schedule - 8 hours per day, 5 days per week (March 2016 to December 2021); and,
- Compressed Schedule - Two 8 hour shifts per day, 5 days per week (March 2016 to January 2019).

Date: July 2015

18.0 HEALTH AND SAFETY

Health and safety procedures will be conducted by the Contractor in accordance with a Health and Safety Plan prepared by the Contractor conducting closure activities. The Health and Safety Plan will meet, at a minimum, the requirements of OSHA Standards and Regulations contained in Title 29, Code of Federal Regulations, Parts 1910 and 1926 and CalOSHA regulations 8 CCR Sub-Chapter 4, Construction Safety Orders and 8 CCR Sub-Chapter 7, General Industry Safety Orders.

The Health and Safety Plan will include, at a minimum:

- A safety and health risk or hazard analysis for each site task and operation found in the work plan;
- Employee training assignments to assure compliance with subsection (e) of 8 CCR 5192;
- Personal protective equipment (PPE) to be used by employees for each of the site tasks and operations being conducted as required by the personal protective equipment program in subsection (g)(5) of 8 CCR 5192;
-
- Medical surveillance requirements in accordance with the program in subsection (f) of 8 CCR 5192;
- Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment to be used;
- Actions and action levels for air monitor equipment readings;
- Site work zones;
- Site control measures in accordance with the site control program required in subsection (d) of 8 CCR 5192;

Formatted: Font color: Auto, Character scale: 100%

- Decontamination procedures in accordance with subsection (k) of 8 CCR 5192;
- An emergency response plan meeting the requirements of subsection (I) of 8 CCR 5192 for safe and effective responses to emergencies, including the necessary PPE and other equipment;
- Confined space entry procedures; and,
- A spill containment program meeting the requirements of subsection 0) of 8 CCR 5192.

The Contractor and all subcontractors shall have 40-hour OSHA HAZWOPER training with current 8-hour refresher. All contractors and subcontractors which conduct work at the facility are also required to comply with the General Environmental, Health & Safety Rules and Regulations for Contractors and Subcontractors Working at Exide Technologies dated November 30, 2011 provided in Appendix W, and are required to conduct and provide a current respirator fit test and medical monitoring (including doctor's clearance to wear a respirator, initial blood lead testing less than 60 days old, and repeat blood lead testing every 30 days) for all on-site personnel.

It is anticipated that closure will be conducted in Level D protection unless workers are required to enter tanks or miscellaneous units at which time the level of protection may be upgraded to Level C if conditions require additional protection. Protocol for selecting and monitoring the protectiveness of the levels will be identified in the Contractor's HASP.

The closure cost estimate assumes that Level C PPE is not required for:

- Transportation and disposal;
- Filter press processing;
- Wastewater treatment operation;
- Laboratory analysis;

- Calculation of risk standards;
- Loading of tanks and debris;
- Building deconstruction (after decontamination);
- ~~Removal and crushing of concrete during Phase 2; and,~~
- Placement of ~~crushed concrete,~~ clean fill and stone.

Unit costs in the Closure Cost Estimate associated with work conducted in Level C have been adjusted to account for a 45% reduction in productivity (i.e., an increase in cost per unit). Production rates in the Closure Cost Estimate associated with work conducted in Level C have been adjusted to account for a 45% reduction in productivity (i.e., a decrease in units performed per hour). Unit cost and production rate adjustments for Level C PPE use are provided in the cost estimate assumptions.

The aforementioned Closure Cost Estimate assumptions for PPE shall not be assumed to dictate the PPE requirements for particular work tasks. The Contractor is expected to select the appropriate PPE for a particular task and monitor the protectiveness of the levels as identified in the Contractor's HASP.

Date: July 2015

19.0 SITE SECURITY

The entire manufacturing area of the facility (all property west of Indiana Street) is enclosed by an 8-foot high chain link fence topped by a 1-foot high, three-strand barbed wire barrier. There are five gates, which will be kept locked except when opened for occasional deliveries or when staffed by a guard.

Signs legible from a distance of 25 feet reading "Danger – Unauthorized Personnel Keep Out" and "Peligro – Personas Que No Son Autorizadas No Entren" in 1-7/8 inch block letters are located in the following locations within the facility:

- Battery unloading dock – south side of the RMPS Building;
- Battery unloading dock – west side of the RMPS Building;
- West personnel door of the RMPS Building;
- North truck doors of the RMPS Building;
- Central Container Storage Building – north side;
- Central Container Storage Building – west side; and,
- West Container Storage Building #2 – east side.

Additionally, signs as required by OSHA's lead standard are posted in appropriate areas of the facility. Miscellaneous safety signs advising the proper use of personal protection equipment and general safety awareness are also posted throughout the facility. All signs are in English and Spanish.

Security measures will be implemented during Phase 1 and Phase 2 and until the closure certification is accepted by DTSC.

Date: July 2015

20.0 CLOSURE REPORTING REQUIREMENTS

20.1 CONTRACTOR DAILY REPORT

During implementation of Phase 1 and Phase 2, the Contractor will prepare a daily report which includes the following:

- Project name and date;
- Weather conditions;
- Description of activities performed during the day;
- Description of any tests, sampling or monitoring performed, including data from previous testing;
- Details of any discrepancies or field conflicts which occurred during the day;
- Descriptions and quantities of materials, labor or equipment mobilized to or demobilized from the facility, including delivery and disposal tickets;
- Description and quantities of materials, labor or equipment used during the day;
- Actual engine runtime hours and fuel usage for all portable equipment engines. The information will be used by Exide for RECLAIM reporting. Mobile equipment does not need to be included;
- Summary of disposal or recycling shipments, including a table providing manifest number, truck number, transporter, contents, weight, destination facility, and other pertinent information.
- Health and safety summary, including personal air monitoring;
- Description of inspections performed during the day including attendees;
- Submittals made during the day or decisions made on previous submittals;
- List of Site visitors and organizations represented;
- Site security activities;
- Any other significant activities; and,
- Contractor representative's signature.

The report will be submitted electronically to Exide, the Resident Engineer, and DTSC by the end of the following day.

20.2 CLOSURE CERTIFICATION REPORT REQUIREMENTS

The Resident Engineer, an independent registered Professional Engineer certified in California, will certify closure of the former IS units. The engineer will review the closure plan prior to the closure activities and will periodically observe closure procedures to verify that the activities were conducted in accordance with the approved Closure Plan.

When each phase of closure (Phase 1 and Phase 2) is completed, the facility will submit certification by both the facility and an independent, qualified engineer registered in the State of California within 60 days of the completion of final closure, to DTSC, SCAQMD and the City of Vernon. This certification will state that the facility has been closed in accordance with the approved closure plan. The Closure Certification Report will include, at a minimum, the following:

- Certification by an independent registered professional engineer;
- Supervisory personnel description;
- Summary of Closure Activities, including confirmatory sampling and decontamination procedures;
- Summary of quantities disposed and recycled;
- Field Engineer Observation Reports;
- Sampling Data and Analyses (i.e., sampling locations, soil boring logs, chain of custody, analytical results, etc.);
- Discussion of Analytical Results;
- Manifests showing disposition of waste inventory;
- Manifests showing disposition of hazardous materials;
- Bill of ladings showing disposition and quantity of recycled materials;

- Detailed description of areas where hazardous waste is left in-place;
- Modifications and Amendments to Closure Plan (if applicable); and,
- Photographs.

Supporting documentation will be maintained at the facility until financial assurance requirements have been released. The following documents will be maintained at the facility and will be made available to DTSC upon request:

- Approved Closure Plan;
- A copy of the independent qualified professional engineer's field observation reports;
- Laboratory results of samples analyzed;
- Quality assurance/quality control demonstrations;
- Manifests showing disposition of waste inventory;
- Miscellaneous documentation (e.g., photographs); and,
- Closure Certification Report.

The City of Vernon will provide a concurrence letter for the closure after DTSC has finalized and issued its closure letter and Exide has met all of the closure requirements for the City of Vernon, including the submission of all demolition diversion/recycling reports, closure documents, and review fees (City of Vernon fees include $976 for annual review of documents, and $268 for final closure letter).

Date: July 2015

21.0 POST-CLOSURE PLAN

This post-closure plan is submitted as required under 22 CCR 66264.118. A copy of the approved plan and all revisions to the plan will be kept at the facility until post-closure is completed in accordance with 22 CCR 66264.118(c).

The post-closure plan identifies the activities that will be carried out after closure of the former IS units and the frequencies of these activities.

The post-closure period is 30 years. Post-closure applies when ~~hazardous soils have been remediated but~~ remediation to residential standards (unrestricted clean closure) has not been achieved. If unrestricted clean closure is achieved, no post-closure activities are necessary.

If ~~hazardous~~ contaminated soils ~~were~~ are left in-place, contingent post-closure activities identified in Section 22.0 would be implemented.

The facility contact during the post-closure period will be determined during closure activities. DTSC will be notified of the contact information.

21.1 CONTENTS OF THE POST-CLOSURE PLAN

The post-closure plan includes:

(1) A description of the planned monitoring activities and the frequencies at which the monitoring will be performed.

(2) A detailed description of the maintenance and monitoring activities.

(3) A detailed description of the steps necessary to collect, transport, and discharge collected stormwater.

(4) The name, address, and phone number of the person or office to contact concerning the hazardous waste management unit and facility during post-closure care.

21.2 AMENDMENT OF POST-CLOSURE PLAN

The facility will prepare and submit a written notification to the DTSC amending this post-closure plan at any time during the monitoring life of the facility (that period during which the facility is annually monitored and maintained) as specified under 22 CCR 66264.118(d). The plan will be amended whenever unexpected events require a modification of the approved post-closure plan. The post-closure plan will also be amended whenever there are changes in the as-built or closed condition of the site, whether by unexpected or by intentional design, which change site operations.

21.3 POST-CLOSURE ACTIVITIES

The post-closure plan will be implemented after Phase 1 closure is complete if ~~hazardous soils have been remediated but~~ remediation to residential standards (unrestricted clean closure) has not been achieved. Monthly inspections of facility surfaces and perimeter fencing will be conducted during the post-closure period. As post-closure does not anticipate that hazardous soils will remain in-place, maintenance and repair of paved or gravel surfaces or buildings will not be required in areas which are remediated to unrestricted levels, except such maintenance as may be required to facilitate access to areas where contamination is left in place, or as may be required by City of Vernon ordinances and codes. Perimeter chain link fencing, fence posts and gates will be inspected, and repaired, if necessary, to maintain site security. Routine maintenance and repairs will be conducted on the facility security system to assure that unauthorized personnel are not permitted to enter the facility during the post-closure care period. The Closure Cost Estimate in Appendix I also includes replacement of the entire length of fencing once during the 30-year period due to the fence reaching the end of its useful life.

During the post-closure care period, facility surface run-off will be discharged. The final stormwater drainage configuration will be determined based on the selected Corrective Action remedy and required Phase 2 soil excavations. Design details will be provided as part of the Corrective Measures Implementation Design or Phase 2 Contingent Closure Plan as appropriate based on timing. Post-closure activities will include monthly inspection of the structural integrity of the Stormwater Surface Impoundment.

21.4 CERTIFICATION OF COMPLETION OF POST-CLOSURE CARE

No later than 60 days after completion of the established post-closure care period for the facility, the facility will submit to DTSC, by registered mail, a certification that post-closure care of the facility was performed in accordance with the specifications in the approved post-closure plan as specified under 22CCR 66264.120. The certification will be signed by the facility and an independent, qualified Professional Engineer, registered in California. Documentation supporting the certification will be furnished to DTSC upon request until DTSC releases the facility from the financial assurance requirements for post-closure care.

Date: July 2015

22.0 CONTINGENT POST-CLOSURE FOR SURFACE IMPOUNDMENT AND UNITS CLOSED WITH HAZARDOUS WASTE IN PLACE

The contingent post-closure plan will be initiated only if ~~removal of hazardous waste related to former IS units~~ Phase 2 activities are found to require a final cover as engineering controls to achieve Closure Performance Standards protective of human health and the environment~~is not achieved and Phase 2 activities are conducted~~. For this document, the contingent post-closure monitoring is assumed to include detection and compliance groundwater monitoring; soil pore-water sampling, soil gas sampling, and surface water sampling; maintenance of the waste management area boundary markers; and notification on the property deed / land use covenant for partial and final closure. A final cover, pursuant to California Code of Regulations, §66264.310(a) will be required if units are closed with hazardous waste in place. Contingent post-closure activities begin after completion of Phase 2. When it is determined necessary to close with waste in place, a RCRA cap to cover the area of contaminated soil to be left in place will be designed and submitted for DTSC review and approval. The cap design standards are provided in Section 16.7.

If upon closure of the hazardous waste facility, hazardous waste remains on-site, no construction, filling, grading, or excavating will occur without the issuance of a variance by DTSC. Post-closure care for each hazardous waste management unit subject to the requirements of 22 CCR 66264.117 through 66264.120 will begin after completion of closure of the unit and continue for 30 years. DTSC will, after permit modifications, shorten the post-closure care period if all units have been cleaned or if the facility can demonstrate to the satisfaction of the DTSC that a reduced period is sufficient to protect human health and environment.

Under the post-closure, the following maintenance and monitoring activities will be conducted:

a) Maintain the integrity and effectiveness of the final cover and make repairs, if necessary;

b) Maintain and monitor groundwater monitoring system and comply with all other applicable requirements of California Code of Regulation, Chapter 14, Article 6; and,

c) Prevent run-on and run-off from eroding or otherwise damaging the final cover.

A Post-closure Permit Application containing more detailed information about the aforementioned monitoring and maintenance activities will be submitted to DTSC review and approval. Application requirements are provided in Section 16.7.

22.1 BOUNDARY MARKER MAINTENANCE

During the contingent post-closure care period, maintenance will be conducted on the markers installed during the Phase 2 contingent closure activities discussed in Section 16.9. Any damaged markers will be replaced as needed. If necessary, the locations will be resurveyed and the location remarked. The Closure Cost Estimate assumes two markers will be replaced each year.

22.2 DEED NOTICE

In finalizing the closure activities, a registered attorney will prepare a Notation on Property Deed/Land Use Covenant for both partial and final closure and waste records. The Notation and waste records will be filed with the local zoning authority and a duplicate copy submitted to DTSC.

Post-closure use of the property in which soil and soil-vapor contaminated above the Closure Performance Standards or hazardous waste remains after partial or final closure will never disturb the structural integrity of the surface pavement, any component of the containment system, or function of the monitoring system unless DTSC finds the disturbance is necessary to

the proposed use of the property and will not increase the potential hazard or is necessary to reduce the threat to human health and environment.

22.3 MONITORING

This section describes monitoring to be conducted at units with hazardous waste closed-in-place during contingent closure. The scope of sampling described herein is assumed and based on a hypothetical Contingent Closure and Contingent Post Closure. Actual requirements for monitoring will be defined in a Water Quality Monitoring and Response Program developed by Exide and submitted with the post-closure permit application.

22.3.1 Groundwater Monitoring

22.3.1.1 **Hydrogeologic Conditions**

As discussed in Section 2.3.4, ~~two~~ three water bearing zones are identified at the Site. The uppermost hydrogeologic unit beneath the facility is the Bellflower Aquiclude, which extends from surface to depths in excess of 90 feet. The Bellflower Aquiclude is a unit of silts and sandy clays commonly containing zones of perched groundwater. The Exposition Aquifer underlies the Bellflower Aquiclude and is reported to extend to a depth of about 175 feet in the area.

Groundwater in the lower-perched zone~~The groundwater~~ beneath the east side of the facility appears to have a groundwater high trending east-west with groundwater flow to the north at a gradient of 0.016 feet per foot (ft/ft) and south at a gradient of 0.05 ft/ft. Groundwater flow beneath the West Yard is to the east-northeast with a hydraulic gradient of approximately 0.03 ft/ft; however, this gradient is difficult to calculate because MW-9R was dry. Groundwater flow in the regional Exposition Aquifer is typically to the south-southwest. Groundwater flow direction and gradient in the upper perched zone is not yet known.

Groundwater investigation at the facility is ongoing as part of the RCRA Facility Investigation.

22.3.1.2 Groundwater Sampling (Hypothetical)

If soil at or above the Closure Performance Standards remains after Phase 2, Exide will submit a post-closure permit application which will include the Water Quality Monitoring and Response Program for post-closure units to DTSC for review and approval.

The Water Quality Monitoring and Response Program will be prepared according to the post-closure care requirements for tanks and/or surface impoundment and Article 6 of California Code of Regulations, Chapter 14.

For the purposes of the contingent post-closure cost estimate, quarterly groundwater monitoring is assumed to be required for the assumed cap area provided in Figure 16.1. Future groundwater monitoring may also be required as part of the final Corrective Action, although those costs are not included here. The contingent post-closure cost estimate assumes monitoring at 14 existing wells (SI-1 through SI-5, MW-5, MW-7R, MW-10R, MW-11R, MW-12, MW-13, MW-14, MW-15 and MW-17). Appendix X contains the Quarterly Groundwater Sampling and Analysis Plan for quarterly and annual monitoring of these wells. Monitoring at wells associated with the RFI is not included in the cost estimate. ~~Monitoring at wells associated with the RFI is not necessary as these wells do not represent impacts from current operations.~~

For the Surface Impoundment, the assumed quarterly analysis includes total and dissolved Title 22 metals, VOCs, sulfate, turbidity, and pH. Background monitoring to establish background values will be performed as specified in Chapter 14, Article 6. Quarterly sampling for at least one year of the full list of Appendix IX constituents will be performed at each of the monitoring wells identified as background. The only background well that has been identified thus far is SI-1. Additional background wells and downgradient monitoring points may be required as more data is gathered from the RFI, or for post-closure groundwater monitoring of any additional former units closed with waste in place.

Following the completion of at least four successive quarters of background data collection at the Surface Impoundment, Exide anticipates that annual analysis of Appendix IX constituents will be performed at each of the wells. ~~The assumed quarterly analysis includes dissolved arsenic, cadmium, lead, zinc, VOCs, sulfate, turbidity, and pH.~~ Annual analysis will include Appendix IX constituents of the following groups: ~~(total cyanide~~, Title 22 metals, (total and dissolved), inorganics, organochlorine and organophosphorous pesticides, ~~and~~ PCBs, chlorinated herbicides, VOCs (including 1,4-dioxane), dioxins and furans, SVOCs, Sulfate, Turbidity, and pH~~)~~. Inorganics include alkalinity as $CaCO_3$, chloride, nitrate-N, phenols, sulfate, sulfide, total organic carbon (TOC), and total cyanide. All inorganics, except total cyanide and TOC, will be included as part of the quarterly monitoring program.

Formatted: Subscript

The assumed contingent post-closure scenario also includes quarterly well inspections and annual repairs.

22.3.1.3 Cleanup Levels for Groundwater

Water Quality Protection Standards for groundwater will apply for those former IS units failing to achieve the Closure Performance Standards. Such areas will be determined by the Phase 1 and ongoing RFI sampling results and proposed in the Phase 2 excavation plan. Areas closed with ~~hazardous~~ waste-in-place will be subject to a post-closure permit and will require ~~various~~ several water quality monitoring plans (as listed in Chapter 15, Article 6).

The Corrective Measures Study, completed as part of the Corrective Action process, will present cleanup standards and feasible alternatives available to cleanup groundwater. DTSC will select a remedy and cleanup standards from the Corrective Measures to present for public comment. Groundwater cleanup will be addressed outside of the Closure Plan.

22.3.2 Soil Pore-Water Sampling (Hypothetical)

If closure with a hazardous waste-in-place designation (i.e., Closure Performance Standards are not achieved) occurs at the Surface Impoundment, pore-water sampling may be required as part of the Water Quality Monitoring and Response Program described in Section 22.3. For cost estimating purposes, the contingent closure scenario assumes soil pore water samples will be collected quarterly concurrent with groundwater sampling at three proposed lysimeters to be installed at the surface impoundment: two down-gradient and one background. The length of time needed to collect the pore water in the lysimeter depends on the amount of sample needed, the soil type, and soil moisture content. Sampling times can vary from less than 1 hour in wet soil to more than 1 day in drier soil. The maximum attempted pore water collection time will be 24 hours. Standard Operating Procedures for lysimeter installation and sampling are provided in the Sampling and Analysis Plan provided in Appendix A.

If other former IS units are closed with ~~hazardous~~ waste-in-place that is attributable to the unit and are not situated within areas subject to Corrective Action, soil pore-water sampling using lysimeters located based on the geography of the unit (e.g. a single lysimeter may be used to represent multiple units located in the same secondary containment area). Samples are assumed to be collected quarterly concurrent with groundwater sampling.

It is assumed that pore water sample quarterly analysis will include dissolved ~~arsenic, cadmium, lead, zinc~~Title 22 metals, VOCs, sulfate, turbidity, and pH. We have also assumed that pore water annual analysis will include Appendix IX constituents of the following chemical groups: Title 22 metals (total and dissolved), inorganics, organochlorine and organophosphorous pesticides, PCBs, chlorinated herbicides, VOCs (including 1,4-dioxane), dioxins and furans, SVOCs, Sulfate, Turbidity, and pH. Inorganics include alkalinity as CaCO3, chloride, nitrate-N, phenols, sulfate, sulfide, total organic carbon (TOC), and total cyanide. All inorganics, except total cyanide and TOC, will be included as part of the quarterly monitoring program. ~~(total cyanide, Title 22 metals, VOCs, SVOCs, Sulfate, Turbidity, pH). Organochlorine pesticides,~~

~~PCBs and chlorinated herbicides are not included in the assumed analysis because they are not considered constituents of potential concern at the facility.~~ If pore water sampling attempts determine that unsaturated soils beneath a former IS unit closed with ~~hazardous~~ waste-in-place are too dry to produce pore water or pore water sample results are consistently below ~~MCLs~~Water Quality Protection Standards for groundwater, Exide may propose, for DTSC approval, a reduction in the parameter list or sampling frequency, or cessation of pore water sampling.

22.3.3 Soil Gas Sampling - Hypothetical

22.3.3.1 **Sampling**

For Contingent Post Closure cost estimating purposes we have assumed that soil gas sampling will be conducted quarterly at one boring adjacent to each unit or group of units within the same secondary containment area closed with a hazardous waste-in-place designation due to VOCs above the closure performance standards, including the surface impoundment. Soil gas samples will be collected at approximately 5 feet and 15 feet below grade using permanent soil gas sampling probes. Sampling will be conducted in accordance with the Sampling and Analysis Plan (Appendix A). Soil gas samples will be analyzed for VOCs using Method TO15 and 8260B. If soil gas sample results are below Industrial Soil Gas CHHSLs for Buildings Constructed with Engineered Fill for four consecutive quarters, Exide may propose, for DTSC approval, a reduction in sampling frequency or cessation of sampling.

22.3.3.2 **Cleanup Levels for VOCs in Soil Gas**

Cleanup levels for VOCs in soil gas will be determined after investigation of soil and groundwater is complete as part of Corrective Action. A Corrective Measures Study will be prepared after investigation is complete that presents feasible alternatives to cleanup

contaminated soil. DTSC will select a draft remedy and cleanup standards from the Corrective Measures Study to present for public comment.

22.3.4 Surface Water Sampling - Hypothetical

For Contingent Post Closure cost estimating purposes we have assumed that one surface water sample will be collected quarterly at the discharge point for the drainage area of the units which are closed with hazardous waste-in-place. We have assumed that the surface water quarterly analysis will include dissolved ~~arsenic, cadmium, lead, zinc~~Title 22 metals, VOCs, sulfate, turbidity, and pH. We have also assumed that surface water annual analysis will include Appendix IX consituents of the following chemical groups: Title 22 metals (total and dissolved), inorganics, organochlorine and organophosphorous pesticides, PCBs, chlorinated herbicides, VOCs (including 1,4-dioxane), dioxins and furans, SVOCs, Sulfate, Turbidity, and pH. Inorganics include alkalinity as CaCO3, chloride, nitrate-N, phenols, sulfate, sulfide, total organic carbon (TOC), and total cyanide. All inorganics, except total cyanide and TOC, will be included as part of the quarterly monitoring program. ~~(total cyanide, Title 22 metals, VOCs, SVOCs, Sulfate, Turbidity, pH). Organochlorine pesticides, PCBs and chlorinated herbicides are not proposed for analysis because they are not considered constituents of potential concern at the facility.~~ If surface water sample results are consistently below ~~MCLs~~Water Quality Protection Standards for surface water, Exide may propose, for DTSC approval, a reduction in the parameter list or sampling frequency, or cessation of pore water sampling.

22.4 CAP MAINTENANCE - HYPOTHETICAL

Annual cap maintenance at units with hazardous waste closed in-place includes quarterly spraying to eliminate weeds. The asphalt surface of the cap will be seal coated once every four years. The Closure Cost Estimate provided in Appendix I assumes that 1/30 of the cap will be replaced each year, which is equivalent to replacement of the full cap area once in the 30 year

post-closure period. The replacement cap section will be the same as the cap section used for original installation.

Date: July 2015

23.0 CLOSURE AND POST-CLOSURE COST ESTIMATE

The estimated cost of closure as required under 22 CCR 66264.142 is summarized as follows:

• Closure Cost	$12,926,967.66
• Contingent Closure Cost	$18,113,546.47
• Post-Closure Cost	$686,592.85
• Contingent Post-Closure Cost	$6,933,194.02
Total	$38,660,300.97

Documentation of how these costs were determined is presented Appendix I. The hazardous waste management units for the facility are presented on Figure 2.2, while the solid waste management units for the facility are presented on Figures 23.1 through 23.5. Cost estimates were calculated using unit costs provided by DTSC, MEANS cost data guide, current facility costs and experience at similar sites. A DTSC Oversight fee of 10 percent, a quality assurance fee of 10 percent and Contractor overhead and profit of 10 percent were added to the closure and contingent closure subtotals. In addition, a contingency of 20 percent was added to the closure, contingent closure, post-closure and contingent post-closure subtotals.

The closure cost estimate assumes that:

- Exide removed select waste materials prior to the start of closure.
- Wastewater Treatment Plant and Desulfurization system are inoperable.
- Concrete pavement and soil excavation during Phase 2 will occur in areas as noted in Section 16.0.

These assumptions are detailed further in Appendix I and were discussed with DTSC and deemed reasonable for actual closure. Because the Closure Cost Estimate was prepared assuming worst case conditions, the assumptions in the Closure Cost Estimate may not match the actual current conditions presented in the Closure Plan. This scenario was used as a basis for the cost estimate, in order to ensure that closure funds are available in the event that Exide could not conduct the closure activities.

Date: July 2015

24.0 FINANCIAL RESPONSIBILITY

24.1 FINANCIAL ASSURANCE

Exide and DTSC have agreed that financial assurance relative to closure and post closure of the facility shall be provided in the approximate amount of $38,660,000. The financial assurance shall be comprised of:

- The existing hazardous waste financial guarantee bond in the amount of $11,158,854 (as of August 2014) which consists of $7,995,909.50 for closure and $3,162,949.50 for post closure.
- A closure/post-closure trust fund (Closure/Post Closure Financial Assurance Trust Fund) created in favor of DTSC to be funded in the aggregate amount of $27,500,000, which consists of $23,044,303.50 for closure and $4,455,696.50 for post-closure. Deposits will be made pursuant to Stipulation and Order HWCA No. 2014-6489 between DTSC and Exide.

Financial assurance documentation is provided in Appendix J.

24.2 PERIOD OF COVERAGE AND RELEASE FROM FINANCIAL ASSURANCE REQUIREMENTS

Within 60 days after receiving certifications from Exide and an independent professional engineer, registered in California, that closure has been accomplished in accordance with the approved closure plan. DTSC shall no longer require that Exide maintain financial assurance for closure of the Vernon facility.

24.3 LIABILITY REQUIREMENTS

Exide has established financial assurance for bodily injury and property damage to third parties caused by sudden and non-sudden accidental occurrences arising from operations of the facility through a certificate of insurance. This documentation is provided in Appendix J.

The mechanism selected by Exide for this purpose is a certificate of insurance established in accordance with 22 CCR 66264.147. Exide has established liability coverage for sudden accidental occurrences in the amount of at least $1 million per occurrence, with an annual aggregate of at least $2 million, exclusive of legal defense costs. The facility will continuously provide liability coverage as required until certifications of closure as specified in 22 CCR 66264.115.

Date: July 2015

25.0 AMENDMENT OF THE CLOSURE PLAN

As with any major construction project, it is anticipated that minor variations to the Closure Plan will be required as field activities occur and unforeseen situations arise. Minor variations may include administrative changes to the plan, submission of additional implementation detail, and field variations for implementation methods and materials which meet the general goal and scope of the Closure Plan. These variations will be submitted to DTSC for approval prior to implementation. DTSC will determine if the changes/variations are significant enough to require public review and comment is required. AQMD and the City of Vernon will be included in the approval process if needed depending on the nature of the variation. The variations will be submitted to DTSC verbally in the field or via letter without resubmitting the complete Closure Plan.

While not anticipated, major variations to the Closure Plan will be submitted to DTSC as a permit modification, as specified in California Code of Regulations, §66264.70.

Date: July 2015

26.0 REFERENCE DOCUMENTS

The following documents will be used for reference during closure:

- ASTM D1452-09, Standard Practice for Soil Exploration and Sampling by Auger Borings
- ASTM D4547-09, Standard Guide for Sampling Waste and Soils for Volatile Organic Compounds
- ASTM D6418-09, Standard Practice for Using the Disposable En Core Sampler for Sampling and Storing Soil for Volatile Organic Analysis
- ASTM D5633-04(2008), Standard Practice for Sampling with a Scoop
- ASTM D6151-08, Standard Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling
- ASTM D6282-98(2005), Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations
- DTSC/CalEPA (2004), Guidance Document for the Implementation of USEPA Method 5035: Methodologies for Collection, Preservation, Storage, and Preparation of Soils to be Analyzed for Volatile Organic Compounds

Date: July 2015

TABLE OF CONTENTS

PAGE NO.

1.0 General 1-1

1.1 Introduction 1-1
1.2 Closure and Corrective Action 1-2
1.3 Project Management 1-3

1.3.1 Owner ..... 1-4~~3~~
1.3.2 Plan Preparer 1-4
1.3.3 Contractor 1-4
1.3.4 Subcontractors 1-5
1.3.5 Owner Oversight 1-5

1.3.5.1 Resident Engineer and Quality Assurance 1-5
1.3.5.2 Air Monitoring Subcontractor ..... 1-7~~6~~

1.3.6 Regulatory Agencies and Agency Oversight ..... 1-7~~6~~

1.3.6.1 DTSC ..... 1-8~~7~~
1.3.6.2 AQMD ..... 1-8~~7~~
1.3.6.3 Dust Mitigation Oversight ..... 1-10~~8~~

1.4 Meetings ..... 1-10~~8~~

1.4.1 Pre-Construction Meeting ..... 1-10~~8~~
1.4.2 Progress Meetings ..... 1-11~~9~~

2.0 Facility Information 2-1

2.1 Facility Identification 2-1
2.2 Facility Location 2-1
2.3 Facility Description ..... 2-3~~2~~

2.3.1 Facility Configuration ..... 2-3~~2~~
2.3.2 Neighboring Wells ..... 2-9~~6~~
2.3.3 Surrounding Land Use ..... 2-10~~7~~
2.3.4 Hydrogeologic Conditions ..... 2-10~~7~~

2.3.4.1 General ..... 2-10~~7~~
2.3.4.2 Groundwater Monitoring ..... 2-13~~8~~

Date: July 2015

TABLE OF CONTENTS
(Continued)

PAGE NO.

2.3.5 Weather Conditions ..... 2-15~~10~~

2.4 Ownership History ..... 2-15~~11~~
2.5 Operational History ..... 2-16~~11~~
2.6 Environmental Permits ..... 2-17~~12~~

2.6.1 SCAQMD Permits ..... 2-17~~12~~
2.6.2 Los Angeles County Sanitation District Waste Discharge Permit ..... 2-17~~12~~
2.6.3 Other Permits Relating to Hazardous Waste Storage or Treatment ..... 2-17~~12~~
2.6.4 NPDES Permit ..... 2-18~~13~~

2.7 Facility Design ..... 2-19~~14~~

2.7.1 Hazardous Waste Units ..... 2-19~~14~~
2.7.2 Containment Areas ..... 2-20~~15~~
2.7.3 Buildings ..... 2-21~~16~~

2.7.3.1 Buildings which are Units ..... 2-21~~16~~
2.7.3.2 Buildings which Contain Units ..... 2-22~~16~~
2.7.3.3 Finished Lead Building ..... 2-23~~18~~
2.7.3.4 Roof Repairs ..... 2-23~~18~~

2.7.4 Emission Control Equipment ..... 2-25~~19~~
2.7.5 Utilities ..... 2-27~~21~~

2.8 Description ff Hazardous Waste Constituents ..... 2-27~~21~~

2.8.1 Raw Materials Received from Off-Site ..... 2-28~~22~~

2.8.1.1 Spent Lead-Acid Batteries ..... 2-28~~22~~
2.8.1.2 Lead-Bearing Material ..... 2-28~~22~~

2.8.2 Material Generated On-Site and Recycled or Treated On-Site ..... 2-29~~23~~

2.8.2.1 Spent Acid ..... 2-30~~24~~
2.8.2.2 Emission Control Dust ..... 2-31~~25~~
2.8.2.3 Lead Paste from Spent Batteries ..... 2-31~~25~~
2.8.2.4 Wastewater Treatment Sludge and Sludge Cake ..... 2-32~~26~~
2.8.2.5 Wastewater ..... 2-33~~27~~

Date: July 2015

TABLE OF CONTENTS
(Continued)

PAGE NO.

2.8.2.6 Reverb Furnace Slag ..... 2-33~~27~~

2.8.3 Material Generated On-Site and Sent Off-Site for Reclamation, Disposal, or Purchase ..... 2-34~~28~~

2.8.3.1 Polypropylene ..... 2-34~~28~~
2.8.3.2 Blast Furnace Slag ..... 2-35~~29~~
2.8.3.3 Stormwater System and Surface Impoundment Sediment ..... 2-35~~29~~
2.8.3.4 Battery Chips/Separator Material ..... 2-37~~31~~
2.8.3.5 Lead Product ..... 2-38~~32~~

2.9 Closure Plan Certification ..... 2-40~~34~~

3.0 General Closure Approach 3-1

3.1 Closure Approach 3-1

3.1.1 General ..... 3-2~~1~~
3.1.2 Contingent Closure (Phase 2) Excavation Rationale ..... 3-5~~3~~
3.1.3 Proposed Units and Ancillary Sumps ..... 3-18~~4~~

3.2 Closure Performance Standards ..... 3-19~~4~~

3.2.1 Closure Performance Standard for Former IS Tanks and Ancillary Equipment ..... 3-22~~6~~

3.2.1.1 Closure Performance Standards for Removal and Reuse ..... 3-23~~6~~
3.2.1.2 Closure Performance Standard for Recycling ..... 3-24~~7~~
3.2.1.3 Closure Performance Standards for Off-Site Disposal ..... 3-25~~8~~
3.2.1.4 Closure Performance Standards for Remaining Tanks and Equipment ..... 3-26~~8~~

3.2.2 Closure Performance Standard for Former IS Miscellaneous Units ..... 3-29~~10~~
3.2.3 Closure Performance Standard for Former IS Containment Building and Containment Areas ..... 3-29~~10~~
3.2.4 Closure Performance Standard for Former IS Stormwater System and Surface Impoundment ..... 3-31~~11~~
3.2.5 Closure Performance Standards for Concrete Demolition Debris ..... 3-34~~13~~
3.2.6 Closure Performance Standards for Steel Structures and Steel Debris ..... 3-35~~13~~

Date: July 2015

TABLE OF CONTENTS
(Continued)

PAGE NO.

3.2.7 Closure Performance Standards for Equipment ..... 3-36~~14~~
3.2.8 Closure Performance Standard for Soils ..... 3-37~~15~~

3.3 Not Used ..... 3-40~~16~~
3.4 Permitting and Regulatory Requirements ..... 3-40~~16~~

3.4.1 DTSC ..... 3-40~~16~~
3.4.2 SCAQMD ..... 3-41~~17~~

3.4.2.1 General ..... 3-41~~17~~
3.4.2.2 Notification (Rule 1420.1) ..... 3-42~~18~~
3.4.2.3 Asbestos Abatement (Rule 1403) ..... 3-42~~18~~
3.4.2.4 Temporary Equipment ..... 3-43~~19~~
3.4.2.5 Excavation (Rule 1150) ..... 3-43~~19~~
3.4.2.6 VOC Emissions During Excavation (Rule 1166) ..... 3-44~~20~~

3.4.3 Water Resources Control Board ..... 3-46~~22~~
3.4.5 Los Angeles County ..... 3-47~~23~~
3.4.6 City ..... 3-47~~23~~

3.4.6.1 Clarifier and Sump Removal ..... 3-47~~23~~
3.4.6.2 Asbestos Abatement ..... 3-48~~24~~
3.4.6.3 Utility Termination ..... 3-48~~24~~
3.4.6.4 Building Deconstruction ..... 3-48~~24~~
3.4.6.5 Soil Borings ..... 3-48~~24~~
3.4.6.6 Erosion and Sediment Control ..... 3-49~~25~~
3.4.6.7 Monitoring Wells ..... 3-50~~26~~

3.4.7 CALOSHA ..... 3-50~~26~~

3.5 Engineering Controls ..... 3-50~~26~~
3.6 Contingency Plan ..... 3-51~~27~~
3.7 Air Monitoring ..... 3-51~~27~~
3.8 Stormwater Management ..... 3-51~~27~~

3.8.1 General Operations ..... 3-51~~27~~
3.8.2 Surface Impoundment Operations ..... 3-52~~28~~
3.8.3 CL-14 Trench Drain ..... 3-53~~29~~

Date: July 2015

TABLE OF CONTENTS
(Continued)

PAGE NO.

3.9 Wastewater Treatment ..... 3-54~~30~~

3.9.1 Existing WWTP ..... 3-54~~30~~
3.9.2 Temporary Filter Press and Water Storage ..... 3-55~~30~~
3.9.3 Temporary WWTP ..... 3-55~~31~~

3.10 1420.1 Activities ..... 3-57~~32~~
3.11 Erosion and Sediment Controls ..... 3-58~~33~~
3.12 Maintenance ..... 3-58~~33~~
3.13 Shipping Procedures ..... 3-58~~33~~
3.14 Transportation ..... 3-59~~34~~

4.0 Phase 1 Closure Sequence 4-1

4.1 Notification 4-1
4.2 Preparation Activities 4-1

4.2.1 Support Zone 4-1
4.2.2 Implementation Plan 4-1
4.2.3 Utilities 4-3
4.2.4 Environmental Survey 4-4

4.3 Phase 1 Sequence 4-5

4.3.1 General 4-5
4.3.2 Existing Unit Operations 4-6
4.3.3 Container Storage Areas 4-7
4.3.4 Oxidation Tank Area 4-8
4.3.5 Mobile Equipment Wash Station ..... 4-11~~10~~
4.3.6 Blast Furnace Feed Room ..... 4-11~~10~~
4.3.7 Rotary Kiln ..... 4-11~~10~~
4.3.8 Baghouse Building Units ..... 4-12~~11~~
4.3.9 Emission Control Equipment Decontamination and Deconstruction ..... 4-14~~12~~
4.3.10 Baghouse Building Decontamination ..... 4-14~~12~~
4.3.11 Baghouse Building Deconstruction ..... 4-15~~13~~
4.3.12 Desulfurization Area Units ..... 4-16~~14~~
4.3.13 Desulfurization Building ..... 4-18~~15~~
4.3.14 RMPS Units ..... 4-19~~16~~
4.3.15 RMPS Building/Upper Feed Room Building ..... 4-26~~21~~

Date: July 2015

TABLE OF CONTENTS
(Continued)

PAGE NO.

4.3.16 Smelter Building Units and Equipment ..... 4-27~~22~~
4.3.17 Smelter Building ..... 4-34~~27~~
4.3.18 Containment Building Decontamination ..... 4-36~~28~~
4.3.19 Finished Lead Building ..... 4-37~~29~~
4.3.20 WWTP Units ..... 4-37~~29~~
4.3.24 WWTP Decontamination and Deconstruction ..... 4-42~~33~~
4.3.21 Non-Permitted Building Roofs ..... 4-43~~34~~
4.3.22 Trailer Staging Area ..... 4-43~~34~~
4.3.23 Concrete Yard System (Former WWTP) ..... 4-43~~34~~
4.3.24 Unregulated Area Decontamination ..... 4-45~~36~~
4.3.25 Stormwater System ..... 4-46~~37~~
4.3.26 Drop Out System ..... 4-46~~37~~
4.3.27 Surface Impoundment ..... 4-49~~39~~
4.3.28 West Yard Truck Wash ..... 4-49~~39~~
4.3.29 Temporary WWTP Decontamination ..... 4-49~~39~~

4.4 Closure of Former Units ..... 4-50~~40~~
4.5 Equipment ..... 4-51~~41~~

5.0 Estimate and Management of Maximum Inventory 5-1
5.1 Maximum Inventory of Hazardous Waste 5-1
5.2 Removal and Management of Maximum Inventory 5-2

5.2.1 General 5-2
5.2.2 Removal and Management 5-3

5.2.2.1 Batteries and Lead Scrap 5-3
5.2.2.2 Plastic Chips ..... 5-5~~4~~
5.2.2.3 Feed Material ..... 5-5~~4~~
5.2.2.4 Paste and Slurry ..... 5-5~~4~~
5.2.2.5 Lead Product ..... 5-6~~5~~
5.2.2.6 Blast Furnace Slag ..... 5-9~~8~~
5.2.2.7 Furnace Brick ..... 5-9~~8~~
5.2.2.8 Wastewater ..... 5-11~~9~~
5.2.2.9 Sand Filter Media ..... 5-11~~9~~
5.2.2.10 WWTP Sludge ..... 5-12~~10~~
5.2.2.11 Surface Impoundment Sediment ..... 5-12~~10~~
5.2.2.12 Acid ..... 5-12~~10~~

Date: July 2015

TABLE OF CONTENTS
(Continued)

PAGE NO.

5.3 Land Disposal Restrictions ..... 5-13~~11~~
5.4 Changes in Maximum Inventory ..... 5-13~~11~~
5.5 Hazardous Materials ..... 5-13~~11~~

6.0 Decontamination Procedures for Units and Equipment 6-1

6.1 General 6-1
6.2 Tank Decontamination 6-1
6.3 Miscellaneous Unit Decontamination 6-2
6.4 Trailer Staging Area 6-2
6.5 Former Units 6-2
6.6 Surface Impoundment 6-3
6.7 Stormwater Management System Decontamination 6-3
6.8 Closure Equipment Cleaning 6-4
6.9 Residue Management 6-4
6.10 Emission Control Equipment 6-4

7.0 Confirmation Sampling and Management of Decontaminated Tanks and Equipment 7-1

7.1 Sampling Objectives/Purpose 7-1
7.2 Wipe Samples 7-1
7.3 Equipment Rinsate Sampling 7-2
7.4 Stormwater System Samples 7-3

7.4.1 Stormwater Piping and Manholes 7-3
7.4.2 Surface Impoundment 7-5

7.5 Quality Control Procedures 7-6
7.6 Analytical Test Methods ..... 7-7~~6~~
7.7 Evaluation of Results 7-7

7.7.1 Rinsate Samples 7-7
7.7.2 Wipe Samples ..... 7-8~~7~~

7.8 Removal of Decontaminated Units 7-8

7.8.1 Tanks and Miscellaneous Units 7-8
7.8.2 Emission Control Equipment ..... 7-10~~9~~

Date: July 2015

TABLE OF CONTENTS
(Continued)

PAGE NO.

8.0 Decontamination Procedures for Containment Structures and Buildings 8-1

8.1 General 8-1
8.2 Secondary Containment Area Decontamination 8-2
8.3 Building Decontamination 8-3
8.4 Building Gutting 8-4
8.5 Utility Termination 8-5
8.6 Asbestos Abatement 8-5

8.6.1 Preparation and Training 8-5
8.6.2 Asbestos Removal 8-6
8.6.3 Documentation ..... 8-8~~7~~

9.0 Confirmation Sampling of Decontaminated Containment Structures and Buildings 9-1

9.1 Sampling Objectives/Purpose 9-1
9.2 Metal Surfaces 9-1

9.2.1 Steel – Recycled Off-Site 9-1
9.2.2 Steel – Remain On-Site 9-2

9.3 Chip Samples 9-2
9.4 Core Samples 9-3
9.5 Quality Control Procedures 9-3
9.6 Analytical Test Methods ..... 9-5~~4~~
9.7 Evaluation of Results ..... 9-5~~4~~

9.7.1 Containment Areas and Sump ..... 9-5~~4~~
9.7.2 Metal Surfaces ..... 9-8~~6~~
9.7.3 Concrete Walls ..... 9-8~~6~~

10.0 Confirmation Soil and Soil Gas Sampling Plan 10-1

10.1 General 10-1
10.2 Confirmation Sampling Locations and Depths 10-2

10.2.1 Unit and Containment Area Soil Sample Locations 10-2
10.2.2 Stormwater System Sampling and Testing 10-3

10.2.2.1 Stormwater System Soil Samples 10-3

Date: July 2015

TABLE OF CONTENTS
(Continued)

PAGE NO.

10.2.2.2 Stormwater System Testing 10-4

10.2.3 Surface Impoundment Soil Samples 10-6
10.2.4 Former Unit Sampling 10-7
10.2.5 Soil Gas Sample Locations 10-7

10.3 Sample Collection 10-8

10.3.1 Soil Sample Collection 10-8
10.3.2 Soil Gas Sample Collection 10-8

10.4 Quality Control Samples 10-9
10.5 Analytical Test Methods 10-9
10.6 Evaluation of Results 10-9
10.7 Soil Parameters 10-10

11.0 Building Deconstruction 11-1

11.1 Concrete Surface Removal 11-1
11.2 Tank Foundations 11-2
11.3 Building Deconstruction 11-2

11.3.1 Preparation 11-2
11.3.2 Deconstruction Engineering Survey 11-3
11.3.3 Deskinning 11-4
11.3.4 Structural Steel 11-6
11.3.5 Concrete 11-6
11.3.6 Material Segregation 11-6
11.3.7 Material Management 11-7

11.3.7.1 Scrap Metal 11-7
11.3.7.2 Concrete 11-7

12.0 Decontamination of Unregulated Areas 12-1

13.0 Groundwater Sampling 13-1

Date: July 2015

TABLE OF CONTENTS
(Continued)

PAGE NO.

14.0 Quality Control Procedures 14-1

14.1 Laboratory Analysis 14-1

14.1.1 Quality Control Samples 14-1
14.1.2 Decontamination of Sampling Equipment 14-1

14.2 Chain-of-Custody Procedures 14-2

15.0 Partial Closure 15-1

16.0 Phase 2 - Contingent Closure Plan 16-1

16.1 Planning 16-1
16.2 Proposed Equipment 16-2
16.3 Soil Removal Procedures 16-2

16.3.1 General 16-2
16.3.2 Concrete Floor Removal and Management 16-4
16.3.3 Soil Removal and Management 16-5
16.3.4 Removal of VOC-Contaminated Soils ..... 16-7~~6~~
16.3.5 Abandoned Stormwater Piping Removal 16-8

16.4 Confirmatory Soil Sampling 16-9
16.5 Restoration 16-9
16.6 Surface Impoundment Restoration ..... 16-10~~9~~
16.7 Contingent Post-Closure Submittals - ..... 11~~10~~
16.8 Equipment Decontamination ..... 16-15~~13~~
16.9 Hazardous Soil Boundary Markers ..... 16-15~~13~~
16.10 Deed Notice ..... 16-17~~14~~
16.11 Capping ..... 16-18~~15~~

17.0 Closure Implementation Schedule 17-1

17.1 General 17-1
17.2 Duration 17-1
17.3 Phase 1 Schedule 17-3
17.4 Phase 2 Schedule 17-4
17.5 Schedule Modifications 17-4

Date: July 2015

TABLE OF CONTENTS
(Continued)

PAGE NO.

17.6 Work Hours 17-4

18.0 Health and Safety 18-1

19.0 Site Security 19-1

20.0 Closure Reporting Requirements 20-1

20.1 Contractor Daily Report 20-1
20.2 Closure Certification Report Requirements 20-2

21.0 Post-Closure Plan 21-1

21.1 Contents of the Post-Closure Plan 21-1
21.2 Amendment of Post-Closure Plan 21-2
21.3 Post-Closure Activities 21-2
21.4 Certification of Completion of Post-Closure Care 21-3

22.0 Contingent Post-Closure for Surface Impoundment and Units Closed with Hazardous Waste In Place 22-1

22.1 Boundary Marker Maintenance 22-2
22.2 Deed Notice 22-2
22.3 Monitoring ..... 22-3~~2~~

22.3.1 Groundwater Monitoring 22-3

22.3.1.1 Hydrogeologic Conditions 22-3
22.3.1.2 Groundwater Sampling (Hypothetical) ..... 22-4~~3~~
22.3.1.3 Cleanup Levels for Groundwater ..... 22-5~~4~~

22.3.2 Soil Pore-Water Sampling (Hypothetical) ..... 22-6~~5~~
22.3.3 Soil Gas Sampling - Hypothetical ..... 22-7~~6~~

22.3.3.1 Sampling ..... 22-7~~6~~
22.3.3.2 Cleanup Levels for VOCs in Soil Gas ..... 22-7~~6~~

22.3.4 Surface Water Sampling - Hypothetical ..... 22-8~~6~~

Date: July 2015

TABLE OF CONTENTS
(Continued)

PAGE NO.

22.4 Cap Maintenance - Hypothetical ..... 22-8~~7~~

23.0 Closure and Post-Closure Cost Estimate 23-1

24.0 Financial Responsibility..... 24-1

24.1 Financial Assurance 24-1
24.2 Period of Coverage and Release from Financial Assurance Requirements..... 24-1
24.3 Liability Requirements..... 24-2

25.0 Amendment of the Closure Plan 25-1

26.0 Reference Documents 26-1

LIST OF TABLES

TABLE

1.1 Maximum Inventory of Waste
1.2 Waste Generated During Closure
1.3 Ancillary Sumps
2.1 Groundwater Elevation Measurements
2.2 Hazardous Waste Management Unit Descriptions
2.3 Hazardous Waste Handled
2.4 COCs by Area
2.5 Emission Control Equipment Summary
2.6 Ancillary Sump Descriptions
2.7 Monitoring Well Construction Summary
3.1 Management of Materials
3.2 Unit Disposition and Testing Requirements
3.3 Hazardous Waste Criteria
3.4 Proposed Receiving Facilities
5.1 Maximum Quantities of Hazardous Waste and Disposal Method
7.1 Typical Small Equipment
10.1 Sample Analysis Summary

Date: July 2015

LIST OF FIGURES

FIGURE

1.1 Project Organization Chart
2.1 Facility Location Map
2.2 Facility Plot Plan
2.3 Monitoring Well Locations
2.4 Active Production Wells
2.5 Comprehensive Zoning Map
2.6 Geologic Cross Section A-A'
2.7 Geologic Cross Section B-B'
2.8 Monitoring Well Hydrographs
2.9 NOT USED
2.10 NOT USED
2.11 Ancillary Sumps
2.12 Process Flow Diagram
2.13 Original Facility Plot Plan
2.14 Emission Control Equipment Plan
2.15 Facility Topographic Map
9.1 Confirmatory Soil Sample Locations
10.1 Stormwater System Soil Sample Locations
11.1 Regulated Building Decontamination and Deconstruction
12.1 Non-Regulated Building Decontamination
16.1 Cap Location
16.2 Conceptual Excavation Plan
23.1 Designated Waste Management Areas
23.2 Management Area No. 1 West Yard
23.3 Management Area No. 2 South Yard
23.4 Management Area No. 3 Retention Pond
23.5 Management Area No. 4 North Yard

LIST OF APPENDICES

APPENDIX

A Sampling and Analysis Plan
B Interim Status Modification for Stormwater Replacement System and Stormwater System Removal and Replacement Completion Reports
C First Quarter 2015 Groundwater Sampling Report
D Unit Descriptions and Work Breakdown Structures
E Topographic Survey
F Closure Schedule
G Engineering Controls Plan
H Ambient Air Monitoring Plan

Date: July 2015

LIST OF APPENDICES

APPENDIX

I Closure Cost Estimate
J Financial Assurance Documentation
K City of Vernon Hazardous Material Inventory
L Boring Logs
M USGS Maps
N City of Vernon Well Location Map
O Closure Plan for the Old Wastewater Treatment Plant and Preliminary Closure Report
P Partial Closure Report, North Acid Storage Tanks No. 64 and 65
Q Stormwater Pollution Prevention Plan
R Spill Prevention Control and Countermeasures Plan
S Crisis Management Plan / Contingency Plan
T Emission Control Equipment Drawings
U CL-14 Trench Drain Letter
V Waste Characterization Plan
W General Environmental, Health & Safety Rules and Regulations for Contractors and Subcontractors Working at Exide Technologies
X Quarterly Groundwater Sampling and Analysis Plan
Y Certification Authorization
Z Transportation Routes
AA Furnace and Kettle Brick Product Data

Date: July 2015

LIST OF ABBREVIATIONS AND ACRONYMS

ACM	asbestos containing material
Advanced GeoServices, AGC	Advanced GeoServices Corp.
AHERA	Asbestos Hazard Emergency Response Act
ASTM	American Society for Testing and Materials
bgs	below ground surface
CA	Corrective Action
CACO	Corrective Action Consent Order
CalEPA	California Environmental Protection Agency
Cal/OSHA	California Occupational Safety and Health Administration
CEQA	California Environmental Quality Act
CHHSL	California Human Health Screening Level
CMS	Corrective Measures Study
COC	contaminant of concern
CSA	Container Storage Area
CWC	California Waste Code
cy	cubic yard
DHS	Department of Homeland Security
DTSC	California Department of Toxic Substances Control
ELAP	Environmental Laboratory Accreditation/Certification Program
F	fahrenheit
ft	feet
ft/ft	feet per foot
Gould	Gould, Inc.
gpm	gallons per minute
HASP	Health and Safety Plan
HDPE	high-density polyethylene
HEPA	high-efficiency particulate arrestance
HWMU	Hazardous Waste Management Unit
IS	Interim Status
LACSD	Los Angeles County Sanitation District
lbs	pounds
LUC	Land Use Covenant
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
mg/kg	milligrams per kilogram
NL	NL Industries
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration

PAH	polyaromatic hydrocarbon
PCB	polychlorinated biphenyl
POTW	Publicly Owned Treatment Works
PPE	personal protective equipment
ppm	parts per million
psi	pounds per square inch
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RL	Reporting Limit
RMPS	Raw Materials Processing System
RSL	Regional Screening Levels
RTO	regenerative thermal oxidizer
SCAQMD	South Coast Air Quality Management District
sf	square feet
STLC	Soluble Threshold Limit Concentrations
SVOC	semi-volatile organic compounds
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TCLP	Toxicity Characteristic Leaching Procedure
TSD facility	treatment, storage and disposal facility
TTLC	Total Threshold Limit Concentrations
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	volatile organic compound
WBS	work breakdown structure
WET	Waste Extraction Test
WWTP	wastewater treatment plant

Date: July 2015

CLOSURE PLAN

EXIDE TECHNOLOGIES
VERNON, CALIFORNIA
(EPA ID NO. CAD 097 854 541)

Prepared For:

EXIDE TECHNOLOGIES, INC.
Vernon, California

Prepared by:

ADVANCED GEOSERVICES
West Chester, Pennsylvania

Project No. 2013-2993-21
February 13, 2014
Revised August 18, 2014
Revised September 30, 2014
Revised May 15, 2015
Revised July 28, 2015

Paul G. Stratman, P.E.
Consultant
California P.E. No. C61595

TABLE 3.1
MANAGEMENT OF MATERIALS
EXIDE TECHNOLOGIES, VERNON, CALIFORNIA

ITEM	DESTINATION		PERFORMANCE STANDARD AND CONFIRMATORY SAMPLING		ACTION
Tank, Misc. Unit, Equipment, Stormwater System, Impoundment	Off-site Re-use at Exide facility		Removal, 66261.3(d)	Not achieved	Manage as hazardous waste
	Metal - Recycle		Removal, 66261.3(d)	Achieved	Off-site recycling
				Not achieved	Manage as hazardous waste
	Plastic - Disposal	Hazardous disposal	Removal, Manage as hazardous waste	Achieved	Characterization per receiving facility, dispose off-site hazardous
		Non-haz disposal	Removal, 66261.3(d)	Not achieved	Manage as hazardous waste
	Concrete - Removal		Removal, 66261.3(d)	Achieved	Manage as nonhazardous waste
				Not achieved	Manage as hazardous waste
	Stormwater system - Removal		Removal, 66261.3(d) applies	Achieved	Manage as nonhazardous waste
				Not achieved	Manage as hazardous waste
	Surface Impoundment - Removal		Removal, 66261.3(d)	Achieved	Manage as non-hazardous waste
				Not achieved	Manage as hazardous waste
Concrete walls - removal	Concrete Wall - Removal		Removal, 66261.3(d)	< standard	Manage as non-hazardous waste
				> standard	Manage as hazardous waste
Concrete floors	Removal		Removal, 66261.3(d)	< standard	Manage as non-hazardous waste
				> standard	Manage as hazardous waste
Deconstruction - Concrete walls, tank/equipment foundations	Disposal	Hazardous disposal	Removal, Manage as hazardous waste	Achieved	Characterization per receiving facility, dispose off-site hazardous
				Not achieved	Characterization per receiving facility, dispose off-site hazardous
		Non-haz disposal	Removal, 66261.3(d)	Not achieved	Manage as hazardous waste
Deconstruction - Metal Debris	Metal - Recycle		Removal, 66261.3(d)	Achieved	Recycle off-site
				Not achieved	Manage as hazardous waste
Steel Structure - Removal	Metal - Removal		Removal, 66261.3(d)	Achieved	Manage as non-hazardous waste
				Not achieved	Manage as hazardous waste
Small Equipment	Re-use off-site at Exide facility		Removal, 66261.3(d)	Not achieved	Manage as hazardous waste
	Metal - Recycle		Removal, 66261.3(d)	Achieved	Recycle off-site
				Not achieved	Manage as hazardous waste
	Disposal	Hazardous disposal	Removal, Manage as hazardous waste		Characterization per receiving facility, dispose off-site
		Non-haz disposal	Removal, 66261.3(d)	Not achieved	Manage as hazardous waste
Soil to 5 ft depth	Removal		Removal, 66261.3(d)	< standard	Manage as non-hazardous waste
				> standard	Manage as hazardous waste
Contaminated Soil below 5 ft depth	Removal		Removal, 66261.3(d)	< standard	Manage as non-hazardous waste
				> standard	Manage as hazardous waste

NOTE:
1. Exide may choose to reclean and resample materials/items not achieving standards or proceed with disposal.
2. No units or equipment will be re-used in California.
3. MDL is Method Detection Limit
4. Clean Debris Surface is defined as 'The surface, when viewed without magnification, shall be free of all visible contaminated soil and hazardous waste except that residual staining from soil and waste consisting of light shadows, slight streaks, or minor discoloration, and soil and waste in crevices, cracks and pits shall be limited to no more than 5% of each square inch of surface area.'
5. Visually Clean Surface is less stringent than Clean Debris Surface. Surface is free of caked on dirt and dust that could fall off or generate lead dust during material handling.

TABLE 3.2
UNIT DISPOSITION AND TESTING REQUIREMENTS

UNIT AND BUILDING INFORMATION					Performance Standards								
CLOSURE AREA	UNIT NO.	UNIT NAME	UNIT TYPE	CONSTRUCTION	Unit Decontamination Procedures (Phase 1)	Unit Disposition	Sampling[10]	Performance Standard					
Container Storage Area	1	Central Container Storage Building	Container Storage Area	Concrete Floor	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Partial concrete wall (both sides)	HEPA vac, pressure wash	Removal	Concrete chip	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal roof (interior, exterior)	HEPA vac, pressure wash	Removal	Wipe sample	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
		Acid Collection Sump 1 & 2	Ancillary	Stainless steel and concrete	HEPA vac, pressure wash, remove stainless steel liner	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	2	West Container Storage Building #1	Container Storage Area	Concrete Floor	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Partial concrete wall (both sides)	HEPA vac, pressure wash	Removal	Concrete chip	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal roof (interior, exterior)	HEPA vac, pressure wash	Removal	Wipe sample	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
		Acid Collection Sumps 5 & 6	Ancillary	Stainless steel and concrete	HEPA vac, pressure wash, remove stainless steel liner	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	3	West Container Storage Building #2	Container Storage Area	Concrete Floor	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Partial concrete wall (both sides)	HEPA vac, pressure wash	Removal	Concrete chip	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal roof (interior, exterior)	HEPA vac, pressure wash	Removal	Wipe sample	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
		Acid Collection Sump 4	Ancillary	Stainless steel and concrete	HEPA vac, pressure wash, remove stainless steel liner	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Acid Collection Sump 3	Ancillary	Stainless steel and concrete	HEPA vac, pressure wash, remove stainless steel liner	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
Oxidation Tank Area	NA	Neptune Scrubber Sump	Ancillary	Concrete	HEPA vac & pressure wash	Removal	Concrete chip, soil, soil gas included in Baghouse Building floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	24	North Oxidation Tank	Tank	Fiberglass; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Off-site disposal	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	25	South Oxidation Tank	Tank	Fiberglass; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Off-site disposal	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Oxidation Tank Area	Containment Area	Concrete Floor	HEPA vac & pressure wash	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete Pedestals	HEPA vac & pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete Walls (both sides)	HEPA vac & pressure wash	Removal	Concrete chip	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
Mobile Equipment Wash Station	35	Mobile Equipment Wash Station	Tank (Sump)	Stainless Steel and Concrete, Open Top	HEPA vac & pressure wash; remove stainless steel liner	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies Management as a hazardous waste unless 22 CCR 66261.3(d) applies					

TABLE 3.2
UNIT DISPOSITION AND TESTING REQUIREMENTS

UNIT AND BUILDING INFORMATION					Performance Standards								
CLOSURE AREA	UNIT NO.	UNIT NAME	UNIT TYPE	CONSTRUCTION	Unit Decontamination Procedures (Phase 1)	Unit Disposition	Sampling[10]	Performance Standard					
Containment Building	34	Blast Furnace Feed Room	Containment Building	Concrete floor	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete Walls (both sides)	HEPA vac, pressure wash	Dispose off-site	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal walls (both sides)	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal roof (interior, exterior)	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
Baghouse Building	69	Rotary Kiln	Miscellaneous Unit; Treatment	Steel	pressure wash	Reuse at Exide Muncie, IN facility	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Rotary Kiln Enclosure	NA	Concrete floor	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas included in Baghouse Building floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete Pedestals	HEPA vac, pressure wash	Dispose off-site	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal walls (both sides)	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal roof (interior, exterior)	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Dryer Baghouse	NA	Steel	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	31	North Flue Dust Slurry Tank	Tank	Stainless Steel; Open Top	3x interior pressure wash, 1x exterior pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	32	South Flue Dust Slurry Tank	Tank	Stainless Steel; Open Top	3x interior pressure wash, 1x exterior pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Reverb Baghouse	NA	Steel	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Soft Lead Baghouse	NA	steel	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Blast Baghouse	NA	steel	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					

TABLE 3.2
UNIT DISPOSITION AND TESTING REQUIREMENTS

UNIT AND BUILDING INFORMATION					Performance Standards								
CLOSURE AREA	UNIT NO.	UNIT NAME	UNIT TYPE	CONSTRUCTION	Unit Decontamination Procedures (Phase 1)	Unit Disposition	Sampling[10]	Performance Standard					
	NA	Material Handling Baghouse	NA	steel	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Hard Lead Baghouse	NA	steel	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Baghouse Building	NA	Concrete floor	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete Pedestals	HEPA vac, pressure wash	Dispose off-site	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal walls (both sides)	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal roof (interior, exterior)	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					

TABLE 3.2
UNIT DISPOSITION AND TESTING REQUIREMENTS

UNIT AND BUILDING INFORMATION					Performance Standards								
CLOSURE AREA	UNIT NO.	UNIT NAME	UNIT TYPE	CONSTRUCTION	Unit Decontamination Procedures (Phase 1)	Unit Disposition	Sampling[10]	Performance Standard					
	NA	Baghouse Building Sump 1	Ancillary	Concrete	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas included with Baghouse Building floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Baghouse Building Sump 2	Ancillary	Concrete	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas included with Baghouse Building floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Baghouse Building Sump 3	Ancillary	Concrete	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas included with Baghouse Building floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Baghouse Building Tire Wash	Ancillary	Concrete	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas included with Baghouse Building floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	22	East Equalization Tank	Tank	Previously removed	N/A	N/A	Concrete chip, soil, soil gas included with Baghouse Building floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	23	West Equalization Tank	Tank	Previously removed	N/A	N/A	Concrete chip, soil, soil gas included with Baghouse Building floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	29	Process Tank	Tank	Previously removed	N/A	N/A	Concrete chip, soil, soil gas included with Baghouse Building floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	30	Filtrate Tank	Tank	Previously removed	N/A	N/A	Concrete chip, soil, soil gas included with Baghouse Building floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
Desulfurization Area	7	North Mud Tank	Tank	Stainless Steel; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	8	Center Mud Tank	Tank	Stainless Steel; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	9	South Mud Tank	Tank	Stainless Steel; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	10	South Acid Storage Tank	Tank	Polyethylene; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	67	Acid Overflow Tank B	Tank	Polyethylene; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	64	North Acid Storage Tank 2	Tank	Previously removed	N/A	N/A	Concrete chip, soil, soil gas included with Desulfurization Building floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	65	North Acid Storage Tank	Tank	Previously removed	N/A	N/A	Concrete chip, soil, soil gas included with Desulfurization Building floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Mud Tank Area Sump 1	Ancillary	Concrete	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas included with Desulfurization Building floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Desulfurization Building	NA	Concrete floor	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete Pedestals	HEPA vac, pressure wash	Dispose off-site	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete Walls (both sides)	HEPA vac, pressure wash	Dispose off-site	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					

TABLE 3.2
UNIT DISPOSITION AND TESTING REQUIREMENTS

UNIT AND BUILDING INFORMATION					Performance Standards								
CLOSURE AREA	UNIT NO.	UNIT NAME	UNIT TYPE	CONSTRUCTION	Unit Decontamination Procedures (Phase 1)	Unit Disposition	Sampling[10]	Performance Standard					
		Building		Metal walls (both sides)	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal roof (interior, exterior)	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					

TABLE 3.2
UNIT DISPOSITION AND TESTING REQUIREMENTS

UNIT AND BUILDING INFORMATION					Performance Standards								
CLOSURE AREA	UNIT NO.	UNIT NAME	UNIT TYPE	CONSTRUCTION	Unit Decontamination Procedures (Phase 1)	Unit Disposition	Sampling[10]	Performance Standard					
RMPS	70	Oscillating Pan Feeder	Miscellaneous Unit; Conveying	Stainless Steel	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	40	RMPS Hammer Mill	Miscellaneous Unit; Treatment	Stainless Steel	pressure wash	Reuse at Exide Muncie, IN facility	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	12	Paste Thickening Unit (Santa Maria)	Tank	Stainless Steel; Open Top	1x interior pressure wash, 1x exterior pressure wash	Reuse at Exide Muncie, IN facility	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	66	Acid Overflow Tank A	Tank	Polyethylene; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies Management as a hazardous waste unless 22 CCR 66261.3(d) applies Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	41	Waste Acid Circulation Tank	Tank	Stainless Steel; Open Top	3x interior pressure wash, 1x exterior pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	68	Clarifying Acid Filter Press	Miscellaneous Unit; Treatment	Cast Iron coated with Acid Resistant Paint	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	42	East Elutriation Column	Miscellaneous Unit; Treatment	Stainless Steel	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	43	West Elutriation Column	Miscellaneous Unit; Treatment	Stainless Steel	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	13	Sink/Float Separator	Tank	Stainless Steel; Open Top	3x interior pressure wash, 1x exterior pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	14	Recycle Tank	Tank	Stainless Steel; Open Top	3x interior pressure wash, 1x exterior pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	80	Plastic Centrifuge #1	Miscellaneous Unit	Stainless Steel	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					

TABLE 3.2
UNIT DISPOSITION AND TESTING REQUIREMENTS

UNIT AND BUILDING INFORMATION					Performance Standards								
CLOSURE AREA	UNIT NO.	UNIT NAME	UNIT TYPE	CONSTRUCTION	Unit Decontamination Procedures (Phase 1)	Unit Disposition	Sampling[10]	Performance Standard					
	45	RMPS Filter Press Unit B	Miscellaneous Unit; Treatment	Carbon Steel coated with Acid Resistant Epoxy	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	79	Surge Tank	Tank	Polyethylene; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Reuse at Exide Muncie, IN facility	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	44	WWTP Filter Press	Miscellaneous Unit; Treatment	Cast Iron coated with Acid Resistant Paint	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	MAPCO Scrubber	NA	steel	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	5	Battery Dump Bin Sump	Tank	Stainless Steel	HEPA vac, pressure wash, remove stainless steel liner	Removal	Concrete chip, soil, soil gas included in RMPS floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	6	RMPS Floor Sump	Tank	Stainless Steel	HEPA vac, pressure wash, remove stainless steel liner	Removal	Concrete chip, soil, soil gas included in RMPS floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	11	Overflow Tank	Tank	Previously removed	NA	NA	Concrete chip, soil, soil gas included in RMPS floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	26	pH Adjustment Tank #1	Tank	Previously removed	NA	NA	Concrete chip, soil, soil gas included in RMPS floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	27	pH Adjustment Tank #2	Tank	Previously removed	NA	NA	Concrete chip, soil, soil gas included in RMPS floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	28	pH Adjustment Tank #3	Tank	Previously removed	NA	NA	Concrete chip, soil, soil gas included in RMPS floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	RMPS Building, Upper Feed Room	NA	Concrete floor	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete Pedestals	HEPA vac, pressure wash	Dispose off-site	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete Walls (both sides)	HEPA vac, pressure wash	Dispose off-site	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal walls (both sides)	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal roof (interior, exterior)	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	89	Receiving Kettle A	Miscellaneous Unit	kettle - steel	pressure wash	Re-use at Exide Muncie IN facility or recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					

TABLE 3.2
UNIT DISPOSITION AND TESTING REQUIREMENTS

UNIT AND BUILDING INFORMATION					Performance Standards								
CLOSURE AREA	UNIT NO.	UNIT NAME	UNIT TYPE	CONSTRUCTION	Unit Decontamination Procedures (Phase 1)	Unit Disposition	Sampling[10]	Performance Standard					
		A	Unit	housing	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				brick	pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	90	Receiving Kettle B	Miscellaneous Unit	kettle - steel	pressure wash	Re-use at Exide Muncie IN facility or recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				housing	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				brick	pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	91	Receiving Kettle E	Miscellaneous Unit	kettle - steel	pressure wash	Re-use at Exide Muncie IN facility or recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				housing	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				brick	pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	92	Receiving Kettle F	Miscellaneous Unit	kettle - steel	pressure wash	Re-use at Exide Muncie IN facility or recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				housing	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				brick	pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	93	Receiving Kettle G	Miscellaneous Unit	kettle - steel	pressure wash	Re-use at Exide Muncie IN facility or recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				housing	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					

TABLE 3.2
UNIT DISPOSITION AND TESTING REQUIREMENTS

UNIT AND BUILDING INFORMATION					Performance Standards								
CLOSURE AREA	UNIT NO.	UNIT NAME	UNIT TYPE	CONSTRUCTION	Unit Decontamination Procedures (Phase 1)	Unit Disposition	Sampling[10]	Performance Standard					
Smelter Building				brick	pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	94	Refining Kettle 1	Miscellaneous Unit	kettle - steel	pressure wash	Re-use at Exide Muncie IN facility or recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				housing	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				brick	pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	95	Refining Kettle 2	Miscellaneous Unit	kettle - steel	pressure wash	Re-use at Exide Muncie IN facility or recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				housing	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				brick	pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	96	Refining Kettle 3	Miscellaneous Unit	kettle - steel	pressure wash	Re-use at Exide Muncie IN facility or recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				housing	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				brick	pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	97	Refining Kettle 4	Miscellaneous Unit	kettle - steel	pressure wash	Re-use at Exide Muncie IN facility or recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				housing	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				brick	pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					

TABLE 3.2
UNIT DISPOSITION AND TESTING REQUIREMENTS

UNIT AND BUILDING INFORMATION					Performance Standards								
CLOSURE AREA	UNIT NO.	UNIT NAME	UNIT TYPE	CONSTRUCTION	Unit Decontamination Procedures (Phase 1)	Unit Disposition	Sampling[10]	Performance Standard					
	98	Refining Kettle 5	Miscellaneous Unit	kettle - steel	pressure wash	Re-use at Exide Muncie IN facility or recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
								Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				housing	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				brick	pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	99	Refining Kettle 6	Miscellaneous Unit	housing	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				brick	pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	100	Refining Kettle 7	Miscellaneous Unit	kettle - steel	pressure wash	Re-use at Exide Muncie IN facility or recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
								Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				housing	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				brick	pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	101	Refining Kettle 8	Miscellaneous Unit	kettle - steel	pressure wash	Re-use at Exide Muncie IN facility or recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
								Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				housing	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				brick	pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	102	Refining Kettle 9	Miscellaneous Unit	kettle - steel	pressure wash	Re-use at Exide Muncie IN facility or recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
								Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				housing	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					

TABLE 3.2
UNIT DISPOSITION AND TESTING REQUIREMENTS

UNIT AND BUILDING INFORMATION					Performance Standards								
CLOSURE AREA	UNIT NO.	UNIT NAME	UNIT TYPE	CONSTRUCTION	Unit Decontamination Procedures (Phase 1)	Unit Disposition	Sampling[10]	Performance Standard					
				brick	pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	36	Reverb Furnace	Miscellaneous Unit; Treatment	Brick	pressure wash	Reuse at Exide Canon Hollow, MO	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Burners, feed screws	pressure wash	Reuse at Exide Canon Hollow, MO	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal structure	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	37	Blast Furnace	Miscellaneous Unit; Treatment	Brick	pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				crucible	pressure wash	Re-use at Exide Muncie IN facility	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				steel structure	pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	North Kettle Gallery Sump	Ancillary	concrete	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas included in Smelter Lower Level floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	South Kettle Gallery Sump	Ancillary	concrete	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas included in Smelter Lower Level floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Cooling Tower Return Sump	Ancillary	concrete	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas included in Smelter Lower Level floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Smelter Building	NA	Concrete floor	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete Pedestals	HEPA vac, pressure wash	Dispose off-site	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete Walls (both sides)	HEPA vac, pressure wash	Dispose off-site	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal walls (both sides)	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal roof (interior, exterior)	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Smelter Building Lower Level	NA	Concrete floor	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete Pedestals	HEPA vac, pressure wash	Dispose off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete ceiling	HEPA vac, pressure wash	Removal	Concrete chip	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete walls	HEPA vac, pressure wash	Removal	Concrete chip	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					

TABLE 3.2
UNIT DISPOSITION AND TESTING REQUIREMENTS

UNIT AND BUILDING INFORMATION					Performance Standards								
CLOSURE AREA	UNIT NO.	UNIT NAME	UNIT TYPE	CONSTRUCTION	Unit Decontamination Procedures (Phase 1)	Unit Disposition	Sampling[10]	Performance Standard					
	63	WWTP Acid Storage Tank	Tank	Polyethylene; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	76	WWTP Recycled Acid Tank	Tank	Polyethylene; Open Top	3x interior pressure wash, 1x exterior pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	52	Equalization Tank 1	Tank	Stainless Steel; Open Top	3x interior pressure wash, 1x exterior pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	53	Equalization Tank 2	Tank	Stainless Steel; Open Top	3x interior pressure wash, 1x exterior pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	57	Reaction Tank 1	Tank	Polyethylene; Open Top	3x interior pressure wash, 1x exterior pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	58	Reaction Tank 2	Tank	Polyethylene; Open Top	3x interior pressure wash, 1x exterior pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	59	Reaction Tank 3	Tank	Polyethylene; Open Top	3x interior pressure wash, 1x exterior pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	60	Reaction Tank 4	Tank	Polyethylene; Open Top	3x interior pressure wash, 1x exterior pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	61	Reaction Tank 5	Tank	Polyethylene; Open Top	3x interior pressure wash, 1x exterior pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	55	Flocculation Tank	Tank	Steel; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Re-use at Exide Canon Hollow, MO	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	56	WWTP Clarifier	Tank	Stainless Steel; Open Top	3x interior pressure wash, 1x exterior pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	77	Sand Filter Feed Tank	Tank	Polyethylene; Open Top	3x interior pressure wash, 1x exterior pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
WWTP	71	#1 Sand Filter	Tank	Stainless Steel; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	72	#2 Sand Filter	Tank	Stainless Steel; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	73	#3 Sand Filter	Tank	Stainless Steel; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	74	#4 Sand Filter	Tank	Stainless Steel; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	75	#5 Sand Filter	Tank	Stainless Steel; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
								Management as a hazardous waste unless 22 CCR 66261.3(d) applies					

TABLE 3.2
UNIT DISPOSITION AND TESTING REQUIREMENTS

UNIT AND BUILDING INFORMATION					Performance Standards								
CLOSURE AREA	UNIT NO.	UNIT NAME	UNIT TYPE	CONSTRUCTION	Unit Decontamination Procedures (Phase 1)	Unit Disposition	Sampling[10]	Performance Standard					
	54	Sludge Holding Tank	Tank	Polyethylene; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
								Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	62	WWTP Sump	Tank	Stainless Steel	HEPA vac, pressure wash, remove stainless steel liner	Removal	Concrete chip, soil, soil gas included in WWTP Area floor	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
								Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	WWTP	Containment Area	Concrete floor	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete Pedestals	HEPA vac, pressure wash	Dispose off-site	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete Walls (both sides)	HEPA vac, pressure wash	Removal	Concrete chip	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
Containment Building	33	Reverb Furnace Feed Room, Lower & Corridor	Containment Building	Concrete floor	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete Walls (both sides)	HEPA vac, pressure wash	Dispose off-site	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal walls (both sides)	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal roof (interior, exterior)	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	51	Truck Wash Sump	Tank	Concrete	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
Baghouse Building	NA	East & West MAC Baghouses	NA	steel	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
Finished Lead Building	NA	Finished Lead Building	NA	Concrete floor	HEPA vac, pressure wash	Removal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete walls (both sides)	HEPA vac, pressure wash	Removal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal walls (both sides)	HEPA vac, pressure wash	Removal	Wipe sample	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal roof (interior, exterior)	HEPA vac, pressure wash	Removal	Wipe sample	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Torit Dust Collector	NA	steel	HEPA vac, pressure wash	Recycle off-site	NA	Decontaminate to nondetect, Management as a hazardous waste unless 22 CCR 66261.3(d) applies					

TABLE 3.2
UNIT DISPOSITION AND TESTING REQUIREMENTS

UNIT AND BUILDING INFORMATION					Performance Standards								
CLOSURE AREA	UNIT NO.	UNIT NAME	UNIT TYPE	CONSTRUCTION	Unit Decontamination Procedures (Phase 1)	Unit Disposition	Sampling[10]	Performance Standard					
Container Storage Area	103	Trailer Storage Area	Container Storage Area	Asphalt floor	HEPA vac & pressure wash	Removal	Asphalt, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
								Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
								Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
Concrete Yard System (Former WWTP)	15	50K Tank	Tank	Previously Removed	NA	NA	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	16	West Reaction Tank	Tank	Previously Removed	NA	NA	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	17	East Reaction Tank	Tank	Previously Removed	NA	NA	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	18	Pump Tank	Tank	Previously Removed	NA	NA	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	19	Sludge Tank	Tank	Previously Removed	NA	NA	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	20	Delta Stack Flocculation	Tank	Previously Removed	NA	NA	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	21	Delta Stack Clarifier	Tank	Previously Removed	NA	NA	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	38	WWTP Area Sump	Tank	Previously Removed	NA	NA	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	39	WWTP Filter Press Sump	Tank	Previously Removed	NA	NA	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Concrete Yard System	NA	Concrete	HEPA vac & pressure wash	Removal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
Non-regulated area	NA	Water Softener Building Sump	Ancillary	Concrete	HEPA vac & pressure wash	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Caustic Tank Sump	Ancillary	Concrete, stainless steel	HEPA vac, pressure wash, remove stainless steel liner	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Railroad Sump	Ancillary	Concrete	HEPA vac & pressure wash	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
Drop Out System	Ancillary	Stormwater Pipe	Pipe	HDPE	Jetting	Removal	Wipe sample	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	46	Pump Sump	Tank	Stainless Steel; Open Top	3x interior pressure wash	Removal	Wipe sample	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	47	Settling Tank No. 1	Tank	Polyethylene; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	48	Settling Tank No. 2	Tank	Polyethylene; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	49	Settling Tank No. 3	Tank	Polyethylene; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					

TABLE 3.2
UNIT DISPOSITION AND TESTING REQUIREMENTS

UNIT AND BUILDING INFORMATION					Performance Standards								
CLOSURE AREA	UNIT NO.	UNIT NAME	UNIT TYPE	CONSTRUCTION	Unit Decontamination Procedures (Phase 1)	Unit Disposition	Sampling[10]	Performance Standard					
	50	Settling Tank No. 4	Tank	Polyethylene; Closed Top	3x interior pressure wash, 1x exterior pressure wash	Off-site disposal	NA	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
	NA	Drop Out Area	Containment Area	Concrete Floor	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Concrete Walls (both sides)	HEPA vac, pressure wash	Removal	Concrete chip	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
				Metal Roof (interior, exterior)	HEPA vac, pressure wash	Removal	Wipe sample	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					

TABLE 3.2
UNIT DISPOSITION AND TESTING REQUIREMENTS

UNIT AND BUILDING INFORMATION					Performance Standards								
CLOSURE AREA	UNIT NO.	UNIT NAME	UNIT TYPE	CONSTRUCTION	Unit Decontamination Procedures (Phase 1)	Unit Disposition	Sampling[10]	Performance Standard					
Surface Impoundment	78	Stormwater Surface Impoundment	Surface Impoundment	Geosynthetics	Pressure wash	Removal	Geosynthetic, soil, soil gas (25% of locations)	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
								Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
								Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
								Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
West Yard Truck Wash	87	West Yard Truck Wash	Tank	Concrete	HEPA vac, pressure wash	Removal	Concrete chip, soil, soil gas	Management as a hazardous waste unless 22 CCR 66261.3(d) applies					
								Management as a hazardous waste unless 22 CCR 66261.3(d) applies					

Note:
1. Closed top tanks is defined as a tank with a covering but may not be fully closed (i.e., an access opening may be present)
2. Tank surface area for decon includes triple rinse of interior surface area and single rinse of exterior surface area, except Unit 12 (single rinse exterior, single rinse interior). Exterior surface area assumed equal to interior surface area.
3. Building demolition includes removal of roof, unit pedestals and foundations and walls to 5 feet below grade. Building demolition occurs during closure (Phase 1).
4. Contingent closure (Phase 2) may include underlying soil excavation in areas where excavation is conducted.
5. Performance standard and clean up levels for soil gas is health risk based standard of a hazard index of 1 and a non-cancer risk of 10-6.
6. All materials being disposed off-site will be characterized as required by the receiving facility.
7. Phase 2 activities presented here assume closure performance standards are achieved and do not include measures to address subsoils below 5 feet (i.e., excavation or capping).
8. The Phase 2 activities presented in this table (i.e., pressure washing) may be modified based on the scope of Phase 2.
9. Concrete pedestals are assumed and may not match closure cost estimate.
10. Concrete characterization chip sampling for pedestals and walls proposed for demolition not shown. The data will be used for characterization for disposal and to determine if a temporary enclosure is needed during demolition. The data will not be used to determine if a performance standard has been met.
11. The order of presentation generally follows the Phase 1 schedule.

TABLE 10.1
SAMPLE ANALYSIS SUMMARY
Closure Plan
Exide Technologies
Vernon, California

SAMPLE TYPE	LOCATION TYPE	ANALYSIS	METHOD
Wipe	All	CAM-17 Total Metals	SW-846 6010 B/C & 7471A
Soil	All	CAM-17 Total Metals	SW-846 6010 B/C & 7471A
		CAM-17 STLC Metals	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET) ; SW-846 6010B/C & 7470A
		pH	SW-846 Method 9045D
		Moisture Content	ASTM D2216
Soil	Sumps, Inground Units, Surface Impoundment (2 samples each)	Appendix IX Total VOCs	SW-846 8260B/C
		Appendix IX STLC VOCs	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); SW-846 8260B/C
Soil	Surface Impoundment (4 samples)	Total Dioxin/Furan	SW-846, Method 8280A/8290A
		STLC Dioxin	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); SW-846 8280A/8290A
Soil	Surface Impoundment (2 samples)	Total PAH	SW-846 8270C/D
		STLC PAH	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); SW-846 8270C/D
Soil	Beneath PCB transformer	Total PCB	SW-846 8082/8082A
Chip/Core	Secondary Containment Area, tank pedestal	CAM-17 Total Metals	SW-846 6010 B/C & 7471A
		CAM-17 STLC Metals	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); SW-846 6010B/C & 7470A
Chip/Core	Sump	CAM-17 Total Metals	SW-846 Method 6010 B/C & 7471A
		CAM-17 STLC Metals	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); EPA 6010B/C & 7470A
		Appendix IX Total VOCs	SW-846 8260B/C
		Appendix IX STLC VOCs	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); SW-846 8260B/C
Chip/Core	Reverb Furnace (36), Blast Furnace (37), Blast Furnace Feed Room (34) - 4 samples each	CAM-17 Total Metals	SW-846 6010 B/C & 7471A
		CAM-17 STLC Metals	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); SW-846 6010B/C & 7470A
		Appendix IX VOCs	SW-846 8260B/C
		Appendix IX STLC VOCs	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); SW-846 8260B/C
		Total PAH	SW-846 8270C/D
		STLC PAH	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET);SW-846 8270C/D
		Total Dioxin/furan	SW-846, Method 8280A/8290A
		STLC Dioxin	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); SW-846 8280A/8290A
Chip/Core	Beneath PCB transformer	Total PCB	SW-846 8082/8082A
Geosynthetic	All	CAM-17 Total Metals	SW-846 6010 B/C & 7471A
		CAM-17 STLC Metals	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); SW-846 6010B/C & 7470A
Concrete Characterization	All	CAM-17 Total Metals	SW-846 6010 B/C & 7471A
Soil Gas	All	VOCs	SW-846 8260B/C
			EPA Method TO-15 (10% of samples)
Groundwater, Surface Water, Pore Water	Quarterly	Metals (dissolved As, Cd, Pb, Zn)	SW-846 6010B/C & 7470A
		Appendix IX VOCs*	SW-846 8260B/C
		Sulfate	EPA 300.0
		turbidity	SM 2130B (EPA 180.1)
		pH	SM4500 H+B
Groundwater	Annual	Total cyanide	SM 4500-CN E or SW-846 9010C/9014
		Appendix IX metals	SW-846 6010B/C, 7470A
		Appendix IX VOCs*	SW-846 8260B/C
		Appendix IX SVOCs*	SW-846 8270C/D
		Organochlorine Pesticides	SW-846 8081A/B
		Chlorinated Herbicides	SW-846 8151A
		PCBs	SW-846 8082/8082A
		Sulfate	EPA 300.0
		turbidity	SM 2130B (EPA 180.1)
		pH	SM4500 H+B
Surface Water, Pore Water	Annual	Total cyanide	SM4500 H+B or SW-846 9045D
		Appendix IX metals	SW-846 6010B/C, 7470A
		Appendix IX VOCs*	SW-846 8260B/C
		Appendix IX SVOCs*	SW-846 8270C/D
		Sulfate	EPA 300.0
		turbidity	SM 2130B (EPA 180.1)
		pH	SM4500 H+B
Equipment Rinsate	All	CAM-17 Total Metals	SW-846 6010 B/C & 7470A

Notes
1. SW-846 - USEPA "SW-846 Test Methods for Evaluating Solid Wastes - Physical/Chemical Methods" Revision
2. MCAWW - USEPA "Methods of Chemical Analysis of Water and Wastes", March 1983.
3. A percent completeness goal of 90% has been set for the laboratory analytical results.
4. [1] Check the methods for the values of specific species.
5. * Appendix IX parameter list excluding herbicides, pesticides, dioxins and furans.
6. The laboratory will only use methods which are approved by CELAP and for which they have certification for.

Date: July 2015

APPENDIX A

Sampling and Analysis Plan

Date: July 2015

CLOSURE PLAN
SAMPLING AND ANALYSIS PLAN

Prepared For:

EXIDE TECHNOLOGIES
Vernon, California

Prepared By:

ADVANCED GEOSERVICES
West Chester, Pennsylvania

Project No. 2013-2993-21
February 13, 2014
Revised August 18, 2014
Revised May 15, 2015
Revised July 28, 2015
Revised August 18, 2015 (DTSC GSB)

Date: July 2015

TABLE OF CONTENTS

PAGE NO.

1.0 Introduction..... Page 1 of 2

1.1 General..... Page 1 of 2
1.2 Organization..... Page 1 of 2
1.3 SAP Organization ..... Page 2 of 2

2.0 Facility Background..... Page 1 of 4

2.1 Site Location ..... Page 1 of 4
2.2 Site Description..... Page 1 of 4
2.3 Operational History..... Page 1 of 4
2.4 Geology and Hydrogeology..... Page 2 of 4

2.4.1 Geologic Setting..... Page 2 of 4
2.4.2 Site Hydrogeology ..... Page 4 of 4

3.0 Project Data Quality Objectives..... Page 1 of 10

3.1 Project Definition..... Page 1 of 10
3.2 Data Quality Objectives..... Page 2 of 10

3.2.1 Problem Statement..... Page 2 of 10
3.2.2 Decision Questions ..... Page 2 of 10
3.2.3 Study Boundaries..... Page 2 of 10

3.3 Data Validation ..... Page 3 of 10

3.3.1 Precision..... Page 3 of 10
3.3.2 Accuracy ..... Page 3 of 10
3.3.3 Representativeness..... Page 4 of 10
3.3.4 Completeness..... Page 4 of 10
3.3.5 Comparability ..... Page 4 of 10

Date: July 2015

TABLE OF CONTENTS
(Continued)

PAGE NO.

3.4 Data Validation and Usability ..... Page 4 of 10

3.4.1 Data Review, Validation, and Verification Requirements..... Page 5 of 10

3.4.1.1 Verification and Validation Methods..... Page 5 of 10

3.4.2 Reconciliation with Data Quality Objectives ..... Page 6 of 10
3.4.3 Documentation and Records ..... Page 6 of 10

3.5 Data Management ..... Page 7 of 10

3.5.1 Document Collection and Organization..... Page 7 of 10
3.5.2 File Preservation ..... Page 7 of 10

3.6 Assessment/Oversight..... Page 8 of 10

3.6.1 Corrective Action..... Page 8 of 10

3.6.1.1 Corrective Action Resulting from Routine Activities .. Page 9 of 10
3.6.1.2 Corrective Action Resulting from QA Audits ..... Page 9 of 10

3.6.2 Quality Assurance Reports to Management ..... Page 10 of 10

4.0 Sampling Rationale ..... Page 1 of 6

4.1 Wipe Samples ..... Page 1 of 6
4.2 Chip Samples ..... Page 1 of 6
4.3 Rinsate Samples ..... Page 2 of 6
4.4 Core Samples ..... Page 2 of 6
4.5 Soil Samples..... Page 2 of 6
4.6 Soil Gas Samples ..... Page 4 of 6
4.7 Surface Water..... Page 5 of 6
4.8 Soil Pore Water ..... Page 5 of 6
4.9 Concrete Characterization..... Page 5 of 6
4.10 Destructive HDPE..... Page 5 of 6

5.0 Request for Analyses ..... Page 1 of 3

5.1 Analysis Narrative ..... Page 1 of 3

Date: July 2015

TABLE OF CONTENTS
(Continued)

PAGE NO.

5.1.1 Wipe Samples ..... Page 1 of 3
5.1.2 Rinsate Samples ..... Page 1 of 3
5.1.3 Chip Samples ..... Page 1 of 3
5.1.4 Core Samples ..... Page 1 of 3
5.1.5 Soil Sample Analysis ..... Page 1 of 3
5.1.6 Soil Gas Sample Analysis ..... Page 2 of 3
5.1.7 Soil Pore Water ..... Page 2 of 3
5.1.8 Surface Water ..... Page 2 of 3
5.1.9 Concrete Characterization ..... Page 2 of 3
5.1.10 Waste Profiling ..... Page 2 of 3
5.1.11 Geosynthetic Samples ..... Page 3 of 3

5.2 Analytical Laboratory ..... Page 3 of 3

6.0 Field Methods and Procedures ..... Page 1 of 10

6.1 Field Equipment ..... Page 1 of 10

6.1.1 Photoionization Detector ..... Page 1 of 10

6.2 Field Testing ..... Page 1 of 10

6.2.1 Photoionization Detector for VOC Field Screening of Soil Samples ..... Page 1 of 10

6.3 Wipe Samples ..... Page 1 of 10
6.4 Rinsate Samples ..... Page 2 of 10
6.5 Chip Samples ..... Page 3 of 10
6.6 Core Samples ..... Page 3 of 10
6.7 Soil Borings ..... Page 4 of 10

6.7.1 Drill Site Preparation ..... Page 4 of 10
6.7.2 Direct-Push Drilling ..... Page 5 of 10
6.7.3 Hollow-Stem Auger Drilling ..... Page 5 of 10
6.7.4 Rotosonic Drilling ..... Page 5 of 10
6.7.5 Soil Sample Retrieval ..... Page 6 of 10
6.7.6 Boring Abandonment ..... Page 7 of 10

Date: July 2015

TABLE OF CONTENTS
(Continued)

PAGE NO.

6.8 Soil Gas Samples ..... Page 7 of 10
6.9 Surveying ..... Page 8 of 10
6.10 Decontamination Procedures ..... Page 8 of 10
6.11 Soil Pore-Water Samples ..... Page 9 of 10
6.12 Surface Water ..... Page 10 of 10
6.13 Concrete Characterization ..... Page 10 of 10
6.14 HDPE Samples ..... Page 10 of 10
6.15 Engineering Controls ..... Page 10 of 10

7.0 Sample Containers Preservation and Storage ..... Page 1 of 3

7.1 Wipe Samples ..... Page 1 of 3
7.2 Rinsate Samples ..... Page 1 of 3
7.3 Chip Samples and Core Samples ..... Page 1 of 3
7.4 Soil Samples ..... Page 2 of 3
7.5 Soil Gas Samples ..... Page 2 of 3
7.6 Soil Pore-Water Samples ..... Page 2 of 3
7.7 Surface Water ..... Page 2 of 3
7.8 Concrete Characterization ..... Page 3 of 3
7.9 Geosynthetic Samples ..... Page 3 of 3

8.0 Disposal of Residual Material ..... Page 1 of 1

9.0 Sample Documentation and Shipment ..... Page 1 of 4

9.1 Field Notes ..... Page 1 of 4
9.2 Sample Labels ..... Page 2 of 4
9.3 Chain of Custody ..... Page 2 of 4
9.4 Sample Packaging and Shipment ..... Page 3 of 4

9.4.1 Laboratory Custody Procedures ..... Page 3 of 4
9.4.2 Sample Storage and Disposal ..... Page 4 of 4

10.0 Quality Control ..... Page 1 of 5

10.1 Field Quality Control Samples ..... Page 1 of 5

10.1.1 Field Duplicate Samples ..... Page 1 of 5
10.1.2 Equipment Decontamination Blanks ..... Page 1 of 5

Date: July 2015

TABLE OF CONTENTS
(Continued)

PAGE NO.

10.1.3 Field Blanks ..... Page 1 of 5
10.1.4 Trip Blanks..... Page 1 of 5
10.1.5 Water Supply Blanks ..... Page 2 of 5

10.2 Laboratory Quality Control Samples..... Page 2 of 5

10.2.1 Method Blank/Reagent Blank..... Page 2 of 5
10.2.1.1 Calibration Standards (Initial Calibration) ..... Page 3 of 5
10.2.1.2 Check Standard (Continuing/Daily Calibration) ..... Page 3 of 5

10.2.2 Laboratory Duplicates..... Page 3 of 5
10.2.3 Laboratory Control Sample (LCS)..... Page 4 of 5
10.2.4 Matrix Spike and Matrix Spike Duplicate (MS/MSD)..... Page 4 of 5
10.2.5 Surrogate Spikes ..... Page 5 of 5

11.0 Field Variance..... Page 1 of 1

12.0 References..... Page 1 of 1

LIST OF TABLES

TABLE

1 Sample Preservation, Holding Times, and Container Requirements
2 Summary of Laboratory Methods and Quality Assurance Goals
3 Reporting Limits

LIST OF FIGURES

FIGURE

1-1 Organization Chart
2.1 Facility Location Map
2.2 Facility Plot Plan

Date: July 2015

TABLE OF CONTENTS
(Continued)

LIST OF ATTACHMENTS

ATTACHMENT

A Direct Push Installation
B Cal Science QA Manual
C Sample Label and Chain of Custody
D Soil Gas Probe Detail
E H&P Mobile Geochemistry QA Manual

1.1 INTRODUCTION

1.2 GENERAL

This Sampling and Analysis Plan (SAP) has been prepared to document the objectives, rationale, and procedures for environmentally-related measurements performed as part of the closure of the Exide Technologies (Exide) facility located at 2717 South Indiana Street in Vernon, California (the Site). The facility office mailing address is 2700 South Indiana Street. This SAP has been prepared by Advanced GeoServices Corp. (Advanced GeoServices) on behalf of Exide. Activities presented in this SAP include concrete, soil, soil gas, equipment rinsate, geosynthetic and wipe sampling/testing. The purpose of this SAP is threefold:

- Implement standardized field methods;
- Identify the anticipated chemical parameters that may be analyzed; and,
- Identify laboratory methods that will be used for sample analysis.

1.3 ORGANIZATION

Key project personnel and project responsibilities are summarized below:

Exide Project Manager: Overall responsibility and authority for project coordination among the consultants, Exide, and regulatory agencies. Designated by leader of Exide Management Team.

Project Manager: Responsible for project coordination between Exide, Environmental Consultant, and regulatory agencies. Responsibilities include overall project quality, technical oversight, schedule and budget management, and report preparation. The Project Manager will be responsible to ensure all project personnel and contractors are qualified and adequately trained to perform the work to which they are assigned. Documentation from contractors may be requested by the Project Manager prior to their starting work. The Project Manager is responsible to ensure all documentation is appropriately filed and maintained. Advanced GeoServices Project Manager.

Project Quality Assurance (QA) Officer: Responsible for ongoing review, monitoring, auditing, and evaluation of the field and laboratory QA/QC program. The QA Officer is also responsible for development and supervision of QA/QC procedures for data management and analysis, and report preparation and review. Advanced GeoServices in-house chemists.

Field Operations Manager: Responsible for the maintenance and calibration of field equipment. All field personnel should have completed current 40-hour OSHA and 8-hour refresher requirements and respiratory training and fit test. Field personnel should be briefed on site-specific technical and quality issues and procedures as related to their

duties. Examples include project objectives and quality requirements, chain-of-custody requirements, sampling and shipping protocols, and project safety. Personnel training will be periodically reviewed by the Project Manager to ensure the training is appropriate, adequate, and current. Personnel who have allowed their training to expire will not be allowed to work until training is updated.

QA/QC problems or deficiencies, if any, identified by the Project QA Officer during the review, monitoring, and auditing process will be brought to the attention of the Project Manager, as appropriate. If QA/QC problems or deficiencies require corrective action, such action will be recommended by the Project Manager and/or the Project QA Officer and the Exide Project Manager. An organization chart is provided as Figure 1-1.

1.4 SAP ORGANIZATION

The remainder of this SAP is organized into the following sections. Section 2.0 presents background information pertaining to the site's location and physiographic setting, its geologic and hydrogeologic characteristics, and a summary of known existing environmental conditions. Section 3.0 is the Project Data Quality Objectives which will be used to monitor and control data quality. Section 4.0 is the Sampling Rationale, which presents the rationale for the individual tasks and detailed procedures for sampling and data gathering. Section 5.0 is the Request for Analysis and Section 6.0 is Field Methods and Procedures. Sections 7.0, 8.0 and 9.0 are for Sample Containers, Management of Investigation Derived Waste and Sample Documentation and Shipping, respectively. Section 10.0 is Quality Control and Section 11.0 is Field Variances. The SAP is supported by a list of references, tables, figures, and attachments, all of which follow the text.

2.1 FACILITY BACKGROUND

This section summarizes background information including site description, site history, regional geology and hydrogeology, and a summary of the past site investigation activities and analytical results. Additional details regarding site history, environmental setting, and the degree and extent of contamination identified during previous investigations have been presented in the Revised Current Conditions Report (Advanced GeoServices, October 5, 2012).

2.2 SITE LOCATION

The Exide facility is located at 2717 South Indiana Street in Vernon, California as shown on Figure 2.1. The property occupies a total area of approximately 15 acres, which is bounded by 26th Street towards the north and Bandini Avenue towards the south. A ±1.5 acre parcel, with approximately 190-ft of frontage along the north side of Bandini Boulevard and 345 ft of frontage along the east side of Indiana Street, is occupied by the Main Office Building (2700 South Indiana Street). The remaining ±13.5 acres, extends along the west side of Indiana Street between Bandini Boulevard and East 26th Street (a distance of approximately 900 ft) and includes the active manufacturing areas. The 13.5-acre parcel has approximately 1000 ft of frontage along Bandini Boulevard and 450 ft of frontage along East 26th Street. A concrete lined flood control channel bisects the Site in a north-south direction and a railroad right of way intersects the Site in an east-west direction, as shown on Figure 2.2. Coordinates for the Site are 34º 00’22” north latitude and 118º 11’48” west longitude. The Site is located approximately 1 mile west of the Long Beach Freeway (I-710).

2.3 SITE DESCRIPTION

The Site is characteristic of the heavy industrial nature of the facility and surrounding land uses. Pavement, buildings and structures cover nearly the entire facility, with the only exceptions being a small grass area near the main office, a few small isolated areas of landscaping or exposed soil. The Site is relatively flat with an average elevation of 175 to 180 feet above sea level and topography that generally slopes from the northwest to the southeast. Notable landmarks include the main office (east of South Indiana Street), the existing smelter building (near the intersection of South Indiana Street and East 26th Street) and the lined storm water pond north of Bandini Boulevard.

2.4 OPERATIONAL HISTORY

In 1922, Morris P. Kirk & Sons, Inc. initiated lead smelting and metals processing operations at the Site. They continued operation until 1973 when NL Industries took control of the operation. In 1979, Gould, Inc. took control of the facility and maintained operations until 1983. In 1983, GNB Technologies bought the facility from Gould. In September 2000, Exide Technologies acquired GNB, including the Vernon facility.

Site operations from 1922 through 1973 included a battery breaking process for the purpose of recovering lead from lead-acid batteries, production of lead sheeting, the production of zinc alloys and the manufacturing of extruded metal components.

In 1982 the facility was the subject of a major modernization and reconstruction project that resulted in construction of the main smelter and battery breaking operations. The lined storm water surface impoundment was constructed in 1984.

Prior to 1922 the Site was reportedly the "boneyard" for a meat rendering plant and before that, the Site west of Indiana Street and additional areas towards the west were quarried for gravel.

2.5 GEOLOGY AND HYDROGEOLOGY

2.5.1 Geologic Setting

The Site is located within the Los Angeles Basin, a deep structural depression largely filled with late Cretaceous through Pleistocene sediments. Coarse, hydraulically conductive materials within these sediments comprise aquifers serving the Los Angeles Basin. Numerous aquicludes and aquitards separate these aquifers. Aquifers present beneath the subject site include the Exposition, Gage, Gardena, Hollydale, Jefferson, Lynwood, Silverado, and Sunnyside aquifers. The coastal plain of Los Angeles County has been divided into four groundwater basins on the basis of geological and physiographic features. The Site is located near the northeastern margin of the Central Basin within the Los Angeles Forebay Area.

Known water-bearing sediments beneath the Los Angeles Forebay Area range in age from Recent to late Pleistocene and extend to an approximate depth of 1,000 feet. The principal water-bearing stratigraphic units include recent alluvium, the early Pleistocene Lakewood Formation and the late Pleistocene San Pedro Formation. Non-water bearing rocks of the Pliocene Pico Formation underlie the San Pedro Formation and are exposed in the Repetto Hills to the north (California Department of Water Resources [DWR], Bulletin 104, 1961). Recent alluvial deposits cover a large portion of the Los Angeles Basin. The alluvium thins northward toward the Repetto Hills (DWR, Bulletin, 104, 1961).

The water-bearing zones within these units are separated by aquicludes or aquitards of varying thicknesses of relatively impermeable silt and clay. The only named aquiclude and the most significant of the region is the near-surface Bellflower aquiclude. In the northern part of the Los Angeles Forebay, the aquifers thin and merge along the thinning margin of the basin. Where the Bellflower aquiclude is missing within the Forebay Area, the aquifers are in direct hydraulic continuity with the surface (DWR, Bulletin 104, 1961).

Lakewood Formation

According to the geologic map published by the DWR (Bulletin 104, 1961), the site and surrounding area are immediately underlain by early Pleistocene deposits of the Lakewood Formation. The Lakewood Formation beneath the site consists of four members: the Bellflower aquiclude, the Exposition aquifer, the Gage-Gardena aquifer, and the unnamed aquiclude that separates the aquifers. The Exposition and Gage-Gardena aquifers merge in the vicinity of the site.

In the upper part of the Lakewood Formation, lithologic changes are rapid with discontinuous permeable zones and considerable variation in particle size. These features represent typical stream-type alluviation with floodplain sediments comprising from 40 to 80 percent of the total deposits. The predominantly fine-grained sediments that comprise the upper part of the formation are referred to as the Bellflower aquiclude. The Bellflower aquiclude thins northward and is thin or absent in the vicinity of the site.

The Exposition aquifer underlies the Bellflower aquiclude and is composed of coarse gravel, coarse to fine sand, silt, and clay and is most likely equivalent to the upper water-bearing zone identified in previous investigations and described throughout this report. The average thickness of the Exposition aquifer in the site vicinity is about 65 feet. The Gage and Gardena aquifers underlie and are separated from the Exposition aquifer by a relatively thin aquitard less than 15 feet thick. The Gage aquifer, which likely correlates with the intermediate zone beneath the site, extends over most of the Coastal Plain of Los Angeles County (DWR, Bulletin 104, 1961) and is composed of variable amounts of gravel, sandy silt, and clay. The Gardena aquifer is primarily composed of coarse sand and gravel that represent an ancestral river that incised a channel and eroded away the sediments comprising the Gage aquifer (DWR, Bulletin 104, 1961). Coarse fluvial deposits filled the channel during a subsequent rise in sea level. Because the Gardena aquifer is similar in thickness, at the same stratigraphic horizon, and in direct continuity with the Gage aquifer (DWR, Bulletin 104, 1961), they are sometimes referred to as the Gage-Gardena aquifer. The base of the Gage-Gardena aquifer varies considerably as shown in the regional cross-section, but on average it is estimated to be at a depth of 200 feet beneath the site.

San Pedro Formation

The Lakewood Formation is immediately underlain by lower Pleistocene deposits of the San Pedro Formation. The San Pedro Formation contains most of the important aquifers used for groundwater production in the Los Angeles coastal plain region. In the type area, the San Pedro Formation is composed largely of stratified and cross-bedded sand, but includes some beds of fine gravel, silty sand and silt. Within the subject area, extensive impermeable beds of silt and clay occur in the San Pedro Formation separating the coarser water-bearing deposits into several distinct aquifers: the Hollydale, Jefferson, Lynwood (400-foot gravel), Silverado, and Sunnyside aquifers. The principal water-producing aquifers of the region are the Lynwood and Silverado

aquifers. The base of the Sunnyside aquifer in the vicinity of the site is estimated to be on the order of 975 feet bgs.

2.5.2 Site Hydrogeology

The ongoing RFI investigation indicates the occurrence of a shallow, thin, discontinuous 'perched' zone occurring at depths from 17 feet to 20 feet below the ground surface (bgs) beneath some areas of the facility. This zone is not being monitored currently. Groundwater elevation measurements collected at the Site indicate the depth to ~~a~~ deeper perched groundwater averages 85 to 90 feet ~~below the ground surface~~bgs and is reported to coincide with the Bellflower Aquiclude. Based on information obtained as part of the ongoing RFI, the perched groundwater is discontinuous. Underlying the Bellflower Aquiclude from approximately 95 to 175 feet, is the middle portion of the Lakewood formation designated the Exposition Aquifer. Based on published information , the Exposition Aquifer is underlain by the lower portion of the Lakewood formation, which includes (in descending order) the Lower Aquiclude, occurring from approximately 175 to 225 feet, followed by the Gage Aquifer from approximately 225 to 280 feet. Additional groundwater investigation is being performed as part of the ongoing RFI which may refine these statements.

3.1 PROJECT DATA QUALITY OBJECTIVES

3.2 PROJECT DEFINITION

The objective of the sampling and measurement program is to document contaminant concentrations and hazardous characteristics of soil, concrete and asphalt pavement, building components and infrastructure intended to remain in-place following closure. Proposed sampling also includes soil gas, geosynthetic liner materials and equipment rinsate. Pore water and surface water sampling is discussed and assumed as part of Contingent Post-Closure cost estimating but would only be required as part of closure where Closure Performance Standards are not achieved. Performance objectives for groundwater are discussed in Appendix X, *Quarterly Groundwater Sampling and Analysis Plan*.

Formatted: Font: Italic

Sampling results will also be utilized to supplement the ongoing RFI and to evaluate the potential risk to human health and environment during site-wide Corrective Action. Procedures for sampling and other data gathering activities are presented in the following sections. Specifications for sample preservation and the holding times are summarized in Table 1.

For the purpose of completing closure of the former IS units, sampling of units (tank or miscellaneous unit), associated containment structures and underlying soils will be completed following completion of waste removal and cleaning activities. Cleaning of the secondary containment structures, pads or pedestals used to support the actual IS Unit and similar features that will remain in-place following closure will be evaluated utilizing chip or core samples. Such features are predominantly concrete but may occasionally be asphalt paving. Subsurface soils will be evaluated based on the results of soil sampling conducted beneath and immediately adjacent to the former IS units or associated secondary containment areas. Soil gas sampling will be conducted in at least one boring beneath or adjacent to each IS unit and at two locations in the Surface Impoundment.

The facility received and processed/recycled lead acid batteries and other lead bearing wastes. The incoming wastes were characteristically hazardous for Federal Waste Codes D002 (waste acids/acidic wastewater), D004 (arsenic), D005 (barium), D006 (cadmium), D007 (chromium), D008 (lead), D010 (selenium) and K069 (secondary lead smelter emission control dust). California Waste Codes are 132 (aqueous solutions with metals), 171 (metals sludge), 172 (dust with metals), 181 (inorganic solid waste), 721 (arsenic), 722 (cadmium), 723 (chromium), 724 (lead), 791 (liquid with pH < 2) and 792 (liquid containing metals with pH < 2). In addition to the hazardous wastes specifically identified in the Closure Plan, the facility also utilized fuels and lubricants to run and maintain vehicles and equipment, and various products for general site maintenance (such as paint and cleaning supplies) that may contain hazardous materials.

Potential Constituents of Concern (COPCs) managed within the former IS units are arsenic, barium, cadmium, chromium, lead and waste sulfuric acid. In addition, the potential exists for spillage of various fuels, lubricants and products containing volatile organic compounds and, if not properly cleaned up, for related residuals to enter the site sumps or drainage system,

including the Surface Impoundment.

3.3 DATA QUALITY OBJECTIVES

3.3.1 Problem Statement

The objective of the sampling and measurement program is to document the adequacy of the closure activities and supplement the RCRA Facility Investigation (RFI). Successful completion of the Closure will meet the following objectives:

1. Provide sufficient data to make decisions about actions that may be required to achieve closure performance standards; and,
2. Support development of corrective measure alternatives in the Corrective Action process.

3.3.2 Decision Questions

To meet the objectives of the Closure as summarized above, the following four decision questions must be answered:

1. **Are COPCs present in soil, pavement, former containment areas, and building components remaining on-site ~~above the Closure Performance Standards~~that would not result in a determination of clean closure by DTSC for the facility?** If "Yes" implement removal to meet residential or background clean-up levels as indicated in Closure Plan. If "No", No Further Action required in subject media as part of Closure. Additional evaluation may be performed as part of Corrective Action.
2. **If Decision Question No. 1 is not achievable, will COPCs remain in soil, pavement, former containment areas, and building components on-**site above the industrial clean-up levels after implementation of the Closure Plan? If "Yes" implement removal to meet industrial clean-up levels as indicated in Closure Plan. If "No", No Further Action required in subject media as part of Closure. Additional evaluation may be performed as part of Corrective Action.
3. **If Decision Question No. 2 is not achievable, will COPCs remain in soil, pavement, former containment areas, and building components on-**site above the Closure Performance Standards after implementation of the Closure Plan? If "Yes" implement removal to meet the Closure Performance Standards as indicated in Closure Plan. If "No", No Further Action required in subject media as part of Closure. Additional evaluation may be performed as part of Corrective Action.
4. **If Decision Question No. 3 is not achievable, how will COPCs that remain in soil, pavement, former containment areas, and building components on-**site above the Closure Performance Standards be managed? Soils will be managed on-site as hazardous waste in a RCRA landfill and capped.

~~1.~~

Formatted: Not Expanded by / Condensed by

Formatted: Not Expanded by / Condensed by

Formatted: Left, Indent: Left: 1.07", No bullets or numbering

3.3.3 Study Boundaries

The study boundaries are the former Interim Status units and the containment areas and buildings which contain them. Soil will be sampled at 1 foot increments to a depth of 7 feet as measured from the bottom of the secondary containment floor or liner system. Samples from the 0 to 1 ft, 1 to 2 ft, 2 to 3 ft, and 4 to 5 ft depths will be submitted for laboratory analysis. The remaining samples will be archived and analyzed if required to refine removal limits during development of the Phase 2 Contingent Closure Plan.

Concrete, asphalt, geosynthetic, soil, and soil gas will be investigated. If Closure Performance Standards are not achieved and closure with a hazardous waste-in-place designation is required, Exide will prepare a Post-Closure Permit Application that includes requirements for Water Quality Monitoring (groundwater, pore water and surface water) necessary under Article 6. Discussion for water quality monitoring are provided in this document to help define and develop assumptions required for Contingent Post-Closure.

3.4 DATA EVALUATION

An objective for the project is to obtain and evaluate data that are representative of site conditions. The data collected must be accurate, precise, and complete. The evaluation of the data must involve an assessment of representativeness of site conditions and comparability to previously collected data. The definitions for accuracy, precision, completeness, comparability, and representativeness are defined in the following sections.

Table 2 presents levels for accuracy and precision established for the results of chemical analyses of both field and laboratory QC samples.

3.4.1 Precision

Precision is the mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision will be determined with analysis of matrix spike duplicates and field duplicates. Precision is measured with the Relative Percent Difference (RPD) between the original sample result and the duplicate sample result using the following calculation:

$$\text{Precision} = \text{RPD} = \frac{\left| \text{difference between the original and duplicate result} \right|}{\text{average of the original and duplicate result}} \times 100$$

RPDs cannot be calculated in cases where one analyte of the duplicate pair was detected.

3.4.2 Accuracy

Accuracy measures the bias in a measurement system. Sources of error are the sampling process, field contamination, preservation, handling, sample matrix, sample preparation and analysis techniques. Sampling accuracy may be assessed by evaluating the results of field blanks (trip blanks, equipment blanks, decon water source blanks) to assess if contamination was introduced during the field activity. Laboratory blanks will be analyzed to determine if contamination was introduced in the laboratory. Matrix spikes will be conducted and analyzed to assess the analytical accuracy. For spiked samples, accuracy is measured as percent recovery (%R) of the spike added using the following calculation:

$$Accuracy = \%R = \frac{(spiked\ sample\ result - sample\ result\ without\ the\ spike}{amount\ of\ spike\ added} \times 100$$

3.4.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter, which is most concerned with the proper design of the sampling program. The representativeness of the data will be maintained by following appropriate and consistent procedures for drilling, well installation, sample collection, aquifer testing, and other types of data collection, and by the application of approved, standard analytical methods. Field QA/QC samples will be used to provide information on the representativeness of the field sampling effort.

3.4.4 Completeness

Completeness is the amount of valid data obtained from a measurement system compared to the amount that was expected to meet the project data goals. A goal of 90 percent completeness has been established for the project chemical data. However, the required level of completeness will vary with the data quality needs of different aspects of the site characterization. In the event that all expected data are not available or suitable to support an aspect of the site characterization, the available data will be specifically assessed for adequacy, or if additional data should be acquired. Measurement completeness (*C*) can be described as the ratio of acceptable measurements obtained for the total number of planned measurements for an activity. For this extended meaning, completeness is defined as:

$$Completeness = \frac{number\ of\ acceptable\ items}{total\ number\ of\ planned\ items} \times 100$$

3.4.5 Comparability

Comparability expresses the confidence with which one data set can be compared to another. Sample data should be comparable with other measurement data for similar samples and sample conditions. This goal is achieved through using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units.

3.5 DATA VALIDATION AND USABILITY

The following sections address the QA activities that occur after the data collection phase of the project is completed. Implementation of these elements determines whether the data conform to the specified criteria, thus satisfying the project objectives.

3.5.1 Data Review, Validation, and Verification Requirements

The first level of review and consequent data validation and verification reporting is done at the laboratory. Data reduction, validation, and reporting at the laboratory will be implemented in accordance with standard EPA methods for analytical and QA protocols. Refer to the laboratory's QA Manual for QA/QC procedures. The data are reduced and validated by the laboratory in accordance with individual analytic methodology, quality control procedures, and the use of appropriate standards and correct transcription.

The second level of data review is conducted by the Environmental Consultant. All data packages are reviewed for precision, accuracy, representativeness, completeness and comparability. If any issues or inconsistencies are encountered, they are investigated and corrective action is implemented, if necessary.

3.4.1.1 **Verification and Validation Methods**

Verification concerns the process of examining a result of a given activity to determine conformance to the stated requirements for that activity. Validation concerns the process of examining a product or result to determine conformance to user needs.

Data Verification

Verification will consist of reviewing data packages for completeness and consistency to confirm that QC parameter values fall within acceptable limits and to identify any samples that require data qualification.

Data Validation

Validation is the process of evaluating the available data against the project DQOs to make sure that the objectives are achieved. The available data reviewed will include analytical results, field QC data and lab QC data, and may include field records. As defined in SW-846, data validation may be very rigorous or cursory, depending on project DQOs. For this project, data validation will be rigorous to ensure DQOs are met.

All analytical data, upon arrival from the laboratory, will receive an initial QA check by a qualified QA Scientist. This QA check will include verification of receipt of all samples, verification that all sample analyses were performed and a scan for extreme values in the results reported. Upon completion of this initial QA check, a more comprehensive review will be conducted. The information examined during this data review process will consist of, but not be limited to: chain-of-custody completeness; holding time limitations; blank contamination; instrument initial and continuing calibration; matrix spike/matrix spike duplicate accuracy; laboratory and field duplicate precision internal standards, serial dilutions; and overall system performance. The data review also verifies proper quality assurance/quality control samples

were collected and analyzed. A validation report will be completed indicating any problems associated with the sample analyses.

3.4.2 Reconciliation with Data Quality Objectives

When the data validation indicates that a control parameter is not within limits specified in this SAP, the impact of the outlier on the usability of the associated data will be assessed. Based on the results of the data validation, qualifiers will be applied to analytical data to indicate the usability of the data. When the reviewed data do not meet quality control requirements specified in this document the data will be flagged with qualifiers. Commonly used qualifiers include:

J – The analyte was positively identified and detected; however, the concentration is an estimated value because the result is less than the detection limit or quality control criteria were not met.

R - Reject, unusable. The data are qualitatively and quantitatively unacceptable.

U – The analyte was not detected at the given detection limit.

No qualifier - Data are acceptable for use as reported.

3.4.3 Documentation and Records

Upon successful completion of the data validation process and assessment of usability of the data, new data generated for the project will be entered/loaded into the project database. Copies of all analytical data and/or final reports are retained in the laboratory files and, at the discretion of the laboratory manager. Subsequent to completion of the project, the files will be transferred to data archives. Data may be retrieved from archives upon request. Exide will be ultimately responsible for record retention on completion of the closure activities.

All reports generated during closure will be provided to DTSC in formats required by DTSC at the time of closure. These submittals, to the extent applicable, could include the following:

- Presentation of analytical results
- Summaries of field data from field measurements;
- Lithologic description logs; and
- Photographs and figures depicting field activities.

Raw data from field measurements and other sample collection activities will be appended to the reports, as appropriate. Where field data have been reduced or summarized, the method of reduction will be documented in the reports.

3.5 DATA MANAGEMENT

The document control system (DCS) for the project is designed to meet the following objectives.

Establish and maintain a repository for project documents and data.
Establish an inventory of documents contained in the DCS.
Facilitate efficient retrieval of information.

The content and organization of the DCS are discussed below, along with a description of the file indexing method, a computer-based document inventory system, and a discussion of document preservation.

3.5.1 Document Collection and Organization

All records, documents, and other information relating to the project will be preserved by Exide as physical or electronic documents, or both. Those preserved as physical documents will be kept in file cabinets in a secure office setting. Alternatively, documents may be converted to electronic format. Specifically, portable document format (PDF) files of the documents may be generated using Adobe Acrobat® software. Documents to be preserved will include, but not limited to, the following:

- Field activity records (i.e., logbooks, notebooks, chain-of-custody records, air bills, surveys, laboratory reports, photographs, etc.)
- Final deliverables submitted to DTSC
- Incoming and outgoing correspondence
- Transmittals
- Photographs
- Waste manifests
- Project memoranda
- Project notes
- Meeting agendas and minutes

3.5.2 File Preservation

All data, records, and documents shall be maintained in the project database and document management system described above for a period of at least six years following completion of closure activities. The DTSC shall be notified in writing a minimum of 90 days prior to the destruction of any of the records, and shall be provided with the opportunity to take possession of any such records. The Exide Project Manager will be responsible to ensure all project documents are appropriately stored and maintained.

Project documents include electronic data and database of field and analytical measurements. Daily backups of electronic data will be performed and appropriately stored. The Project

Manager is responsible to ensure all individuals on the distribution list receive current copies of all documents.

3.6 ASSESSMENT/OVERSIGHT

This section describes the activities associated with assessing the effectiveness of the project QA/QC procedures in terms of audit procedures, corrective action, and reports to management.

Internal audits will also be performed and will be the responsibility of the Project Manager. Performance and system audits will be conducted as presented in the following paragraphs with additional audits performed if problems are discovered. System audits are qualitative reviews of project activities to check that the overall QA program is functioning. Performance audits are quantitative checks on different aspects of internal support or project work, and are most appropriate for environmental sampling and analysis activities. It is anticipated that two field performance audits will be conducted during closure activities as part of the project audit program.

The Environmental Consultant's Project Manager will be responsible for the performance audits anticipated during the project. The field audits will involve observing field activities to check that the QA/QC procedures described in this SAP and other related work plans are being followed and that the required field documentation is complete. Problems or deviations from the procedures will be brought to the attention of, and discussed with, field personnel so that corrections can be made immediately.

On completion of each field audit, the Project Manager will document any deficiencies or problems encountered and the proposed corrective measures. It will be the Project Manager's responsibility to make sure that all of the recommended corrective actions are implemented in a timely manner. Copies of the audit memoranda and any follow-up correspondence will be included in the project files.

3.6.1 Corrective Action

An important part of a QA program is a well-defined, effective policy for correcting problems. The QA program is established to prevent problems, but it also serves to identify and correct those that exist. Usually these problems require either on the spot, immediate corrective action or long term corrective action.

The corrective action system used during the field activities is designed to quickly identify problems, and solve them efficiently. The Project Manager is responsible for the direction of this system and receives full support from management for its implementation. The essential steps are:

Identify and define the problem.
Assign responsibility for investigating the problem.
Determine a corrective action to eliminate the problem.
Assign and accept responsibility for implementing the corrective action.
Implement the corrective action.
Verify that the corrective action has eliminated the problem.
Document the problem identified, the corrective action taken and its effectiveness in eliminating the problem.

Corrective action procedures that will be used to resolve deficiencies found during routine activities or QA audits of field, laboratory, or office activities are as described in the following section.

3.6.1.1 **Corrective Action Resulting from Routine Activities**

Deficiencies found during routine activities will be resolved by implementing corrective action as part of normal operating procedures by staff. Corrective actions of this type will be noted in the field or laboratory logbook; no other formal documentation is necessary unless further corrective action is required. If normal procedures do not solve the problem, the staff will verbally inform the Project Manager of the problem and, if significant, the problem will be documented in a formal memo addressed to the Project Manager and copied to the project file. The Project Manager will be responsible for implementing or assigning personnel to problem resolution.

3.6.1.2 **Corrective Action Resulting from QA Audits**

Deficiencies encountered during a QA audit will be corrected as soon as possible. The Project Manager is responsible for completion of appropriate corrective action. The procedures used to expedite corrective action are as follows:

Auditor verbally notifies the Project Manager and field personnel immediately during audits of deficiencies found.
The Project Manager institutes corrective action as soon as possible.
The Project Manager distributes the audit report promptly.

3.6.2 Quality Assurance Reports to Management

Reports that present field or laboratory measurements will contain a QA section addressing the quality of the data and its limitations. The QA section will address the following points as appropriate:

- Adherence to the work plan. Deviations from the work plan and DQOs will be explained and documented.
- Precision, accuracy, and completeness of the data reported, in quantitative terms, as compared with the objectives set for those parameters.
- Representativeness and comparability of data in qualitative terms as compared with objectives set for those parameters.
- Changes and revisions to the documents governing field work.
- Summary of QC activities, including development of standard operating procedures (SOPs) and QC procedures.
- Summary of QA activities.
- Results of performance and/or system audits.
- Description of quality problems found.
- Description of corrective actions taken.

Any deviations from the plans that may have generated results inconsistent with the DQOs will be discussed with the Project Manager and reconciled appropriately. Any limitations of the data and the corresponding final resolutions will be included in the QA section of the reports.

All documents produced as part of the project will undergo peer review by the Environmental Consultant's staff. The review of each document will be documented by the initials or signature of the person responsible for the review. The Project Manager is responsible for ensuring that all technical comments are addressed. The Internal Review Draft is revised based on the peer review comments to become Exide's draft version of the document. Comments by Exide will be incorporated into the final document to be submitted to DTSC.

4.1 SAMPLING RATIONALE

4.2 WIPE SAMPLES

Wipe sampling will be conducted as noted in the Closure Plan to demonstrate that tanks, miscellaneous units, small equipment, furnace brick, steel structures and the stormwater system piping and manholes proposed to remain on-site, or intended to be shipped off-site for re-use/recycling, following Closure have been decontaminated properly.

If the tank will remain on-site or intended to be shipped off-site for re-use/recycling, wipe samples will be collected once per 300 sf of tank interior, and a minimum of three samples per closed-top tank (one each from interior top, bottom and side) and a minimum of two samples per open-top tank (one each from interior bottom and side).

If the miscellaneous unit will remain on-site or intended to be shipped off-site for re-use/recycling, wipe samples will be collected once per 300 sf of miscellaneous unit surface. A minimum of three wipe samples will be collected per miscellaneous unit.

Steel structures remaining on-site or intended to be shipped off-site for re-use/recycling will be wipe sampled once per 300 sf per each wall. A minimum of one (1) sample per wall and one sample per ceiling will be taken.

Furnace brick remaining on-site or intended to be shipped off-site for re-use/recycling will be wipe sampled once per 20 new/unused bricks. If the surface of the brick is too coarse for wipe sampling to be effective, Exide may elect to use other sampling methods (e.g., rinseate, chip or core sampling) to determine the effectiveness of decontamination.

The stormwater management system primary HDPE pipe and HDPE manhole will be wipe sampled. Wipe samples will be collected from the flow line at the down-slope end of each HDPE pipe run, at the bottom of each HDPE manhole and within the Unit 46 stainless steel insert. HDPE pipe samples will be collected at the downstream end of the pipe on the interior bottom surface, approximately 1 foot upstream from the end of the pipe. HDPE manhole samples will be collected at the bottom of the manhole

The locations and boundaries of each unit are provided on Figure 2.2.

4.3 CHIP SAMPLES

Chip samples will be collected from concrete and asphalt to determine the effectiveness of decontamination of secondary containment areas intended to remain in-place.

Chip samples will be collected at the maximum frequency of once per 1,000 sf, of interior surface area intended to remain in-place (floor, pedestal, and wall (both sides)) with no less than

five samples per closure area. For containment areas containing multiple regulated units, an additional chip sample shall be collected for each additional unit or 1,000 sf of interior surface area above 5,000 sf, whichever is greater. Chip samples will be co-located with soil samples. Chip samples will be preferentially located to areas that are damaged and/or degraded, stained or cracked. For containment areas of 5,000 sf or less of interior surface area, at least one chip sample must be collected from each raised pad/pedestal supporting regulated tanks or units (if

present), and one chip sample shall be collected from the bottom of each containment area sump, or containment area low point.

If chip sampling identifies an area of secondary containment where cracking, corrosion or other damage is identified to penetrate the full thickness of the containment, subsequent soil borings (Section 4.5) shall be co-located to allow sampling of soil beneath the compromised area of the containment.

Soil sample locations are provided on Figure 9.1 in the Closure Plan. The number of borings presented on Figure 9.1 coincides with the number of chip samples required within each containment area. Core sampling, described in Section 4.4, shall be performed in lieu of chip sampling at those locations where the floor is identified to have multiple layers of concrete or asphalt comprising the secondary containment floor. Each core location shall represent only one of the required chip samples (i.e. two or more samples will be collected from each core location, but the location of the core may only replace one of the required chip samples).

4.4 RINSATE SAMPLES

Decontamination of equipment that cannot be wipe sampled and are intended to remain on-site or intended to be shipped off-site for re-use/recycling, will be conducted by analyzing rinse water that has passed through the equipment. A minimum of one representative equipment sample will be collected for each particular component (i.e., pump or similar device).

4.5 CORE SAMPLES

Core samples will be collected from areas designated for chip samples where multiple layers of flooring are identified during soil sampling, where extensive surficial degradation (i.e. deeper than 1-inch) may be present that may not be accurately characterized by chip sampling as determined in the field between Exide and DTSC, and where chip sampling techniques are determined to be ineffective or inefficient. Core samples will be collected from the top to bottom of the floor. Representative samples shall be collected from the upper 1-inch of each distinct floor layer and the remaining core will be archived for possible future analysis.

4.6 SOIL SAMPLES

To investigate soil for releases of hazardous wastes or constituents through the secondary containment area floor system or Stormwater Surface Impoundment liner system, soil sampling will be conducted beneath the floor at each containment area/closure area. Soil sampling will focus on the soils immediately beneath the containment area and Surface Impoundment liner system, because if contaminants were released to the subsoil, indications are expected to remain in the form of residual contaminants adhering to soil particles. Concentrations of residual contaminants typically decrease with greater depths. The primary exception is volatile organic

compounds (VOCs) where residual contaminants in near surface samples may have volatilized leaving higher VOC concentrations at deeper intervals.

Soil samples will be collected using hand augers, direct-push, roto-sonic or hollow stem auger soil sampling, as appropriate based on depth and accessibility, once every 1,000 sf of floor, or a minimum of five locations per containment area plus one additional soil boring for each additional unit contained therein (whichever is greater). Where accessible, soil borings will be placed at the mid-points of all four sides of the secondary containment system, and at the center of the regulated unit. If several units occupy the same secondary containment area, additional boring locations will be situated directly below each tank, miscellaneous unit and sump within the containment system. A soil boring will also be conducted below or immediately adjacent to the secondary containment area sumps associated with the IS units, including the Container Storage Areas. Sampling locations will preferentially target areas of cracked or damaged floor or pavement. Prior to sampling, all liners/floors will be inspected for cracks, holes, staining, odors etc., to determine targeted sampling locations in addition to grid sampling. Proposed sample locations are provided on Figure 9.1 of the Closure Plan. If alternate sampling locations are proposed, a figure showing proposed soil sample locations will be submitted to DTSC for approval prior to implementing field activities. Where the secondary containment structure limits access to the interior of a containment area by sampling equipment, soil borings shall be placed immediately adjacent to the secondary containment area.

Soil samples will be collected along the stormwater system at locations where subsoils were visually impacted (staining or wet) by pipe leakage along the bottom of the excavation during removal of the original stormwater system piping during the 2013/2014 upgrades. These locations are identified in Closure Plan Appendix B as occurring at the following locations:

- Deterioration in the bottom of metal pipe at ED+0+10 (invert elevation 7 feet bgs) extended approximately three feet towards Structure D. Soil beneath the deteriorated pipe section was moist, but not wet, fill which indicated that leakage was not actively occurring.
- Deterioration in the bottom of the metal pipe at ED+0+50 to Structure D (approximately 20 feet long, invert elevation 5 feet bgs). Sporadic staining was observed. Soil beneath the pipe was moist, but not wet, fill which indicated that leakage was not actively occurring.
- Deterioration in the bottom of the metal pipe from MH-1 to NORTHCL-3 (approximately 50 feet long, invert elevation 27 inches bgs).
- Localized staining and odor beneath pipe with concrete encasement at HG+0+43 (invert elevation 8 feet bgs).

These locations are summarized on Closure Plan Figure 10.1.

Soil samples will be collected at each location from 0 to 1 ft, 1 to 2 ft, and 2 to 3 ft below the pipeline. Sample depths may be adjusted based on specific site conditions. If impacts from the

stormwater system are identified at the 2 to 3 ft. depth, then additional sampling will be necessary at greater depth. The techniques and frequency of such sampling will be subject to DTSC approval, before implementation.

At the time of closure, the HDPE piping system will be pressure tested to document piping system integrity. If the piping passes the pressure testing, no sampling along the alignment of the pipe will be necessary. If the HDPE pipe fails the pressure testing, soil borings shall be conducted every 20 feet adjacent (within 18-inches) to the alignment of the pipe and soil samples collected at depths corresponding to 0 to 1 ft., 1 to 2 ft., and 2 to 3 ft. below the invert of the pipe. Trench drain sections that cannot be pressure tested will be sampled using soil borings every 40 feet along the alignment of the trench drain pipe.

At the Stormwater Surface Impoundment, the liner system will be removed at the sample location to allow access to underlying soils. The removed primary and secondary geomembrane will be collected as a geosynthetic sample discussed in Section 4.10. Soil borings will be collected at the locations shown on Figure 9.1 of the Closure Plan. Soil borings completed on the bottom of the Surface Impoundment will extend to 7 feet below the liner system of the Surface Impoundment. Soil borings completed on the side slopes of the surface impoundment will extend to 3 feet below grade. Soil samples will be collected at every 12 inches over the length of the borings. Samples from 0-1 ft, 1-2 ft, 2-3 ft and 4-5 ft (Surface Impoundment bottom borings only) will be submitted for laboratory analysis and the remaining samples (3-4 ft, 5-6 ft, and 6-7 ft (bottom samples only)) will be archived for later analysis, if needed. Side slope samples will be collected at one-foot increments to 3 feet below the liner surface and all three samples at each location will be analyzed. Additional samples may be needed at the hand auger locations based on the sample results. Damage to the liner system will be repaired by patching the geosynthetic layers and inspected by a licensed Professional Engineer or Geologist. Sample frequency is provided above. Analytes are provided in Section 5.0.

Except for soil borings completed as part of Surface Impoundment Closure and along the stormwater system pipe, soil samples will be collected at each location from 0 to 1 ft, 1 to 2 ft, 2 to 3 ft, 3 to 4 ft, 4 to 5 ft, 5 to 6 ft and 6 to 7 ft below the bottom of the secondary containment area floor. The sampler will submit samples from the 0 to 1 ft, 1 to 2 ft, 2 to 3 ft and 4 to 5 ft intervals for the specified analysis. The remaining samples will be archived for possible future analysis. Sample depths may be adjusted in consultation with the DTSC field representative based on location specific conditions.

Sampling plan addendums will be submitted for DTSC's approval if additional soil sampling is required.

4.7 SOIL GAS SAMPLES

To confirm that no releases of VOCs have occurred from the bottom of secondary containment areas or through the Stormwater Surface Impoundment liner system, soil gas sampling will be

performed at approximately 5 and 15 feet deep in one boring beneath or adjacent to each IS unit and at three locations beneath the Surface Impoundment, one at each Surface Impoundment sump. Soil gas samples will be collected from a target depth of 5 and 15 feet. Soil gas sample locations are shown on Figure 9.1 of the Closure Plan.

4.8 SURFACE WATER

If units are closed with hazardous waste-in-place, surface water monitoring will be conducted for post-closure monitoring as required by Article 6 and detailed in the Water Quality Monitoring and Response Program prepared and submitted by Exide with the Post-Closure permit application and approved by DTSC.

4.9 SOIL PORE WATER

If units are closed with hazardous waste-in-place, soil pore water samples will be conducted for post-closure monitoring as required by Article 6 and detailed in the Water Quality Monitoring and Response Program prepared and submitted by Exide with the Post-Closure permit application and approved by DTSC.

4.10 CONCRETE CHARACTERIZATION

Concrete pedestals and walls proposed for demolition shall be chip sampled as discussed in Section 4.2 before demolition. The chip sample results will be used for characterization and disposal purposes and to determine whether or not a temporary enclosure is necessary during demolition.

~~Concrete floors that are demolished and crushed for use as coarse backfill during Phase 2 shall be chip sampled as discussed in Section 4.2 before demolition. Crushed concrete will be sampled for characterization to determine if the crushed concrete can be re-used on site as backfill. Samples will be collected once per 500 cy (1,000 tons) of crushed concrete.~~

4.11 DESTRUCTIVE HDPE

HDPE geomembrane samples will be collected from the primary and secondary geomembrane once every 650 sf of Stormwater Surface Impoundment liner system, concurrent with soil sampling.

HDPE pipes failing to meet the Closure Performance Standards based on wipe samples will be destructively sampled at the downstream end of the pipe on the interior bottom surface, approximately 1 foot upstream from the end of the pipe. HDPE manholes failing the Closure Performance Standards based on wipe samples will be destructively sampled at the bottom of the manhole.

Destructive HDPE samples will consist of shaving off the uppermost approximately 0.2 inches of pipe wall or manhole bottom using a decontaminated chisel or knife.

5.1 REQUEST FOR ANALYSES

5.2 ANALYSIS NARRATIVE

5.2 For the purposes of developing the Closure Cost Estimate, the following discussion relates to the analyses required to determine adequacy for meeting the Closure Performance Standards (i.e., hazardous waste or non). This Sampling and Analysis Plan (SAP) does not discuss satisfying clean-up levels that are anticipated to be included as part of Closure (i.e., clean closure or closure with land-use restrictions for an industrial-type scenario) and are not yet known. Exide will submit an additional SAP to DSTCDTSTC to address this issue within 60 days of approval of the Closure Plan.

Formatted: Font: No underline, Underline color: Auto, (Intl) Times New Roman, Not Expanded by / Condensed by

Formatted: Left, Indent: Left: 0.58", No bullets or numbering

Formatted: Left, No bullets or numbering

5.2.1 Wipe Samples

Wipe samples shall be analyzed for Title 22 CAM-17 Metals. Additional information is provided in Table 2.

5.2.2 Rinsate Samples

Rinsate samples shall be analyzed for Title 22 CAM-17 total Metals. Additional information is provided in Table 2.

5.2.3 Chip Samples

All chip samples shall be analyzed for Title 22 CAM-17 total and STLC Metals. Chip samples collected from the bottom of sumps or pits shall also be analyzed for Appendix IX total and STLC VOCs. In addition to Title 22 CAM-17 metals, chip samples from the floors of the Smelter Building and Blast Furnace Feed Room shall include analysis for Appendix IX total and STLC VOCs, total and STLC PAH, and total and STLC dioxin/furans. Additional information is provided in Table 2.

If electrical transformers are found to contain PCB fluids, concrete or asphalt samples beneath the transformer will be analyzed for PCBs.

5.2.4 Core Samples

Core samples shall be analyzed for the same parameters as chip samples.

5.2.5 Soil Sample Analysis

Soil sample analysis will include the following:

- Field Screening with PID – all samples
- pH (Laboratory) – all sample submitted for lab analysis

- Title 22 CAM-17 Total and STLC Metals – all sample submitted for lab analysis
- Moisture Content – all samples submitted for lab analysis
- Two soil samples collected beneath/adjacent to sumps, in ground IS units and the Surface Impoundment shall be analyzed for the Appendix IX total and STLC VOC Target List . (4 soil samples from the bottom of the Surface Impoundment will be analyzed for total and STLC dioxin/furans.)

- Two soil samples completed in the bottom of the Surface Impoundment for VOC analysis will also be analyzed for total and STLC PAHs.

Additional information is provided in Table 2. If any transformers are found to contain PCB fluids, concrete or asphalt and soil samples beneath the transformer will be analyzed for PCBs.

5.2.6 Soil Gas Sample Analysis

Soil gas samples will be analyzed for VOCs using EPA Method 8260B with 10% of samples also being analyzed by EPA Method TO-15. Laboratory detection limits will be equal or less than the residential California Human Health Screening Levels for intrusive soil gas VOCs.

5.2.7 Soil Pore Water

For development of the Contingent Post-Closure cost estimate, we have assumed that soil pore water quarterly analysis will include dissolved arsenic, cadmium, lead, zinc, VOCs, sulfate, turbidity, and pH. Soil pore water annual analysis will include Appendix IX (total cyanide, Title 22 metals, VOCs, SVOCs, Sulfate, Turbidity, pH). Actual analysis will be defined in the Water Quality Monitoring and Response Program required as part of the Post-Closure permit application. The Contingent Post-Closure Cost Estimate will likely need to be revised as a result.

5.2.8 Surface Water

For development of the Contingent Post-Closure cost estimate, we have assumed that surface water quarterly analysis will include dissolved arsenic, cadmium, lead, zinc, VOCs, sulfate, turbidity, and pH. Surface water annual analysis will include Appendix IX (total cyanide, Title 22 metals, VOCs, SVOCs, Sulfate, Turbidity, pH). Actual analysis will be defined in the Water Quality Monitoring and Response Program required as part of the Post-Closure permit application. The Contingent Post-Closure Cost Estimate will likely need to be revised as a result.

5.2.9 Concrete Characterization

Crushed concrete samples will be analyzed for CAM-17 total metals.

Concrete characterization chip samples used for disposal characterization and to determine whether or not a temporary enclosure is necessary for wall demolition will be analyzed for CAM-17 total metals.

5.2.10 Waste Profiling

Materials destined for off-site disposal are expected to consist of Investigation Derived Wastes (IDW) (soils cutting and excess sample volume). IDW may be combined with similar waste

streams generated during facility decontamination and closure activities. Characterization sampling shall be completed in accordance with the requirements of the proposed disposal facility.

5.2.11 Geosynthetic Samples

Geosynthetic samples will be analyzed for CAM-17 total and STLC metals.

5.3 ANALYTICAL LABORATORY

Primary laboratory analyses for the project will be performed by Calscience Environmental Laboratories Inc. (Calscience), of Garden Grove, California. The laboratory Project Manager will be responsible for assuring that all samples are analyzed in accordance with approved QA/QC procedures. A copy of Calscience's Quality Assurance Manual can be found in Attachment B.

On-site mobile laboratory services will be provided by H&P Mobile Geochemistry Inc. of Carlsbad, California. The laboratory Project Manager will be responsible for assuring that all samples are analyzed in accordance with the approved QA/QC procedures. A copy of H&P's Quality Assurance Manual is provided in Attachment E.

6.1 FIELD METHODS AND PROCEDURES

6.2 FIELD EQUIPMENT

6.2.1 Photoionization Detector

The PID that will likely be used for soil sample screening and air monitoring during drilling operations will be similar to a MiniRAE 2000 (10.6eV bulb). The PID will be calibrated at the beginning of each day of use against a "zero gas" and a calibration standard of known concentration. In calibration mode, the PID will prompt the user to "connect zero gas." Ambient air is used as the zero gas to account for "background" interference. The PID will next prompt the user to "connect span gas." An evacuated Tedlar sample bag is filled with a 100-ppm isobutylene in air mixture. The appropriate calibration gas concentration is entered into the PID using the instrument keypad. The Tedlar bag is connected to the instrument and the valve is opened. The instrument completes the calibration process automatically. Upon completion, the PID will show readings within 10% ± of 100 ppm. The date, time, and calibration gas type and concentration used during each calibration event will be recorded in the field logbook. Field personnel performing the calibration will also record any problems encountered during PID calibration in the field logbook.

6.3 FIELD TESTING

6.3.1 Photoionization Detector for VOC Field Screening of Soil Samples

Soil samples will be screened for VOCs in the field to help assess the appropriate level of personal protective equipment (PPE), particularly respiratory protection, and also as a basis for selecting soil samples for possible chemical analysis. Soil samples collected for VOC field screening will include disturbed samples of drill cuttings and depth-specific disturbed or undisturbed soil. The depth-specific samples will typically be a portion of the sample retrieved using the SPT or modified California samplers but not the portion retained for possible chemical analysis. Irrespective of how the sample is collected, the field screening process is the same. Specifically, as soon as the sample collection device is opened, the probe of a properly calibrated PID equipped with a 10.6eV lamp is used to sweep near the surface of a freshly exposed soil. The organic vapor content, if any, is then recorded on the field boring log. If field observations or PID screening indicates possible soil contamination, a soil sample may be collected for possible chemical analysis.

6.4 WIPE SAMPLES

A 300 sf grid system will be established for each unit being sampled using wipe samples. Two wipe samples will be collected from two 1 ft^2 in the center of each grid. Two wipe samples are needed by the laboratory to conduct the required analysis. If areas of visual staining or deterioration are observed, wipe sample locations will be moved to the areas in question.

The 1 ft^2 area will be marked with a 12 inch by 12 inch template. The area will be sampled with a gauze square pre-moistened with DI water. The gauze square will be held with a pair of stainless steel forceps or gloved hand and will be used to thoroughly swab the area marked by the template. The template will be decontaminated between sample locations. The sample container is a new, sealable plastic bag (Ziplock or similar).

The NIOSH surface wipe method will be used as follows:

1. Use a wipe pre-moistened with DI water.
2. Place the template over the area to be sampled or measure a 12 inch by 12 inch area. If the object has a total surface area less than 1 ft^2, sample the whole surface area, if possible, and record the surface area. If the surface does not allow the use of the template, determine the dimensions that will equal 1 ft^2.
3. Wipe the surface with firm pressure, using S-strokes from edge to edge, top to bottom. Fold the exposed side of the pad inward (i.e., fold in half).
4. Using the once-folded media, wipe the same area using S-strokes from edge to edge at right angles to the first wipe (i.e., left to right). Fold the exposed side of the pad inward.
5. Using the twice-folded media, wipe using S-strokes from edge to edge in the original direction. Fold the exposed side of the pad or filter in.
6. Place the media in a plastic bag. Seal the bag. Record the sample identification on the bag.
7. Decontaminate reusable templates or discard paper templates.
8. Record the sample identification, surface area sampled, and description of the sample and surface.

Stormwater management system HDPE piping and manholes will also be wipe sampled using the methods described above. HDPE pipe samples will be sampled at the downstream end of the pipe on the interior bottom surface, approximately 1 foot upstream from the end of the pipe. HDPE manhole samples will be collected at the bottom of the manhole.

6.5 RINSATE SAMPLES

Ancillary equipment associated with former IS units (such as pumps and piping used to convey waste to/from the unit) proposed to remain on-site after Closure will be decontaminated by rinsing three times with a pressure washer or flushing with liquid three times. Once decontamination is complete, laboratory-supplied deionized water will be passed through the equipment by pouring or pumping the deionized water through the equipment. The water will be collected in the laboratory-supplied sample jar at the downstream end of the equipment. Sampling equipment will be decontaminated prior to use and between samples.

6.6 CHIP SAMPLES

Chip samples are considered grab samples and they are intended to represent the post-cleaning surface of the wall, floor, or sump from which they are collected. Chip samples will be collected to a 1-inch maximum depth from a 4-inch by 4-inch area using a chisel and hammer. The target sample area and depth will produce approximately 16 cubic inches of sample volume. The sampler will strike the chisel with the hammer to liberate chips from the targeted sample location. The effort required to obtain the sample will be a function of the hardness and general condition of the concrete or asphalt. The sampler may utilize a shield to prevent sample fragments from projecting away from the sample area. Material generated by the sampling activity shall be collected and placed into a clean zip lock bag periodically as sampling progresses and resealed to prevent loss of volatile compounds. Discrete samples will be collected; samples will not be homogenized. If difficulty is encountered using the chisel and hammer method, the sampler may utilize a hammer drill or similar power tool to generate the sample, or utilize core sampling techniques.

The sampling tools (chisel or drill bits) will be decontaminated between locations. If the concrete or asphalt is not in a pulverized state prior to analysis, the samples will be sent as-is to the lab for pulverization and analysis. Each sample will be submitted in a 4-ounce laboratory supplied sample jar. The sample jar will be filled by placing the sample in the jar or zip lock bag. Coatings or sealants on the concrete surface that is not removed by cleaning/pressure washing shall be included in the sample subject to analysis.

6.7 CORE SAMPLES

Core samples will be collected with a portable concrete core machine or geoprobe with concrete core barrel. The diameter of the core samples will typically be 6 inches; however, a smaller or larger diameter may be necessary based on field conditions. Samples will be collected in those areas where multiple layers of flooring are identified, where extensive surficial degradation may be present or where chip sampling techniques are inefficient or ineffective. Samples will be co-located with soil samples where possible. Sampling equipment will be decontaminated prior to use and between each location. Coring will be performed utilizing water to lubricate the core barrel as recommended by the manufacturer. Sampler will attempt to retrieve a full depth sample of the surface being cored. The sampler will document the physical condition and appearance of the core within the entire collection length. The core shall be split between each material/layer interface, if necessary utilizing a decontaminated chisel. The upper 1-inch of each surface shall be broken from the core using a hammer and chisel. The core shall be placed on a clean sheet of plastic when the target sample horizon is being removed. If the concrete or asphalt is not in a pulverized state prior to analysis, the samples will be sent as-is to the lab for pulverization and analysis. Each sample will be submitted in a new Ziploc baggie. If a sample cannot be retrieved from the sample the entire core shall be sent to the lab with instructions to cut or pulverize the target portion of the sample. Coatings or sealants on the concrete surface that is not removed by cleaning/pressure washing shall be included in the sample subject to analysis.

6.8 SOIL BORINGS

Soil gas probes and shallow soil borings are expected to be completed using direct-push methods or hand augers. Actual techniques will be selected based on recommendations from the drilling contractor and anticipated subsurface conditions. Procedures for drilling and related tasks are described in the following sections.

6.8.1 Drill Site Preparation

Drill site preparation will involve identifying subsurface utilities; coring or sawing through pavement materials; verifying the absence of subsurface utilities at the boring locations; setting up work zones; providing the containers required to contain waste materials; laying down polyethylene sheeting or equivalent to minimize the post-drilling cleanup operation, and establishing required engineering controls.

To identify subsurface utilities, an oversized "box" will be spray-painted or otherwise marked around each boring/well site. At least 48 hours prior to drilling, Underground Service Alert (USA) will be called to identify subsurface utilities inside and adjacent to the box. To minimize the potential for damaging unmarked buried utilities, an outside utility locating company may be retained to identify any other potential subsurface obstructions using geophysical instruments. The presence of power lines and other overhead features will be taken into consideration prior to drilling or other related activities. If the drill site is paved with concrete or asphalt, it will be cored or saw-cut to provide access to the underlying soil.

The work support zone will be delineated in the field using a combination of orange traffic cones, barricades, and yellow caution tape as necessary. The dimensions of the zone will be established in the field based on site-specific geography. At a minimum, the work zone will be large enough to accommodate the drill rig (if used), any required support vehicles, waste containers, and a sample processing table.

The area around the boring site and beneath the back end of the drill rig, the spoil pile, and the waste containers will be protected by laying down heavy-gauge (10 mil or greater) polyethylene sheeting. While the integrity of this sheeting will almost certainly be compromised during the drilling operations, its presence will help minimize post-drilling cleanup. On completion of drilling operations, the polyethylene sheeting will be rolled up and disposed of along with other miscellaneous solid wastes.

Additional engineering controls during sampling are provided in Closure Plan Appendix G.

6.8.2 Direct-Push Drilling

Shallow soil borings deeper than 3 feet and soil gas probes are expected to be completed using direct push drilling methods with a truck-mounted rig. Direct push refers to tools and sensors that are "pushed" into the ground without the use of drilling to remove soil or to make a path for the tool. A Geoprobe® direct-push rig relies on a relatively small amount of static (vehicle) weight combined with percussion as the energy for advancement. Direct push drilling is one of the faster methods of drilling and sampling shallow borings and does not generate soil cuttings. The Geoprobe® system uses hollow, steel push rods ranging from 1-inch to 3.25-inches in diameter and are typically four feet in length. As the push rod is advanced into the ground, additional lengths of rod are added. Various sampling tools can be attached to the rods to allow for continuous or depth-discrete soil sampling.

6.8.3 Hollow-Stem Auger Drilling

Hollow-stem drilling techniques are not anticipated to be the preferred option, primarily because of cost, although it is capable of producing the desired samples and subsurface information. The hollow-stem auger consists of a hollow, cylindrical cutting head to which cutting blades or fingers, typically tipped with tungsten carbide, are attached. Sections of steel tube, typically 5 feet long, with an external, continuous spiral flight. These sections are added to the drill stem as the boring is advanced. They are attached via threaded joints or bolted connections, with or without O-ring seals. An adapter that rotates the augers and through which a variety of downhole tools can be deployed via one or more winches. A downhole plug prevents soil entering the hollow stem of the augers.

The adapter at the top of the drill stem and auger flight is designed to allow the auger to advance with the plug in place. As the hole is drilled, additional lengths of hollow-stem auger are added. The downhole plug may be removed at any time during drilling to permit disturbed, undisturbed, or core sampling below the bottom of the cutter head while the hollow-stem augers support the boring. This process also permits the use of augering in loose deposits below the water table.

6.8.4 Rotosonic Drilling

Rotosonic drilling utilizes high-frequency resonant energy to advance an outer, temporary conductor casing(s) and an internal core barrel into the underlying formation(s). Hydraulic motors on the drill head oscillate internal unbalanced weights. As a result of the weights being unbalanced, extreme vibrations are created in the drill stem allowing the drill to penetrate virtually any material with minimal side wall disturbance. In addition to the vibration, rotosonic drilling uses both rotation and down pressure of the drill casing to advance the borehole. The core barrel provides a continuous core of subsurface materials, while the conductor casing stabilizes the boring and provides a temporary seal of water-bearing unit(s) during coring. Rotosonic drilling also allows for telescoping of multiple outer conductor casings to seal-off multiple water-bearing units as needed.

6.8.5 Soil Sample Retrieval

Soil samples will be collected for field screening for VOCs, visual classification and chemical analyses. At a minimum, soil samples will be collected for field screening and visual soil classification whenever drilling is performed. The principal requirement for soil sampling is that the samples be representative of the stratum being sampled. Disturbed bulk soil samples, typically collected from the cuttings returned to the surface during drilling, will generally be collected only for field screening and visual soil classification. Relatively undisturbed soil samples can be collected for chemical analyses. Undisturbed samples may be collected using a number of soil sampling devices, the most common of which are as follows:

- Geoprobe® macro core sampler (or similar direct-push brand) (primary method);
- Standard split-spoon sampler (backup method);
- Modified California sampler (backup method); and
- Roto-sonic core barrel.

The Geoprobe® Macro Core Sampler is a closed piston sampler for soil sampling at discrete depths. Its design allows the sampler to remain completely sealed while driven to depth. The sampler recovers a soil sample typically measuring 24 to 48 inches (depending on tube length) in length and 1.5 inch in diameter. The sampler contains either clear acetate liners or PVC, or stainless steel sleeves. At selected depths, the drive tip at the end of the tool is detached and the sampler is advanced by direct push or by using the vibrating hammer to allow undisturbed soil to enter the sampler. After retrieval from the boring, the sampling tool is disassembled, the sample sleeves removed, and plastic caps lined with Teflon foil fitted to each end of the sleeve. Geoprobe sampling will be the primary method of sample collection.

The standard split-spoon sampler, also known as the standard penetration test or SPT, is made up of a cutting shoe, a barrel consisting of a section of tube split lengthwise, and a coupling to attach the spoon to the drill rod. For cohesionless soils, various inserts are available to retain the sample in the tube. Upon sample recovery, the shoe and coupling are unscrewed and the two halves of the barrel opened to expose the soil. Split-spoon sampling is not anticipated to be the preferred option for sample collection.

Modified California samplers are split-barrel drive samplers with a drive shoe at the lower end and a drive head and waste barrel at the upper end. Different length and diameter configurations are available. The most common sampler configuration consists of an 18-inch long sampling barrel, 2.5 inches outside diameter (O.D.), and 2.0 inches inside diameter (I.D.). The split barrel contains three or four thin-walled sample sleeves. The sample sleeves are typically stainless steel and are 2 inches O.D. and 4 to 6 inches in length. The sampler is disassembled on recovery from the boring. The sample sleeves are removed, the ends of the soil sample trimmed flush, and plastic caps lined with Teflon foil fitted to each end of the sleeve. Modified California samplers are not anticipated to be the preferred option for sample collection.

Roto-sonic core barrel collects a continuous sample in a plastic sleeve. The sample remains in the plastic sleeve upon removal from the core barrel and is accessed for conducting field screening, visual inspection and sample retrieval. The core barrel shoe is decontaminated and a new plastic sleeve inserted for each sample run. Roto-sonic drilling is not the preferred technique for soil sampling because of rig availability, limited accessibility and generally low production rates.

Soil samples for chemical analysis will be collected primarily using a Geoprobe® Macro Core Sampler. On recovery of the sampler, the ends of the sample sleeves selected for analysis are capped with plastic end caps lined with Teflon foil. If used, soil samples collected using the modified California sampler will not be extruded from the sample sleeves in the field to minimize the potential for volatization of organic compounds. The soil-filled sample sleeves will be labeled and immediately placed on ice in a cooler. Soil samples for possible chemical analysis will be maintained in a chilled state until delivery to the analytical laboratory (typically on the day of collection). Soil samples for VOC analysis will be collected and preserved immediately upon retrieval of the sampler in accordance with EPA Method 5035A and DTSC Method 5035 Guidance. Specifications for sample preservation and the holding times are summarized in Table 1.

Soil samples to be analyzed for VOC analysis more than four hours after collection (i.e., from a stationary laboratory) will be collected immediately upon sample retrieval using EnCore® or TerraCore® samplers. Specifically, three 5-gram EnCore® samplers will be collected from each 2-inch sleeve for those sample depths selected for the analysis of VOCs using EPA Method 5035/8260B.

6.8.6 Boring Abandonment

Soil borings completed to 20 feet bgs or less will be abandoned using granular bentonite. Bentonite will be placed by hand into the boring from grade and hydrated in place with potable water. Borings that are drilled beyond 20 feet bgs will be abandoned using neat cement grout by the tremie method. A 0.5- to 1-inch diameter tremie pipe will be placed in the borehole, filled with cement grout, and removed in 5- to 10-foot sections to allow the cement to fill the vacated space at the base of the boring. This procedure will be repeated until the boring is backfilled to grade. The following day, the borings will be topped off should the cement within the borings settle overnight.

6.9 SOIL GAS SAMPLES

Soil gas probes (aka soil vapor probes) are expected to be constructed utilizing direct push drilling techniques. The probe depth will be based on lithology such that the sand pack around the probe intercepts a sand layer, and terminates immediately above a fine grain layer, although target depths in all proposed probes is 5 and 15 feet below the ground surface. Final depth

selection will be based on zones with highest PID measurements during drilling and visual observations. Attachment D shows a conceptual detail for a multi-increment gas probe. Proposed soil gas probe locations are provided on Figure 9.1 in the Closure Plan.

Lithologic logs will be prepared for all probe installations. The completed probes will be constructed of 1/8 to ¼ inch tubing that will not react or interact with site contaminants. An appropriate probe tip will be attached to the bottom end. The tip will be installed in the center of a sand pack that is a minimum of one foot thick.

At least one foot of dry bentonite granules will be placed on top of the sand pack and potable water will be added to the top of the dry bentonite granules to form a seal. Then hydrated fine sand mixed with bentonite grout will be added in the boring. The bentonite will be added up to the bottom of the next higher sand pack depth.

The probes will be supported by fastening the probe and tubing to a 1-inch PVC pipe, sealed to prevent cross-contamination or ambient air intrusion. The desired depths for each probe will be marked on the tubing prior to placement in the boring.

Soil gas will be analyzed in the field for the compounds indicated in Table 2.

6.10 SURVEYING

Each boring will be surveyed for location and elevation. Locations will be surveyed to the nearest 0.5 feet relative to the California State Plane Coordinate System using Global Positioning System (GPS) surveying techniques. The ground surface elevation will also be surveyed at each boring. The surveying will be conducted under the supervision of a civil engineer licensed in the State of California. The location of all benchmarks used in the survey, as well as the date of the survey, will be documented.

6.11 DECONTAMINATION PROCEDURES

This section describes the equipment decontamination procedures to be used during the field activities. All solid and liquid wastes will be contained and handled as described in Section 8.0.

All downhole equipment used during drilling and soil sampling will be cleaned thoroughly prior to entry into each borehole. Most equipment, including bits, rods, augers, and cable, will be high-pressure steam cleaned. Sensitive equipment that may be damaged by steam cleaning will be washed and scrubbed in an Alconox detergent solution followed by one potable and one distilled water rinse. Cleaning and decontamination of drilling equipment will be performed prior to commencement of investigation activities, between successive borings, and prior to leaving the site.

Sampling equipment that will be in direct contact with samples for chemical analyses will be disassembled and thoroughly cleaned prior to use by the following procedure:

- wash and scrub the equipment with tap water;
- manual scrub with non-phosphate soap solution;
- tap water rinse;
- 10% nitric acid rinse (if sampling for metals);
- distilled/de-ionized water rinse;
- pesticide grade acetone rinse (if sampling for organics); and,
- air dry.

This cleaning procedure will be repeated between successive sampling attempts to avoid cross-contamination at different depth intervals.

6.12 SOIL PORE-WATER SAMPLES

If closure with hazardous waste-in-place is performed at the Surface Impoundment, the Contingent Post-Closure cost estimate assumes that pore-water samples will be collected quarterly concurrent with groundwater sampling. The cost estimate assumes that two surface Impoundment lysimeters (L-1 and L-2) and one background lysimeter (L-3) will be installed during Phase 2 closure activities. The length of time needed to collect the pore water in the lysimeter depends on the amount of sample needed, the soil type, and soil moisture content. Sampling times can vary from less than 1 hour in wet soil to more than 1 day in drier soil. The maximum pore water collection time will be 24 hours.

If other units are closed with hazardous waste-in-place, a Post-Closure permit application, including Water Quality Monitoring and Response Program will include additional lysimeters as appropriate based on the configuration of the area closed with hazardous waste-in-place and the nature of the contaminants remaining in-place. Samples will be collected quarterly concurrent with groundwater sampling.

If soil conditions are unconducive to soil pore-water sampling (i.e., sample collection is unsuccessful for four consecutive quarters), soil pore-water sampling will be terminated.

6.13 SURFACE WATER

For units closed with hazardous waste-in-place, and a reasonable potential exists for surface water to erode and mobilize waste materials (i.e., the waste is exposed to surface water), the Water Quality Monitoring and Response Program required as part of the Post-Closure permit application will include surface water sampling at the discharge point for the drainage area of the unit(s) which is closed with hazardous waste-in-place. The sampler will approach the sampling point from downstream and will avoid disturbing any sediments on the surface. The laboratory supplied sample container will be placed in the water flow until full.

~~6.14 CONCRETE CHARACTERIZATION~~

~~If concrete will be crushed during Phase 2 Closure and utilized as backfill, the crushed concrete will be stockpiled in 500 cy piles. A 5 point composite sample will be collected from the pile and homogenized in a disposable pan and disposable scoop or decontaminated trowel. A representative sample will be placed in the laboratory supplied sample container.~~

~~6.15~~6.14 HDPE SAMPLES

Geomembrane samples will be collected from the primary and secondary geomembrane of the Stormwater Surface Impoundment liner system. Sampling will be conducted concurrent with soil sampling. The geomembrane will be cut with a utility knife to the size desired to allow soil sampling, and placed in the sample container. The geomembrane samples will be collected at every soil sample location, but will be analyzed once per 650 sf.

If needed, HDPE samples will be collected at HDPE pipe and manhole locations where wipe samples did not meet the performance standard. HDPE samples will be collected by scraping, grinding or cutting adequate sample volume from the HDPE surface to a depth of approximately 0.2 inches. HDPE pipe and manhole samples will be at the same location as the wipe sample; however, the same area may be expanded to obtain adequate volume for lab analysis.

6.15 ENGINEERING CONTROLS

Additional detail regarding engineering controls during sampling are provided in Closure Plan Appendix G (Engineering Controls Plan).

7.1 SAMPLE CONTAINERS PRESERVATION AND STORAGE

Sample quantities, types, and locations will be determined before the actual fieldwork commences. The field sampler will be responsible for the care and custody of the samples until properly transferred. Protective gloves will be worn at all times when handling samples and are required to be changed prior to handling different samples. For example, when handling soil samples retrieved from the drill rig, gloves should be changed before handling the next set of samples from a deeper interval. Also, gloves should be changed when the field personnel's tasks change (i.e., going from decontamination activities to soil sampling activities, etc.).

Sample custody begins with the shipment of the empty sampling containers to the site. All sample containers are shipped from the laboratory in sealed coolers or cartons with appropriate tamper-proof seals and custody documentation. Custody transfer will be documented on the chain-of-custody form. Each sample will be labeled and properly sealed immediately upon collection.

Samples for VOC analysis shall be collected in accordance with DTSC's *Guidance Document for the Implementation of United States Environmental Protection Agency Method 5035: Methodologies for Collection, Preservation, Storage, and Preparation of Soils to be Analyzed for Volatile Organic Compounds*, or DTSC Method 5035 guidance dated November 2004.

7.2 WIPE SAMPLES

Wipe samples for chemical analyses will be placed in clean zip lock bags, sealed and placed on ice to await shipment to the laboratory for analysis. The zip lock bag will be labeled with required sample collection information including unique sample identification, date and time of collection and sampler name.

7.3 RINSATE SAMPLES

Rinsate samples for metals analysis will be collected into laboratory-supplied sample containers. See Table 1.

7.4 CHIP SAMPLES AND CORE SAMPLES

Chip and core samples for laboratory analysis (except for VOC analysis) shall be placed in laboratory-supplied sample containers and placed on ice. Chip or core samples proposed for VOC analysis shall be collected using an EnCore® or Terra Core® samplers, or pre-tared VOA vials capped with PFTE-lined septums.

7.5 SOIL SAMPLES

Soil samples for chemical analyses are collected using primarily the modified California sampler or Geoprobe® Macro Core Sampler. Soil samples collected for VOC analysis will be collected immediately upon retrieval of the sampler in accordance with EPA Method 5035A and DTSC's *Guidance Document for the Implementation of United States Environmental Protection Agency Method 5035: Methodologies for Collection, Preservation, Storage, and Preparation of Soils to be Analyzed for Volatile Organic Compounds* (DTSC Method 5035 Guidance), dated November, 2004. Discrete samples will be placed in the sample container. Homogenization will not be conducted. Specifications for sample preservation and the holding times are summarized in Table 1. The selection of soil samples for VOC analysis will be based on targeted depths and, in the field, based on possible indications of contamination. Indications could include discoloration, odor, PID screening, and the like. DTSC currently requires EPA Method 5035A for collection of samples for analysis of volatile compounds. Soil samples to be analyzed more than four hours after collection (i.e., from a stationary laboratory) will be collected immediately upon sample retrieval using EnCore® or Terra Core® samplers. Specifically, three 5-gram EnCore® samplers will be collected from each 2-inch sleeve for those sample depths selected for the analysis of VOCs using EPA Method 5035/8260B.

7.6 SOIL GAS SAMPLES

Soil gas samples collected for field analysis shall be collected from the sample tube using a 100 ml to 200 ml syringe. From the syringe, the sample may be injected directly into the GC for analysis or transferred into a Tevlar bag and then introduced into the GC for analysis.

If laboratory analysis is desired for soil gas samples, the sample shall be collected directly into a Summa canister as indicated in Table 1 and delivered under chain of custody to CalScience Laboratories, a California Department of Public Health certified laboratory.

On-site mobile laboratory analysis will be performed by H&P Mobile Geochemistry Inc.

7.7 SOIL PORE-WATER SAMPLES

Soil pore-water samples if required as part of Contingent Post-Closure will be collected into laboratory supplied sample containers. Table 1 provides preservatives and holding times.

7.8 SURFACE WATER

Surface water samples if required as part of Contingent Post-Closure will be collected into laboratory supplied sample containers. Table 1 provides preservations and holding times.

7.9 CONCRETE CHARACTERIZATION

Characterization samples of crushed concrete, if concrete is crushed during Phase 2 Closure, will be placed in laboratory supplied sample containers. Table 1 provides preservatives and holding times.

7.10 GEOSYNTHETIC SAMPLES

Geosynthetic samples will be collected into new zip lock bags or laboratory supplied sample containers. Table 1 provides preservations and holding times.

8.0 DISPOSAL OF RESIDUAL MATERIAL

Investigation-derived wastes (IDWs) likely to be generated during site investigative activities include soil and water containing metals and VOCs. Soil cuttings generated during drilling operations will likely be containerized at each of the boring locations in either 20-cubic yard roll-off bins with polyethylene liners or in United Nations (UN)-approved 55-gallon steel drums. Decontamination rinsate will likely be stored in 55-gallon drums or 250 +/- gallon DOT approved polyethylene totes. Discrete samples of each solid waste type will be collected from each bin or drum and combined, by equal volume, into a single composite sample on-site or at the analytical laboratory. Water samples will be sent to the on-site wastewater treatment plant or temporary wastewater treatment plant and processed with facility liquids. If the wastewater treatment systems are no longer operational, the water will be characterized and sent for off-site disposal and an appropriately permitted facility.

The excess soil and residual solids (such as excess chip sample material) samples will be submitted for VOC analysis using EPA Method 8260B and analyzed for metals following Toxicity Characteristic Leaching Procedure (TCLP) and/or STLC extraction methods or other parameters as specified by the disposal or recycling facility. Disposal options will be considered by Exide based on the results of these analyses and subsequent profiling of the wastes. Exide will arrange transportation and disposal of the IDWs, as appropriate.

Additional detail regarding management of wastes is provided in Closure Plan Appendix G (Engineering Controls Plan).

9.1 SAMPLE DOCUMENTATION AND SHIPMENT

This section describes procedures for sample custody that will be followed for sample collection, transfer, analysis, and disposal throughout the investigation. The purpose of these procedures is to assure that the integrity of samples is maintained during their collection, transportation, and storage prior to analysis. Sample identification documents will be carefully prepared so that identification and chain-of-custody records can be maintained and sample disposition can be controlled. Forms and labels will be filled out with waterproof ink. Identification documents that will be used during the investigations are sample labels and chain-of-custody forms samples of the documents are presented in Attachment C.

9.2 FIELD NOTES

Field logbooks will be used to record daily activities as they relate to the progress of the investigation. Completed field logbooks will be provided to the Project Manager in a timely manner and will be retained in the project files according to the project number for that task. All entries must be legible, in ink, and primarily factual in content. Field observations can be entered but should be noted accordingly. At a minimum, field logs will include the following:

- Project name and number
- Site name and location
- Arrival and departure date/time
- Name and affiliation of personnel onsite, and personnel contacted
- Author name and date
- Field instrument calibration methods and identification number
- Chronology and location of activities
- Sampling locations on site map
- Sample identification numbers, amount collected, sampling method, and container (size/type) for each sample collected, including QC samples. Sample processing techniques such as filtration, compositing, and preservation techniques should be noted.
- Date and time of sample collection
- Name of sampler
- Field observations and applicable comments
- Number of shipping coolers packaged and sent
- Name and address of all receiving laboratories
- Any modifications or deviations from the Closure Plan or the SAP.
- Weather conditions
- Names and titles of visitors
- Equipment used onsite
- Type of activity
- Level of personal protective equipment

The calibration data included on the daily field log should include the date and time that each instrument was calibrated, name of the person performing the calibration, the type and model number of the instrument being calibrated, the strength of the calibration media (if applicable), and the instrument readings during the calibration.

9.3 SAMPLE LABELS

Sample labels are necessary to prevent misidentification of samples. Preprinted sample labels will be provided. Where necessary, the label will be protected from water and solvents with clear label-protection tape. Each label contains the following information:

- Project name
- Project number
- Name of collector
- Date and time of collection
- Field identification number or sample identification number
- Preservative used (if applicable)
- Analyses required

9.4 CHAIN OF CUSTODY

A chain-of-custody record will be filled out and accompany every sample to the laboratory to establish the documentation necessary to trace sample possession from the time of collection. A copy of the chain-of-custody form will be retained in the investigation files according to project/task number. An example chain-of-custody form is shown in Attachment C. The following information will be recorded on the form:

- Sample number or identifications
- Name of sampler(s)
- Signature of collector, sampler, or recorder
- Location of project
- Project manager's name
- Date of collection
- Place of collection (site location)
- Sample type
- Analyses requested
- Inclusive dates of possession
- Signature of person receiving sample
- Laboratory sample number, where applicable
- Date and time of sample receipt

9.5 SAMPLE PACKAGING AND SHIPMENT

Samples will always be accompanied by a chain-of-custody record. When transferring samples, the individuals relinquishing and receiving the samples will sign and date the chain-of-custody record. During the sampling procedure, the sample coolers and samples will remain in the control of the field sampling team at all times. Should the samples be left unattended, the samples will be stored in a secure area of the site to which only the field sampling team has access.

Samples will be packaged properly for shipment, including isolation of samples thought to have high chemical concentrations, and dispatched to the appropriate laboratory for analysis. Samples will be placed on ice, if necessary, using double-bagged ice. Ice should also be placed on top of the samples. Label coolers correctly with "Fragile" and "This-End-Up" labels, as appropriate. Hazardous materials labels may be required if the coolers are being shipped by common carrier. Custody seals are not deemed necessary when the samples will be in continuous possession of technical or laboratory personnel. Custody seals will be used when samples are shipped via courier service. The chain-of-custody record will accompany each shipment. The method of shipment, courier name(s), and other pertinent information will be entered in the chain-of-custody record. A copy of the chain-of-custody record will be retained by the sampler and forwarded to the Project QA Manager for review and filing. The project personnel or designated couriers will transport the coolers to the analytical laboratories.

9.5.1 Laboratory Custody Procedures

A laboratory designated sample custodian will accept custody of the shipped samples and verify that the information on the sample label matches that on the chain-of-custody form(s). Pertinent information as to sample condition upon receipt, method of shipment, pickup and delivery, and courier will also be checked on the chain-of-custody form(s). The custodian will then enter the appropriate data into the laboratory sample tracking system. The laboratory custodian will use the sample number on the sample label or assign a unique laboratory number to each sample. The custodian will then transfer the sample(s) to the proper analyst(s) or store the sample(s) in the appropriate secure area. The laboratory will also check the temperature of the sample cooler upon arrival. The laboratory will ensure that all laboratory analysis is performed within the prescribed holding times.

Laboratory personnel will be responsible for the care and custody of samples from the time they are received until they are exhausted. Data sheets and laboratory records will be retained by the laboratory as part of the permanent documentation for a period of at least 3 years.

9.5.2 Sample Storage and Disposal

Samples and extracts will be retained by the analytical laboratory for up to 30 days after the data are reported by the laboratory. Unless notified otherwise by the Project Manager, excess or unused samples should be disposed by the laboratory in a manner consistent with appropriate methods adopted by the laboratory.

10.1 QUALITY CONRTOL

10.2 FIELD QUALITY CONTROL SAMPLES

This section describes procedures for collecting QC samples in the field. Other field QC procedures, such as field instrument calibration and equipment decontamination, are described elsewhere in this SAP.

10.2.1 Field Duplicate Samples

At a minimum, field duplicates of wipe, rinsate, geosynthetic, chip, core and soil samples will be collected at a rate of 5 percent of the samples collected per sampling event. Field duplicate samples will be collected, preserved, packaged, labeled, and sealed in a manner identical to the other samples being collected. Field duplicates will be collected from areas where moderate to high levels of contamination are anticipated. Duplicate samples will be analyzed for the same target analytes as the original sample.

10.2.2 Equipment Decontamination Blanks

Equipment decontamination blanks will be collected from the final rinse water from equipment decontamination. The blank is prepared in the field by pouring or pumping deionized water through the sampling equipment and into the appropriate sample containers after equipment decontamination. The decontamination blank serves as a check to verify the effectiveness of the decontamination procedures. An equipment decontamination blank will be collected at a target frequency of one per day. Decontamination blanks will be analyzed for all target analytes submitted for analysis on that day.

10.2.3 Field Blanks

A field blank consists of organic-free water supplied by the analytical laboratory and is prepared in the field by pouring an appropriate volume of water from a contaminant-free container into the sample container without contacting sampling equipment. The field blank serves as a measure of sample contamination resulting from ambient field/site conditions, such as fugitive dust or vapors. Field blanks shall be collected on days when VOC sampling is being performed and no equipment blanks are being collected.

10.2.4 Trip Blanks

Trip blanks will consist of a container of organic-free water supplied by the analytical laboratory in the cooler in which the empty sample containers are shipped. The trip blank sample accompanies the empty sample containers to the field and is then returned, unopened, to the laboratory along with the field samples. One trip blank will be placed in each cooler that

contains aqueous samples for VOC analyses. Trip blanks will be submitted for VOC analyses only.

10.2.5 Water Supply Blanks

The water used to decontaminate equipment will likely be obtained from the local municipal water supply. As the local municipal water supply may contain VOCs or metals, water supply blank samples will be collected and analyzed at the start of sampling activities and prior to utilizing any new water supply system. The water supply blanks will be analyzed for VOCs and metals.

10.3 LABORATORY QUALITY CONTROL SAMPLES

Two types of QC checks will be employed to evaluate the performance of a laboratory's analytical procedures. The QC checks represent the controlled samples introduced into the sample analysis stream and are used to evaluate the accuracy and precision of the chemical analysis program. The QC check samples will be introduced or analyzed based on the size of sample lots. A sample lot or batch will consist of greater than zero but fewer than 20 samples that are extracted and analyzed as a batch by the laboratory. Laboratory quality control (QC) samples will be collected in double volume (or triple volume if required by the laboratory method) at a frequency of 1 per 20 samples. These additional sample containers will be labeled "for matrix spike/matrix spike duplicate (MS/MSD) analysis" and will be used by the laboratory for their internal quality control. Samples for laboratory QC will be selected from locations where low levels of contamination are expected based on the available historical data. Samples with low levels of contamination are preferred for laboratory QC samples to minimize the possibility of diluting out the spike to a concentration below the quantitation limit. Laboratory QC samples will be designated on the chain-of-custody record and in the field logbook.

10.3.1 Method Blank/Reagent Blank

A laboratory-grade water blank is analyzed, along with all aqueous and non-aqueous samples submitted for analyses. The method/reagent blank is processed through all procedures, materials, reagents, and labware used for sample preparation and analysis. The frequency for method blank preparation and analysis is a minimum of 1 per 20 field samples or per analytical batch, whichever is most frequent. For VOC analysis by EPA Method 8260, the frequency for method blanks is 1 per every 12 hours of sample analysis, or 1 per 20 samples, whichever is more frequent. An analytical batch is defined as a maximum of 20 samples from one project that are analyzed together with the same method sequence, the same lots of reagents, and with the manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch are to be of similar composition or matrix. Calibration blanks are required for metals analysis to establish the analytical curve.

10.3.1.1 **Calibration Standards (Initial Calibration)**

The calibration standard is prepared in the laboratory by dissolving a known amount of pure (nominally 100 percent) analyte in an appropriate matrix. The final concentration calculated from the known quantity is the true value of the standard. All calibration standards must be traceable to certified reference materials or certified check standards. The results obtained from these standards are used to generate a standard curve, which can be used to quantify the compound in the environmental sample. Calibration standards at a minimum of five concentration levels and a blank will be used in generating a calibration curve for all organic analyses. With the exception of the mercury analysis, a minimum of three calibration standards and a blank will be used to generate a calibration curve for all inorganic analyses. A four-point calibration curve is required for mercury analysis. For organic analyses, a relative standard deviation (RSD) of the calibration factor (defined in method) of less than 20 percent over the working range of the curve is required before initial calibration is accepted. For inorganic analyses, a minimum correlation coefficient of 0.995 (using linear regression analysis) must be achieved before the initial calibration curve is considered linear and accepted.

10.3.1.2 **Check Standard (Continuing/Daily Calibration)**

The check standard is prepared in the same manner as a calibration standard. The final concentration calculated from the known quantity is the true value of the standard. The check standard result is used to monitor the continuing validity of an existing calibration curve or concentration calibration standard file. The check standards are known as the "continuing calibration verification standards". Continuing calibration standards must satisfy method-specific QC requirements prior to initiation of sample analysis.

To verify the accuracy of the analytical system at the low concentration end of the calibration curve, a second type of check standard is prepared at a concentration of two to five times the instrument detection limit and analyzed at the beginning (after calibration) and end of the day or analytical "run". The laboratory will have the option of analyzing two low-level standards as described above or analyzing a mid-level standard every 10 samples as described in SW-846 Method 8000 for GC analysis. The criteria for the two low-level standards are that the response for each analyte must not exceed a 15 percent difference when compared to the continuing/daily response.

For inorganic analysis, the check standards outlined in the associated methods must be analyzed and the standards must pass the criteria outline in the associated methods.

10.3.2 Laboratory Duplicates

Aliquots (e.g., subsamples) are made in the laboratory from the same sample, and each aliquot is treated exactly the same throughout the analytical method. The RPD between the values of the duplicates, as calculated below, is taken as a measure of the precision (reproducibility) of the analytical method:

$$RPD = \frac{2(D_1 - D_2)}{D_1 - D_2} \times 100$$

Where:

RPD = relative percent difference
D_1 = first sample value
D_2 = second sample value (duplicate)

The duplicate is a measure of the precision of the laboratory sampling (i.e., aliquoting) and analysis procedure and of the homogeneity of the sample matrix as provided to the laboratory. Laboratory duplicates will be analyzed at a minimum frequency of 1 per 20 samples or per analytical batch.

10.3.3 Laboratory Control Sample (LCS)

LCS analyses (sometimes referred to as Method Control Samples (MCS)) are spikes on blank matrix to assess accuracy independent of matrix effects. These matrices are deionized water for water samples and reagent sand for soil samples. The LCS is prepared by adding a known amount of target analyte to the matrix. If LCS analyses do not meet the recovery criteria, the LCS sample will be reanalyzed to determine if the failure is due to a transient instrumental condition. If the second analysis does not meet the recovery criteria, the LCS and the entire analytical batch will be re-extracted and reanalyzed within the holding time.

10.3.4 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

A sample matrix spike is prepared by adding a known amount of the pure analyte to the environmental sample before extraction/digestion. The added analyte is the same as the analyte being assayed for in the environmental sample. An analytical spike is prepared by adding a known amount of analyte(s) to a known amount of sample digestate or extract. Background and interferences having an effect on the actual sample analyte will have a similar effect on the spike. The calculated percent recovery of the matrix spike is considered to be a measure of the relative accuracy of the total analytical method (i.e., sample preparation and analysis). The calculated percent recovery of the analytical spike is considered to be a measure of the relative accuracy of the sample analysis procedure only. The matrix spike, the surrogate spike, and the analytical spike are also measures of the effect of the sample matrix on the ability of the methodology to detect specific analytes. When there is no change in volume due to the spike, percent recovery is calculated as follows:

$$R = 1OO(A-X)/T$$

Where:

R = percent recovery
A = measured analyte concentration after the spike is added
X = measured analyte concentration in the sample before the spike is added
T = value of spike

Tolerance limits for acceptable percent recoveries are established in the referenced methods and are summarized in the Laboratory QA Manual (Appendix B). Project-specific QC acceptance limits may be established on a parameter-specific basis for each analysis method if, after sufficient data have been compiled, it is apparent that different limits than those specified in the referenced methodology should be applied. Matrix spikes will be analyzed at a minimum frequency of 1 per 20 samples of similar matrix or analytical batch. Analytical spikes and surrogate spikes are required for every sample for some analysis routines and specific methods.

For organic analyses, matrix spike duplicate samples are required at a specified frequency of 1 per 20 samples. A matrix spike duplicate is prepared from a second aliquot of the sample that was analyzed as the matrix spike. The relative percent difference (RPD) between the matrix spike and the matrix spike duplicate for each spike analyte must be reported.

10.3.5 Surrogate Spikes

Surrogate spikes are used to evaluate whether laboratory equipment is operating within the prescribed limits of laboratory QC and are checked by the laboratory for accuracy and proper chemical identification. Surrogate spikes will be added, as appropriate, for organic analyses to all blanks, standards, and environmental samples.

11.0 FIELD VARIANCE

Any deviations from the SAP that may have generated results inconsistent with the DQOs will be discussed with the Project Manager and reconciled appropriately. Any limitations of the data and the corresponding final resolutions will be included in the QA section of the reports.

12.0 REFERENCES

Advanced GeoServices Corp, 2012, Revised *Current Conditions Report*.

California Department of Water Resources, 1990, Water Well Standards: State of California Bulletin 74-81 and Supplement 74-90.

U.S. Environmental Protection Agency, 2004, *Test Methods for Evaluating Solid Waste - Physical/Chemical Methods (SW-846*), Revision 6, Office of Solid Waste.

U.S. Environmental Protection Agency, 2002, *National Functional Guidelines for Inorganic Data Review, EPA 540-R-01-008*, Office of Emergency and Remedial Response

U.S. Environmental Protection Agency, 2001, *USEPA Requirements for Quality Assurance Project Plans*, (EPA QA/R-5), EPA/240/B-01/002, Office of Environmental Information.

U.S. Environmental Protection Agency, 1999, *National Functional Guidelines for Organic Data Review*, EPA540/R-99/008, Office of Emergency and Remedial Response

U.S. Environmental Protection Agency, 1983, *Methods for Chemical Analysis of Water and Wastes*, PB84-128677, Office of Research and Development.

U.S. EPA, 2006, 'Guidance for the Data Quality Objectives Process', (EPA QA/R-5), EPA/600/R-96/055.

Date: July 2015

TABLES

Date: July 2015

TABLE 1
SAMPLE PRESERVATION, HOLDING TIMES,
AND CONTAINER REQUIREMENTS
Closure Plan Sampling and Analysis Plan
Exide Technologies - Vernon Smelter

ANALYSIS	MATRIX	CONTAINER	PRESERVATIVE	HOLDING TIME LIMIT
Total Metals	Solid	4 oz jar	Cool, 4ºC	180 days; Mercury 28 days
STLC Metals	Solid	4 oz jar	Cool, 4ºC	180 days; Mercury 28 days
Total VOCs	Solid (soil)	Terra Core (3 minimum)	Cool, 4ºC	48 hours; 14 days if transferred to preserved vial
STLC VOCs	Solid (soil)	4 oz jar	Cool, 4ºC	14 days
pH	Solid	4 oz jar	Cool, 4ºC	24 hr
Moisture Content	Solid	4 oz jar	Cool, 4ºC	10 days
Total PAHs	Solid	8 oz jar	Cool, 4ºC	14 days to extraction, 40 days from extraction to analysis
STLC PAHs	Solid	8 oz jar	Cool, 4ºC	14 days to STLC leach, 7 days to extraction for leachate, 40 days from extraction to analysis~~14 days to extraction, 40 days from~~
Total Dioxin/Furans	Solid	8 oz amber jar	Cool, 4ºC	30 days to extraction, 45 days from extraction to analysis
STLC Dioxin	Solid	4 oz jar	Cool, 4ºC	30 days to extraction, 45 days from extraction to analysis
Total PCBs	Solid	4 oz jar	Cool, 4ºC	14 days to extraction, 40 days from extraction to analysis
Total Metals	Wipe	2-Gauze wipesw/ DI water	Cool, 4ºC	180 days; Mercury 28 days, two wipes required if requesting Mercury
Appendix IX Total Metals	Aqueous	500 mL HDPE	HNO3 to pH < 2	180 days (except mercury, 28 days)
Appendix IX Dissolved Metals	Aqueous	500 mL HDPE	HNO3 to pH < 2	180 days (except mercury, 28 days)
STLC Metals	Aqueous	1 liter HDPE	Cool, 4ºC	180 days; Mercury 28 days
Appendix IX VOCs	Aqueous	3 40 ml VOA vials	HCL, pH<2, Cool, 4ºC	14 days
Appendix IX SVOCs	Aqueous	2 1-liter amber	Cool, 4ºC	7 days to extraction, 40 days to analysis
pH	Aqueous	500 mL HDPE	Cool, 4ºC	Analyze Immediately
Turbidity	Aqueous	125 ml HDPE	Cool, 4ºC	48 hours
Sulfate	Aqueous	500 mL HDPE	Cool, 4ºC	28 days
Cyanide	Aqueous	500 mL HDPE	NaOH, Cool, 4ºC	14 days
Organochlorine Pesticides	Aqueous	2 1-liter amber	Cool, 4ºC	7 days to extraction, 40 days to analysis
Herbicides	Aqueous	2 1- liter amber	Cool, 4ºC	7 days to extraction, 40 days to analysis
PCBs	Aqueous	2 1-liter amber	Cool, 4ºC	7 days to extraction, 40 days to analysis
Total VOCs	Solid (concrete, asphalt)	4 oz jar	Cool, 4ºC	14 days
STLC VOCs	Solid (concrete, asphalt)	4 oz jar	Cool, 4ºC	14 days
VOCs	Soil gas	1 liter canister	Ambient	30 days
VOCs	Soil gas	100 ml to 200 ml syringe	Ambient	48 hour

Formatted Table

TABLE 2
SUMMARY OF LABORATORY METHODS
AND QUALITY ASSURANCE GOALS
Closure Plan Sampling and Analysis Plan
Exide Technologies - Vernon Smelter
Los Angeles, California

SAMPLE TYPE	LOCATION TYPE	ANALYSIS	METHOD	PRECISION[1]	ACCURACY[1]
Wipe	All	CAM-17 Total Metals	SW-846 6010 B/C & 7471A	20	75-125
Soil	All	CAM-17 Total Metals	SW-846 6010 B/C & 7471A	20	75-125
		CAM-17 STLC Metals	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET) ; SW-846 6010B/C & 7470A	20	75-125
		pH	SW-846 Method 9045D	20	75-125
		Moisture Content	ASTM D2216	20	N/A
Soil	Sumps, Inground Units, Surface Impoundment (2 samples each)	Appendix IX Total VOCs	SW-846 8260B/C	20	80-120
		Appendix IX STLC VOCs	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); SW-846 8260B/C	20	80-120
Soil	Surface Impoundment (4 samples)	Total Dioxin/Furan	SW-846, Method 8280A/8290A	25	80-140
		STLC Dioxin	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); SW-846 8280A/8290A	25	80-140
Soil	Surface Impoundment (2 samples)	Total PAH	SW-846 8270C/D	20	in-house limits[2]
		STLC PAH	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); SW-846 8270C/D	20	in-house limits[2]
Soil	Beneath PCB transformer	Total PCB	SW-846 8082/8082A	25	50-135
Chip/Core	Secondary Containment Area, tank pedestal	CAM-17 Total Metals	SW-846 6010 B/C & 7471A	20	75-125
		CAM-17 STLC Metals	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); SW-846 6010B/C & 7470A	20	75-125
Chip/Core	Sump	CAM-17 Total Metals	SW-846 Method 6010 B/C & 7471A	20	75-125
		CAM-17 STLC Metals	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); EPA 6010B/C & 7470A	20	75-125
		Appendix IX Total VOCs	SW-846 8260B/C	20	80-120
		Appendix IX STLC VOCs	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); SW-846 8260B/C	20	80-120
Chip/Core	Reverb Furnace (36), Blast Furnace (37), Blast Furnace Feed Room (34) - 4 samples each	CAM-17 Total Metals	SW-846 6010 B/C & 7471A	20	75-125
		CAM-17 STLC Metals	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); SW-846 6010B/C & 7470A	20	75-125
		Appendix IX Total VOCs	SW-846 8260B/C	20	80-120
		Appendix IX STLC VOCs	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); SW-846 8260B/C	20	80-120
		Total PAH	SW-846 8270C/D	20	in-house limits[2]
		STLC PAH	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET);SW-846 8270C/D	20	in-house limits[2]
		Total Dioxin/furan	SW-846, Method 8280A/8290A	25	80-140
		STLC Dioxin	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); SW-846 8280A/8290A	25	80-140
Chip/Core	Beneath PCB transformer	Total PCB	SW-846 8082/8082A	25	50-135
Geosynthetic	All	CAM-17 Total Metals	SW-846 6010 B/C & 7471A	20	75-125
		CAM-17 STLC Metals	CAC, Title 22, § 66261.126, App. II Waste Extraction Test, (WET); SW-846 6010B/C & 7470A	20	75-125
Concrete Characterization	All	CAM-17 Total Metals	SW-846 6010 B/C & 7471A	20	N/A
Soil Gas	All	VOCs	8260B	N/A	N/A
			EPA Method TO-15 (10% of samples)	N/A	N/A
Groundwater, Surface Water, Pore Water	Quarterly	Metals (dissolved As, Cd, Pb, Zn)	SW-846 6010B/C & 7470A	20	75-125
		Appendix IX VOCs*	SW-846 8260B/C	20	80-120
		Sulfate	EPA 300.0	20	75-125
		Turbidity	SM 2130B (EPA 180.1)	20	75-125
		pH	SM4500 H+B	20	75-125
Groundwater	Annual	Total Cyanide	SM 4500-CN E or SW-846 9010C/9014	20	75-125
		Appendix IX metals	SW-846 6010B/C, 7470A	20	75-125
		Appendix IX VOCs*	SW-846 8260B/C	20	80-120
		Appendix IX SVOCs*	SW-846 8270C/D	21	in-house limits[2]
		Organochlorine Pesticides	SW-846 8081A/B	25	50-135
		chlorinated herbicides	SW-846 8151A	30	30-130
		PCBs	SW-846 8082/8082A	20	50-135
		Sulfate	EPA 300.0	20	75-125
		Turbidity	SM 2130B (EPA 180.1)	20	75-125
		pH	SM4500 H+B	20	N/A
Surface Water, Pore Water	Annual	Total cyanide	SM4500 –CN E or SW-846 9010C/9014~~SM4500 H+B or SW-846~~	20	75-125
		~~Total~~	SW-846 6010B/C, 7470A	20	75-125
		Appendix IX VOCs*	SW-846 8260B/C	20	80-120
		Appendix IX SVOCs*	SW-846 8270C/D	20	in-house limits[2]
		Sulfate	EPA 300.0	20	75-125
		Turbidity	SM 2130B (EPA 180.1)	20	75-125
		pH	SM4500 H+B	20	N/A
Equipment Rinsate	All	CAM-17 Total Metals	SW-846 6010 B/C & 7470A	20	75-125

Notes
SW-846 - USEPA "SW-846 Test Methods for Evaluating Solid Wastes - Physical/Chemical Methods" Revision 6, November 2004.
MCAWW - USEPA "Methods of Chemical Analysis of Water and Wastes", March 1983.
A percent completeness goal of 90% has been set for the laboratory analytical results.
[1] Initial laboratory control limits.
[2] Laboratory Control limits generated for individual compounds using statistical data.
* Appendix IX parameter list excluding herbicides, pesticides, pcb, dioxins and furans.
N/A - Not applicable to methodology

Formatted Table

TABLE 3
REPORTING LIMITS
Closure Plan Sampling and Analysis Plan
Exide Technologies, Vernon, California

COMPOUND	METHOD	CAS	AQUEOUS			SOLID		
			UNIT	MDL	RL	UNIT	MDL	RL
Volatile Organic Compounds								
1,1,1,2-Tetrachloroethane	EPA 8260B	630-20-6	ug/L	0.4	1	ug/kg	0.24	1.0
1,1,1-Trichloroethane	EPA 8260B	71-55-6	ug/L	0.3	1	ug/kg	0.23	1.0
1,1,2,2-Tetrachloroethane	EPA 8260B	79-34-5	ug/L	0.41	1	ug/kg	0.35	2.0
1,1,2-Trichloroethane	EPA 8260B	79-00-5	ug/L	0.38	1	ug/kg	0.35	1.0
1,1-Dichloroethane	EPA 8260B	75-34-3	ug/L	0.28	1	ug/kg	0.21	1.0
1,1-Dichloroethene	EPA 8260B	75-35-4	ug/L	0.43	1	ug/kg	0.35	1.0
1,2,3-Trichloropropane	EPA 8260B	96-18-4	ug/L	0.64	5	ug/kg	0.83	2.0
1,2,4-Trichlorobenzene	EPA 8260B	120-82-1	ug/L	0.5	1	ug/kg	0.31	2.0
1,2-Dibromo-3-Chloropropane	EPA 8260B	96-12-8	ug/L	1.2	5	ug/kg	1.7	5.0
1,2-Dibromoethane	EPA 8260B	106-93-4	ug/L	0.36	1	ug/kg	0.26	1.0
1,2-Dichlorobenzene	EPA 8260B	95-50-1	ug/L	0.46	1	ug/kg	0.23	1.0
1,2-Dichloroethane	EPA 8260B	107-06-2	ug/L	0.24	0.5	ug/kg	0.31	1.0
1,2-Dichloropropane	EPA 8260B	78-87-5	ug/L	0.42	1	ug/kg	0.44	1.0
1,3,5-Trimethylbenzene	EPA 8260B	108-67-8	ug/L	0.28	1	ug/kg	0.55	2.0
1,3-Dichlorobenzene	EPA 8260B	541-73-1	ug/L	0.4	1	ug/kg	0.18	1.0
1,4-Dichlorobenzene	EPA 8260B	106-46-7	ug/L	0.43	1	ug/kg	0.22	1.0
2-Butanone	EPA 8260B	78-93-3	ug/L	2.2	10	ug/kg	3.8	20
2-Hexanone	EPA 8260B	591-78-6	ug/L	2.1	10	ug/kg	1.8	20
4-Methyl-2-Pentanone	EPA 8260B	108-10-1	ug/L	4.4	10	ug/kg	4.3	20
Acetone	EPA 8260B	67-64-1	ug/L	10	20	ug/kg	6.2	50
Acetonitrile	EPA 8260B	75-05-8	ug/L	1.1	20	ug/kg	2.5	100
Acrolein	EPA 8260B	107-02-8	ug/L	14	50	ug/kg	12	100
Acrylonitrile	EPA 8260B	107-13-1	ug/L	8	20	ug/kg	3	100
Allyl Chloride	EPA 8260B	107-05-1	ug/L	0.81	20	ug/kg	0.67	100
Benzene	EPA 8260B	71-43-2	ug/L	0.14	0.5	ug/kg	0.13	1.0
Bromodichloromethane	EPA 8260B	75-27-4	ug/L	0.21	1	ug/kg	0.23	1.0
Bromoform	EPA 8260B	75-25-2	ug/L	0.5	1	ug/kg	0.79	5.0
Bromomethane	EPA 8260B	74-83-9	ug/L	3.9	10	ug/kg	9.4	20
c-1,2-Dichloroethene	EPA 8260B	156-59-2	ug/L	0.48	1	ug/kg	0.28	1.0
c-1,3-Dichloropropene	EPA 8260B	10061-01-5	ug/L	0.25	0.5	ug/kg	0.25	1.0
Carbon Disulfide	EPA 8260B	75-15-0	ug/L	0.41	10	ug/kg	0.31	10
Carbon Tetrachloride	EPA 8260B	56-23-5	ug/L	0.23	0.5	ug/kg	0.28	1.0
Chlorobenzene	EPA 8260B	108-90-7	ug/L	0.17	1	ug/kg	0.22	1.0
Chloroethane	EPA 8260B	75-00-3	ug/L	2.3	5	ug/kg	1.5	2.0
Chloroform	EPA 8260B	67-66-3	ug/L	0.46	1	ug/kg	0.24	1.0
Chloromethane	EPA 8260B	74-87-3	ug/L	1.8	10	ug/kg	0.30	20
Chloroprene	EPA 8260B	126-99-8	ug/L	7.5	20	ug/kg	0.61	100
Dibromochloromethane	EPA 8260B	124-48-1	ug/L	0.25	1	ug/kg	0.57	2.0
Dibromomethane	EPA 8260B	74-95-3	ug/L	0.46	1	ug/kg	0.77	1.0
Dichlorodifluoromethane	EPA 8260B	75-71-8	ug/L	0.46	1	ug/kg	0.44	2.0
Ethylbenzene	EPA 8260B	100-41-4	ug/L	0.14	1	ug/kg	0.15	1.0
Ethyl methylacrylate	EPA 8260B	97-63-2	ug/L	TIC		ug/kg	TIC	
Hexachloro-1,3-Butadiene	EPA 8260B	87-68-3	ug/L	0.32	20	ug/kg	0.32	100
Iodomethane	EPA 8260B	74-88-4	ug/L	9	20	ug/kg	8.3	100
Isobutyl Alcohol	EPA 8260B	78-83-1	ug/L	4.8	20	ug/kg	4.6	100
Methacrylonitrile	EPA 8260B	126-98-7	ug/L	3.8	20	ug/kg	2.9	100
Methyl Methacrylate	EPA 8260B	80-62-6	ug/L	1.1	20	ug/kg	1.6	100
Methylene Chloride	EPA 8260B	75-09-2	ug/L	0.64	10	ug/kg	1.3	10
Naphthalene	EPA 8260B	91-20-3	ug/L	2.5	10	ug/kg	0.81	10
o-Xylene	EPA 8260B	95-47-6	ug/L	0.23	1	ug/kg	0.56	1.0
p/m-Xylene	EPA 8260B	179601-23-1	ug/L	0.24	1	ug/kg	0.27	2.0
Propionitrile	EPA 8260B	107-12-0	ug/L	5.9	20	ug/kg	3.8	100
Styrene	EPA 8260B	100-42-5	ug/L	0.17	1	ug/kg	0.60	1.0
t-1,2-Dichloroethene	EPA 8260B	156-60-5	ug/L	0.37	1	ug/kg	0.51	1.0
t-1,3-Dichloropropene	EPA 8260B	10061-02-6	ug/L	0.25	0.5	ug/kg	0.61	2.0

TABLE 3
REPORTING LIMITS
Closure Plan Sampling and Analysis Plan
Exide Technologies, Vernon, California

COMPOUND	METHOD	CAS	AQUEOUS			SOIL		
			UNIT	MDL	RL	UNIT	MDL	RL
Volatile Organic Compounds								
t-1,4-Dichloro-2-Butene	EPA 8260B	764-41-0	ug/L	2.2	20	ug/kg	2.4	100
Tetrachloroethene	EPA 8260B	127-18-4	ug/L	0.39	1	ug/kg	0.21	1.0
Toluene	EPA 8260B	108-88-3	ug/L	0.24	1	ug/kg	0.52	1.0
Trichloroethene	EPA 8260B	79-01-6	ug/L	0.37	1	ug/kg	0.30	2.0
Trichlorofluoromethane	EPA 8260B	75-69-4	ug/L	1.7	10	ug/kg	0.38	10
Vinyl Acetate	EPA 8260B	108-05-4	ug/L	2.8	10	ug/kg	4.7	10
Vinyl Chloride	EPA 8260B	75-01-4	ug/L	0.3	0.5	ug/kg	0.50	1.0
Semivolatile Organic Compounds								
1,2,4,5-Tetrachlorobenzene	EPA 8270C	95-94-3	ug/L	1.0	10	mg/kg	0.38	1.5
1,2,4-Trichlorobenzene	EPA 8270C	120-82-1	ug/L	2.8	10	mg/kg	0.059	0.50
1,2-Dichlorobenzene	EPA 8270C	95-50-1	ug/L	3.0	10	mg/kg	0.064	0.50
1,3,5-Trinitrobenzene	EPA 8270C	99-35-4	ug/L	0.81	20	mg/kg	0.19	1.5
1,3-Dichlorobenzene	EPA 8270C	541-73-1	ug/L	3.1	10	mg/kg	0.073	0.50
1,3-Dinitrobenzene	EPA 8270C	99-65-0	ug/L	0.90	10	mg/kg	0.25	1.5
1,4-Dichlorobenzene	EPA 8270C	106-46-7	ug/L	2.9	10	mg/kg	0.075	0.50
1,4-Naphthoquinone	EPA 8270C	130-15-4	ug/L	0.76	20	mg/kg	0.18	1.5
1,4-Phenylenediamine	EPA 8270C	106-50-3	ug/L	1.6	50	mg/kg	0.31	1.5
1-Methylnaphthalene	EPA 8270C	90-12-0	ug/L	2.8	10	mg/kg	0.056	0.50
1-Naphthylamine	EPA 8270C	134-32-7	ug/L	0.79	20	mg/kg	0.14	1.5
2,3,4,6-Tetrachlorophenol	EPA 8270C	58-90-2	ug/L	1.5	50	mg/kg	0.40	1.5
2,4,5-Trichlorophenol	EPA 8270C	95-95-4	ug/L	2.5	10	mg/kg	0.064	0.50
2,4,6-Trichlorophenol	EPA 8270C	88-06-2	ug/L	2.5	10	mg/kg	0.077	0.50
2,4-Dichlorophenol	EPA 8270C	120-83-2	ug/L	2.5	10	mg/kg	0.058	0.50
2,4-Dimethylphenol	EPA 8270C	105-67-9	ug/L	2.4	10	mg/kg	0.27	0.50
2,4-Dinitrophenol	EPA 8270C	51-28-5	ug/L	13	50	mg/kg	0.34	2.5
2,4-Dinitrotoluene	EPA 8270C	121-14-2	ug/L	2.3	10	mg/kg	0.067	0.50
2,6-Dichlorophenol	EPA 8270C	87-65-0	ug/L	1.5	50	mg/kg	0.42	1.5
2,6-Dinitrotoluene	EPA 8270C	606-20-2	ug/L	2.4	10	mg/kg	0.073	0.50
2-Acetylaminofluorene	EPA 8270C	53-96-3	ug/L	1.3	20	mg/kg	0.42	1.5
2-Chloronaphthalene	EPA 8270C	91-58-7	ug/L	2.8	10	mg/kg	0.059	0.50
2-Chlorophenol	EPA 8270C	95-57-8	ug/L	2.3	10	mg/kg	0.067	0.50
2-Methylnaphthalene	EPA 8270C	91-57-6	ug/L	2.8	10	mg/kg	0.060	0.50
2-Methylphenol	EPA 8270C	95-48-7	ug/L	2.1	10	mg/kg	0.087	0.50
2-Naphthylamine	EPA 8270C	91-59-8	ug/L	0.81	50	mg/kg	0.20	1.5
2-Nitroaniline	EPA 8270C	88-74-4	ug/L	2.2	10	mg/kg	0.052	0.50
2-Nitrophenol	EPA 8270C	88-75-5	ug/L	2.6	10	mg/kg	0.067	0.50
2-Picoline	EPA 8270C	109-06-8	ug/L	1.6	50	mg/kg	0.29	1.5
3,3'-Dichlorobenzidine	EPA 8270C	91-94-1	ug/L	2.6	25	mg/kg	0.36	2.5
3,3-Dimethylbenzidine	EPA 8270C	119-93-7	ug/L	0.85	100	mg/kg	0.89	5.0
3/4-Methylphenol	EPA 8270C	65794-96-9	ug/L	2.2	10	mg/kg	0.16	0.50
3-Methylcholanthrene	EPA 8270C	56-49-3	ug/L	1.0	20	mg/kg	0.35	1.5
3-Nitroaniline	EPA 8270C	99-09-2	ug/L	2.3	10	mg/kg	0.070	0.50
4-(Dimethylamino)azobenzene	EPA 8270C	60-11-7	ug/L	1.2	10	mg/kg	0.065	1.5
4,6-Dinitro-2-Methylphenol	EPA 8270C	534-52-1	ug/L	14	50	mg/kg	0.63	2.5
4-Aminobiphenyl	EPA 8270C	92-67-1	ug/L	0.57	20	mg/kg	0.29	1.5
4-Bromophenyl-Phenyl Ether	EPA 8270C	101-55-3	ug/L	2.7	10	mg/kg	0.061	0.50
4-Chloro-3-Methylphenol	EPA 8270C	59-50-7	ug/L	2.4	10	mg/kg	0.066	0.50
4-Chloroaniline	EPA 8270C	106-47-8	ug/L	2.0	10	mg/kg	0.065	0.50
4-Chlorophenyl-Phenyl Ether	EPA 8270C	7005-72-3	ug/L	2.7	10	mg/kg	0.064	0.50
4-Nitroaniline	EPA 8270C	100-01-6	ug/L	2.1	10	mg/kg	0.065	0.50
4-Nitrophenol	EPA 8270C	100-02-7	ug/L	1.6	10	mg/kg	0.054	0.50
4-Nitroquinoline-1-oxide	EPA 8270C	56-57-5	ug/L	2.1	50	mg/kg	0.84	5.0
7,12-Dimethylbenz[a]anthracene	EPA 8270C	57-97-6	ug/L	1.5	10	mg/kg	0.34	1.5
5-Nitro-o-toluidine	EPA 8270C	99-55-8	ug/L	0.86	10	mg/kg	0.19	1.5
Acenaphthene	EPA 8270C	83-32-9	ug/L	2.8	10	mg/kg	0.063	0.50

TABLE 3
REPORTING LIMITS
Closure Plan Sampling and Analysis Plan
Exide Technologies, Vernon, California

COMPOUND	METHOD	CAS	AQUEOUS			SOIL		
			UNIT	MDL	RL	UNIT	MDL	RL
Semivolatile Organic Compounds								
Acenaphthylene	EPA 8270C	208-96-8	ug/L	2.9	10	mg/kg	0.060	0.50
Acetophenone	EPA 8270C	98-86-2	ug/L	1.5	10	mg/kg	0.29	1.5
alpha,alpha-Dimethylphenethylamine	EPA 8270C	122-09-8	ug/L	1.3	100	mg/kg	0.046	1.5
Aniline	EPA 8270C	62-53-3	ug/L	1.5	10	mg/kg	0.060	0.50
Anthracene	EPA 8270C	120-12-7	ug/L	3.0	10	mg/kg	0.063	0.50
Aramite	EPA 8270C	140-57-8	ug/L	1.3	50	mg/kg	0.36	1.5
Azobenzene	EPA 8270C	103-33-3	ug/L	2.6	10	mg/kg	0.054	0.50
Benzidine	EPA 8270C	92-87-5	ug/L	6.5	50	mg/kg	0.83	10
Benzo (a) Anthracene	EPA 8270C	56-55-3	ug/L	4.7	10	mg/kg	0.057	0.50
Benzo (a) Pyrene	EPA 8270C	50-32-8	ug/L	2.4	10	mg/kg	0.054	0.50
Benzo (b) Fluoranthene	EPA 8270C	205-99-2	ug/L	2.3	10	mg/kg	0.064	0.50
Benzo (g,h,i) Perylene	EPA 8270C	191-24-2	ug/L	2.5	10	mg/kg	0.055	0.50
Benzo (k) Fluoranthene	EPA 8270C	207-08-9	ug/L	3.2	10	mg/kg	0.065	0.50
Benzoic Acid	EPA 8270C	65-85-0	ug/L	12	50	mg/kg	0.50	2.5
Benzyl Alcohol	EPA 8270C	100-51-6	ug/L	2.2	10	mg/kg	0.066	0.50
Bis(2-Chloroethoxy) Methane	EPA 8270C	111-91-1	ug/L	2.5	10	mg/kg	0.056	0.50
Bis(2-Chloroethyl) Ether	EPA 8270C	111-44-4	ug/L	2.5	25	mg/kg	0.41	2.5
Bis(2-Chloroisopropyl) Ether	EPA 8270C	39638-32-9	ug/L	3.2	10	mg/kg	0.057	0.50
Bis(2-Ethylhexyl) Phthalate	EPA 8270C	117-81-7	ug/L	3.2	10	mg/kg	0.053	0.50
Butyl Benzyl Phthalate	EPA 8270C	85-68-7	ug/L	2.5	10	mg/kg	0.054	0.50
Chlorobenzilate	EPA 8270C	510-15-6	ug/L	1.5	50	mg/kg	0.33	1.5
Chrysene	EPA 8270C	218-01-9	ug/L	2.8	10	mg/kg	0.064	0.50
Diallate	EPA 8270C	2303-16-4	ug/L	1.3	10	mg/kg	0.30	1.5
Dibenz (a,h) Anthracene	EPA 8270C	53-70-3	ug/L	2.5	10	mg/kg	0.046	0.50
Dibenzofuran	EPA 8270C	132-64-9	ug/L	2.8	10	mg/kg	0.060	0.50
Diethyl Phthalate	EPA 8270C	84-66-2	ug/L	2.8	10	mg/kg	0.058	0.50
Dimethoate	EPA 8270C	60-51-5	ug/L	1.4	10	mg/kg	0.43	1.5
Dimethyl Phthalate	EPA 8270C	131-11-3	ug/L	2.6	10	mg/kg	0.11	0.50
Di-n-Butyl Phthalate	EPA 8270C	84-74-2	ug/L	2.9	10	mg/kg	0.060	0.50
Di-n-Octyl Phthalate	EPA 8270C	117-84-0	ug/L	2.5	10	mg/kg	0.10	0.50
Dinoseb	EPA 8270C	88-85-7	ug/L	0.90	10	mg/kg	0.35	0.50
Diphenylamine	EPA 8270C	122-39-4	ug/L	1.4	10	mg/kg	0.33	1.5
Disulfoton	EPA 8270C	298-04-4	ug/L	1.4	10	mg/kg	0.22	0.50
Ethyl Methanesulfonate	EPA 8270C	62-50-0	ug/L	1.5	20	mg/kg	0.053	1.5
Famphur	EPA 8270C	52-85-7	ug/L	3.2	10	mg/kg	1.2	5.0
Fluoranthene	EPA 8270C	206-44-0	ug/L	3.1	10	mg/kg	0.062	0.50
Fluorene	EPA 8270C	86-73-7	ug/L	2.7	10	mg/kg	0.063	0.50
Hexachloro-1,3-Butadiene	EPA 8270C	87-68-3	ug/L	2.9	10	mg/kg	0.063	0.50
Hexachlorobenzene	EPA 8270C	118-74-1	ug/L	3.1	10	mg/kg	0.067	0.50
Hexachlorocyclopentadiene	EPA 8270C	77-47-4	ug/L	6.9	25	mg/kg	0.50	1.5
Hexachloroethane	EPA 8270C	67-72-1	ug/L	3.0	10	mg/kg	0.078	0.50
Hexachlorophene	EPA 8270C	70-30-4	ug/L	46	200	mg/kg	26	100
Hexachloropropene	EPA 8270C	1888-71-7	ug/L	1.1	10	mg/kg	0.38	1.5
Indeno (1,2,3-c,d) Pyrene	EPA 8270C	193-39-5	ug/L	2.1	10	mg/kg	0.053	0.50
Isodrin	EPA 8270C	465-73-6	ug/L	1.2	10	mg/kg	0.23	1.5
Isophorone	EPA 8270C	78-59-1	ug/L	2.5	10	mg/kg	0.057	0.50
Isosafrole	EPA 8270C	120-58-1	ug/L	1.5	10	mg/kg	0.36	1.5
Kepone	EPA 8270C	143-50-0	ug/L	2.2	50	mg/kg	2.7	10
Methapyrilene	EPA 8270C	91-80-5	ug/L	3.1	50	mg/kg	0.54	1.5
Methyl Methanesulfonate	EPA 8270C	66-27-3	ug/L	1.5	20	mg/kg	0.049	1.5
Methyl Parathion	EPA 8270C	298-00-0	ug/L	1.2	10	mg/kg	0.087	0.50
Naphthalene	EPA 8270C	91-20-3	ug/L	2.9	10	mg/kg	0.059	0.50
Nitrobenzene	EPA 8270C	98-95-3	ug/L	3.0	25	mg/kg	0.32	2.5
N-Nitrosodiethylamine	EPA 8270C	55-18-5	ug/L	1.0	10	mg/kg	0.11	1.5
N-Nitrosodimethylamine	EPA 8270C	62-75-9	ug/L	3.2	10	mg/kg	0.047	0.50

TABLE 3
REPORTING LIMITS
Closure Plan Sampling and Analysis Plan
Exide Technologies, Vernon, California

COMPOUND	METHOD	CAS	AQUEOUS			SOIL		
			UNIT	MDL	RL	UNIT	MDL	RL
Semivolatile Organic Compounds								
N-Nitroso-di-n-butylamine	EPA 8270C	924-16-3	ug/L	1.4	10	mg/kg	0.32	1.5
N-Nitroso-di-n-propylamine	EPA 8270C	621-64-7	ug/L	2.4	10	mg/kg	0.084	0.50
N-Nitrosodiphenylamine	EPA 8270C	86-30-6	ug/L	2.8	10	mg/kg	0.14	0.50
N-Nitrosomethylethylamine	EPA 8270C	10595-95-6	ug/L	2.1	10	mg/kg	0.28	1.5
N-Nitrosomorpholine	EPA 8270C	59-89-2	ug/L	1.3	10	mg/kg	0.30	1.5
N-Nitrosopiperidine	EPA 8270C	100-75-4	ug/L	1.2	10	mg/kg	0.34	1.5
N-Nitrosopyrrolidine	EPA 8270C	930-55-2	ug/L	1.2	10	mg/kg	0.34	1.5
O,O,O-Triethyl phosphorothioate	EPA 8270C	126-68-1	ug/L	1.3	50	mg/kg	0.36	1.5
O-Toluidine	EPA 8270C	95-53-4	ug/L	0.53	10	mg/kg	0.021	1.5
Parathion	EPA 8270C	56-38-2	ug/L	1.3	10	mg/kg	0.38	0.50
Pentachlorobenzene	EPA 8270C	608-93-5	ug/L	1.4	10	mg/kg	0.26	1.5
Pentachloroethane	EPA 8270C	76-01-7	ug/L	1.0	10	mg/kg	0.29	1.5
Pentachloronitrobenzene	EPA 8270C	82-68-8	ug/L	1.3	10	mg/kg	0.32	0.50
Pentachlorophenol	EPA 8270C	87-86-5	ug/L	4.6	10	mg/kg	0.39	2.5
Phenacetin	EPA 8270C	62-44-2	ug/L	1.4	10	mg/kg	0.43	1.5
Phenanthrene	EPA 8270C	85-01-8	ug/L	2.9	10	mg/kg	0.069	0.50
Phenol	EPA 8270C	108-95-2	ug/L	2.1	10	mg/kg	0.048	0.50
Phorate	EPA 8270C	298-02-2	ug/L	1.3	10	mg/kg	0.21	1.5
Pronamide	EPA 8270C	23950-58-5	ug/L	1.0	10	mg/kg	0.044	0.50
Pyrene	EPA 8270C	129-00-0	ug/L	3.0	10	mg/kg	0.077	0.50
Pyridine	EPA 8270C	110-86-1	ug/L	3.0	10	mg/kg	0.055	0.50
Safrole	EPA 8270C	94-59-7	ug/L	1.3	10	mg/kg	0.40	1.5
Sulfotepp(TEDP)	EPA 8270C	3689-24-5	ug/L	1.3	10	mg/kg	0.065	1.5
Thionazin	EPA 8270C	297-97-2	ug/L	1.6	10	mg/kg	0.048	1.5
1,4-Dioxane	EPA 8270C Isotope Dilution	123-91-1	ug/L	0.28	1	ug/kg	6.8	25
PAH								
Acenaphthene	EPA 8270C	83-32-9	ug/L	2.8	10	mg/kg	0.063	0.50
Acenaphthylene	EPA 8270C	208-96-8	ug/L	2.9	10	mg/kg	0.060	0.50
Anthracene	EPA 8270C	120-12-7	ug/L	3.0	10	mg/kg	0.063	0.50
Benzo (a) Anthracene	EPA 8270C	56-55-3	ug/L	4.7	10	mg/kg	0.057	0.50
Benzo (a) Pyrene	EPA 8270C	50-32-8	ug/L	2.4	10	mg/kg	0.054	0.50
Benzo (b) Fluoranthene	EPA 8270C	205-99-2	ug/L	2.3	10	mg/kg	0.064	0.50
Benzo (g,h,i) Perylene	EPA 8270C	191-24-2	ug/L	2.5	10	mg/kg	0.055	0.50
Benzo (k) Fluoranthene	EPA 8270C	207-08-9	ug/L	3.2	10	mg/kg	0.065	0.50
Chrysene	EPA 8270C	218-01-9	ug/L	2.8	10	mg/kg	0.064	0.50
Dibenz (a,h) Anthracene	EPA 8270C	53-70-3	ug/L	2.5	10	mg/kg	0.046	0.50
Fluorene	EPA 8270C	86-73-7	ug/L	2.7	10	mg/kg	0.063	0.50
Fluoranthene	EPA 8270C	206-44-0	ug/L	3.1	10	mg/kg	0.062	0.50
Indeno (1,2,3-c,d) Pyrene	EPA 8270C	193-39-5	ug/L	2.1	10	mg/kg	0.053	0.50
Naphthalene	EPA 8270C	91-20-3	ug/L	2.9	10	mg/kg	0.059	0.50
Phenanthrene	EPA 8270C	85-01-8	ug/L	2.9	10	mg/kg	0.069	0.50
Pyrene	EPA 8270C	129-00-0	ug/L	3.0	10	mg/kg	0.077	0.50
Herbicides								
2,4,5-T	EPA 8151A	93-76-5	ug/L	0.18	0.50	--	--	--
2,4,5-TP (Silvex)	EPA 8151A	93-72-1	ug/L	0.22	0.50	--	--	--
2,4-D	EPA 8151A	94-75-7	ug/L	1.8	5.0	--	--	--
2,4-DB	EPA 8151A	94-82-6	ug/L	1.5	5.0	--	--	--
Dalapon	EPA 8151A	75-99-0	ug/L	3.7	13	--	--	--
Dicamba	EPA 8151A	1918-00-9	ug/L	0.17	0.50	--	--	--
Dichlorprop	EPA 8151A	120-36-5	ug/L	1.8	5.0	--	--	--
Dinoseb	EPA 8151A	88-85-7	ug/L	0.95	2.5	--	--	--
MCPA	EPA 8151A	94-74-6	ug/L	170	500	--	--	--
MCPP	EPA 8151A	93-65-2	ug/L	170	500	--	--	--

TABLE 3
REPORTING LIMITS
Closure Plan Sampling and Analysis Plan
Exide Technologies, Vernon, California

COMPOUND	METHOD	CAS	AQUEOUS			SOIL		
			UNIT	MDL	RL	UNIT	MDL	RL
Pesticides								
4,4'-DDD	EPA 8081	72-54-8	ug/L	0.027	0.10	--	--	--
4,4'-DDE	EPA 8081	72-55-9	ug/L	0.027	0.10	--	--	--
4,4'-DDT	EPA 8081	50-29-3	ug/L	0.027	0.10	--	--	--
Aldrin	EPA 8081	309-00-2	ug/L	0.027	0.10	--	--	--
Alpha-BHC	EPA 8081	319-84-6	ug/L	0.028	0.10	--	--	--
Beta-BHC	EPA 8081	319-85-7	ug/L	0.030	0.10	--	--	--
Chlordane	EPA 8081	57-74-9	ug/L	0.33	1.0	--	--	--
Delta-BHC	EPA 8081	319-86-8	ug/L	0.029	0.10	--	--	--
Dieldrin	EPA 8081	60-57-1	ug/L	0.029	0.10	--	--	--
Endosulfan I	EPA 8081	959-98-8	ug/L	0.028	0.10	--	--	--
Endosulfan II	EPA 8081	33213-65-9	ug/L	0.027	0.10	--	--	--
Endosulfan Sulfate	EPA 8081	1031-07-8	ug/L	0.029	0.10	--	--	--
Endrin Aldehyde	EPA 8081	7421-93-4	ug/L	0.026	0.10	--	--	--
Endrin Ketone	EPA 8081	53494-70-5	ug/L	0.024	0.10	--	--	--
Gamma-BHC	EPA 8081	58-89-9	ug/L	0.030	0.10	--	--	--
Endrin	EPA 8081	72-20-8	ug/L	0.031	0.10	--	--	--
Heptachlor	EPA 8081	76-44-8	ug/L	0.026	0.10	--	--	--
Heptachlor Epoxide	EPA 8081	1024-57-3	ug/L	0.025	0.10	--	--	--
Methoxychlor	EPA 8081	72-43-5	ug/L	0.025	0.10	--	--	--
Toxaphene	EPA 8081	8001-35-2	ug/L	0.59	2.0	--	--	--
Polychlorinated Biphenyls								
Aroclor-1016	EPA 8082	12674-11-2	ug/L	0.29	1	ug/kg	14	50
Aroclor-1221	EPA 8082	11104-28-2	ug/L	0.28	1	ug/kg	13	50
Aroclor-1232	EPA 8082	11141-16-5	ug/L	0.25	1	ug/kg	11	50
Aroclor-1242	EPA 8082	53469-21-9	ug/L	0.18	1	ug/kg	12	50
Aroclor-1248	EPA 8082	12672-29-6	ug/L	0.2	1	ug/kg	14	50
Aroclor-1254	EPA 8082	11097-69-1	ug/L	0.23	1	ug/kg	12	50
Aroclor-1260	EPA 8082	11096-82-5	ug/L	0.26	1	ug/kg	11	50
Aroclor-1262	EPA 8082	37324-23-5	ug/L	0.26	1	ug/kg	12	50
Dioxins/Dibenzofurans								
2,3,7,8-Tetra CDD	EPA 8290	1746-01-6	pg/L	1.2	20	pg/g	0.12	2
1,2,3,7,8-Penta CDD	EPA 8290	40321-76-4	pg/L	0.9	50	pg/g	0.13	5
1,2,3,4,7,8-Hexa CDD	EPA 8290	39227-28-6	pg/L	1.2	50	pg/g	0.1	5
1,2,3,6,7,8-Hexa CDD	EPA 8290	57653-85-7	pg/L	1.2	50	pg/g	0.12	5
1,2,3,7,8,9-Hexa CDD	EPA 8290	19408-74-3	pg/L	1.1	50	pg/g	0.1	5
1,2,3,4,6,7,8-Hepta CDD	EPA 8290	35822-46-9	pg/L	1.2	50	pg/g	0.18	5
Octa CDD	EPA 8290	3268-87-9	pg/L	1.1	100	pg/g	0.11	10
Total Tetra CDD	EPA 8290	41903-57-5	pg/L	1.3	20	pg/g	0.23	2
Total Penta CDD	EPA 8290	36088-22-9	pg/L	0.9	50	pg/g	0.15	5
Total Hexa CDD	EPA 8290	34465-46-8	pg/L	2	50	pg/g	0.7	5
Total Hepta CDD	EPA 8290	37871-00-4	pg/L	1.2	50	pg/g	0.11	5
2,3,7,8-Tetra CDF	EPA 8290	51207-31-9	pg/L	0.9	20	pg/g	0.1	2
1,2,3,7,8-Penta CDF	EPA 8290	57117-41-6	pg/L	1	50	pg/g	0.11	5
2,3,4,7,8-Penta CDF	EPA 8290	57117-31-4	pg/L	1	50	pg/g	0.1	5
1,2,3,4,7,8-Hexa CDF	EPA 8290	70648-26-9	pg/L	0	50	pg/g	0.09	5
1,2,3,6,7,8-Hexa CDF	EPA 8290	57117-44-9	pg/L	0.8	50	pg/g	0.09	5
2,3,4,6,7,8-Hexa CDF	EPA 8290	60851-34-5	pg/L	0.8	50	pg/g	0.09	5
1,2,3,7,8,9-Hexa CDF	EPA 8290	72918-21-9	pg/L	0.9	50	pg/g	0.11	5
1,2,3,4,6,7,8-Hepta CDF	EPA 8290	67562-39-4	pg/L	1	50	pg/g	0.15	5
1,2,3,4,7,8,9-Hepta CDF	EPA 8290	55673-89-7	pg/L	1.1	50	pg/g	0.1	5
Octa CDF	EPA 8290	39001-02-0	pg/L	1	100	pg/g	0.11	10
Total Tetra CDF	EPA 8290	55722-27-5	pg/L	0.9	20	pg/g	0.1	2

TABLE 3
REPORTING LIMITS
Closure Plan Sampling and Analysis Plan
Exide Technologies, Vernon, California

COMPOUND	METHOD	CAS	AQUEOUS			SOIL		
			UNIT	MDL	RL	UNIT	MDL	RL
Dioxins/Dibenzofurans								
Total Penta CDF	EPA 8290	30402-15-4	pg/L	1	50	pg/g	0.11	5
Total Hexa CDF	EPA 8290	55684-94-1	pg/L	0.8	50	pg/g	0.1	5
Total Hepta CDF	EPA 8290	38998-75-3	pg/L	1.1	50	pg/g	0.12	5
Total TEQ	EPA 8290	N/A	pg/L	N/A	N/A	pg/g	0.37	N/A
Metals								
Aluminium	EPA 6010B	7429-90-5	mg/L	0.0124	0.05	mg/kg	0.358	2.5
Antimony	EPA 6010B	7440-36-0	mg/L	0.00787	0.015	mg/kg	0.149	0.75
Arsenic	EPA 6010B	7440-38-2	mg/L	0.00438	0.01	mg/kg	0.259	0.75
Barium	EPA 6010B	7440-39-3	mg/L	0.00296	0.01	mg/kg	0.154	0.5
Beryllium	EPA 6010B	7440-41-7	mg/L	0.000561	0.01	mg/kg	0.137	0.25
Cadmium	EPA 6010B	7440-43-9	mg/L	0.00269	0.01	mg/kg	0.135	0.5
Chromium	EPA 6010B	7440-47-3	mg/L	0.00271	0.01	mg/kg	0.142	0.25
Cobalt	EPA 6010B	7440-48-4	mg/L	0.00295	0.01	mg/kg	0.148	0.25
Copper	EPA 6010B	7440-50-8	mg/L	0.00267	0.01	mg/kg	0.135	0.5
Lead	EPA 6010B	7439-92-1	mg/L	0.00406	0.01	mg/kg	0.132	0.5
Mercury	EPA 7470A	7439-97-6	mg/L	0.0000453	0.0005	--	--	--
Mercury	EPA 7471A	7439-97-6	--	--	--	mg/kg	0.00587	0.0833
Nickel	EPA 6010B	7440-02-0	mg/L	0.00298	0.01	mg/kg	0.145	0.25
Selenium	EPA 6010B	7782-49-2	mg/L	0.00699	0.015	mg/kg	0.3	0.75
Silver	EPA 6010B	7440-22-4	mg/L	0.00139	0.005	mg/kg	0.0857	0.25
Thallium	EPA 6010B	7440-28-0	mg/L	0.00291	0.015	mg/kg	0.152	0.75
Metals								
Tin	EPA 6010B	7440-31-5	mg/L	0.00193	0.05	mg/kg	0.149	2.5
Vanadium	EPA 6010B	7440-62-2	mg/L	0.00244	0.01	mg/kg	0.141	0.25
Zinc	EPA 6010B	7440-66-6	mg/L	0.00352	0.01	mg/kg	0.178	1
Conventionals								
Sulfate	EPA 300.0	14808-79-8	mg/L	0.32	1	mg/kg	2.8	10
pH	EPA 9045D	--	--	--	--	pH units	--	0.01
pH	SM4500 H+B	--	pH units	--	0.01	--	--	--
Turbidity	SM 2130/180.1	--	NTU	0.044	0.05	--	--	--
Cyanide, Total	SM 4500-CN E	57-12-5	mg/L	0.007	0.02	mg/kg	0.22	0.5

TABLE 3
REPORTING LIMITS
Closure Plan Sampling and Analysis Plan
Exide Technologies, Vernon, California

COMPOUND	METHOD	CAS	VAPOR				
			UNIT	MDL	RL	MDL	RL
Volatile Organic Compounds				**TO-15**		**8260B**	
1,1,1-Trichloroethane	EPA TO-15/8260B	71-55-6	ppb (v/v)	2.5	5	1.0	5.0
1,1,2,2-Tetrachloroethane	EPA TO-15/8260B	79-34-5	ppb (v/v)	4	1	1.0	5.0
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA TO-15/8260B	76-13-1	ppb (v/v)	5	10	1.0	5.0
1,1,2-Trichloroethane	EPA TO-15/8260B	79-00-5	ppb (v/v)	7	10	1.0	5.0
1,1-Dichloroethane	EPA TO-15/8260B	75-34-3	ppb (v/v)	5	10	1.0	5.0
1,1-Dichloroethene	EPA TO-15/8260B	75-35-4	ppb (v/v)	2	5	1.0	5.0
1,2,4-Trichlorobenzene	EPA TO-15/8260B	120-82-1	ppb (v/v)	4	10	1.0	5.0
1,2,4-Trimethylbenzene	EPA TO-15/8260B	95-63-6	ppb (v/v)	4	10	1.0	5.0
1,2-Dibromoethane	EPA TO-15/8260B	106-93-4	ppb (v/v)	2	5	1.0	5.0
1,2-Dichlorobenzene	EPA TO-15/8260B	95-50-1	ppb (v/v)	4	10	1.0	5.0
1,2-Dichloroethane	EPA TO-15/8260B	107-06-2	ppb (v/v)	3.5	5	1.0	5.0
1,2-Dichloropropane	EPA TO-15/8260B	78-87-5	ppb (v/v)	4	10	1.0	5.0
1,3,5-Trimethylbenzene	EPA TO-15/8260B	108-67-8	ppb (v/v)	4	10	1.0	5.0
1,3-Dichlorobenzene	EPA TO-15/8260B	541-73-1	ppb (v/v)	4	10	1.0	5.0
1,4-Dichlorobenzene	EPA TO-15/8260B	106-46-7	ppb (v/v)	4	10	1.0	5.0
2-Butanone	EPA TO-15/8260B	78-93-3	ppb (v/v)	9.6	10	TIC	
2-Hexanone	EPA TO-15/8260B	591-78-6	ppb (v/v)	3	10	TIC	
4-Ethyltoluene	EPA TO-15/8260B	622-96-8	ppb (v/v)	4	10	1.0	5.0
4-Methyl-2-Pentanone	EPA TO-15/8260B	108-10-1	ppb (v/v)	6	10	TIC	
Acetone	EPA TO-15/8260B	67-64-1	ppb (v/v)	10	20	TIC	
Benzene	EPA TO-15/8260B	71-43-2	ppb (v/v)	2	5	1.0	5.0
Benzyl Chloride	EPA TO-15/8260B	100-44-7	ppb (v/v)	4	10	TIC	
Bromodichloromethane	EPA TO-15/8260B	75-27-4	ppb (v/v)	4	10	1.0	5.0
Bromoform	EPA TO-15/8260B	75-25-2	ppb (v/v)	4	10	1.0	5.0
Bromomethane	EPA TO-15/8260B	74-83-9	ppb (v/v)	7	10	1.0	5.0
c-1,2-Dichloroethene	EPA TO-15/8260B	156-59-2	ppb (v/v)	4	10	1.0	5.0
c-1,3-Dichloropropene	EPA TO-15/8260B	10061-01-5	ppb (v/v)	4	10	1.0	5.0
Carbon Disulfide	EPA TO-15/8260B	75-15-0	ppb (v/v)	4	10	TIC	
Carbon Tetrachloride	EPA TO-15/8260B	56-23-5	ppb (v/v)	1.5	2	1.0	5.0
Chlorobenzene	EPA TO-15/8260B	108-90-7	ppb (v/v)	2	5	1.0	5.0
Chloroethane	EPA TO-15/8260B	75-00-3	ppb (v/v)	8	10	1.0	5.0
Chloroform	EPA TO-15/8260B	67-66-3	ppb (v/v)	3	5	1.0	5.0
Dichlorodifluoromethane	EPA TO-15/8260B	75-71-8	ppb (v/v)	2	10	1.0	5.0
Dichlorotetrafluoroethane	EPA TO-15/8260B	76-14-2	ppb (v/v)	2.5	10	TIC	
Ethylbenzene	EPA TO-15/8260B	100-41-4	ppb (v/v)	2	5	1.0	5.0
Hexachloro-1,3-Butadiene	EPA TO-15/8260B	87-68-3	ppb (v/v)	4	10	TIC	
Methylene Chloride	EPA TO-15/8260B	75-09-2	ppb (v/v)	4.5	10	1.0	5.0
Methyl-t-Butyl Ether (MTBE)	EPA TO-15/8260B	1634-04-4	ppb (v/v)	4.5	10	1.0	5.0
o-Xylene	EPA TO-15/8260B	95-47-6	ppb (v/v)	2	5	1.0	5.0
p/m-Xylene	EPA TO-15/8260B	179601-23-1	ppb (v/v)	5	10	1.0	5.0
Styrene	EPA TO-15/8260B	100-42-5	ppb (v/v)	4	10	1.0	5.0
t-1,2-Dichloroethene	EPA TO-15/8260B	156-60-5	ppb (v/v)	5	10	1.0	5.0
t-1,3-Dichloropropene	EPA TO-15/8260B	10061-02-6	ppb (v/v)	4	10	1.0	5.0
Tetrachloroethene	EPA TO-15/8260B	127-18-4	ppb (v/v)	2.5	5	1.0	5.0
Toluene	EPA TO-15/8260B	108-88-3	ppb (v/v)	3	10	1.0	5.0
Trichloroethene	EPA TO-15/8260B	79-01-6	ppb (v/v)	2.5	5	1.0	5.0
Trichlorofluoromethane	EPA TO-15/8260B	75-69-4	ppb (v/v)	3	10	1.0	5.0
Vinyl Acetate	EPA TO-15/8260B	108-05-4	ppb (v/v)	5	10	TIC	
Vinyl Chloride	EPA TO-15/8260B	75-01-4	ppb (v/v)	4	5	1.0	5.0

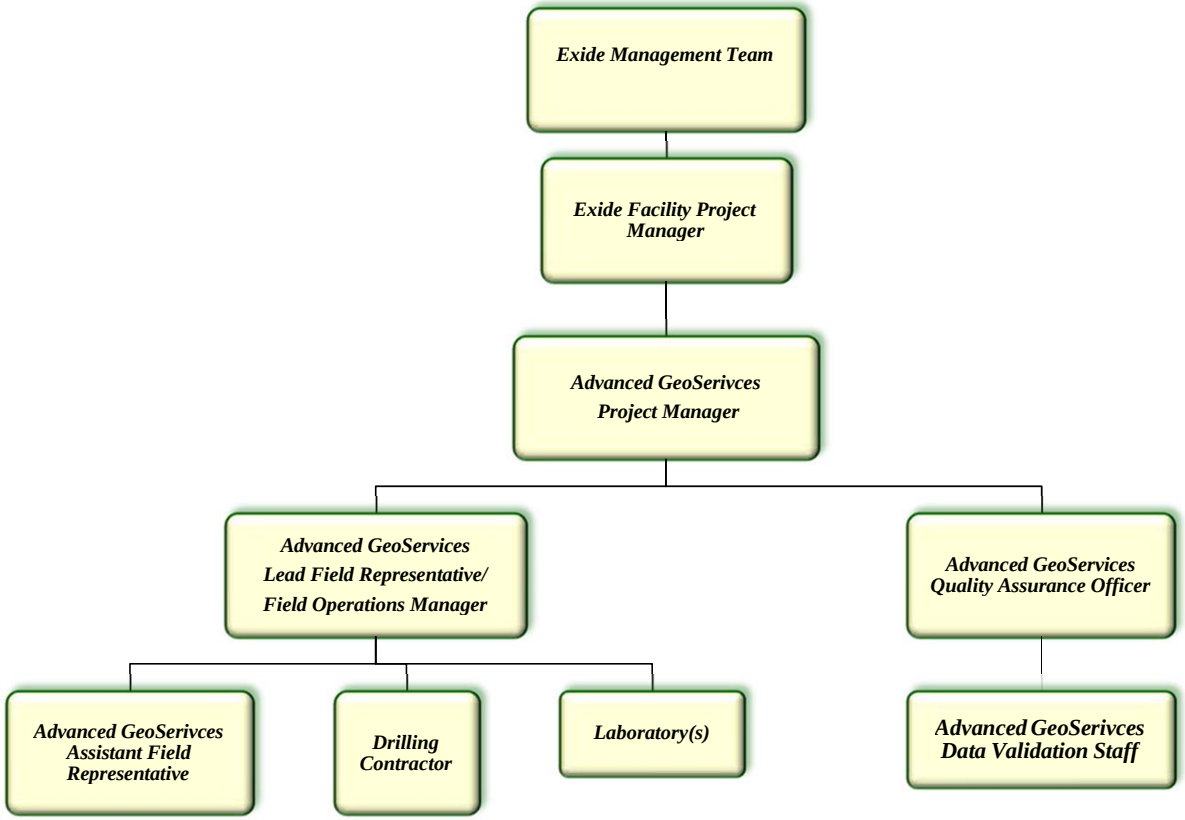
TABLE 3
REPORTING LIMITS
Closure Plan Sampling and Analysis Plan
Exide Technologies, Vernon, California

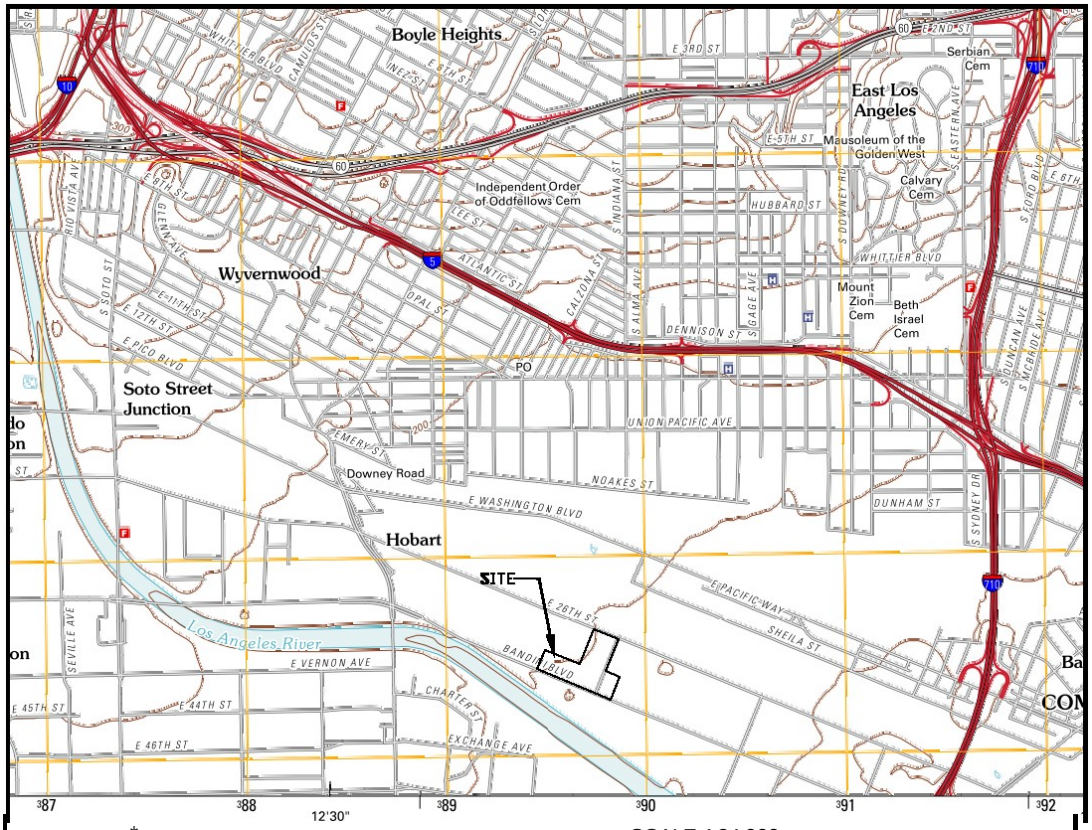
Compound	METHOD	CAS	WIPE		
			UNIT	MDL	RL
Metals					
Antimony	EPA 6010B	7440-36-0	ug/sample	0.298	1.5
Arsenic	EPA 6010B	7440-38-2	ug/sample	0.518	1.5
Barium	EPA 6010B	7440-39-3	ug/sample	0.308	1.0
Beryllium	EPA 6010B	7440-41-7	ug/sample	0.274	0.50
Cadmium	EPA 6010B	7440-43-9	ug/sample	0.270	1.0
Chromium	EPA 6010B	7440-47-3	ug/sample	0.284	0.5
Cobalt	EPA 6010B	7440-48-4	ug/sample	0.296	0.5
Copper	EPA 6010B	7440-50-8	ug/sample	0.270	1.0
Lead	EPA 6010B	7439-92-1	ug/sample	0.264	1.0
Mercury	EPA 7470A	7439-97-6	ug/sample	0.0117	0.167
Molybdenum	EPA 6010B	7439-98-7	ug/sample	0.264	0.5
Nickel	EPA 6010B	7440-02-0	ug/sample	0.290	0.5
Selenium	EPA 6010B	7782-49-2	ug/sample	0.600	1.5
Silver	EPA 6010B	7440-22-4	ug/sample	0.171	0.50
Thallium	EPA 6010B	7440-28-0	ug/sample	0.304	1.5
Vanadium	EPA 6010B	7440-62-2	ug/sample	0.282	0.50
Zinc	EPA 6010B	7440-66-6	ug/sample	0.256	2.0

Date: July 2015

FIGURES

FIGURE 1-1
ORGANIZATION CHART
CLOSURE PLAN
SAMPLING AND ANALYSIS PLAN





SCALE 1:24 000

KILOMETERS

METERS

MILES

MN

GN

12° 32′
223 MILS

0° 40′
12 MILS

UTM GRID AND 2012 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

ADVANCED GeoServices

Engineering for the Environment. Planning for People. ™

1055 ANDREW DRIVE, SUITE A, WEST CHESTER PA, 19380
tel 610.840.9100 fax 610.840.9199 www.advancedgeoservices.com

FACILITY LOCATION MAP

Ende Technology
Vernon, California

SCALE:	NTS
PROJECT NUMBER:	2013-2993-01
DATE:	
FIGURE	**2.1**

S:\Projects\2013\20132993 - Ende Vernon Permitting Assistance\Cad\2013-2993-07BAYFIGURE 1 1 & 1-14.dwg

HAZARDOUSWASTEMANAGEMENTUNITSBYPROCESS

ContainerStorage

- 1 CentralContainerStorageBuilding
- 2 WestContainerStorageBuilding1
- 3 WestContainerStorageBuilding2
- 103 TrailerStagingArea

RMPS

- 5 BatteryDumpBinSump
- 6 RMPSFloorSump
- 7 NorthMudTank
- 8 CenterMudTank
- 9 SouthMudTank
- 10 SouthAcidStorageTank
- 12 PasteThickeningUnit(SantaMaria)
- 13 SinkFloatSeparator
- 14 RecycleTank
- 40 RMPSHammerMill
- 41 WasteAcidCirculationTank
- 42 EastElutriationColumn
- 43 WestElutriationColumn
- 45 RMPSFilterPressUnitB
- 66 AcidOverflowTankA
- 67 AcidOverflowTankB
- 68 ClarifyingAcidFilterPress
- 70 OscillatingPanFeeder
- 79 SurgeTank(Proposed)
- 80 CentrifugeNo.1

OxidationTanks

- 24 NorthOxidationTank
- 25 SouthOxidationTank

FlueDustSlurryTanks

- 31 NorthFlueDustSlurryTank
- 32 SouthFlueDustSlurryTank

Miscellaneous

- 35 MobileEquipmentWashStation
- 87 WestYardTruckWash

WWTP

- 44 WWTPFilterPress
- 52 EqualizationTank1
- 53 EqualizationTank2
- 54 SludgeHoldingTank
- 55 FlocculationTank
- 56 WWTPClarifier
- 57 ReactionTank1
- 58 ReactionTank2
- 59 ReactionTank3
- 60 ReactionTank4
- 61 ReactionTank5
- 62 WWTPSump
- 63 WWTPAcidStorageTank
- 71 1SandFilter
- 72 2SandFilter
- 73 3SandFilter
- 74 4SandFilter
- 75 5Sandfilter
- 76 WWTPRecycledAcidTank
- 77 SandFilterFeedTank

DropOutSystemSurfaceImpoundment

- 46 PumpSump
- 47 SettlingTankNo.1
- 48 SettlingTankNo.2
- 49 SettlingTankNo.3
- 50 SettlingTankNo.4
- 78 StormwaterSurfaceImpoundment

SmelterBuilding

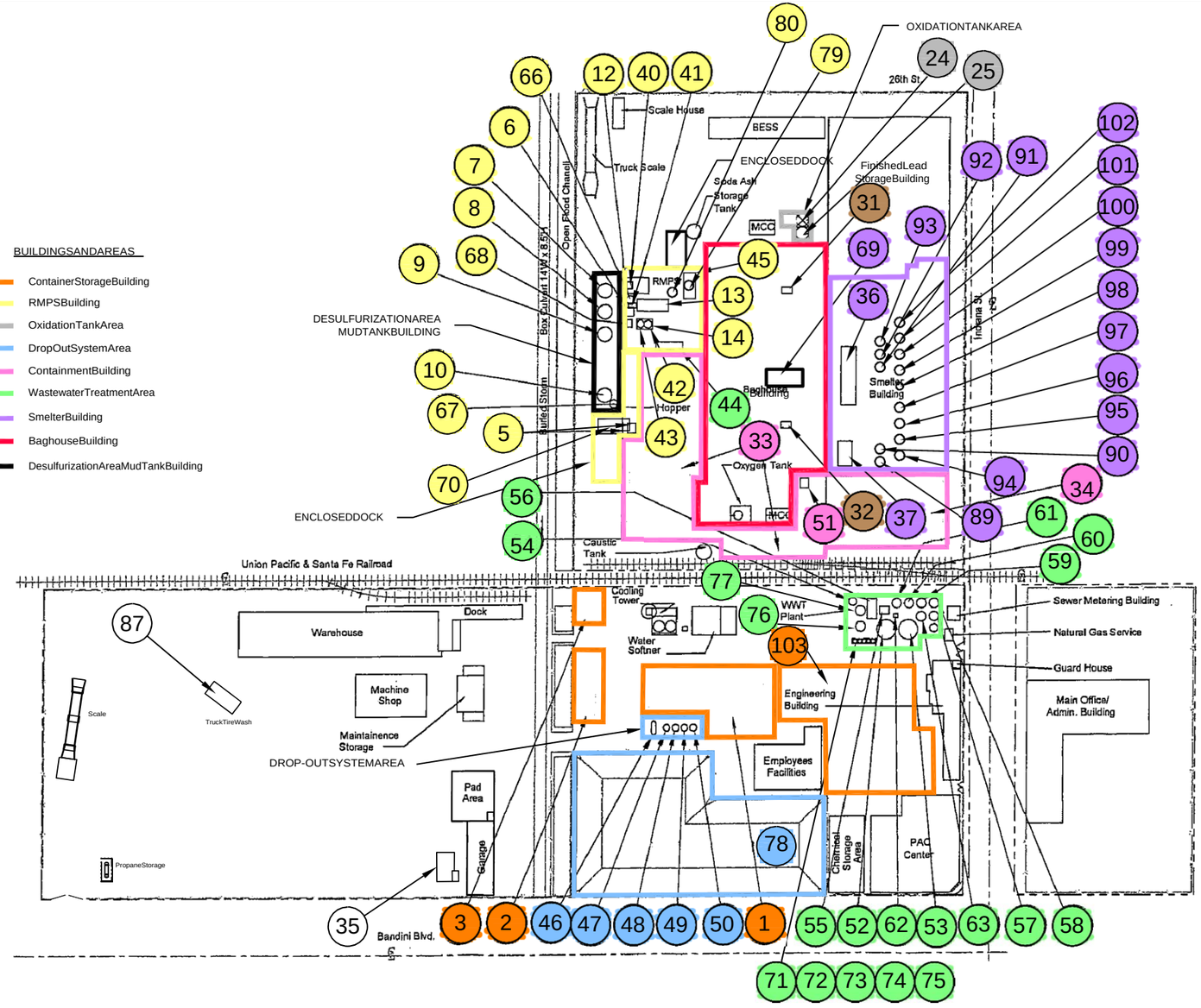
- 36 ReverbFurnace
- 37 BlastFurnace
- 69 RotaryKiln
- 89 ReceivingKettleA
- 90 ReceivingKettleB
- 91 ReceivingKettleE
- 92 ReceivingKettleF
- 93 ReceivingKettleG
- 94 RefiningKettle1
- 95 RefiningKettle2
- 96 RefiningKettle3
- 97 RefiningKettle4
- 98 RefiningKettle5
- 99 RefiningKettle6
- 100 RefiningKettle7
- 101 RefiningKettle8
- 102 RefiningKettle9

ContainmentBuilding

- 33 ReverbFurnaceFeedRoom
- 34 BlastFurnaceFeedRoom
- 51 TruckWashSump

BUILDINGSANDAREAS

- ContainerStorageBuilding
- RMPSBuilding
- OxidationTankArea
- DropOutSystemArea
- ContainmentBuilding
- WastewaterTreatmentArea
- SmelterBuilding
- BaghouseBuilding
- DesulfurizationAreaMudTankBuilding



NOTE:

1. ADAPTED FROM LAKE ENGINEERING FIGURE 5.2 FROM PART B APPLICATION, MAY 2002.
2. SECONDARY CONTAINMENT AREAS ARE THE BUILDING BOUNDARIES, SEE APPENDIX GG.
3. 'UNIT PROCESS' INDICATES THE PROCESS IN WHICH A UNIT IS USED, NOT ITS LOCATION.
4. UNIT SIZES AND LOCATIONS ARE APPROXIMATE
5. SEE APPENDIX A FOR ADDITIONAL DRAWINGS

ADVANCED GeoServices
Engineering for the Environment. Planning for People.™
1055 ANDREW DRIVE, SUITE A, WEST CHESTER PA, 19380
tel 610.840.9100 fax 610.840.9199 www.advancedgeoservices.com

FACILITY PLOT PLAN

Exide Technologies
Vernon, California

SCALE: N.T.S.	Figure 2.2
PROJECT NUMBER: 2013-2993-21	
DATE: 5/15/15	

F:\Projects\2013\2013\2993-ExideVernonPermittingAssistance\Cad\2013-2993-07B\2013-2993-01-14.dwg

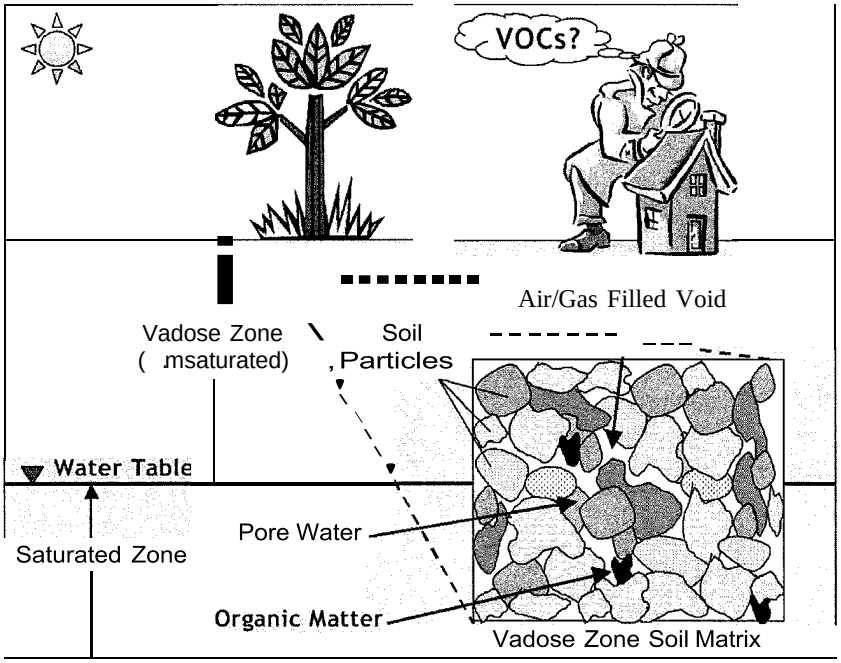
Date: July 2015

ATTACHMENT A

Direct Push Installation

Direct Push Installation of Devices for Active Soil Gas Sampling & Monitoring

Technical Bulletin No. MK3098
Prepared: May, 2006



Geoprobe Systems"

Section 1.0
Purpose

This document details the collection of representative soil gas samples with appropriate direct push (DP) methods to meet a range of data quality objectives, site-specific conditions, and regulatory requirements. New requirements for vapor intrusion investigations (U.S. EPA 2002, Cal. DTSC 2003, NYDOH 2005, etc.) establish higher sample data quality objectives to meet the needs for the human health risk assessment for this pathway. Downhole tools and sample collection methods needed to obtain the higher quality soil gas samples are reviewed.

Section 2.0
Background

What is soil gas? Where is the vadose zone? The ASTM Standard Guide 05314 for soil gas monitoring gives us the following definitions:

soil gas = vadose zone atmosphere
vadose zone = the hydrogeological region extending from the soil surface to the top of the principal water table

Soil gas is simply the gas phase (air) that exists in the open spaces between the soil particles in the unsaturated portion of the subsurface (Figure 1). Soil gas is normally comprised primarily of nitrogen and oxygen like the aboveground air it is in equilibrium with. However, when volatile organic compounds (VOCs) have been released in the subsurface due to spills or leaks, they will begin to evaporate from the fluid phase and become a part of the soil gas. Over time the VOCs can migrate through the soil and/or groundwater and present a potential hazard to human health or the environment. Intrusion of volatile contaminant vapors into an occupied building (home, office, school, etc.) can lead to exposure of the occupants to the potentially harmful contaminants (US EPA 2002).

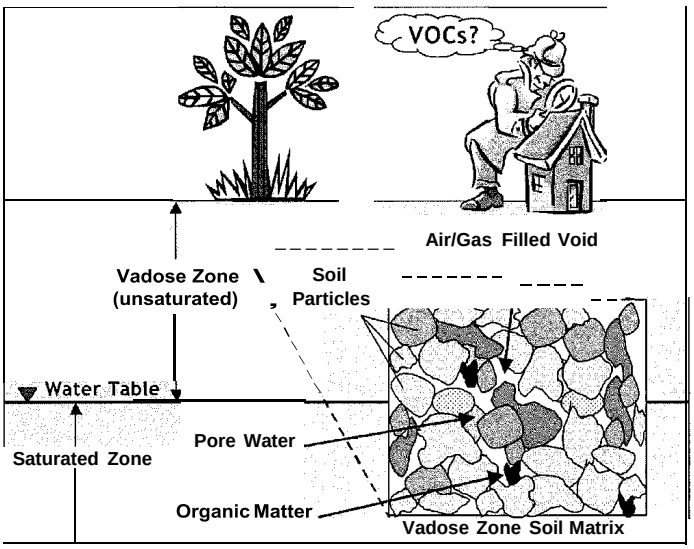


Figure 1: Schematic showing relationship of the vadose zone and saturated zone. Also exploded view showing the primary components of the soil matrix. VOCs will equilibrate with the solid, liquid, and gas phases of the soil matrix. Free product may also be present in the void space of the soil matrix.

Previously,soil gas sampling and monitoring were used primarily as cost- and time-effective means to track soil and groundwater contamination by VOCs and identify potential source areas (US EPA 1997). As our understanding of the vapor intrusion pathway develops,the use of soil gas data is being appliedto evaluate this potential human health hazard. Because the vapor intrusion pathway deals with human health risk assessment,the sample and data quality objectives for soil gas samples are more stringentforthis application than for simple plume tracking and source location activities. This technology overview will provide guidance on selection of the appropriate tools and methods for soil gas sampling and monitoring depending on the data quality objectives of the project.

It is useful to realize that VOCs will be partitioned between the different components (phases) of the vadose zone (Figure 1) (ASTM D5314, McCall et al. 2006) depending on their physical and chemical characteristics. The VOCs will be present in the soil gas phase,dissolved in any liquid water that may be present, and probably sorbed to the solid soil particles, especially any organic matter. Near the source of contamination, free product also may be present in the soil. The distribution of the contaminant(s) in different phases of the soil matrix is important to consider when sampling. Ifa strong vacuum is applied to the sample interval,VOCs that were partitioned into the liquid phase or sorbed to the solid matrix may be stripped and enter the vapor phase. This can result in an inaccurate measure of the amount of the contaminant actually in equilibrium with the vapor phase and lead to erroneous conclusions in a risk assessment.

3.0
VOCs and Other Soil Gases of Interest

The primary contaminants of interest in soil gas sampling and vapor intrusion studies are chlorinated volatile organic compounds (X-VOCs),aromatic compounds, and some landfill gases (Table 1). The volatility of a compound is primarily a function of its vapor pressure. The higher the compound's vapor pressure (Table 1) at ambient conditions the greater it's volatility. This simply means any spilled liquid will quickly evaporate and enter the gas phase. If spilled on soil or leaked into the subsurface, a compound will tend to enter the soilatmosphere. Don't forget these compounds also will be partitioned into the other phases of the soil matrix (Figure 1). In general,compounds with vapor pressures greater than about 0.5 mm Hg are considered to be detectable with active soil gas methods.

At many sites,VOC releases will contaminate the groundwater and then migrate down gradient with the flowing groundwater. Over time these groundwater contaminant plumes can become sources for VOC migration into the overlying soil gas that may potentially become a vapor intrusion source. The Henry's Law constant of a compound is used to describe its tendency to partition between water and vapor. One way to determine the Henry's Law constant of a compound is to divide the equilibrium concentration of the compound in air by it's concentration in water. This provides a unitless ratio. The higher the Henry's Law constant the more the compound tends to enter the gas phase. Usually compounds with Henry's law constants greater than 0.1 and sufficiently high vapor pressures are considered to be detectable with active soil gas sampling (EPA 1997).

4.0
Conceptual Site Model (CSM)

The conceptual site model (CSM) is a simplified picture and/or written description of what may be a complex system (U.S. EPA 2002). The purpose of the CSM is to provide the investigation team and other interested parties an initial idea about the subsurface conditions, possible contaminant migration pathways, potential receptors, local soils and geology, and potential sources for the volatile contaminants under investigation. The CSM should include preliminary site maps, geologic cross sections and other pertinent diagrams. This may include maps of sewer lines, water lines and other underground utility lines that may provide preferential conduits for migration of volatile contaminants to homes, schools, offices and other buildings where vapor intrusion could pose a health hazard. Sensitive environments and endangered species also should be evaluated.

A good CSM will help the investigation team identify additional information that will be required to complete the investigation and determine ifthe vapor intrusion pathway is complete. The CSM should be viewed as a dynamic tool that will be updated and modified as additional information,samples,and data are obtained that better characterize the site conditions. Soil samples may be required to verify local soil and geological conditions and identify potential source areas. Groundwater samples may be required to determine if a groundwater plume is acting as a source for volatiles across the site area and what the contaminant concentrations are. Measurements of hydraulic conductivity or soil permeability may be needed to evaluate the potential rate of contaminant migration. Several direct push methods are available to obtain these samples and other information needed to confirm or modify the CSM to accurately reflect site specific conditions. Direct push electrical conductivity logs, hydraulic profiling tool (HPT) logs, membrane interface probe (MIP) logs for volatiles, and CPT logs may provide methods to achieve a detailed site model in a relatively short time frame. In addition, ASTM Standards are available for particular methods and procedures for sampling and investigation that may provide useful insights and special knowledge. Some pertinent ASTM Standards particular to direct push methods include D6001, D6282, D6725, and D7242.

Section 5.0
Data Quality Objectives {DQOs) and Selection of Sampling Methods

As mentioned previously,the data quality objectives will determine how samples are obtained in the field and analyzed. The project manager and field team will have to determine which downhole tools are required and the specific sample collection and analysis methods that should be used to meet the DQOs of the project. But first, what are data quality objectives? DQOs are basically a set of rules that define the amount of uncertainty that is acceptable in the results obtained from an environmental investigation. How confident are you that the sample you collected is representative? Are you sure the analytical method applied accurately identifies the contaminant and what its concentrations are in the sample?

One of the first steps in determining your DQOs is to clearly define the regulatory requirements that must be met to determine ifthe potential hazard (e.g.vapor intrusion) is an actual threat to the population of concern. Review the state or federal regulations and guidance documents (Cal RWQCB 1997, Cal.DTSC 2003, NYDOH 2005, U.S.EPA 2002, etc.) to be sure you know what is required and how the data is to be used. The following outline of objectives for three different projects may help clarify where and when different levels of data quality are required.

Project 1:

- Are VOCs present in soil gas?
- What are gross concentration ranges?
- What is approximate extent of the contamination?

Project 2:

What are the specific types of VOCs present in the soil gas?
What are approximate concentrations of each contaminant type at each location?

- Define and map the extent of the contaminant plume and locate source areas.

Project 3:

- Determine the specific VOC compounds present in the soil gas.
- Determine the concentration of each compound at each location with good precision and accuracy.
- Define and map the plume for each analyte and locate sources.

Determine ifthe contaminants present a threat to human health or the environment (is the vapor intrusion pathway complete?).
Obtain data that can be used to determine appropriate remedial actions or if remedial actions are required.

Once you determine what level of data quality is required you can then determine the appropriate sampling tools, sample collection procedures, and analytical methods that are required to meet your objectives. Table 2 may be used to guide you in selecting the appropriate methods to use in the field to be sure the project manager, facility owners, and regulators are able to make the correct decisions. **Establishing project DQOs and selecting the appropriate field methods for sample collection and downhole tool systems is not a trivial process and should be completed well inadvance of starting field work.** Details of the sample collection methods and downhole sampling systems listed inTable 2 are discussed in the following sections.

Of course the final data quality is controlled by the analytical method chosen and the analytical quality control that is used. You can collect a low quality sample and spend hundreds of dollars on an expensive analytical method with rigorous quality control, this would be a mistake. Ifyou have low confidence inthe sample quality (poorly representative) it will not matter how much you spend on the analysis, the final data will still be of low quality (poorly representative). You can't improve the quality of a bad sample by using expensive analytical methods. Inthe end the analytical result is only as good as the sample quality. For guidance on selection of the appropriate analytical methods review the appropriate federal or state guidance documents (Cal RWQCB 1997, Cal. DTSC 2003, NYDOH 2005, U.S. EPA 2002, etc.) and/or the SW846 manual (EPA 1986).

5.1 Analytical Methods

The EPA Draft Guidance for the vapor intrusion pathway includes a table listing more than a dozen analytical methods used to test for VOCs. The purge and trap methods such as 8260(were primarily written for soil and groundwater analysis. Purge and trap methods may be useful if you are conducting passive soil gas sampling and collecting VOCs in a sorbent trap. However, direct injection may be conducted with method 8260(and this provides a useful method for analysis of soil gas samples. Method T0-17 is also a method that requires the use of a sorbent trap for sample collection and later purge and trap gas chromatograph (GC) analysis. This is sometimes used for ambient air monitoring in buildings.

(continued on Page 6)

Table 1: Basic chemical properties A,B,C,D of selected voes and gases of interest in soil gas investigations.

Chemical Name	Molecular Formula	Molecular Weight	Density *(glee)*	Henry's Law Constant Ratioc (atm·m'/mol)"	Boiling Point (°C)	Water Solubility %A (g/L @ 25°C)"	Vapor Pressure (mm Hg @ 68°F)	Viscosity" (mPa·s @ 2s°C, 1 atm)	Ionization Potential (eV)
Aromatics and Aliphatics									
Benzene	C,H,	78.11	0.877	0.215	176°F	0.04% @ 54°F (1.77)	75	0.604	9.24
Toluene	C,H,CH,	92.1	0.87	0.262	232°F	0.05% @ 61°F (0.53)	20 (at 65°F)	0.56	8.82
Ethyl Benzene	C,H,CH,CH,	106.2	0.87	0.322 (8.SE-3)	277°F	0.01% (0.16)	10 (at 79°F)	0.631	8.76
Xylenes (o,m,p isomers)	C,H.(CH,)$_2$	106.2	0.88 to 0.86	0.304	269°F to 292°F	- 0.01% (0.16 to 0.18)	*71919*	0.760, 0.581, 0.603	8.44 to 8.56
(n-)Octane	CH,(CH,),CH,	114.2	0.70		258°F	-insoluble	10	0.508	9.82
Methyl t-butyl ether (MTBE)[0]		88.15	0.74	0.018 (5.5E-4)	55.2	(51.2)	245		
Chlorinated VOCs									
Vinyl Chloride	CH,CHCl (chloroethene)	62.5	0.911	(1.1E-2)	-13.3 (7°F)	-0.1% @ 77°F (2.8)	>760	---	9.99
1,1 Dichloroethane (1,1-DCA)	CHCl, CH,	99.0	1.18	---	135°F	0.6%	230mm (at 77°F)	0.464	11.06
1,2-Dichloroethylene	(CH)$_2$Cl$_2$ (1,2-DCE)	97.0	1.27 (at 77°F)	(3.0E-2)	118° to 140°F	0.4% (2.4)	180 to 264	Cis = 0.445 Trans = 0.317	9.65
1,1,2-Trichloroethane	CHCl$_2$CH$_2$Cl (TCA)	133.4	1.44	---	237°F	0.4% (4.4)	19	---	11.0
Trichloroethylene	ClCH=CCl, (TCE)	131.4	1.46	---	189°F	0.1% @ 77°F	58	0.545	9.45
Tetrachloroethylene	Cl$_2$C=CCl$_2$ (Perchloroethene)	165.8	1.62	--	250°F	0.02% @ 77°F (1.2)	14	0.844	9.32
Carbontetrachloride	CCl_4	153.8	1.59	---	170°F	0.05% (1.2)	91	0.908	11.47
Landfill Gases									
Methane	CH_4	16.04	0.4228[-162]	---	-161.5	Soluble	-	---	12.98
Carbon dioxide	CO,	44.0	---	---	sublimes	0.2% @ 77°F	>760	---	13.77

glee = grams per cubic centimeter. atm·m3/mol = atomosphere cubic meter per mole. °C = degrees centigrade. °F = degrees Fahrenheit. g/L = grams per liter.
mm Hg = millimeters of mercury. mPa·s = millipascal second = centipoise. atm = atmosphere. eV = electron volt
A) NIOSH Pocket Guide to Chemical Hazards, 1990. B) CRC Handbook of Chemistry and Physics, 1995. C) U.S. EPA, 1997. D) www.epa.gov/opptintr/chemfact/s_mtbe.txt

Table 2: Matrix for selection of field methods to achieve DQOs.

Downhole Sampling System		Sample Collection Method			
		Syringe	Tedlar Bag	Glass Bulb	Summa Canister
	Increasing Quality				
Direct Sampling		*Low I Low*			*Low I High*
PRT System					
Implants					
Gas Wells		*High I Low*			*High I High*

Dashed arrow shows general path for selection of methods that will result in sampling and collection with compatible quality procedures to achieve desired DQO level. If method pairs in the upper right or lower left corner are used the final sample analytical quality will be of low confidence regardless of the analytical method applied. To achieve intermediate DQOs for an initial survey the PRT system is often combined with collection in Tedlar bags or glass sampling bulbs and field analysis utilizing a mobile lab equipped with a gas chromatograph.

For active soil gas sampling you will probably be involved with one or more of the following methods:

Method #	Analytes	Instruments	Det. Limits
8260	Aromatic, Halogenated and other VOCs	GC/MS	50 ug/m^3
8260 SIM	Aromatic, Halogenated and other VOCs	GC/MS	10 ug/m^3
8021	Aromatic and Halogenated VOCs	PID/ELCD-GC	> 5 ug/m^3
T0-15	VOCs in Air with Summa Canisters	GC/MS	1 to 10 ug/m^3
T0-17	VOCs in Air with Sorbent Tubes	GC/MS	0.5 to 25 ppbv

GC = Gas Chromatograph MS = Mass Spectrometer PID =Photo Ionization Detector
ELCD = Electrolytic Conductivity Detector

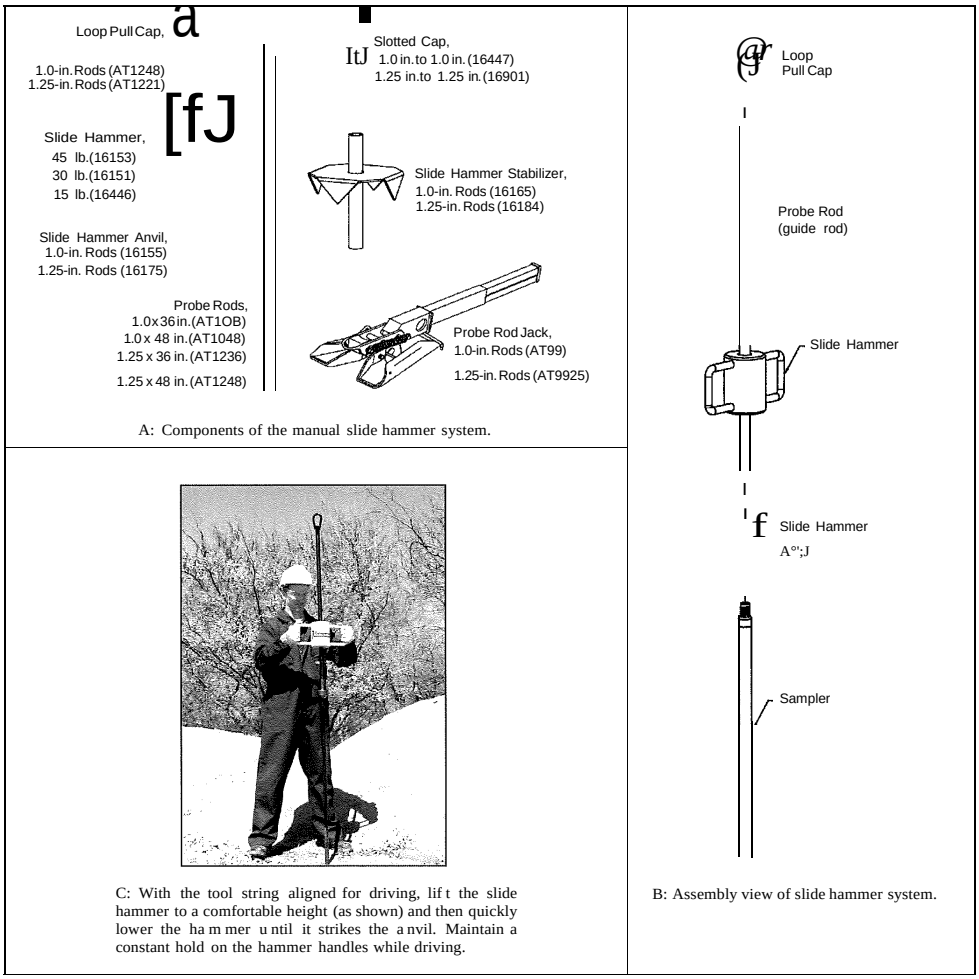
The 8021 Method is often modified for use in a mobile lab in the field. Air samples are direct injected on column for analysis. Sometimes an ECO (electron capture detector) is used instead of the ELCO(electrolytic conductivity detector) to detect the chlorinated VOCs. Field analysis with the 8021 method allows the field team to track/map plumes while in the field and locate source areas. The field analysis is also a useful way of screening samples to determine which are best submitted for more expensive off-site analysis. Knowing approximate sample concentrations also may be used to select the appropriate lab analysis.

For soil gas samples with elevated concentrations the standard 8260 method will provide sufficient sensitivity and detection limits. Samples with lower concentrations may be suitable for the 8260 SIM (selected ion monitoring) method. Low concentration samples requiring lower detection limits and high data quality may require the T0-15 method. Be aware that not all labs provide the same level of data quality for the same method. A cheaper price may mean less QA/QC. Be sure the final data package will meet your data quality requirements.

Section 6.0
Downhole Soil Gas Sampling Methods for Preliminary Assessments and Plume Tracking

6.1 Methods to Advance Tool Strings

Several methods for soil gas sampling were developed in the 1980s and used to track VOC plumes and locate potential source areas. One of the earlier methods included manually driving galvanized steel pipe to the desired depth with a slam-bar or fence-post-driver. While physically demanding, these manual methods may still prove valuable inaccessing delicate ground in residential areas (landscaped plant beds, etc.) or where access is otherwise limited. Improvements to this manual method have been made to improve sample quality and minimize the physical demands for driving and removing the probe rods (Figure 2) (Geoprobe Systems®, 2001). When site access conditions permit, soil gas sampling tools may be advanced into the subsurface with a Geoprobe® direct push machine (Figure 3) to minimize the physical effort required and speed up the sampling process.



A: Components of the manual slide hammer system.

C: With the tool string aligned for driving, lift the slide hammer to a comfortable height (as shown) and then quickly lower the hammer until it strikes the anvil. Maintain a constant hold on the hammer handles while driving.

B: Assembly view of slide hammer system.

Figure 2: Components, assembly, and operation of the manual sampling tools.

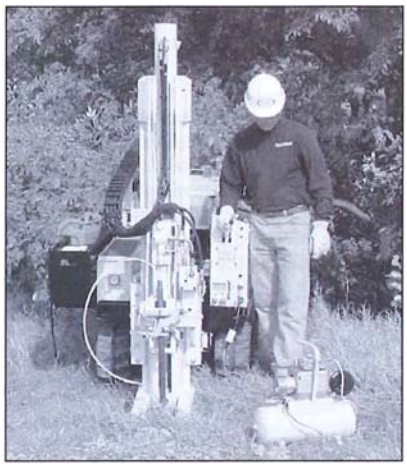


Figure 3: Using a Geoprobe® direct push machine to advance soil gas sampling tools to depth. Note use of portable vacuum/volume system for purging and sampling.

6.2 Direct Sampling System

Initially the collection of soil gas samples was conducted directly through the rods driven to depth (Figure 4). An expendable point was advanced to depth on the leading end of the drive rods. Then the rods were retracted a specified distance to release the expendable point and create an open void where soil gas could enter the rod string for sampling. A gas sampling cap with appropriate fitting was attached to the top of the drive rods and gas was purged and then collected for analysis. While this method is quick and cost effective there is potential for leaks at each rod joint that could compromise sample quality. This method also requires that the steel rods be thoroughly decontaminated between each use. In addition, some contaminants may be sorbed or degraded on the metal surface of the drive rods, especially if the rods are rusty.

6.3 PRT Sampling System

The Post Run Tubing (PRT) system was developed to help eliminate some of the problems with sampling directly through the steel rods. The PRT method uses an adapter and tubing to isolate the soil gas sample from the steel drive rods (Figure 5). This also eliminates possible leaks of ambient air from the rod joints into the gas being sampled. Tool configurations for soil gas sampling with the PRT system using different size probe rods are shown in Figure 6. PRT adapters (Table 3) must be selected to fit the desired tubing (Table 4) that will be used for sample collection.

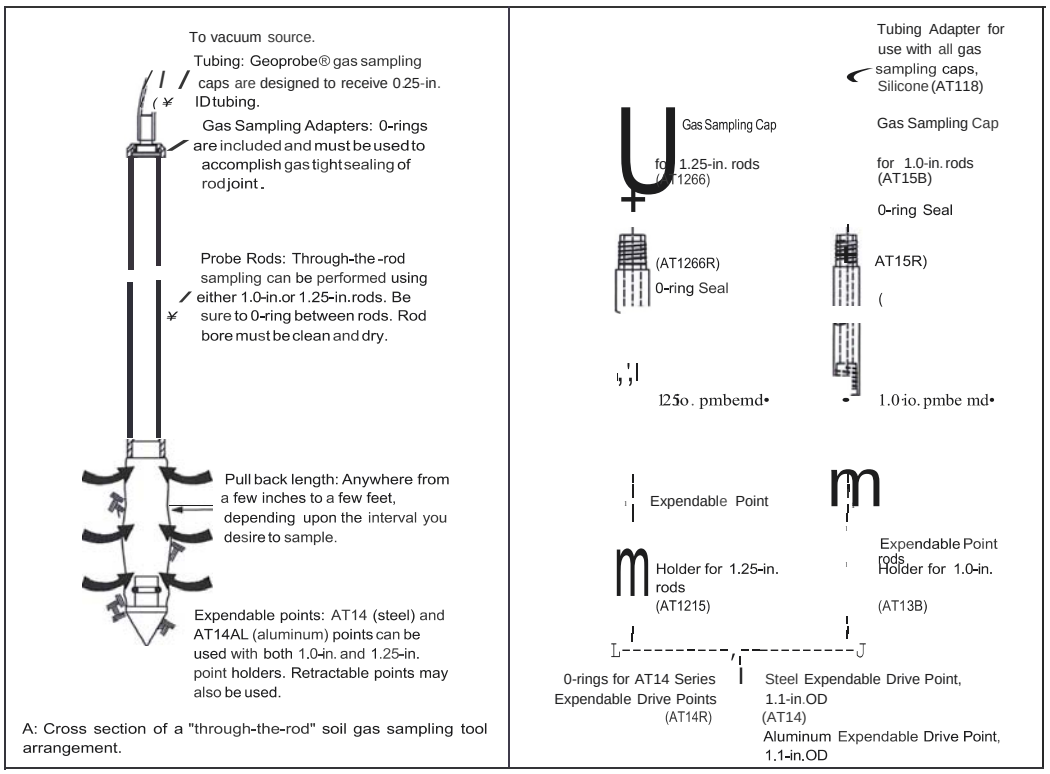


Figure 4: Direct sampling systems.

The basic steps to conduct soil gas sampling with the PRT system are as follows:

- An expendable point holder is attached to the lead rod.
- The expendable point is placed in the point holder, use 0-ring.

  The tool string is advanced to the desired sampling depth. Additional probe rods are added as required.
- Next, the stainless steel PRT adapter with appropriate sized barb is attached to the selected tubing cut to length.

  The drive cap is removed from the tool string and the PRT Adapter is lowered on the tubing down the tool string.

  The PRT adapter is threaded into the reverse thread fitting in the top of the PRT expendable point holder by manually rotating the tubing counterclockwise until the 0-ring on the adapter seals against the point holder. The top end of the tube may be sealed to minimize gas exchange with the ambient air and possible loss of VOCs.

  A leak test of the PRT tubing system may be conducted at this time by applying vacuum to the tubing. An in-line gauge may be used to verify that leaks do not occur after the vacuum is applied.
- The direct push machine is then used to retract the probe rods a specified interval, usually 6 to 12 inches (or 150to 300 mm). This provides an open cylinder in the soil through which the soil gas may be purged and sampled.
- The upper end of the tube is connected to the purging/sampling system and the sample is collected.

  The direct push machine is used to remove the probe rods. Once at the surface, the 0-ring seal between the PRT adapter and the expendable point may be visually inspected to further verify sample integrity.

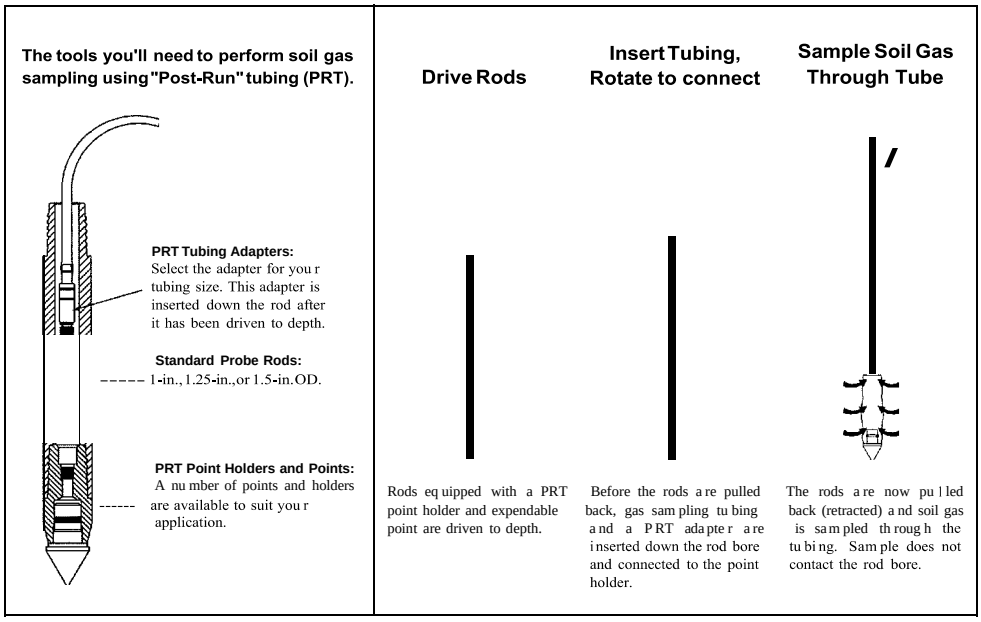


Figure 5: PRT sampling system.

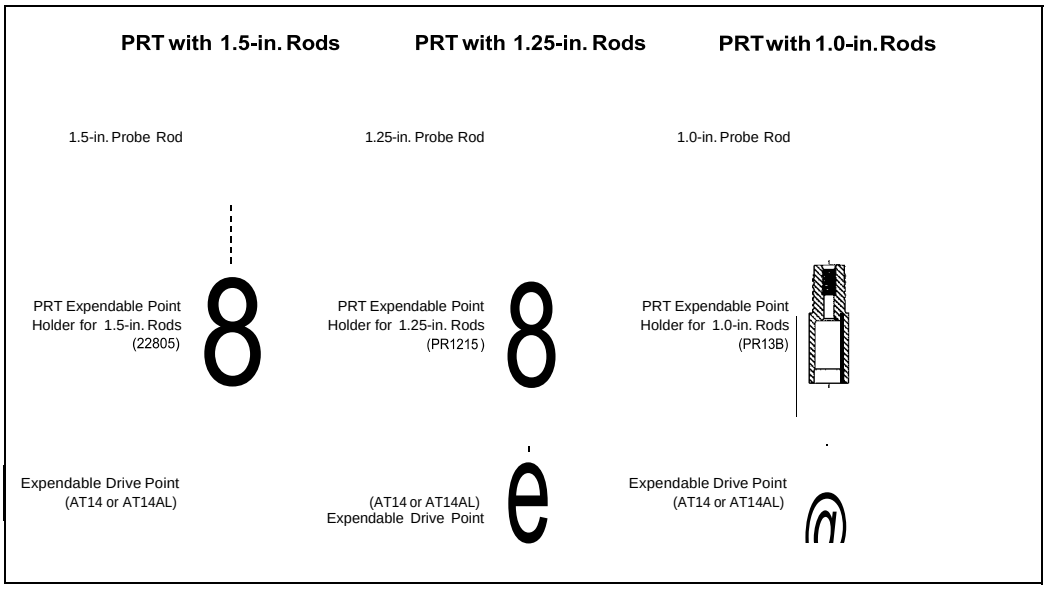
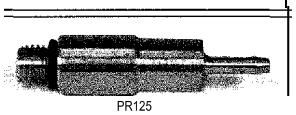


Figure 6: Tool configurations for PRT soil gas sampling.

Table 3: PRT adapter selection guide.

PRT Adapter Selection Guide

PRT ADAPTER and PART NUMBER	RECOMMENDED TUBING SIZE (ID)	GEOPROBE® TUBING PART NO.	TUBING INTERNAL VOLUME
 PR125	1/8 in. (3.2 mm)	TB12T Teflon®	2.4 ml/ft (7.9 ml/m)
PR175	0.17 in. (4.3 mm)	TB17l LDPE	4.5 ml/ft (14.6 ml/m)
	3/16 in. (4.8 mm)	TB17T Teflon®	5.4 ml/ft (17.8 ml/m}
PR255	1/4 in. (6.4 mm)	TB25l LDPE	9.7 ml/ft (31.7 ml/m)
PR305	5/16 in. (7.9 mm)	TB30T Teflon®	15.1 ml/ft (49.5 ml/ml
& 0-Rings for all PRT Adapters PR25R (pack of 25)			

NOTE: The sorption characteristics of certain tubing may not permit their use in all soil gas sampling applications.

Table 4: Tubing selection guide for PRT adapters and soil gas implants.

Part Number	Tubing Material	Inside Diameter, inches (mm)	Outside Diameter, inches (mm)	Wall Thickness, inches (mm)	Length, feet (m)	Tubing Internal Volume, ml/ft (mL/m	PRT Adapter Part Number	Implant Part Numbers[1]
TB17L	LDPE2	0.17 (4.8)	1/4 (6.4)	0.040 (1.0)	500 (152)	4.5 (14.6)	PR17S	AT8617S AT8717S
TB25L	LDPE[2]	1/4 (6.4)	3/8 (9.5)	1/16 (1.6)	500 (152)	9.7 (31.7)	PR25S	AT8625S AT8725S
TB37L	LDPE[2]	3/8 (9.5)	1/2 (12.7)	1/16 (1.6)	100 (31)	21.7 (71.2)	NA	AT9637[3] AT9638[4]
TB12T	Teflon®	1/8 (3.2)	1/4 (6.4)	1/16 (1.6)	50 (15)	2.4 (7.9)	PR12S	AT8612S AT8712S
TB17T	Teflon®	3/16 (4.8)	1/4 (6.4)	1/32 (0.8)	50 (15)	5.4 (17.8)	PR12S	AT8612S AT8712S
TB30T	Teflon®	5/16 (7.9)	3/8 (9.5)	1/32 (0.8)	50 (15)	15.1 (49.5)	PR30S	AT8630S AT8730S
TB45SL	Silicone	3/16 (4.8)	7/16 (11)	1/8 (3.2)	25 (8)	-	NA	NA
TB50TY	Vinyl	1/4 (6.4)	7/16 (11)	3/32 (2.4)	25 (8)	-	NA	NA
TB100TY	Vinyl	1/4 (6.4)	7/16 (11)	3/32 (2.4)	100 (31)	-	NA	NA
AT82	Stainless Steel	0.085 (2.2)	1/8 (3.2)	0.040 (1.0)	50 (15)	-	NA	AT86SW12

1 - 86 series implants are 6 in. (152 mm) long and 87 series implants are 21 in. (533 mm) long.
2 - Low-density polyethylene.
3 - 96series implants are for use in 1.25-in.or 1.5-in.OD probe rods with an ID of 0.625 in.(15.9 mm). Screen is 12in.(305 mm) long. Use with any plastic tubing with an ID ranging from 1/4 in. to 7/16 in. (6.4 mm to 11 mm).
4 - This implant is designed for air sparging only and is equipped with a porous polyethylene lining.

6.4 Vapor Implants / Small ID Rods

These simple devices allow the investigator to install a small screen at the desired depth to conduct long-term monitoring of soil gas in the subsurface. The implants may be installed through 1.0-, 1.25-, or 1.5-inch outside diameter probe rods for many applications. However, when installed through these smaller rods it may not be possible to achieve the high-integrity seal required for human health risk assessments as in evaluation for the vapor intrusion pathway. High-integrity seals can be obtained by installing the implants through larger diameter rods as discussed later in Section 7.0.

The implants consist of a stainless steel wire mesh screen with a threaded fitting on the bottom for anchoring and a fitting at the top to connect to tubing (Figure?). The AT86 series screens are 6 inches (152 mm) long, the AT87 series screens are 21 inches (533 mm) long, and both have an OD of less than 0.5 inches (13 mm). The AT96 series screens are 12 inches (305 mm) long with an OD of less than 0.625 inches (16 mm). All have a pore diameter of approximately 0.006 inches (0.15 mm) in the stainless screens (Table 5).

The implants are installed through the drive rods after they are advanced to the desired depth (Figure 8). An expendable implant anchor/drive point at the lead end of the rod string has a threaded fitting at the upper end and the implant is anchored in place by threading in counterclockwise. As the rods are retracted with the direct push machine, fine glass beads (P/N AT84) may be poured in around the screen to prevent clogging. Once the rods are above the screen, a bentonite powder mix (PIN AT85) may be added to the rod annulus to seal the probe hole. Do not hydrate the bentonite until the rod string is completely removed from the ground. The tubing should be capped to prevent venting to the ambient atmosphere until ready for sampling. A simple PVC pipe with cap may be installed over the implant tubing at the surface for protection. Conventional well protectors (P/N WP1771 or WP1741) may be used if necessary.

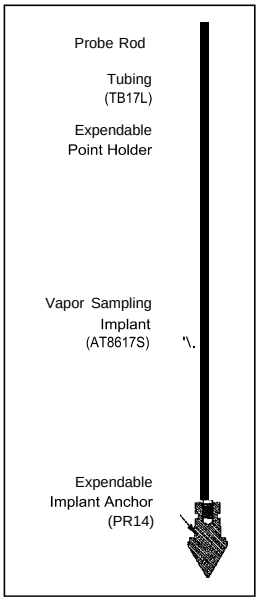


Figure 7: Schematic of a soil gas implant assembly.

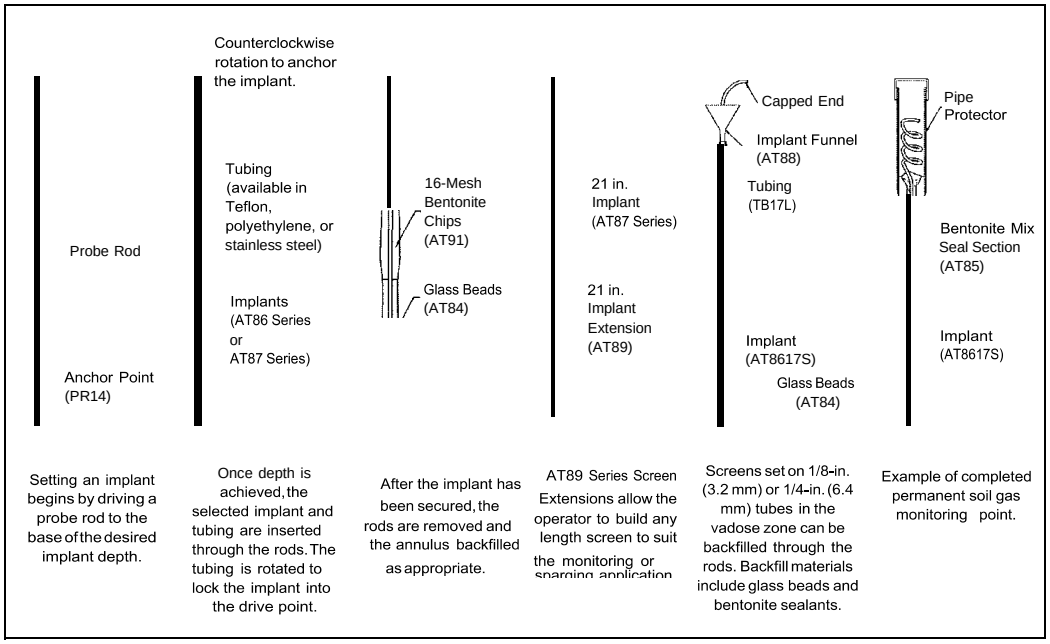


Figure 8: Installing implants through small-diameter probe rods.

Table 5: Implant selection guide.

END FITTING	SUGGESTED SAMPLING USE	RECOMMENDED TUBING SIZE	GEOPROBE® TUBING PART NO.	IMPLANT PART NUMBERS 6-in. (152 mm) SCREEN LENGTH	IMPLANT PART NUMBERS 21-in. (533 mm) SCREEN LENGTH
Barbed	Soil Gas	1/8 in. ID (3.2 mm ID)	TB12T	AT8612S	AT8712S
Barbed	Soil Gas	0.17 in.ID (4.3 mm ID)	TB17L	AT8617S	AT8717S
		3/16 in. ID (4.8 mm ID)	TB17T		
Barbed	Soil Gas, Shallow Groundwater	1/4 in.ID (6.4 mm ID)	TB25L	AT8625S	AT8725S
Barbed	Soil Gas, Shallow Groundwater	5/16 in.ID (7.9 mm ID)	TB30T	AT8630S	AT8730S
Swagelok™	Soil Gas	1/8 in.OD (3.2 mm OD)	AT82 (1/8 in. stainless)	AT86S\N12	
		3/16 in. ID (4.8 mm ID)		AT86S\N17	
		1/4 in. OD (6.4 mm 0D)		AT86S\N25	AT87S\N25
PRT Socket	Soil Gas, Shallow Groundwater	Screen Extension (for use with AT87 Series Implants)			AT89

For 125-in. and 1.5-in. Probe Rods Only		RECOMMENDED TUBING SIZE	GEOPROBE® TUBING PART NO.	12-in. (305 mm) SCREEN LENGTH
Tapered Screw Thread	Soil Gas, Shallow Groundwater, Air sparging (AT9638)	Any plastic tubing 1/4 in.ID to 7/16 in.ID (6.4 mm to 11 mm ID)	TB37L	AT9637 (sampling) AT9638 (sparging)

AT86 Series: Screen is 0.25 in. ID x 6 in. long (6.4 mm x 152 mm) with 0.15 mm pore openings. AT86 implants will fit through 0.5-in. (12.7 mm) bore tooling.

AT87 Series: Screen is 0.25 in. ID x 21 in long (6.4 mm x 533 mm) with 0.1Smm pore openings. AT87 implants will fit through 0.5-in. (12.7 mm) bore tooling.

AT9637 and AT9638 Implants: Screen is 3/8 in. ID x 12 in. long (9.5 mm x 305 mm) with 0.15mm pore openings. These implants require a minimum 0.625-in.(15.9 mm) rod bore for passage.

AT9638 implants are the only implants recommended for gas sparging (injection) as they have a porous polyethylene lining inside the implant screen. This interior filter prevents the implant from clogging with formation fines which may backflow into standard implants during periods of pressure shut down.

6.5 Soil Gas Profiling with Dual Tube Systems

In some situations it may be necessary to conduct vertical profiles of soil gas to determine if there is a significant change in concentration or contaminant type with depth. The methods discussed in previous sections could be used to obtain profiles, but a separate advancement would be required for each depth interval. Conversely, dual tube systems can provide access to soil gas or ground water at multiple depths during a single advancement of the tool string. The DT325 soil sampling system can be combined with a simple screen to conduct profiles of soil gas or groundwater if necessary (Figure 9). A summary of the procedure for soil gas profiling follows:

The equipment operator may conduct continuous soil sampling as the tool string is advanced or install a solid drive point {P/N 28509) if soil sampling is not required.

Once the cutting shoe is immediately above the desired soil gas sampling interval, the sample sheath and soil sample or solid drive point is removed.

The profiler screen assembly (Figure 9) with a 12-inch {305 mm) screen {P/N 14402) or 6-inch (152 mm) screen {P/N 14401) is then attached to the inner drive rods and lowered through the annulus of the 3.25-inch rods.

- The screen is pushed through the open cutting shoe and advanced into the formation until the 0-ring on the profiler head {P/N 21379) seals in the throat of the cutting shoe.

  At this point the tubing adapter {P/N 13521) is attached to the selected tubing (Table 4) and lowered through the bore of the inner rods.

  The inner tube and adapter are rotated counterclockwise to thread the tubing adapter into the top of the screen drive head (P/N 12567 or 16913).

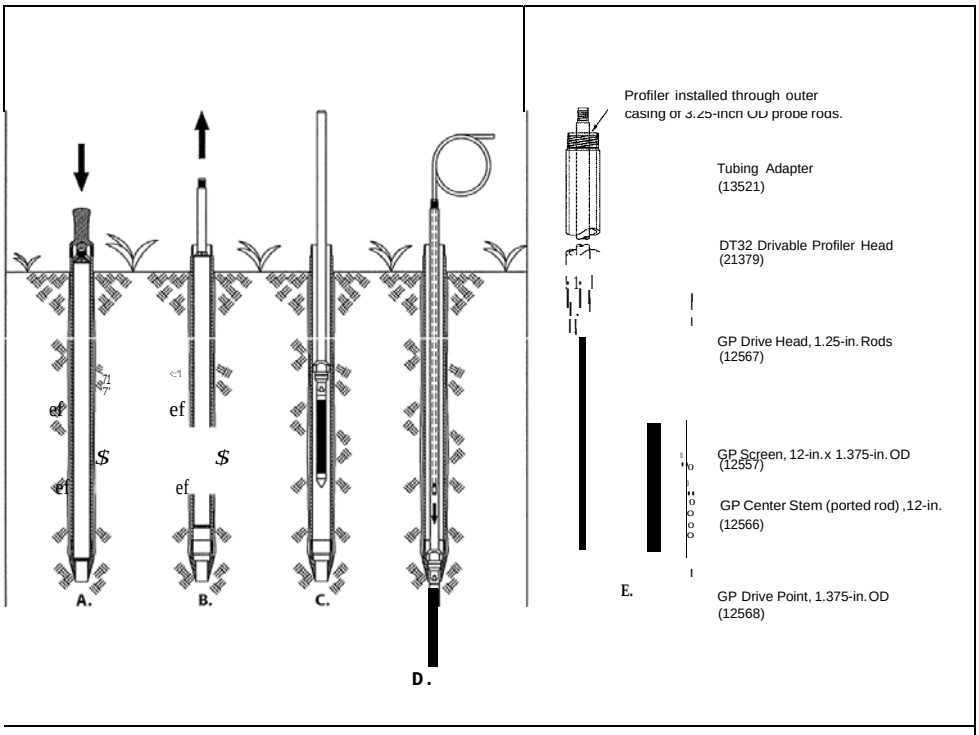
  This then provides a sealed sampling system for collection of soil gas samples.

- Once the soil gas sample is collected, the tubing is removed and the inner rods and screen are retracted and removed.

  To advance to the next depth, either the solid drive point is installed in the cutting shoe or a soil sample barrel is installed for the next interval. The tool string is advanced to the next desired depth (with removal of soil cores as necessary).

- Installation of the screen and tubing is repeated for the next soil gas sample (Figure 9, Steps C and D).

Once the soil gas profiling is complete, it is possible to install permanent implants at multiple depths as the 3.25-inch rod string is retracted. See Section 7.3 for further discussion of this procedure. Be sure to soil core through any intervals where soil gas implants are to be installed. This will help minimize compression of the formation and loss of gas permeability. If permanent implants will not be installed, abandon the probe hole as required by local regulations (see Section 9.0).



A. Soil sampling as the tool string is advanced to minimize compression of the soil and loss of gas permeability.

B. Extracting the soil sample.

C. Installing the profiler screen through the rod bore.

D. The selected tubing (Table 4) with attached tubing adapter (PIN 13S21) are lowered through the bore of the inner rod string and threaded into the Screen Drive Head (P/N 12567). The soil gas is purged and sample is collected.

E. Components of the profiler screen assembly for use with the DT325 system. The 12-inch (305 mm) screen assembly is shown here (P/N 14402). A 6-inch (152 mm) screen assembly (P/N 14401) is also available .

Figure 9: Soil gas profiling with the DT325 system.

Section 7.0
Downhole Soil Gas Monitoring Methods for Evaluation of the Vapor Intrusion Pathway

Data obtained for evaluation ofthe vapor intrusion pathway (VIP) will generally be used to conduct a human health risk assessment (HHRA). Because the data will be used for a HHRA, the data quality objectives are very high and most of the soil gas sampling methods described in previous sections may not meet the sample quality requirements. To achieve the higher DQOs and to permit long-term monitoring of soil gas, most regulatory agencies are requiring the use of permanent soil gas monitoring wells or implants with filter media around the screens and high-integrity seals. In some situations, multilevel monitoring is required to define the vertical distribution of soil gas inthe subsurface and evaluate the potential for contaminant degradation. The following sections outline some field methods that will enable the investigator to achieve the higher DQOs when either single-level or multilevel monitoring of soil gas is required.

7.1 Single-Depth High-Integrity Soil Gas Implants for Monitoring

If the installation of implants with smaller probe rods as described previously will not meet the higher DQOs for your project, the DT21 dual tube system may be required. This system uses 2.125-inch (54 mm) OD by 1.5-inch (38 mm) ID outer probe rods and 1-inch (25 mm) OD inner rods to provide access to the desired sampling interval either by use of a solid drive point or soil coring system (Figure 10, see also Technical Bulletin # 982100). To minimize compression of the formation and reduction of gas permeability,it is best to stop the DT21 system just above the interval where soil gas is to be sampled. The following steps (Figure 11) should be followed to install an implant for long-term soil gas monitoring:

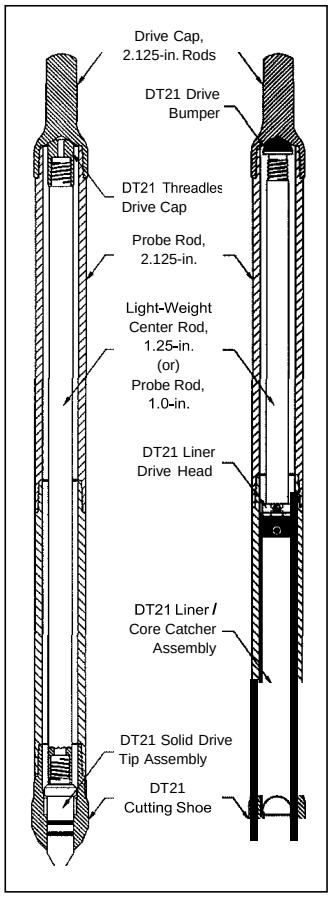


Figure 10: DT21 soil sampling tool string configurations.

Once at the desired depth, the inner rod string and any soil sample is removed.

A small thin-walled sample tube (P/N 19484) with drive head (P/N DT4055) is lowered through the outer rods and advanced ahead ofthe cutting shoe to remove a soil core where the implant will be installed (Figure 11). This sample tube (P/N 19484) is designed for low-density sands and finer-grained materials only.

Once the soil core is removed a stiff brush (P/N BU600) may be lowered by extension rods (P/N AT671, etc.) into the open core hole in fine-grained or otherwise cohesive formations. The brush is rotated and moved up and down gently through the cored interval to relieve any smearing and reestablish natural gas flow into the void where the implant will be installed.

The appropriate 6-inch (152 mm) or 12-inch (305 mm) long implant (Table 5) is attached to the selected tubing (Table 4) and lowered into the open core hole below the probe rods. Cap or cover the end of the tube at the surface to prevent clogging and/or loss of volatiles.

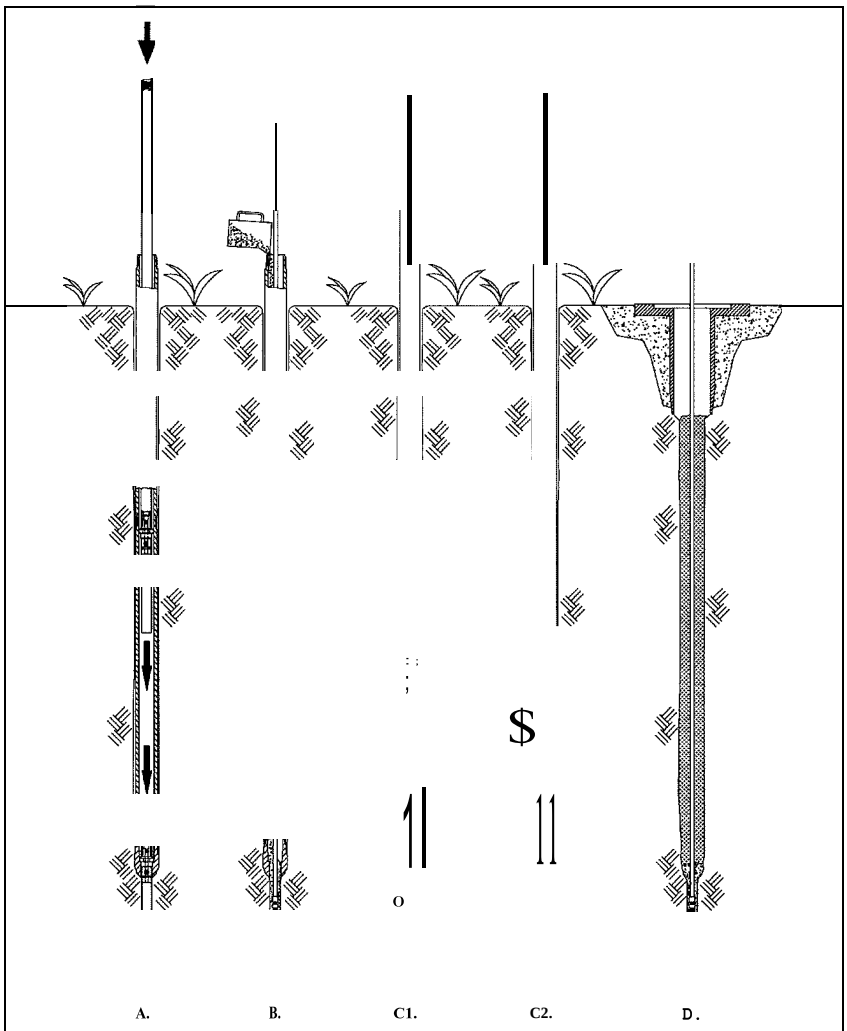
Next, either environmental sand (P/N AT95) or fine glass beads (P/N AT93) are poured through the rod bore to fill the open hole around the implant screen. The probe rods should be retracted slowly to keep the filter media below the cutting shoe. Measure with suitable depth indicator to confirm the filter media extends at least 6 to 12 inches (152 to 305 mm) above the top of the implant.

Grouting of the annulus may be accomplished in one of two ways.

1. Fine bentonite chips (P/N AT91) are gravity poured through the rod bore as the rods are slowly retracted to keep chips below the cutting shoe. The chips are hydrated with water every 4- to 6-inch (102 to 152 mm) increment. Water should be added through a tube extending below the cutting shoe. This will prevent wetting the ID of the rods and possible bridging.
2. A grout slurry of either bentonite powder (PIN AT92) or neat cement may be pumped by tremie tube using an appropriate grout machine to fill the bore hole as the drive rods are retracted.

Once grouting is completed, suitable surface protection (PIN WPl 771 or WP1741) should be installed to meet local needs and regulatory requirements. In remote locations such as landfills, a simple PVC pipe with slip-cap may provide suitable protection for short-term monitoring requirements.

The DT325 sampling system may also be used in a similar fashion to install high-integrity single-depth implants for soil gas sampling and long-term monitoring.



A. Advance the DT21 system to depth and remove the inner rod string. The pre-core assembly is attached to the lead inner rod and lowered through the outer rod bore. The thin-walled tube is advanced into the virgin soil ahead of the drive rods to remove a soil core.

B. The soil gas implant is assembled and lowered into the open core hole with the tubing. Fine sand or glass beads are added through the rods slowly to prevent bridging.

C1. Fine bentonite chips are added through the drive rods. A tube with funnel at the surface should be used to add water to hydrate the bentonite incrementally as the rods are retracted.

C2. Alternatively, grout slurry may be pumped through a tremie tube to fill the probe hole as the rods are retracted. Use appropriate pump (GS1000 or GSSOO) and nylon tremie tube (P/N 11633).

D. The sample tube is sealed with a suitable airtight cap or valve. Well protection is installed to meet local requirements

Figure 11: Installation of single-level implants for soil gas monitoring with the DT21 system.

7.2 Single-Depth, High-Integrity Soil Gas Wells

Under some conditions or to meet specific regulatory requirements, it may be necessary to install prepacked screen monitoring wells (Figure 12) for long-term soil gas monitoring. Smaller diameter wells (e.g. 0.5- or 0.75-inch ID) may be preferred for this option to minimize the amount of purging required before sampling is conducted. The DT21 system allows for this option and will provide high-integrity well construction with an excellent annular seal and well defined screened interval with filter media. This gas well installation process utilizes the same basic procedure as for the installation of prepacked screen wells for groundwater monitoring. See Geoprobe® Technical Bulletin No. 962000 for detailed discussion of this procedure or ASTM Standard Practice

different cap and seal mechanism will be required for the well to prevent venting of volatiles and permit for appropriate purging and sampling activities.

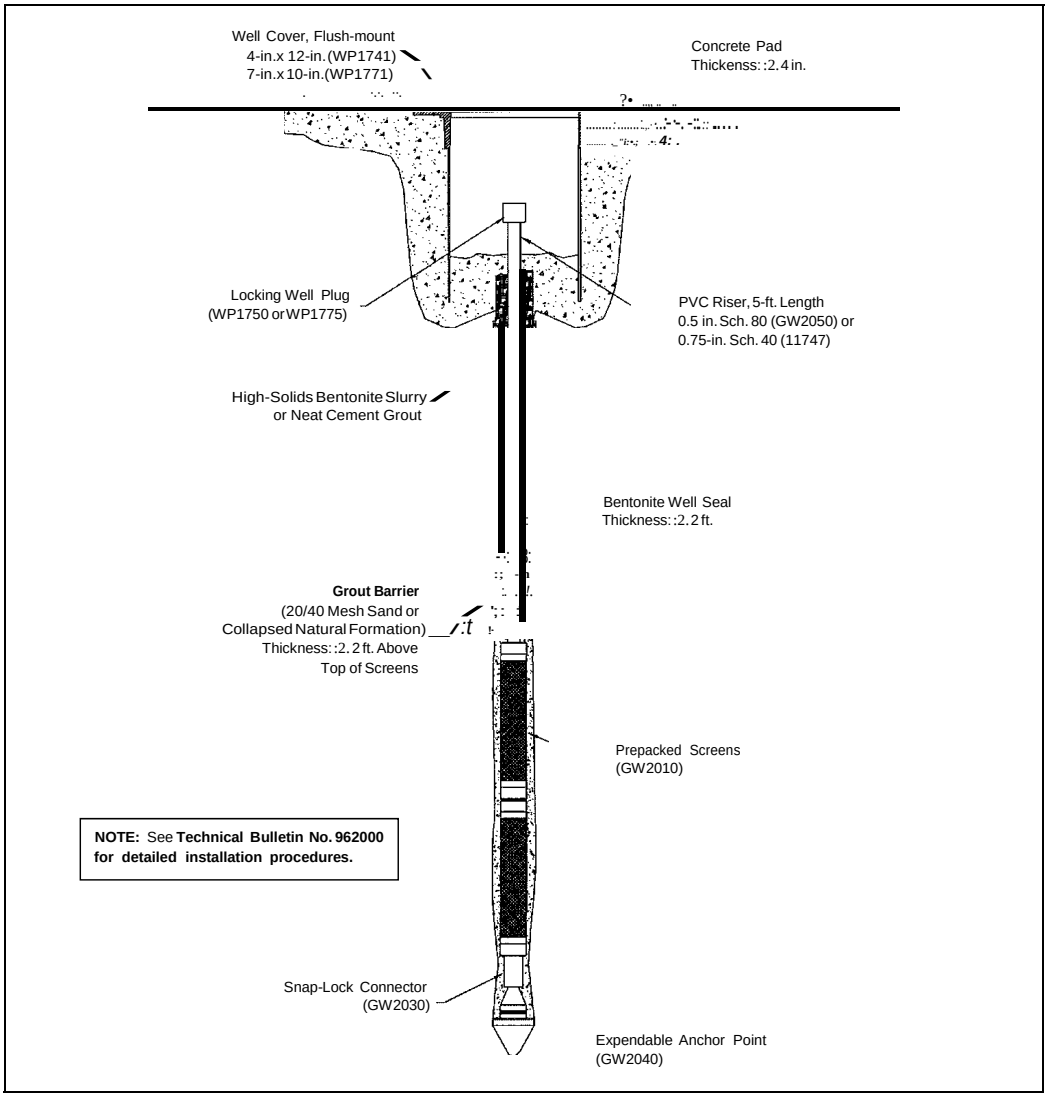


Figure 12: A properly installed Geoprobe® prepacked screen monitoring well.

7.3 Multiple-Depth High-Integrity Implants

Soil gas profiling with the DT325 system was discussed previously in Section 6.5 and Figure 9. As noted, this system may be used to install multilevel soil gas implants as the 3.25-inch diameter rods are retracted. It is recommended that DT325 soil sampling be conducted through the entire interval where soil gas implants are to be installed. Removal of the soil cores will minimize compression of the formation and loss of gas permeability where implants are to be installed. Once soil coring has been completed to the maximum desired depth, the multilevel soil gas implant installation is conducted as follows (refer to Figure 13):

- The inner rod string and last soil core is removed.

  A soil core may be removed below the cutting shoe as described above (Figure 11) for installation of the deepest gas implant, if desired.
- The selected implant (Table 5) and tubing (Table 4) are assembled and lowered to the bottom of the bore hole.

  Filter media is poured through the rod bore as the rods are slowly retracted until filter media extends at least 6 to 12 inches (152 to 305 mm) above the implant. Measure depth to top offilter media and keep below rods and cutting shoe to prevent bridging.
- Fine bentonite chips are poured through the rod bore as the rods are slowly retracted. Water is added through a tube to hydrate each 4- to 6-inch (102 to 152 mm) increment of bentonite. Avoid wetting the interior of the rods to prevent bridging of sand and bentonite that could result in damage or loss of implants. (Alternately, grout slurry could be pumped by tremie tube and grout pump to install the seal at each level. See Figure 11, Part C2.)
- Repeat the last three steps for each soil gas implant as the rods are retracted.

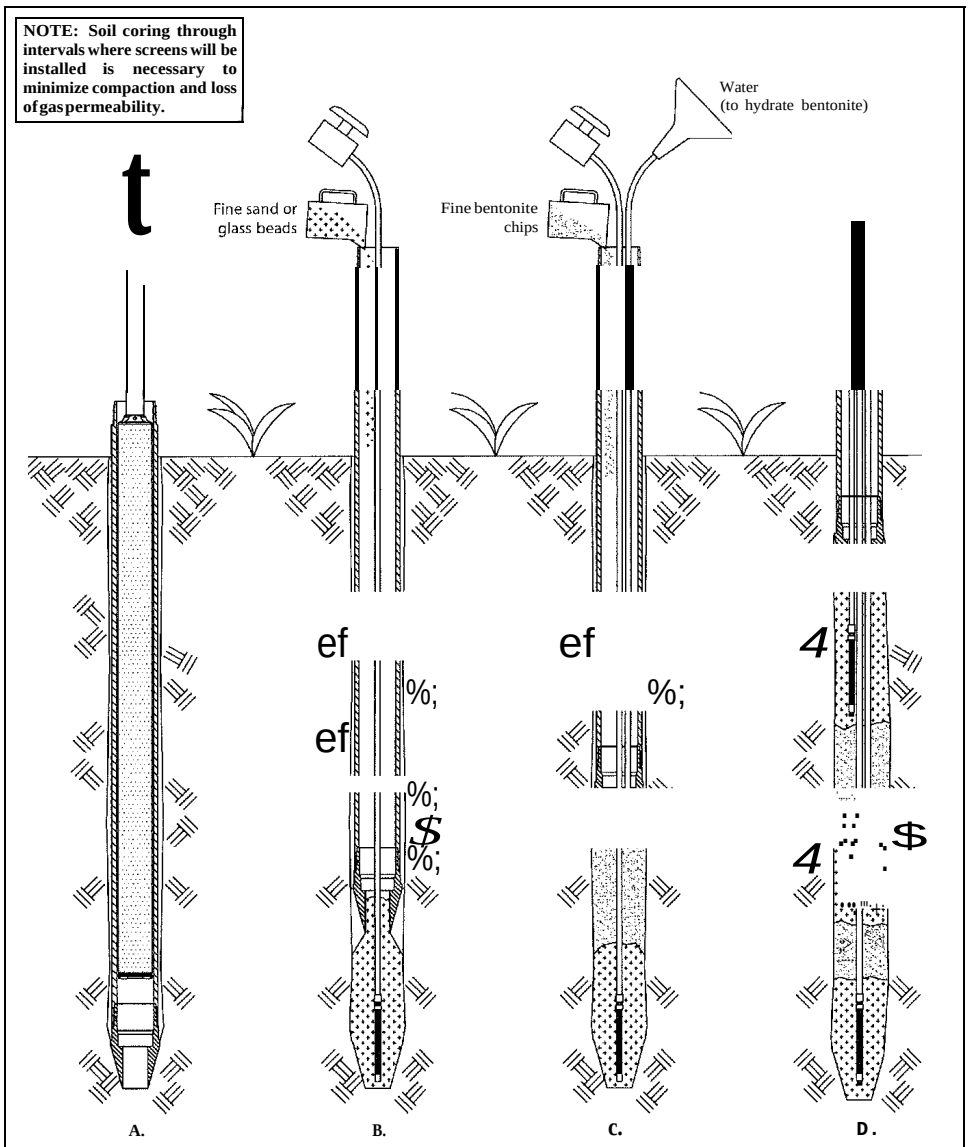
  Grout from top of the filter pack for the uppermost implant to about 1 foot (0.3 m) below grade.
- Install surface protection as required.

Vapor monitoring implants installed following this procedure will enable you to achieve stringent data quality objectives for collection of soil gas samples to be used in human health risk assessments for the vapor intrusion pathway (Cal RWQCB 1997, Cal. DTSC 2003, NYDOH 2005, U.S. EPA 2002, etc.).

Section 8.0
Direct Push Equipment Decontamination and Equipment Blanks

Without appropriate decontamination of downhole tooling and other sampling accessories there is significant opportunity for cross contamination and erroneous results. Various methods may be appropriate for equipment decontamination (decon) depending on the contaminant types and concentrations encountered (ASTM D 5088, Parker and Ranney, 2003). Most often downhole tools such as probe rods and point holders are cleaned with a soap-and-water wash and one or more clean water rinses. This may be most effective for VOCs if a heated pressure sprayer is used to conduct the decontamination. Measures for the control and containment of the spray and wastewater must be implemented. Appropriate health and safety protocols should be followed and adequate personal protective equipment should be worn. Refer to the project specific work plan and health and safety plan for guidance on appropriate safety protocols. Smaller parts may be washed and heated in an oven to drive off volatiles when appropriate.

When field analyses are conducted as sampling is performed in the field the analytical data can be used to guide decontamination requirements. Equipment used to collect samples that are nondetect will require less stringent decontamination measures than equipment used to collect samples from grossly contaminated areas. To assure that cross contamination is controlled equipment blanks should be collected on a regular basis (e.g. once a day or once every 10 samples, as appropriate to meet project DQOs). Equipment blanks should be collected from tool strings and sampling trains assembled just as they are for a typical sample location. The equipment blanks should be labeled and handled as other samples and submitted to the laboratory for the same analytical protocol.



A. Advance DT325 system to depth with soil coring as needed. Remove last soil core.

B. Install the selected implant and tubing. Gravity install fine sand or glass beads to provide a filter pack. Extend filter pack at least 4 to 6 inches (102 to 152 mm) above the top of the implant.

C. Gravity install fine bentonite chips to create annular seal. Use funnel and tubing to incrementally hydrate the bentonite as the rods are retracted. Avoid wetting rod ID to prevent bridging and loss of boring. Alternatively, grout slurry can be installed with a grout pump and tremie tube.

D. Repeat Steps B and C at specified intervals to obtain a multilevel monitoring system. Install well protection to meet local requirements.

Figure 13: Use of the DT325 system to install multilevel soil gas implants.

Section 9.0
Abandonment and Grouting

To prevent migration of contaminants vertically along the probe hole to previously clean areas, proper abandonment and grouting techniques must be followed. For very shallow probe holes (e.g. < 5 ft (1.5 m)) in cohesive soils that remain open after the drive rods are removed, bentonite powder or fine bentonite chips may be added to the open hole incrementally and hydrated. Ingeneral,grout slurries should be pumped down the drive rods (Figure 14) or a tremie tube (Figure 11, Part C2) as the original drive rods are retracted from depths exceeding 5 feet (1.5 m). Pumps and accessories capable of injecting bentonite grout slurries or neat cement grout slurries through the small-diameter DP tools (Figure 15) will be required. Usually a 25% solids bentonite slurry is acceptable or a neat cement grout with 7 to 8 gallons (27 to 30 liters) of water per bag of cement may be required. Verify with state and local regulators the type and density of grout material necessary to meet local regulations. Proper abandonment and grouting is necessary to prevent substantial liability for contaminant migration if boreholes are left open.

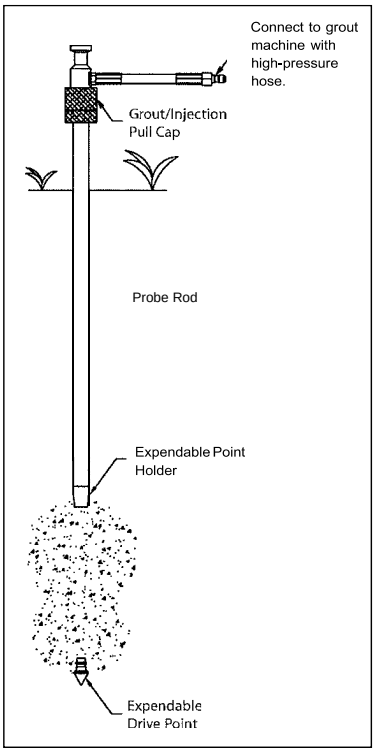


Figure 14: Grouting through tool string after soil gas sampling.

Section 10.0
Techniques for Collection of Soil Gas Samples

10.1 DQOs Select the Technique

As discussed previously in Section 5.0, you must clearly define the DQOs before going to the field to collect soil gas samples. Samples that will be used for a human health risk assessment require much more stringent DQOs than samples that will simply be used to qualitatively determine ifVOCs are present in the soil gas. A simple matrix (Table 2) will help you select the appropriate downhole tools paired with the correct sample collection methods to achieve the required sample quality. Remember, an expensive analysis does not make a poor quality sample better, it just wastes your money and time.

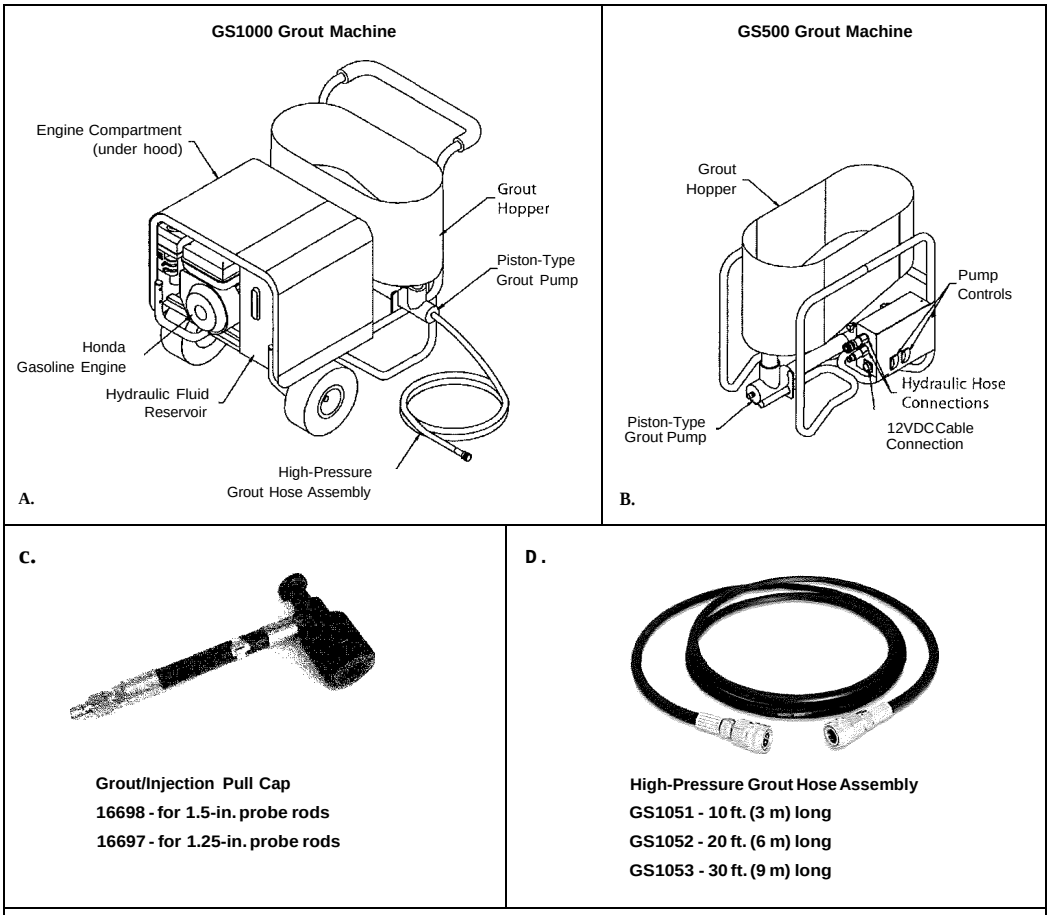
10.2 Sample Collection Flow Rate and Purge Volume

Another important consideration for sample collection is the actual flow rate at which the sample is purged from the ground. Some guidance documents indicate that the purge and sample flow rate for soil gas sample collection should not exceed 200 ml/min. (Cal RWQCB 1997, Cal. DTSC 2003, NYDOH 2005, U.S. EPA 2002, etc.). If very high flow rates or strong vacuum is applied, volatiles that were sorbed to solid phases or liquids in the pore space may be stripped out and enter the gas phase for sampling. Thus, the use of high flow rates or strong vacuum for soil gas sampling may result in a strong positive bias. This could cause an over estimation of the risk to human health and may result in expensive remedial actions being applied that are not necessary.

For most soil gas sampling activities it is common to purge at least one to three volumes from the sampling system before the sample is collected. For direct sampling methods this will simply be the volume inside the drive rods multiplied bythree. For PRT methods this will essentially consist of the volume inside the tubing and the open cylinder inthe ground created by retraction of the rods. The internal volume of common tubing sizes by foot or meter of length is provided in Table 4.

For permanent soil gas implants or wells, the volume of void space inthe filter pack around the screen should be included in the calculation along with the open volume inside the screen and tubing to the surface. For a clean sand filter pack a porosity of 30% is usually considered representative. The following example of purge volume calculation may be useful.

(continued on Page 23)



A. Self-contained grouting system with gasoline engine and hydraulic fluid reservoir.
B. Portable grout machine (65 lb / 30 kg) that is powered by the hydraulic and electrical systems of a direct push machine.
C. Injection pull caps allow you to pump grout directly through the rod string during retraction.
D. High-pressure grout hoses used to connect the grout pump to the injection pull cap and probe rod string.

Figure 15: Typical grouting equipment for direct push soil gas operations.

Volume of a cylinder = 1T x radius^2 x height, where 1T 3.141

For a 2.125-inch (5.4 cm) diameter borehole 24 inches (61 cm) long, the total volume in milliliters would be:

3.147 x (2.7 cm)2 x 67 cm = 1397 cc or approximately 1400 ml

For a 0.375-inch (0.95 cm) diameter implant 12 inches (30.5 cm) long, the volume would be:

3.141 x (0.475)2 x 30.5 cm = 27.6 cc or approximately 22 ml

Now subtract the implant volume from the total probe hole volume and then multiply the remainder by 0.30 to determine the 30% pore space in the filter media. This will be:

(1400 ml - 22 ml) x 0.30 = 413.3 ml

Add back in the total volume of the void in the implant and you have:

413.3 ml + 22 ml = 435.3 ml of void volume in the implant screen and filter media

If you have 12 feet (3.7 m) of 0.25-inch (6.4 mm) ID tubing, the volume per foot from Table 4 is 9.7 ml. One purge volume will be:

435.3 ml + (12 ft x 9.7 ml/ft) = 557.7 ml

and three purge volumes would be about 1650 ml. Purging at 200 ml/min, it would require approximately

1650 ml I200 ml/min = 8.25 minutes

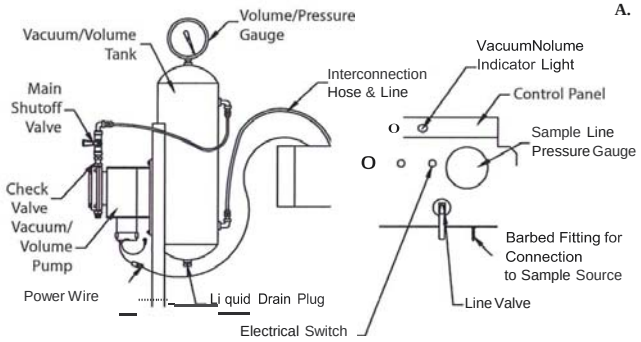
to complete the three volume purge for this implant system before you would be ready to collect your sample. So you would want to estimate at least ten minutes for sample collection in your cost proposal when similar implants are to be sampled.

The purge volumes and time required to purge using the PRT sampling system with three different probe rod diameters, using a one-foot (30.5 cm) retraction/void is summarized below in Table 6.

Table 6: Purge volume and time with PRT system and selected rod diameters.

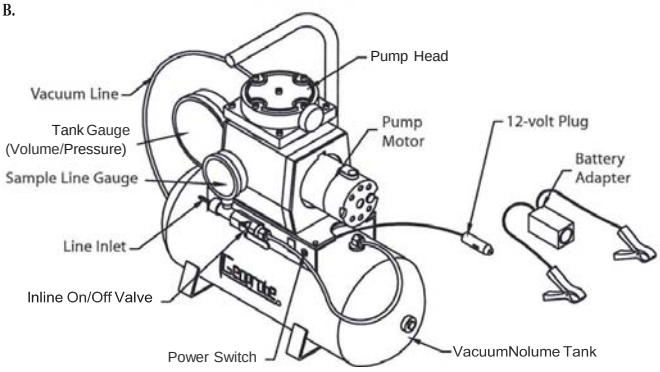
Rod Diameter, inches (cm)	1.0 (2.54)	1.25 (3.18)	1.5 (3.81)
Void Radius (r), inches (cm)	0.5 (1.27)	0.625 (1.59)	0.75 (1.91)
Void Lenght (L), inches (cm)	12 (30.5)	12 (30.5)	12 (30.5)
Single Void Volume (ml) (1T x r^2 x L, where 1T 3.141)	155	242	350
Tubing ID, inches (cm)	0.25 (0.64)	0.25 (0.64)	0.25 (0.64)
Tube Volume (ml/ft)	9.7	9.7	9.7
Tube Length (ft)	10	10	10
Total Tube Volume (ml)	97	97	97
Total System 1-volume (ml)	252	349	447
Approximate 3-System Volume (ml)	750	1050	1350
Required Purge Time at Flow Rate of 200 ml/min	3.75 min	5.25 min	6.75 min

A.



AT1001 - Mountable Vacuum/Volume System
Weight: 35 lb (16 kg)

B.



AT1000 - Portable Vacuum/Volume System
Weight: 40 lb (18 kg)

A. This system mounts in the back of a truck or van, often along with a Geoprobe® Model 541O direct push machine.

B. The portable 12V system may be powered from the vehicle 12V accessory outlet (cigarette lighter) or clipped directly to the vehicle battery.

NOTE: Both systems include an 7 7-liter (2.9 gal.) tank and can provide up to 21 in. of Hg (70 centibars) of vacuum.

Figure 16: Vehicle-mounted and field-portable vacuum/volume systems for soil gas sampling.

10.3 The Vacuum/Volume System

The vacuum/volume *(VN)* system (Figure 16) has been used to good advantage for soil gas sampling during soil gas surveys, especially when large purge and sample volumes (liters) are required. The *VN* system allows the field operator to perform three basic functions that are essential to successful soil gas sampling. These are measurement of the:

- volume of gas extracted at a sample point
- initial vacuum applied to a sample point
- amount of time for a sampling point to return to atmospheric pressure after a vacuum has been applied for sampling

The field operator may wish to incorporate an adjustable needle valve at the sample line inlet to control the flow rate to the desired level. The portable *VN* system may be useful for periodic sampling of permanent wells or implants for monitoring purposes. Detailed operation instructions for the *VN* system are available (Geoprobe® 2003).

10.4 Syringe sampling & purging

During initial surveys and plume tracking efforts, a mobile lab with onboard gas chromatograph (GC) may be used to conduct field analysis. This can significantly reduce analytical costs and the need for multiple mobilizations to determine the extent of the contaminant plume. When a van-mounted Geoprobe® direct push machine is equipped with a GC it is convenient to collect the soil gas sample directly from the PRT sample line with the syringe that will be used to inject the gas sample on the GC column (Figure 17). A short section of silicone tubing is placed in-line to allow for insertion of the GC syringe and collection of the sample. The sample is then immediately injected in the onboard GC for analysis. This collection and field analysis technique is especially amenable to use of the Triad approach for site characterization (EPA 2003).

Figure 17: Syringe sampling for field analysis.

When smaller purge volumes are required, a large syringe may be used to purge the sample tube. Gas sampling syringes made of glass or plastics are available from scientific supply warehouses in sizes ranging from 50 ml volume to 250 ml volume. This may be a particularly useful approach when shallow sampling is done in areas that are difficult to access with larger tools and equipment. Usually a small on/off valve is fitted to the end of the sample tube and is closed as the syringe is removed to be emptied and reattached for additional purging. The field tech will have to manually control the purge and sample flow rate. After purging the syringe may be used to inject a sample into a Tedlar bag, or glass bulb for on-site analysis. If off-site analysis will be conducted, a small summa canister may be used to collect the sample.

10.5 Tedlar bags and glass sampling bulbs

These two sample collection options (Figure 18) have been widely used in soil gas surveys, especially when a mobile lab is stationed on-site to conduct the analyses as the samples are collected. These sample collection options also may be used when an off-site lab is to perform analyses but holding times for the samples may be limited. In addition, standard Tedlar bags and glass bulbs are transparent and exposure to sunlight is a concern. Some volatile organic contaminants may degrade when exposed to sunlight (especially ultraviolet light) so the sample containers must be stored out of the sunlight. A cooler or suitable box may be sufficient. Do not cool the samples if stored in a cooler as this may cause condensation and lead to biased sample results. Light-blocking Tedlar bags are available.

There are at least two ways to collect a sample in Tedlar bags. A large syringe may be used to extract the sample from the sample line and then it is injected into the Tedlar bag. Appropriate valves must be used on the syringe and bag to prevent ambient air contamination of the sample during transfer. Decontamination of the syringes between samples will be required to prevent cross contamination. An alternate method is to place the Tedlar bag inside a vacuum chamber with a port that allows connection to the sample line. A vacuum is applied outside the Tedlar bag and the bag expands and fills with gas from the sample line and downhole source. The downhole sample train must be purged before sample collection. Tedlar bags are generally considered a one-use disposable item, not to be decontaminated for reuse. Some regulatory agencies (Cal. EPA) discourage the use of Tedlar bags for soil gas sampling.

(continued on following page)

Alternatively, glass bulbs may be decontaminated for multiple reuse. However the glass bulbs are expensive and fragile, and decontamination requires additional equipment and man-hours. Blank analyses will also have to be performed periodically on the bulbs to verify no cross contamination occurs. The glass bulbs are usually placed in line during the purging process so they equilibrate with the gas being sampled. Smaller volume bulbs will require smaller system purge volumes and should still provide sufficient sample volume for duplicates and other QC measures if required. Decon may be accomplished by attaching the open bulbs to a vacuum pump and purging the bulbs while they are being heated in a small oven in the mobile labon-site. A tubing manifold can connect several bulbs to one vacuum pump.

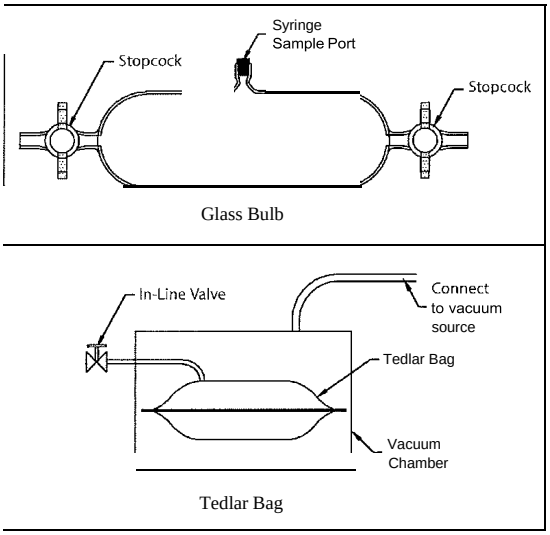


Figure 18: Tedlar bag and glass bulb for soil gas sampling.

10.6 Summa Canisters

For evaluation of the vapor intrusion pathway and human health risk assessments, summa canisters (Figure 19) are preferred for sample collection and transport to a fixed lab facility for analysis. These stainless steel devices are usually supplied by the lab clean and ready for sample collection. The canisters are under vacuum and are simply attached to the sample line for collection of the soil gas. (The three-volume pre-sampling purge is conducted before the summa canister is attached to the sampling train.)

A vacuum gauge and valve should be included on the canister inlet. The gauge will indicate when the canister is full and the valve can be used to control the sample flow rate from the downhole source at the 200 ml/min rate to prevent stripping of volatiles and biased sample results. Flow control valves may be set by the supplier at the requested flow rate. Smaller summa canisters (500 ml) may be preferable to minimize the sample collection time at the 200 ml/min flow rate.

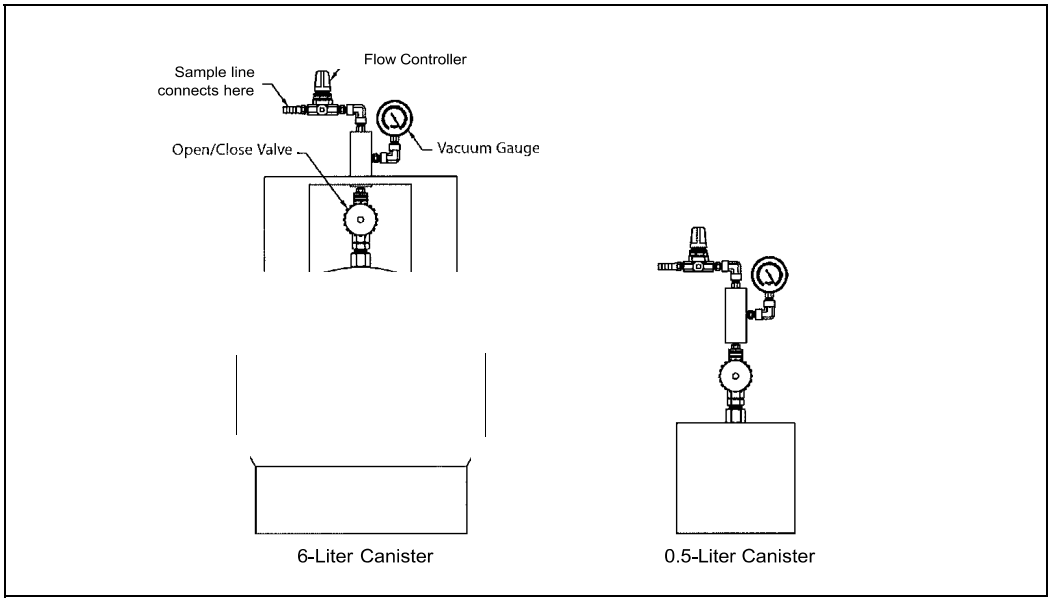


Figure 19: Summa canisters used for collection, storage, and transport of high-quality soil gas samples.

Section 11.0
System Leak Tests for Field QC

Leak testing is a critical step to perform in the field to assure that system leaks do not degrade sample quality and cause biased results. There are at least three categories of leak testing that should be considered. These are:

- Integrity of vacuum source
- Integrity of the sampling train
- Integrity of downhole tool system

The vacuum source may be as simple as a large syringe or as complex as a vacuum/volume system (see Figure 16). To verify that the vacuum supply itself does not have leaks, it should be tested periodically (e.g. once a day or every 10 samples). To test the integrity of your vacuum system the inlet valve should be closed or the inlet line should be plugged appropriately. The vacuum source is activated (syringe plunger retracted/vacuum pump turned on) and vacuum is applied. An in-line vacuum gauge should be included to quantitatively monitor loss of vacuum over time. Once the vacuum is applied, the system is "shut-in" so that loss of vacuum over time may be observed. For more complex systems the leak test may need to last 30 minutes to check for smaller leaks. Corrective action should be taken if leaks are detected.

Most often system leaks occur at aboveground plumbing connections where the sampling device is connected in-line between the vacuum supply and the sample line from the subsurface (sampling train). Probably the easiest and most effective way to determine if there are leaks during the sampling process is to apply a volatile compound around the fittings and analyze for that compound at the lab. One of the simplest and most effective ways to accomplish this is to wet paper towels with isopropyl alcohol and wrap them around the fittings and connections in the sampling train. Isopropyl alcohol may be purchased at the local pharmacy or department store. Remember, this material (liquid and vapor) is flammable and should be stored and handled appropriately.

Some downhole grab sampling systems can be tested for leaks before sampling is conducted. This may be accomplished for the direct sampling system (Figure 4) and the PRT sampling system (Figure 5). Expendable points with 0-rings must be used so that an effective leak test can be accomplished. [Note: Neither monitoring nor grab sampling systems with downhole screens can be leak tested in this manner.] For the direct sampling system, the gas sampling cap with 0-ring is installed on the drive rods and the tubing is connected between the cap and vacuum supply. Before the rods are retracted from the expendable point, a vacuum is applied to the sampling train and downhole system. The system is shut-in and the in-line vacuum gauge is observed for a period of time to determine if leaks are present.

For the PRT system, the PRT adapter (with fresh 0-ring) is installed on the selected tubing. The adapter and tubing are lowered through the drive rods and the adapter is threaded into place. Before the drive rods are retracted off of the expendable point, vacuum is applied to the sampling train. The in-line vacuum gauge is observed to determine if leaks are present. Once the integrity of the sampling system is confirmed, the drive rods are retracted and soil gas purging and sampling is conducted.

A note of caution: System leak tests as described above will not allow you to determine if ambient air or soil gas from overlying zones is migrating into the interval being sampled. In order to prevent this problem, be sure that the expendable point and point holder are no larger in diameter than the outside diameter of the drive rods used in the tool string. Additionally, bentonite powder may be poured around the tool string at the ground surface and hydrated to help prevent ambient air intrusion during the sampling process.

Section 12.0
Mapping Soil Gas Plumes

During the initial stages of a soil gas or VIP investigation it is wise to construct site maps that plot the location of each soil gas sample collection point. Then once the sample analyses are completed, the results may be plotted on the map and contours drawn to define the probable extent of the plume and areas of differing concentration (Figures 20 and 21). In many situations this will help locate sources for the contaminant plumes and define the general direction of contaminant migration. Often, soil gas plumes will develop over groundwater contaminant plumes and roughly mimic the extent of contamination in the local groundwater. In many urban and suburban areas there may be multiple plumes of different contaminants originating from different sources. Sometimes the source area(s) may be located outside the initial boundaries set for the investigation.

Use of on-site analysis with a mobile laboratory will optimize the investigation and plume definition. When field analyses are plotted on site maps daily as results are obtained, the field team can determine if new sample locations should be added to better define the plume. Just as important, nondetect samples can indicate that additional sampling locations planned for some areas may be deleted to minimize cost and time requirements. Application of the Triad Approach (EPA 2003) can be used to obtain the data needed while minimizing costs and multiple mobilizations to the field.

Section 13.0
Health & Safety Considerations

All personnel working on an investigation where hazardous contaminants may be present must be OSHA 40 hour health and safety trained as required by 29 CFR 1910.120. The following discussion is provided as a brief overview of some of the health and safety issues that may be encountered during soil gas investigations. The field team should have a written health and safety plan that adequately addresses the possible physical and chemical exposure hazards that may be encountered during the investigation. Daily meetings to review health and safety conditions and any changes inthe work environment should be conducted with the field team.

There are many types of health and safety issues to be considered during a soil gas investigation, or at any site where potentially hazardous contaminants may be present. These include physical hazards as well as potential exposure hazards to contaminants under investigation. Some of the physical hazards are associated with the use and operation of tools, equipment, and Geoprobe® direct push machines in the field. Basic precautions should be followed to prevent injury when operating tools and equipment such as wearing hard hats,steel-toe boots,appropriate gloves, eye protection, and hearing protection as necessary. Watch for pinch points on hydraulic equipment, machinery,and tools. Befamiliar with the safety features of equipment being operated in the field, such as kill switches. Whenever subsurface sampling is to be conducted, all subsurface utilities must be professionally located and clearly marked to prevent accidents. Overhead utilities,especially high-voltage electrical lines,should be avoided. Adequate spacing between high-voltage lines and equipment masts or derricks should be maintained, check local requirements. When working in areas where vehicular traffic is a concern, wear appropriate high visibility clothing and use traffic cones to mark the work area.

The potential for exposure to hazardous contaminants is a reality whenever subsurface environmental investigations are conducted. The use of appropriate ambient air monitoring equipment is a must. Wearing appropriate clothing (e.g.tyvek,saranex, nitrile gloves) and air purification equipment (e.g.air purifying respirators (APR) or self contained breathing apparatus (SCBA)) for personal protection should be a routinely planned for and donned when necessary. The field team should have a written health and safety planthat reviews all these concerns and more that provides for appropriate measures when ambient air concentrations of contaminants exceeds the predetermined safety levels.

Section 14.0
Summary

There are several tools and methods available to obtain soil gas samples with direct push techniques. Single tube methods are generally more time efficient and are often used during surveys to define the extent of the plume and help with location of source areas. These methods primarily provide sampling at a single-depth with each advance of the tool string. Conversely,dual tube methods are generally a little more time consuming but allow the operator the option to conduct soil gas profiling at multiple depths during one advancement of the tool string. The dual tube systems also allow the investigator to install high-integrity soil gas implants or monitoring wells. The placement of filter media in the screened interval and annular seals by the dual tube methods allows the sampler to achieve sample quality levels to meet the needs of human health risk assessments for the vapor intrusion pathway. Selection of the appropriate sample collection device and procedure is an integral part of achieving the required DQOs. While on-site analysis with a well-equipped mobile laboratory can expedite completion of the field work and plume definition, off-site analytical work may be required under some conditions to meet the more stringent requirements of human health risk assessment for the vapor intrusion pathway.

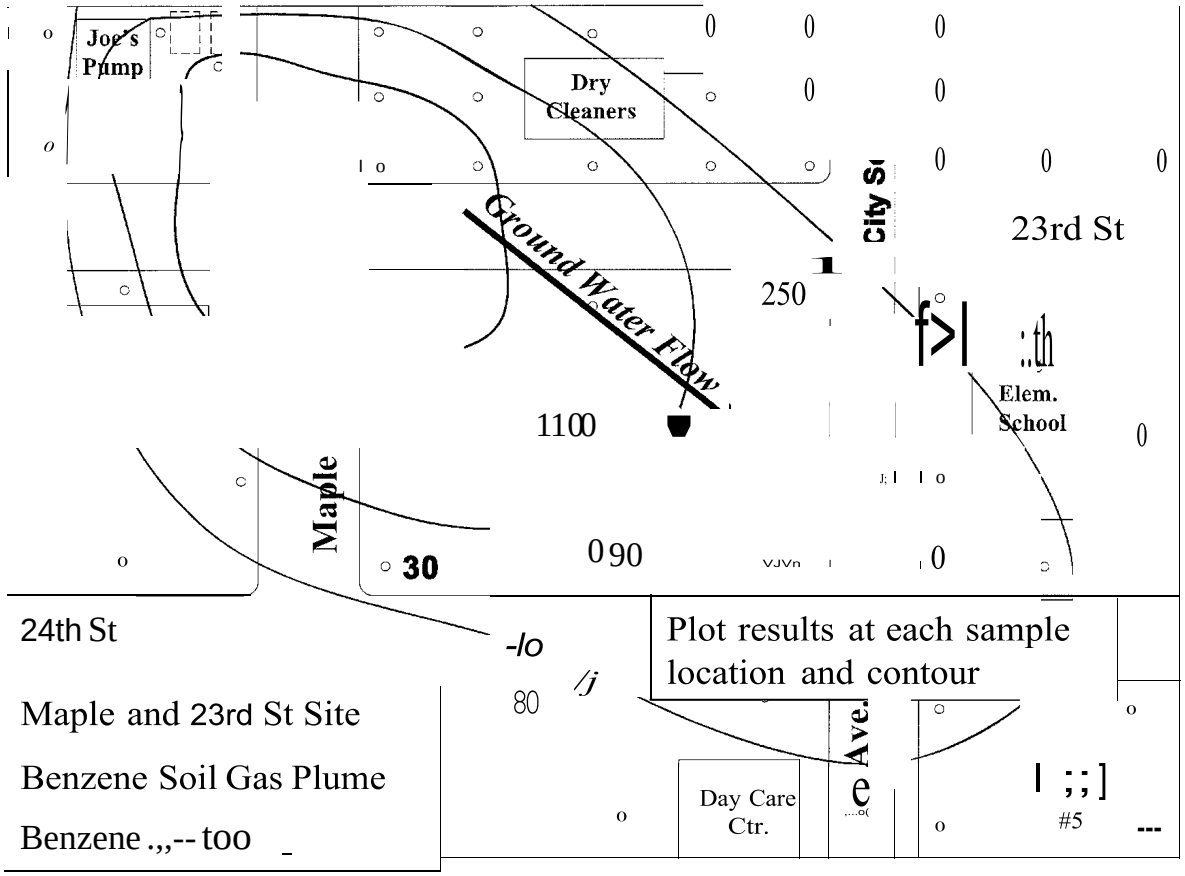


Figure 20: Mapping benzene plume for soil gas investigation.

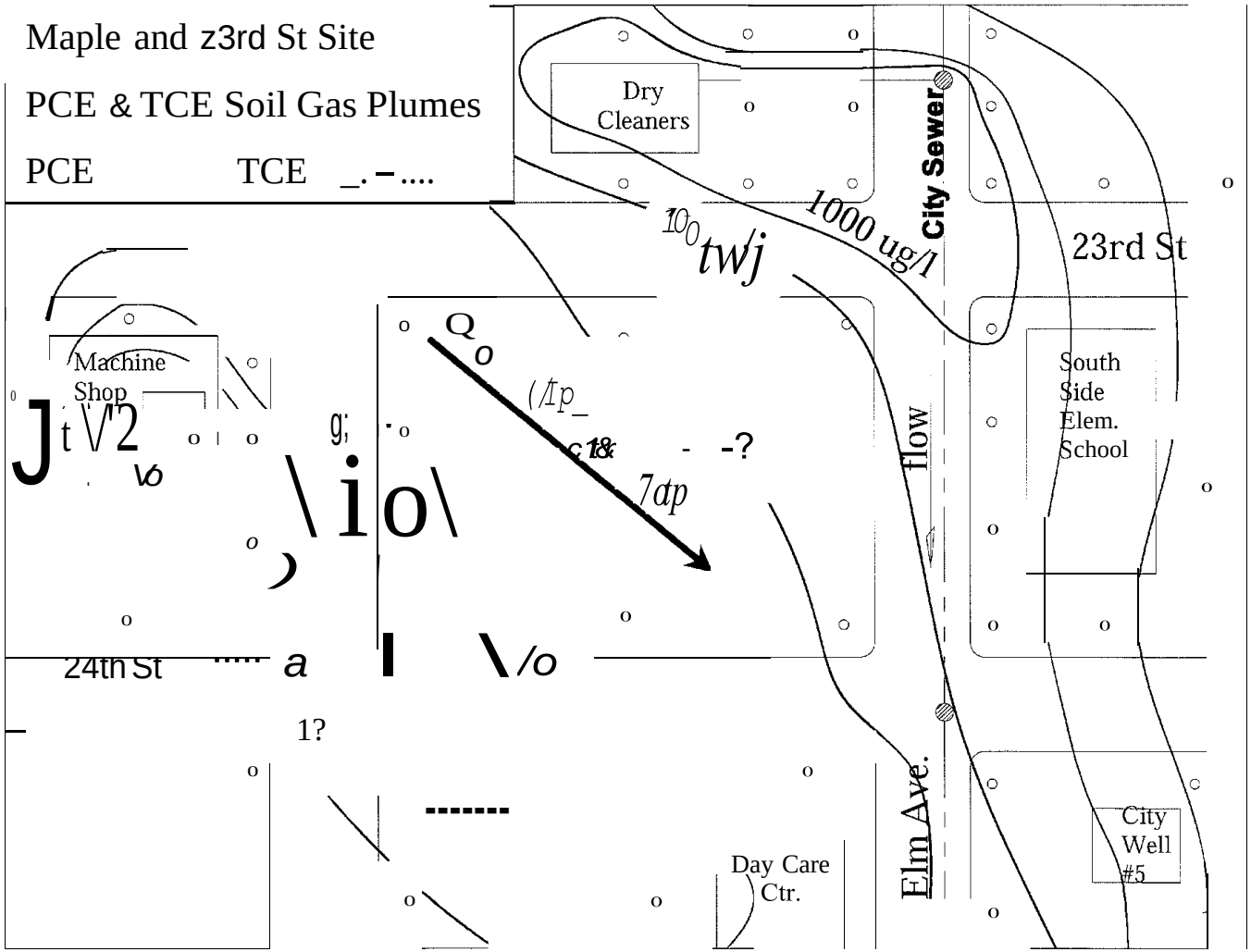


Figure 21: Mapping X-VOC plumes for soil gas investigation.

References

American Society ofTesting and Materials (ASTM) 2004. D5088 Standard Practice for Decontamination of Field Equipment Used atWaste Sites. In Annual Book of ASTM Standards Vol. 04.08. ASTM West Conshohocken, PA. www.astm.org.

ASTM 2004. D5314 Standard Guide for Soil Gas Monitoring in the Vadose Zone. In Annual Book of ASTM Standards Vol. 04.08. ASTM West Conshohocken, PA. www.astm.org.

ASTM 2005. D6001 Standard Guide for Direct-Push Water Sampling for Geoenvironmental Investigations. In Annual Book of ASTM Standards Vol. 04.09. ASTM West Conshohocken, PA. www.astm.org.

ASTM 2005. D6282 Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations. In Annual Book of ASTM Standards Vol. 04.09. ASTM West Conshohocken, PA. www.astm.org.

ASTM 2005. D6725 Standard Practicefor Direct Push Installation of Prepacked Screen Monitoring Wells in Unconsolidated Aquifers. In Annual Book of ASTM Standards Vol. 04.09. ASTM West Conshohocken, PA. www.astm.org.

ASTM 2006. D7242 Standard Practice for Field Pneumatic Slug (Instantaneous Change in Head) Tests to Determine Hydraulic Properties of Aquifers with Direct Push Ground Water Samplers. ASTM West Conshohocken, PA. www.astm.org.

CRC Press, 1975. CRC Handbook of Chemistry and Physics, 76'" Edition. David R. Lide, Ph.D.,Editor in Chief. CRC Press, New York.

Geoprobe Systems®, 2001. Manual Slide Hammer, Operation Instructions. Technical Bulletin No. 17743. Kejr Inc., Salina, KS.

Geoprobe Systems®, 2002. Geoprobe® 0.5-in.x 1.4-in.OD and 0.75-in.x 1.4-in.OD Prepacked Screen Monitoring Wells, Standard Operating Procedure. Technical Bulletin No. 962000. Kejr Inc.,Salina, KS.

Geoprobe Systems®,2003. Geoprobe® DT21 Dual Tube Soil Sampling System, Standard Operating Procedure. Technical Bulletin No.982100. Kejr Inc., Salina, KS.

Geoprobe Systems®, 2003. Geoprobe Systems® Tools Catalog,V. 6. Kejr,Inc.,Salina, KS. www.geoprobe.com

McCall, Wesley, David M. Nielsen, Stephen P Rarrington, and Thomas M. Christy,2006. Use of Direct Push Technologies in Environmental Site Characterization and Ground-Water Monitoring. In *Practical Handbook of Environmental Site Characterization and Ground-Water Monitoring,* David M. Nielsen, Ed. CRC Press, Boca Raton, Florida. Pages 345 -471.

California Regional Water Quality Control Board, Los Angeles Region, 1997. Interim Guidance for Active Soil Gas Investigation. February.www.waterboards.ca.gov/losangeles.

California Department ofToxic Substances Control and Los Angeles Regional Water Quality Control Board, 2003. Advisory – Active Soil Gas Investigations. January.www.waterboards.ca.gov/losangeles.

New York State Department of Health (NY DOH), 2005. Guidance for Evaluating Soil Vapor Intrusion in the State of New York: Public Comment Draft. Center for Environmental Health, Bureau of Environmental Exposure Investigation. Troy, New York. www.dec.state.ny.us/website/der/guidance/vapor.

National Institute for Occupational Safety and Health (NIOSH), 1990. Pocket Guide to Chemical Hazards. U.S. Dept.of Health and Human Services. Washington, D.C.June.

Parker,Louise V.and Thomas A. Ranney,2003. An Environmental Friendly Decontamination Protocol for Ground Water Sampling Devices. Ground Water Monitoring & Remediation, Vol. 23, no.2. March. Pages 84-91.

U.S. EPA, 1986.Test Methods for Evaluating Solid Waste,Laboratory Manual,Third Ed. OSWER,Washington, D.C.SW-846. November.

U.S. EPA 1997. Expedited Site AssessmentTools for Underground Storage Tank Sites: A Guide for Regulators. Office of Underground Storage Tanks, OSWER. OSWER 5403G: EPA 51O-B-97-001. March.

U.S. Environmental Protection Agency, 2002. OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). Federal Register Notice – November 29,2002. www.epa.gov/ epaoswer/hazwaste/ca/eis/vapor.htm.

U.S. EPA 2003. Using the Triad Approach to Streamline Brownfields Site Assessment and Cleanup. EPA 542-B-03-002. June. www.epa.gov/tio.

Geoprobe®, Geoprobe Systems®, Macro-Core®, and Direct Image®
are Registered Trademarks of Kejr, Inc., Salina, Kansas

© 2006 Kejr, Inc.
ALL RIGHTS RESERVED.

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, without written permission from Kejr, Inc.

Geoprobe Systems®

601 N. Broadway · Salina, KS 67401
1-800-436-7762 · Fax 785-825-2097
www.geoprobe.com

Date: July 2015

ATTACHMENT B

Cal Science QA Manual

Uncontrolled Copy

QUALITY SYSTEMS MANUAL FOR ENVIRONMENTAL ANALYTICAL SERVICES

eurofins | Calscience

Version 5.7
June 2015

Prepared By

Eurofins Calscience, Inc.
7440 Lincoln Way
Garden Grove, CA 92841-1427
Telephone: 714-895-5494
Facsimile: 714-894-7501
Internet: www.calscience.com

Based On

The NELAC Institute (TNI)
National Environmental Laboratory Accreditation Program (NELAP)
Management and Technical Requirements for Laboratories Performing Environmental Analysis
TNI Standard (EL-V1-2009) Effective Septe er 09, 2009

Larry Lem
QUALITY ASSURANCE MANAGER

Linda Scharpenberg
QUALITY ASSURANCE / TECHNICAL DIRECTOR

Virginia Huang
OPERATIONS DIRECTOR

Elizabeth Winger
LABORATORY DIRECTOR

Steven L. Lane
VICE-PRESIDENT / BUSINESS UNIT MANAGER

TABLE OF CONTENTS
QUALITY SYSTEMS MANUAL

PREFACE TO THE QUALITY SYSTEMS MANUAL....5

ACROYNM LIST....7

QUALITY SYSTEMS....8

1.0 SCOPE....8

2.0 REFERENCES....8

3.0 DEFINITIONS....8

4.1 ORGANIZATION AND MANAGEMENT....9
4.2 Legal Definition of Laboratory....9
4.3 Organization....9

5.1 QUALITY SYSTEM - ESTABLISHMENT, AUDITS, ESSENTIAL QUALITY CONTROLS, AND DATA VERIFICATION....10
5.2 Establishment....10
5.3 Quality Systems Manual (QSM) Elements....11
a) Policy Statement....11
b) Organization and Management Structure
c) Relationships....12
d) Records Procedures....12
e) Job Descriptions, Roles and Responsibilities....13
f) Approved Signatories....21
g) Policies on Traceability of Measurements....21
h) List of Methods....21
i) Review of New Work....21
j) Calibration Procedures....21
k) Sample Receiving and Handling....22
l) Major Equipment....23
m) Calibration, Verification and Maintenance of Equipment....23
n) Verification Practices....23
o) Corrective Actions....24
p) Permitting Exceptions and Departures....24
q) Complaints....25
r) Confidentialty / Proprietary Rights....25
s) Audits and Data Review....25
t) Personnel Experience and Training....25
u) Ethics Policy Statement....26
v) Reporting of Results....27
w) Table of Contents, References, Glossaries and Appendice....30
Figure 1 -- Organization Chart 1....31
Figure 2 -- Organization Chart 2....32

5.4 Audits....33
5.3.1 Internal Audits....33
5.3.2 Management Review....33
5.3.3 Audit Review....34
5.3.4 Performance Audits....34
5.3.5 Corrective / Preventive Actions....34
5.4 Essential Quality Control Procedures....35

6.1 PERSONNEL 35
6.2 General Requirements for Laboratory Staff 35
6.3 Laboratory Management Responsibilities 36
6.2.1 Transfer of Ownership / Out of Business 37
6.4 Personnel Records 37

7.1 PHYSICAL FACILITIES – ACCOMMODATION AND ENVIRONMENT 37
7.2 Environment 37
7.3 Work Areas 38

8.0 EQUIPMENT AND REFERENCE MATERIALS 38

9.1 MEASUREMENT TRACEABILITY AND CALIBRATION 39
9.2 General Requirements 39
9.3 Traceability of Calibration 39
9.4 Reference Standards 39
9.5 Calibration 41
9.5.1 Support Equipment. 41
9.5.2 Instrument Calibration 42

10.1 TEST METHODS AND STANDARD OPERATING PROCEDURES 44
10.2 Methods Documentation 44
10.2.1 Standard Operating Procedures (SOPs) Administrative 44
10.2.2 Standard Operating Procedures (SOPs) Analytical 44
10.3 Exceptionally Permitting Departures from Documented Policies / Procedures 45
10.4 Test Methods 46
10.5 Test Method Assessment. 46
10.6 Demonstration of Capability 46
10.7 Sample Aliquots 46
10.8 Data Verification 47
10.9 Documentation and Labeling of Standards and Reagents 47
10.10 Computers and Electronic Data Related Requirements 47

11.1 SAMPLE HANDLING, SAMPLE ACCEPTANCE POLICY AND SAMPLE RECEIPT 48
11.2 Sample Tracking 48
11.3 Sample Acceptance Policy 48
11.4 Sample Receipt Protocols 49
11.5 Storage Conditions 51
11.6 Sample Disposal 51

12.1 RECORDS 51
12.2 Record Keeping System and Design 52
12.3 Records Management and Storage 52
12.4 Laboratory Sample Tracking 53
12.4.1 Sample Handling 53
12.4.2 Laboratory Support Activities 53
12.4.3 Analytical Records 53
12.4.4 Administrative Records 54

13.0 LABORATORY REPORT FORMAT AND CONTENTS 54

14.0 SUBCONTRACTING ANALYTICAL SAMPLES 56

15.0 OUTSIDE SUPPORT SERVICES AND SUPPLIES 57

16.0 INQUIRIES AND COMPLAINTS 57

17.0 REVIEW OF WORK REQUESTS, CONTRACTS AND TENDERS....58

18.0 MANAGEMENT REVIEW, MANAGEMENT OF CHANGE AND CONTINUOUS IMPROVEMENT ..59
18.1 Management Review....59
18.2 Management of Change....60
18.3 Continuous Improvement....60

NELAC APPENDICES....62

APPENDIX A - REFERENCES....63

APPENDIX B - GLOSSARY....65

APPENDIX C - DEMONSTRATION OF CAPABILITY....73
C.1 PROCEDURE FOR DEMONSTRATION OF CAPABILITY....73
C.2 CERTIFICATION STATEMENT....75

APPENDIX D - ESSENTIAL QUALITY CONTROL REQUIREMENTS....76
D.1 CHEMICAL TESTING....76
D1.1 Positive and Negative Controls....77
D1.2 Analytical Variability / Reproducability....77
D1.3 Method Evaluation....77
D1.4 Analytical Measurement Uncertainty Estimation....77
D1.4.1 Using the LCS to Estimate Analytical Uncertainty....78
D1.4.2 Additional Compoments to Estimating Analytical Uncertainty....79
D1.5 Detection Limits....81
D1.6 Data Reduction....81
D1.7 Quality of Standards and Reagents....81
D1.8 Selectivity....82
D1.9 Constant and Consistent Test Conditions....82
D1.10 Method Validation - Modified Procedures, Non-Standard Methods, Additional Analytes....82
D1.10.1 Significant Modification / New Method / Additional Analyte Documentation....83

APPENDIX E - LIST OF ACCREDITED METHODS....85

APPENDIX F - LIST OF PHYSICAL LOCATIONS....87

APPENDIX G - SPECIAL PROGRAM REQUIREMENTS....88
G.1 United States Department of Defense / Energy Environmental Laboratory Accreditation Program 88

APPENDIX H - LIST OF MAJOR ANALYTICAL INSTRUMENTATION....89

END OF DOCUMENT....105

PREFACE TO THE QUALITY SYSTEMS MANUAL

Purpose

The purpose of this document is to provide implementation guidance on the establishment and management of quality systems for Eurofins Calscience, Inc (ECI) and is based on the National Environmental Laboratory Accreditation Conference's (NELAC) Quality System requirements, the Department of Defense / Energy Environmental Laboratory Accreditation Program (DOD/DOE ELAP) and International Organization for Standardization / International Electrotechnical Commission (ISO/IEC) 17025:2005.

These three programs are built upon one another and are mutually reinforcing in their Quality Assurance programs and protocols.

Background

To be accredited and in compliance under the following three programs:

1. The National Environmental Laboratory Accreditation Program (NELAP). Accredited laboratories shall have a comprehensive quality system in place, the requirements for which are outlined in The NELAC Institute (TNI) 2009 Volume 1: Management and Technical Requirements for Laboratories Performing Environmental Analysis (EL-V1-2009). This manual was written with guidance primarily from Volume 1: Modules 2, 3, 4, 5, and 7.

   Additional information may be found at:

   - http://www.nelac-institute.org/

2. The Department of Defense Environmental Laboratory Accreditation Program (DOD/DOE ELAP) will provide a means for laboratories to demonstrate conformance to the DOD/DOE Quality Systems Manual for Environmental Laboratories (DOD/DOE QSM) as authorized by DOD Instruction 4715.15.

   The DOD/DOE QSM Revision 5.0 (July 2013) is based on the National Environmental Laboratory Accreditation Conference (NELAC) Quality Systems standard which provides guidelines for implementing the international standard, ISO/IEC 17025.

   Additional information may be found at:

   - http://www.denix.osd.mil/edqw/Accreditation/
   - http://www.denix.osd .mil/edqw/upload/QSM -Version-5-0-FINAL.pdf

3. ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories is for use by laboratories in developing their management system for quality, administrative and technical operations. Laboratory customers, regulatory authorities and accreditation bodies may also use it in confirming or recognizing the competence of laboratories.

   Additional information may be found at:

   - http://www .iso.org/iso/home .html

Project Specific Requirements

Project-specific requirements or regulations may supersede requirements contained in this manual. The laboratory bears the responsibility for meeting all **State requirements.** Nothing in this document relieves the laboratory from complying with contract requirements, or with **Federal, State, and/or local regulations.**

Results and Benefits

- **Standardization of Processes** – Because this manual provides the laboratory with a comprehensive set of requirements that meet the needs of many clients, as well as the NELAP, the laboratory may use it to create a standardized quality system. Ultimately, this standardization saves laboratory resources by establishing one set of consistent requirements for all environmental work. Primarily, the laboratory bears the responsibility for meeting all State requirements as outlined in their respective certification programs.

- **Deterrence of Improper, Unethical, or Illegal Actions** – Improper, unethical, or illegal activities committed by only a few laboratories have implications throughout the industry, with negative impacts on all laboratories. This manual establishes a minimum threshold program for all laboratories to use to deter and detect improper, unethical, or illegal actions.

- **Foundations for the Future** – A standardized approach to quality systems, shared by laboratories and The NELAC Institute, paves the way for the standardization of other processes. For example, this manual might serve as a platform for a standardized strategy for Performance Based Measurement System (PBMS) implementation.

Document Format

This ECI Quality Systems Manual (QSM) is designed to implement the TNI 2009 (EL-V1-2009) standards along with the DOD/DOE QSM 5.0 and the ISO/IEC 17025:2005 standards.

The section numbering has been changed from that of these standards as the manual is meant to be a stand-alone document. Thus the numbering in this document is not consistent with the numbering in the above-mentioned standards; however, all required elements are covered, herein.

ACROYNM LIST

°C: Degrees Celsius
ANSI/ASQC: American National Standards Institute / American Society for Quality Control
ASTM: American Society for Testing and Materials
CAS: Chemical Abstract Service
CCV: Continuing calibration verification
CFR: Code of Federal Regulations
CLP: Contract Laboratory Program
COC: Chain of Custody
CV: Coefficient of Variation
DO: Dissolved Oxygen
DOC: Demonstration of Capability
DOD/DOE: Department of Defense / Energy
DQOs: Data Quality Objectives
EPA: Environmental Protection Agency
g/L: Grams per Liter
GC/MS: Gas Chromatography / Mass Spectrometry
ICP-MS: Inductively Coupled Plasma / Mass Spectrometer
ICV: Initial Calibration Verification
ID: Identifier
ISO/IEC: International Standards Organization / International Electrotechnical Commission
LCS: Laboratory Control Sample
LCSD: Laboratory Control Sample Duplicate
LOO: Limit of Detection
LOQ: Limit of Quantitation
LQMP: Laboratory Quality Management Plan
MDL: Method Detection Limit
ME: Marginal Exceedance
mg/kg: Milligrams per Kilogram
MS: Matrix Spike
MSD: Matrix Spike Duplicate
NELAC: National Environmental Laboratory Accreditation Conference
NELAP: National Environmental Laboratory Accreditation Program
NIST: National Institute of Standards and Technology
OSHA: Occupational Safety and Health Administration
PBMS: Performance Based Measurement System
PC: Personal Computer
PCBs: Polychlorinated Biphenyls
PT: Proficiency Testing
QA: Quality Assurance
QAD: Quality Assurance Division (EPA)
QAMS: Quality Assurance Management Section
QAPP: Quality Assurance Project Plan
QSM: Quality Systems Manual
QC: Quality Control
RL: Reporting Limit
RPO: Relative Percent Difference
RSD: Relative Standard Deviation
SD: Serial Dilutions
SOP: Standard Operating Procedure
TNI: The NELAC Institute
TSS: Total Suspended Solids
UV: Ultraviolet
VOC: Volatile Organic Compound

QUALITY SYSTEMS

Quality Systems include all quality assurance (QA) policies and quality control (QC) procedures that are delineated in a Quality Systems Manual (QSM) and followed to ensure and document the quality of the analytical data. Eurofins Calscience, Inc. (ECI), accredited under the National Environmental Laboratory Accreditation Program (NELAP), assures implementation of all QA policies and the applicable QC procedures specified in this Manual. The QA policies, which establish essential QC procedures, are applicable to all areas of ECI, regardless of size and complexity.

The intent of this document is to provide sufficient detail about quality management requirements so that all accrediting authorities evaluate laboratories consistently and uniformly.

The NELAC Institute (TNI) is committed to the use of Performance Based Measurement Systems (PBMS) in environmental testing and provides the foundation for PBMS implementation in these standards. While this standard may not currently satisfy all the anticipated needs of PBMS, NELAC will address future needs within the context of State statutory and regulatory requirements and the finalized EPA implementation plans for PBMS.

Chapter 5 is organized according to the structure of ISO/IEC 17025, 2005. Where deemed necessary specific areas within this Chapter may contain more information than specified by ISO/IEC 17025.

All items identified in this QSM shall be available for on-site inspection or data audit.

1.0 SCOPE

a) This QSM sets the general requirements that ECI must successfully demonstrate to be recognized as competent to perform specific environmental tests.

b) This QSM includes additional requirements and information for assessing competence or for determining compliance by the organization or accrediting authority that grants approval.

   If more stringent standards or requirements are included in a mandated test method or by regulation, the laboratory demonstrates that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed.

c) ECI uses this QSM in the development and implementation of its quality systems. Accreditation authorities use this NELAC based standard to assess the competence of environmental laboratories.

2.0 REFERENCES

See Appendix A.

3.0 DEFINITIONS

The relevant definitions from ISO/IEC Guide 2, ANSI/ASQC E-4, 1994, the EPA "Glossary of Quality Assurance Terms and Acronyms," and the *International vocabulary of basic and general terms in metrology (VIM)* are applicable. The most relevant is quoted in Appendix A, Glossary, of Chapter 1 of NELAC, together with further definitions applicable for the purposes of this Standard.

4.1 ORGANIZATION AND MANAGEMENT

4.2 Legal Definition of Laboratory

ECI is legally definable as evidenced by its business license, and current California State Water Resources Control Board (SWRCB) Services Environmental Laboratory Accreditation Program (ELAP) certificate. It is organized and operates in such a way that its facilities meet the requirements of the Standard. See the graphical presentations of the Organization and QA responsibility in Figures 1 and 2, respectively.

4.3 Organization

Eurofins Calscience Inc.:

a) Has a managerial staff with the authority and resources necessary to discharge their duties;

b) Has processes to ensure that its personnel are free from any commercial, financial and other undue pressure that adversely affect the quality of their work;

c) Is organized in such a way that confidence in its independence of judgment and integrity is maintained at all times;

d) Specifies and documents the responsibility, authority, and interrelationship of all personnel who manage, perform or verify work affecting the quality of calibrations and tests;

   Such documentation includes:

   1) A clear description of the lines of responsibility in the laboratory, and is proportioned such that adequate supervision is ensured, and

   2) Job descriptions for all positions.

e) Provides supervision by persons familiar with the calibration or test methods and procedures, the objective of the calibration or test, and the assessment of the results.

   The ratio of supervisory to non-supervisory personnel ensures adequate supervision and adherence to laboratory procedures and accepted techniques.

f) Has a technical director who has overall responsibility for the technical operation of ECI.

   The technical director certifies that personnel who perform the tests for which the laboratory is accredited have the appropriate educational and/or technical background. Such certification is documented.

   The technical director meets the requirements specified in the Accreditation Process. (See NELAC Section 4.1.1.1.)

g) Has a quality assurance manager who has responsibility for the quality system and its implementation.

   The quality assurance officer has direct access to the technical director and to the highest level of management at which decisions are made regarding laboratory policy or resources.

   The quality assurance manager (and/or his/her designees):

   1) Serves as the focal point for *QNQC* activities, and is responsible for the oversight and/or review of quality control data;

2) Has functions independent from laboratory operations for which she/he has quality assurance oversight;

3) Is able to evaluate data objectively and perform assessments without outside (e.g., managerial) influence;

4) Has documented training and/or experience in *QNQC* procedures and is knowledgeable in the quality system, as defined under NELAC;

5) Has a general knowledge of the analytical test methods for which data review is performed;

6) Arranges for and conducts internal audits as per ECI QSM section 5.3 annually; and

7) Notifies ECI management of deficiencies in the quality system and monitors corrective action.

h) Nominates, by way of the "Alternates List," deputies in case of absence of the Technical Director and/or the Quality Assurance Director;

i) ECI makes every effort to ensure the protection of its clients' information as confidential and proprietary.

ii) ECI is sensitive to the fact that much of the analytical work performed for clientele may be subject to litigation processes. ECI, therefore, holds all information in strict confidence with laboratory release only to the client.

iii) Information released to entities other than the client is performed only upon written request from the client.

iv) Due to the investigative nature of most site assessments, analytical information may become available to regulatory agencies or other evaluating entities during site assessment of the laboratory for the specific purpose of attaining laboratory certifications, accreditations, or evaluation of laboratory qualification for future work. During these occurrences, the laboratory will make every effort to maintain the confidence of client specific information.

j) For purposes of qualifying for and maintaining accreditation, participates in a proficiency test program as outlined in Chapter 2 of NELAC. Results of ECI's performance in rounds of proficiency testing are available by request or on the web site.

5.1 QUALITY SYSTEM - ESTABLISHMENT, AUDITS, ESSENTIAL QUALITY CONTROLS, AND DATA VERIFICATION

5.2 Establishment

ECI establishes and maintains quality systems based on the required elements contained in this Manual and appropriate to the type, range and volume of environmental testing activities it undertakes.

a) The elements of this quality system are documented in this quality manual.

b) The quality documentation is available for use by all laboratory personnel.

c) The laboratory defines and documents its policies and objectives for, and its commitment to accepted laboratory practices and quality of testing services.

d) The laboratory management ensures that these policies and objectives are documented in the quality manual and are communicated to, understood and implemented by all laboratory personnel concerned.

i. All staff members are given access to a controlled copy of the Quality Systems Manual (QSM) for review at the commencement of employment. However, the individual Standard Operating Procedures are the training documents that have precedence. The QSM is provided as a general overview.

ii. A controlled copy of the quality manual is also available in each department.

e) The quality manual is maintained current under the responsibility of the quality assurance department. This manual is reviewed on an annual basis or more frequently, and revised as necessary.

5.3 Quality Systems Manual (QSM) Elements

This Quality Systems Manual (QSM) and related quality documentation state ECI's policies and operational procedures established in order to meet the requirements of this Standard.

This manual lists on the title page: a document title; the laboratory's full name and address; the name, address, and telephone number of individuals responsible for the laboratory and the effective date of the version.

This quality manual and related quality documentation also contains:

a) A quality ***policy statement,*** including objectives and commitments, by top management;

i. Eurofins Calscience, Inc. (ECI) is committed to providing the highest quality environmental analytical services available. To ensure the production of scientifically sound, legally defensible data of known and proven quality, an extensive Quality Assurance program has been developed and implemented. This document, ECI's Quality Systems Manual for Environmental Analytical Services, presents an overview of the essential elements of our Quality Assurance program. ECI has modeled this systems manual after EPA guidelines as outlined in "Guidance for Quality Assurance Project Plans (EPA QA/G-5)", Office of Monitoring Systems and Quality Assurance, Office of Research and Development,
U.S. EPA, EPA/240-R-02/009 December 2002. ECI's QA Program is closely monitored at the Corporate, Divisional, and Group levels, and relies on clearly defined objectives, well-documented procedures, a comprehensive quality assurance/quality control system, and management support for its effectiveness.

ii. This QA Program Systems Manual is designed to control and monitor the quality of data generated at ECI. The essential elements described herein are geared toward generating data that is in compliance with federal regulatory requirements specified under the Clean Water Act, the Safe Drinking Water Act, the Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation, and Liability Act, and applicable amendments, and state and DOD/DOE/DoE equivalents. Although the quality control requirements of these various programs are not completely consistent, each of the programs base data quality judgments on the following three types of information, the operational elements of each being described elsewhere in this manual.

- Data which indicates the overall qualifications of the laboratory to perform environmental analyses;
- Data which measures the laboratory's daily performance using a specific method; and
- Data which measures the effect of a specific matrix on the performance of a method.

iii. It is important to note that the QA guidelines presented herein will always apply unless adherence to specific Quality Assurance Project Plans (QAPPs) or client and/or regulatory agency specific requirements are directed. In these cases, the elements contained within specified direction or documentation shall supersede that contained herein.

iv. This manual is a living document subject to periodic modifications to comply with regulatory changes and technological advancements. All previous versions of this document are obsolete. Users are urged to contact ECI to verify the current revision of this document.

b) The organization and management structure of the laboratory, its place in any parent organization and relevant organizational charts;

See Figure 1 Organizational Chart, and Figure 2 and 3 Responsibility Charts.

c) The relationship between management, technical operations, support services and the quality system;

d) Procedures to ensure that all records required under the NELAP are retained, as well as procedures for control and maintenance of documentation through a document control system which ensures that all standard operating procedures, manuals, or documents clearly indicate the time period during which the procedure or document was in force;

i. Ensuring a high quality work product in the environmental laboratory not only requires adherence to the quality issues discussed in the previous sections, but also requires the ability to effectively archive, restore, and protect the records that are generated.

ii. Procedures are in place to ensure that all records are retained. In addition, a documentation control system is employed to clearly indicate the time period during which a standard operating procedure, manual, or document was in force. These procedures are outlined in the laboratory standard operating procedure SOP-T002.

iii. All laboratory logbooks, instrument response printouts, completed analytical reports, chain-of-custodies, and laboratory support documentation are stored for a minimum of five years. Project specific data are stored in sequentially numbered project files and include copies of the applicable laboratory logbooks, instrument response printouts, completed analytical reports, chain-of-custodies, and any other pertinent supporting documentation.

iv. When complete, the project specific data are high speed optically scanned and transformed into digital CD media. Additional copies of these records are created at the time of scanning and are stored off-site for protection of the data. These records are stored for a minimum of five years.

v. Access to all systems is limited by use of log-in and password protection and is maintained by the system administrator.

vi. There are four forms of electronic data that are generated in the laboratory. Refer to Table 1 – Data Archiving Schedule below for a synopsis of general data archiving schedules.

vii. All electronic records are stored for a minimum of five years.

TABLE 1 - DATA ARCHIVING SCHEDULE

LIMS Database

Backup frequency:	Daily
Backup media:	Hard Disk
Backup software:	MS SQL Server Backup
Backup versions kept:	Ten previous versions
Onsite copy:	Redundancy by using mirrored hard drive
Offsite copy:	One (Replicate to Lampson Facility)

Instrument Data

Backup frequency:	Daily
Backup media:	Hard Disk
Backup software:	NT Backup
Backup versions kept:	All versions
Offsite copy:	One (Replicate to Lampson Facility)

e) Job Descriptions, Roles and Responsibilities

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to their job function and the quality program as a whole.

The responsibility for quality lies with every employee at ECI. As such, all employees have access to the Quality Assurance Manual and are responsible for knowing the content of this manual and upholding the standards therein. Each employee is expected to conduct themselves in accordance with the procedures in this manual and the laboratory's SOPs.

The following descriptions define the primary roles and their relationship to the Quality Assurance Program. Members of the key staff include the following:

- Management (e.g., President, Vice-President, Business Unit Manager, Laboratory Director);
- Technical managers (e.g., Technical Director, Section Supervisors);
- Quality managers;
- Support systems and administrative managers (e.g., IT manager, Facilities manager, project managers); and
- Other staff

In these positions, members of the key staff are responsible for assuring compliance with the National Environmental Laboratory Accreditation Program (NELAP), California Environmental Laboratory Accreditation Program (ELAP), Department of Defense / Energy (DOD/DOE) ELAP, State and Federal Agencies, and ISO 17025:2005 Standard requirements. In these roles, key personnel may set or enforce quality policies, monitor compliance, initiate corrective actions, interface with laboratory, client, and regulatory personnel, and provide general program oversight.

Business Unit Manager:

ECI's Business Unit Manager represents ECI to the Eurofins US and Global Corporate entities.

c::> Ensures that ECI's financial and production performance meets assigned metrics.
c::> Determines need for capital and employee resources and allocates as appropriate.
c::> Serves as the legal representative for ECI.
c::> Responsible for yearly budget and overruns.
c::> Point person for major new initiatives

Laboratory Director:

ECI's Laboratory Director, through its Business Unit Manager, is the final authority on all issues dealing with data quality and has the authority to require that procedures be amended or discontinued, or analytical results voided or repeated. He or she also has the authority to suspend or terminate employees on the grounds of non-compliance with QA/QC procedures. In addition, the Laboratory Director:

- Ensures that ECI remains current with all regulations which affect operations and disseminate all such changes in regulatory requirements to the QA Director, Technical Director, QA Manager, and Group Leaders;
- Provides one or more Technical Directors for the appropriate fields of testing. The name(s) of the Technical Director are included **in** the national database. (The Laboratory Director may also act in the Technical Director capacity.) If the Technical Director is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director will designate another full time staff member meeting the qualifications of the Technical Director to temporarily perform this function. **If** the absence exceeds 35 consecutive calendar days, the primary accrediting authority will be notified in writing;
- Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented;
- Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work;
- Oversees the development and implementation of the QA Program which assures that all data generated will be scientifically sound, legally defensible, and of known quality;
- In conjunction with the QA Manager, conducts annual reviews of the QA Program;
- Oversees the implementation of new and revised QA procedures to improve data quality;
- Ensures that appropriate corrective actions are taken to address analyses Identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth **in** the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director;
- Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to;
- Oversees all laboratory accreditation efforts

Operations Director:

The Operations Director manages and directs the analytical production sections of the laboratory. He or she reports directly to the Laboratory Director and assists in determining the most efficient instrument utilization. More specifically, he/she:

- Evaluate the level of internal/external non-conformances for all departments;
- Continuously evaluate production capacity and improves capacity utilization;
- Continuously evaluate turnaround time and addresses any problems that may hinder meeting the required and committed turnaround time from the various departments;
- Develop and improve the training of all analysts **in** cooperation with the Laboratory Director, QA Director, QA Manager and Group Leaders, and in compliance with regulatory requirements;
- Ensure that scheduled instrument maintenance is completed;
- Are responsible for efficient utilization of supplies;
- Constantly monitor and modify the processing of samples through the departments; and
- Maintain sufficient personnel, equipment and supplies to achieve production goals.

Technical Director:

The Technical Director reports to the Business Unit Manager and is responsible for all laboratory, client, and project technical issues. More specifically, he/she:

- For major projects and/or clients, act as a technical resource for the client and the laboratory in matters of method selection or QC criteria.
- Company-wide, maintains all training-related documentation in a single secure location. Develops training guides and other training documentation as needed;

- Interface directly with Project Management staff in response to questions pre-release or from the client post-release. Determine causation and interface with QA staff to prevent recurrences;
- Interface directly with clients, or other client representatives in matters related to technical data quality requests.
- Attend client, Business Development, or industry meetings with or without management when a 'technical representative' is required or would be beneficial to ECI.
- Provide support to Business Development through the review of DOD/DOE-related SAPs, QAPPs, and work plans. Provide comment and alternative solutions if unable to meet specific requirements. Populate DOD/DOE UFP QAPP tables for client SAPs/QAPPs when needed;
- Support QA and Operations with SOP revisions, where needed;
- Perform full QA reviews and/or data validation where required;
- Provide technical solutions to QA with regard to laboratory procedures, data quality issues, possible solutions, and appropriate corrective actions;
- Provide technical opinions and support to Operations with regard to current procedures or new method development;
- Interface with QA staff as necessary to ensure continuous improvement in all areas of ECI's operations.
- Provide LIMS input; and
- As may be necessary, act as Program Director for DOD/DOE or other high profile projects.

Quality Assurance Director:

The Quality Assurance (QA) Director has full authority through the Business Unit Manager in all matters relating to quality assurance and quality control systems. The QA Director can make recommendations to the Business Unit Manager and/or Laboratory Director regarding the suspension analytical activities or the suspension or termination of employees on the grounds of non-compliance with QA/QC systems or procedures. An alternate QA Director is always assigned. In the absence of the primary designate, the alternate will act in the QA Director's capacity with the full authority of the position as allowed by ECI governing documents. In addition, the QA Director performs the following:

- Oversight and monitoring of and compliance with ECI's QA program;
- Ensuring continuous improvement in all aspects of ECI's QA program such as:
  - accreditations/certifications;
  - analytical method management;
  - internal and external audits;
  - documentation;
  - training;
  - proficiency evaluation studies;
- Ensuring ECI's QA program remains up-to-date consistent with current regulatory requirements and ECI's QA policies;
- Supervision and direction of all QA staff; and
- Serving as a technical resource for analytical chemistry or QA matters;
- Provide support and oversight to QA staff with regard to external audit responses. Provide input on, and define appropriate corrective actions for the laboratory. Document corrective action responses, and monitor the required audit response time frames, as needed.
- Oversees in-house training on quality assurance and control.

Quality Assurance Manager:

The Quality Assurance (QA) Manager has full authority through the Quality Assurance Director in matters dealing within the laboratory. The QA Manager can make recommendations to the Quality Assurance Director and/or Laboratory Director regarding the suspension or termination of employees on the grounds of

non-compliance with QA/QC procedures. An alternate QA Manager is always assigned. In the absence of the primary designate, the alternate will act in the QA Manager's capacity with the full authority of the position as allowed by ECI governing documents. In addition, the QA Manager performs the following:

- Maintains and updates the QAM on an annual basis;
- Implements ECI's QA Program;
- Monitors the QA Program within the laboratory to ensure complete compliance with its objectives, QC procedures, holding times, and compliance with client or project specific data quality objectives;
- Distributes performance evaluation (PE) samples on a routine basis to ensure the production of data that meets the objectives of its QA Program;
- Maintains all SOPs used at ECI;
- Maintains records and archives of all PE results, audit comments, and customer inquiries concerning the QA program;
- Performs statistical analyses of QC data and establish controls that accurately reflect the performance of the laboratory;
- Conducts periodic performance and system audits to ensure compliance with the elements of ECI's QA Program;
- Prescribes and monitors corrective action;
- Serves as in-house client representative on all project inquiries involving data quality issues;
- Coordinates data review process to ensure that thorough reviews are conducted on all project files;
- Develops revisions to existing SOPs;
- Reports the status of in-house QA/QC to the Laboratory Director;
- Maintains records and archives of all QA/QC data including but not limited to method detection limit (MDL) studies, accuracy and precision control charts, and completed log books; and
- Conducts and/or otherwise ensures that an adequate level of QA/QC training is conducted within the laboratory.

Quality Assurance Assistant:

The QA Assistant reports to the QA Manager and performs the following functions:

- Assists the QA Manager and lab staff with internal audits, corrective action review, test method assessments and overall implementation of the QA program;
- Generates and reviews, in conjunction with the QA Manager, Control Charts and Method Detection Limit (MDL) studies;
- Reviews and revises SOPs as needed;
- Distributes new SOPs to all applicable lab areas.
- Writes and promulgates QA Directives.

Director of Business Development:

The Director of Business Development reports to the Laboratory Director and serves as the interface between the laboratory's technical departments and the laboratory's clients. The staff consists of the Project Management team, Business Development team and satellite office Operations Manager. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Technical training and growth of the Project Management team;
- Business liaison for the Project Management team;
- Human resource management of the Project Management team;
- Responsible for the review and negotiation of client contracts and terms and conditions;

- Responsible for establishing standard fee schedules for the laboratory;
- Responsible for preparation of proposals and quotes for clients and client prospects;
- Accountable for response to client inquiries concerning sample status;
- Responsible for assistance to clients regarding the resolution of problems concerning Chains-of-Custody;
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory;
- Notifying the department managers of incoming projects and sample delivery schedules;
- Accountable to clients for communicating sample progress in daily status meeting with agreed-upon due dates;
- Responsible for discussing with client any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff;
- Responsible for staff familiarization with specific quotes, sample log-in review, and final report completeness; and
- Ensure that all non-conformance conditions are reported to the QA Manager, Operations Manager, and/or Laboratory Director via the Corrective Action process.

Technical Managers (at ECI known as Group Leaders):

The Group Leaders report directly to the Operations Director. They have the authority to accept or reject data based on pre-defined QC criteria. In addition, with the approval of the QA Manager, the Group Leaders may accept data that falls outside of normal QC limits if, in his or her professional judgment, there are technical justifications for the acceptance of such data. The circumstances must be well documented and any need for corrective action identified must be defined and initiated. The authority of the Group Leaders in QC related matters results directly from the QA Manager. The Group Leaders also

- Coordinating, writing, and reviewing test methods and SOPs, with regard to quality, integrity, regulatory requirements and efficient production techniques;
- Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process and providing technical and troubleshooting expertise on routine and unusual or complex problems;
- Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis; and
- Coordinates audit responses with supervisors and QA Manager.
- Actively support the implementation of ECI's QA Program;
- Ensure that their employees are in full compliance with ECI's QA Program;
- Maintain accurate SOPs (by reviewing and implementing updates) and enforce routine compliance with SOPs;
- Conduct technical training of new staff and when modifications are made to existing procedures;
- Maintain a work environment which emphasizes the importance of data quality;
- Ensure all logbooks are current, reviewed and properly labeled or archived;
- Ensure that all non-conformance conditions are reported to the QA Manager, Operations Manager, and/or Laboratory Director via Corrective Action reports;
- Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Director, Operations Manager, and/or QA Manager. Each is responsible for 100% of the data review and documentation, nonconformance issues, and the timely and accurate completion of performance evaluation samples and MDLs, for his/her department;.

- Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and using appropriate documentation techniques;.
- Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He or she is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments;
- Provide written responses to external and internal audit issues; and
- Provide support to all levels of ECI Management.

Technical Managers (Sample Control Group Leader):

The Sample Control Group Leader reports to the Operations Manager. The responsibilities are outlined below:

- Direct the receipt, handling, labeling and proper storage of samples in compliance with laboratory procedures and policies;
- Oversee the training of Sample Control Technicians regarding the above items;
- Direct the logging of incoming samples into the LIMS and ensure the verification of data entry from login;
- Oversee all sample courier operations;
- Acts as a liaison between Project Managers and Analytical departments in respect to handling rush orders and resolving inconsistencies and problems with chain-of-custody forms, and routing of subcontracted analyses; and
- Oversees the handling of samples in accordance with the Waste Disposal SOP, the Hazardous Waste Contingency Plan in the Chemical Hygiene/Safety Manual, and the U. S. Department of Agriculture requirements.

Laboratory Analysts

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the group leader or supervisor. The responsibilities of the analysts are listed below:

- Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, the Data Integrity Policy, and project-specific QA plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on work sheets, bench sheets, preparation logbook, and/or a Non-Conformance report;
- Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to the Group Leader and/or the QA Manager;
- Perform 100% review of the data generated prior to entering and submitting for secondary level review; and
- Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

Laboratory Technicians:

- Prepare samples for analysis by weighing, extracting or digesting, filtering, or concentrating samples; and

- Prepare method specific QC Samples with each preparation batch. All personnel must adhere to all QC procedures specified in the analytical method and in accordance to procedures or policies and are responsible for the full documentation of these procedures.

Project Managers:

The Project Manager normally reports to the Senior Project Manager and/or Business Development Director. Typical responsibilities include:

- Serving as the laboratories' primary point of contact for assigned clients;
- Working with laboratory chemists to resolve questions on data;
- Scheduling of courier deliveries and pick-ups;
- Tracking the progress of all laboratory production efforts;
- Advising clients of any scheduling conflicts, possible delays, or other problems which may arise;
- Resolving any questions or issues that clients may have with regard to our services, especially our reports;
- Preparation of bottle kits for use by clients in their sampling efforts (as necessary);
- Reviewing of reports/EDDs (Electronic Data Deliverables) as necessary prior to release;
- Invoice preparation and review prior to release to client;
- Serving as back-up contact person for other Project Managers in the event of his/her absence;
- Coordination of all subcontracting efforts for projects assigned;
- Preparation and implementation of program QAPPs (Quality Assurance Project Plans), if needed;
- Preparation of project Case Narratives, as needed; and
- Assembly of full data packages in accordance with company or client protocol, as needed.

Project Management Assistant:

The Project Management Assistant normally receives direction from the Project Manager(s) for which he/she is assigned. Typical responsibilities include:

- Working with laboratory chemists to resolve questions on data;
- Scheduling of courier deliveries and pick-ups;
- Tracking the progress of all laboratory production efforts;
- Advising clients of any scheduling conflicts, possible delays, or other problems which may arise;
- Resolving any questions or issues that clients may have with regard to our services, especially our reports;
- Preparation of bottle kits for use by clients in their sampling efforts;
- Reviewing of reports/EDDs (Electronic Data Deliverables) prior to release;
- Invoice preparation and review prior to release to client;
- Serving as back-up contact person for the project managers in the event of his/her absence;
- Coordination of all subcontracting efforts for projects assigned; and
- Preparation and implementation of program QAPPs (Quality Assurance Project Plans), if needed.
- As part of the administrative staff, this person may also be required to answer phones, do occasional filing, mailing, etc.

Health, Safety, and Respiration Protection Manager:

The Health and Safety Manager reports to the Laboratory Director and ensures that systems are maintained for the safe operation of the laboratory. The EHS Manager is responsible for:

- Conducting ongoing, necessary safety training and conducting new employee safety orientations;
- Assisting in developing and maintaining the Chemical Hygiene/Safety Manual;
- Oversees the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed; and
- Completes accident reports, follows up on root causes and defines corrective actions.

Hazardous Waste Coordinator:

The Hazardous Waste Coordinator reports directly to the Environmental Health & Safety Manager. The duties of the HWC consist of:

- Staying current with the hazardous waste regulations and continuing training on hazardous waste issues;
- Contacting the hazardous waste subcontractors for review of procedures and opportunities for minimization of waste;
- Supervise the recording of the transfer of samples from refrigerated conditions to ambient conditions [in the sample disposal log sheets (SOLS)];
- Check the records in SDLS against the logbook (LIMS) records;
- Coordinate the collection of waste throughout the laboratory that will be disposed of through "Lab Packs";
- Coordinate and supervise Hazardous Waste Technician(s);
- Dispose of solid waste to an assigned Tote;
- Supervise the recording and disposal of acid and soil with methylene chloride extracts into appropriate drums;.
- Prepare and discharge treated wastewater to the sewer system;
- Maintain Uniform Hazardous Waste Manifest files;
- Prepare weekly sample disposal schedules;
- Coordinate and schedule waste pick-up;
- Check **all** waste containers for appropriate labels; and
- Maintain safe housekeeping and practices.

Education and Experience

ECI makes every effort to hire analytical staff that posses a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions are made based upon experience and an individual's ability to learn as there are many **in** the industry that are more than competent, experts perhaps, who have not earned a college degree.

Selection of qualified individuals for employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Experience and specialized training may be accepted in lieu of a college degree (basic lab skills such as using a balance, aseptic or quantitation techniques, etc. are also considered).

Included in Section 5.2 (e) of this Quality Assurance Manual are the basic job titles and personnel responsibilities for anyone who manages, performs or verifies work affecting the quality of the laboratory's environmental sample testing. Minimum education and training requirements are summarized in the following table:

When an analyst does not meet these minimum requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Group Leader, and are considered an analyst in training. The person supervising an analyst **in** training is directly accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

Job Type	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.}, Titrimetric and Gravimetric Analyses,	H.S. Diploma or GED	On the job training
GFAA CVAA, FLAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC	A college degree in an applied science or 2 years of college with at least 1 year of college chemistry, or	2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pest, PCB, Herb, HPLC, etc.}, GCMS	A college degree in an applied science or 2 years of college chemistry, or	5 years of prior analy!ical experience is required
Spectra Interpretation	A college degree in an applied science or 2 years of college Chemistry, and	2 years relevant experience, or 5 years of prior analy!ical experience is required
Group Leaders - Advanced Instrumentation	Bachelors Degree in an applied science with 16 semester hours in chemistry. An advanced (MS, PhD.} degree may substitute for one year of experience, and	2 years experience in the analy!ical technique for environmental analysis of representative analyj;es for which they will oversee
Group Leaders - Wet Chemist[V (Basic Skills}	Associates degree in an applied science or 2 years of college with 16 semester hours in Chemistry, and	2 years relevant experience

f) Identification of the laboratory's approved signatories; at a minimum, the title page of the quality manual has the signed and dated concurrence (with appropriate titles) of all responsible parties including the QA Manager, Operations, QA, Technical, Laboratory and Operations Directors.

g) The laboratory's procedures for achieving traceability of measurements;

h) A list of all test methods under which the laboratory performs its accredited testing may be found in the Index of Standard Operating Procedures, a separate document.

i) Mechanisms for ensuring that the laboratory reviews all new work to ensure that it has the appropriate facilities and resources before commencing such work;

j) Reference to the calibration and/or verification test procedures used;

Calibration procedures and verification of acceptability for each set of required calibrations are defined in Section 13 (Calibration) and Section 12 (Quality Control) of each standard operating procedure.

k) Procedures for handling samples received;

The generation of quality analytical data begins with the collection of the sample and, therefore, the integrity of the sample collection process is of importance to ECI. Samples must be collected in such a way that foreign material is not introduced into the samples and that analytes of interest do not escape from the samples or degrade prior to their analysis. To ensure sample integrity and representativeness, the following items must be considered:

- Samples must be collected in appropriate containers. In general, glass containers are used for organic analytes and polyethylene for inorganic/metal analytes;
- Only new sample containers which are certified and documented clean in accordance with U.S. EPA OSWER Directive No. 9240.0-0.05 specifications shall be provided by ECI for sample collection;
- Certain extremely hazardous samples or samples that have the potential to become extremely hazardous will not be accepted. These include (but are not limited to)

  1. Radioactive samples that significantly exceed background levels
  2. Biohazardous samples (medical wastes, body fluids, etc.)
  3. Explosive samples in pure form (Semtex, Flash or gunpowder, ammunition, flares, etc.)
  4. Neurological or other toxic agents (Sarin, Anthrax, Ricin, etc.)

ECI's chain-of-custody document is used to forward samples from the client to the laboratory. As the basic elements of most all chain-of-custody (COC) documents are similar, clientele may choose to use their own chain-of-custody document to forward samples to ECI.

Any discrepancies in the COC must be documented on the Sample Receipt Form and resolved prior to analysis of samples. Further guidance may be found in SOP T100 "Sample Receipt and Log-In Procedures".

Upon receipt by ECI, samples proceed through an orderly processing sequence designed to ensure continuous integrity of both the sample and its documentation from sample receipt through its analysis and beyond.

All coolers that are received by the Sample Control Group undergo a preliminary examination in accordance of the Sample Receipt Form. Specifically, each sample is carefully examined for label identification, proper container (type and volume), chemical preservation when applicable, container condition, and chain-of-custody documentation consistency with sample labels. Discrepancies are noted on both the Sample Receipt Form and the Sample Anomaly Form and, if possible, discussed with the client prior to his or her departure. If this is not possible, the discrepancies are communicated to the client for resolution prior to the completion of the log-in process. The temperature of the cooler is measured and, with other observations, is recorded.

During the log-in process each sample is assigned a unique laboratory identification number through a computerized Laboratory Information Management System (LIMS), which stores all essential project information. ECI maintains multiple security levels of access into LIMS to prevent unauthorized tampering/release of sample and project information.

Once all analyses for a sample have been completed and the sample container is returned to Sample Control, it shall remain in refrigerated storage for a period not less than 14 days following sample receipt unless the client requests return/forwarding of the sample. Following the 14-day refrigerated storage period, the samples are placed into ambient storage for another period not less than 14 days after which the samples are bulked into drums for later disposal.

Extended storage may be requested at prevailing per sample rates.

l) Reference to the major equipment and reference measurement standards used as well as the facilities and services used by the laboratory in conducting tests;

A list of major equipment is kept up-to-date on the List of Major Assets, reference Appendix G. This, as well as a list of reference measurement standards and their certificates of calibration, is maintained by the QA Manager or the respective departments. In general, all calibrations and references should be traceable to NIST

m) Reference to procedures for calibration, verification and maintenance of equipment; Laboratory SOPs (T043 and T066) are available to staff for calibration, verification and maintenance of equipment. In general,

n) Reference to verification practices which may include inter-laboratory comparisons, proficiency testing programs, use of reference materials and internal quality control schemes;

Instrument calibration is required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity such that required reporting limits can be met. Each instrument is calibrated with standard solutions appropriate to the type of instrument and the linear range established for the analytical method. The manufacturer's guidelines, the analytical method, and/or the requirements of special contracts determine the frequency of calibration and the concentration of calibration standards, whichever is most applicable. The following are very general guidelines and are not meant to be all-inclusive. Detailed calibration procedures are specified in the SOP for each method performed.

Gas Chromatography/Mass Spectroscopy (GC/MS): Each day prior to analysis of samples, all GC/MS instruments are tuned with 4-bromofluorobenzene (BFB) for VOCs and decafluorotriphenylphosphine (DFTPP) for SVOCs in accordance with the tuning criteria specified in the applicable methods. Samples are not analyzed until the method-specific tuning requirements have been met.

After the tuning criteria are met, the instrument is then calibrated for all target analytes and an initial multipoint calibration curve established. The calibration curve is then validated by the analysis of a second source standard, referred to as the initial calibration verification (ICV). Alternatively, the previous calibration curve may be used if validated by a continuing calibration verification (CCV) standard. All target analytes are represented in the calibration and certain key target analytes referred to as system performance calibration compounds (SPCCs) and calibration check compounds (CCCs) are used for curve acceptance determination. For the initial calibration to be deemed acceptable, the SPCCs and CCCs must meet established acceptance criteria and must be re-evaluated and meet the acceptance criteria, at a minimum, every twelve (12) hours thereafter.

Non-GC/MS Chromatography: The field of chromatography involves a variety of instrumentation and detectors. While calibration standards and control criteria vary depending upon the type of system and analytical methodology required for a specific analysis, the general principles of calibration apply uniformly. Each chromatographic system is calibrated prior to sample analysis. An initial multipoint calibration curve is generated using all target analytes. All target analytes must meet the acceptance criteria for the calibration to be deemed acceptable. The calibration curve is then validated by the analysis of a second source standard, referred to as the initial calibration verification (ICV). The continued validity of the initial multipoint calibration is verified every 12 hours using continuing calibration verification (CCV) standard containing all target analytes. If the CCV fails to meet the acceptance criteria, the system is re-calibrated and all samples analyzed since the last acceptable CCV must be re-analyzed.

Inductively Coupled Plasma Emission Spectroscopy: Initial calibration consists of a calibration blank (CB) plus one calibration standard. The calibration is verified by the re-analysis of the standard and initial calibration verification (ICV) standard. If the standard and the ICV fail to meet the acceptance criteria, the initial calibration is considered invalid and is re-performed.

Continuing calibration verification (CCV) consists of a mid-concentration standard plus a calibration blank (CB) analyzed every 10 samples and at the end of the sequence. If the CCV and/or CB fail to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV and/or CB must be re-analyzed.

ICP/MS Spectroscopy: Each day prior to the analysis of samples, all ICP/MS instruments undergo mass calibration and resolution checks prior to initial calibration. Initial calibration consists of a calibration blank (CB) and at least one calibration standard. The calibration is verified by the re-analysis of the standard and initial calibration verification (ICV) standards. If the standard and the ICV fail to meet the acceptance criteria, the initial calibration is considered invalid and is re-performed.

Continuing calibration verification (CCV) consists of a mid-concentration standard plus a calibration blank (CB) analyzed every 10 samples and at the end of the sequence. If the CCV and/or CB fail to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV and/or CB must be re-analyzed.

Cold Vapor Atomic Absorption Spectroscopy: Initial calibration consists of a calibration blank plus a series of at least 5 standards. The calibration curve is then validated by the analysis of a second source standard, referred to as the initial calibration verification (ICV). Continuing calibration verification (CCV) consists of midpoint calibration standard plus a continuing calibration blank (CCB) analyzed every 10 samples and at the end of the sequence. If the CCV and/or CCB fail to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV and/or CCB must be re-analyzed. If the calibration blanks contain target analyte concentrations exceeding the acceptance limits, the cause must be determined and corrected.

Flame and Graphite Furnace Atomic Absorption Spectroscopy: Initial calibration consists of a calibration blank plus a low, medium, and high calibration standard. Continuing calibration verification (CCV) consists of midpoint calibration standard plus a continuing calibration blank (CCB) analyzed every 10 samples and at the end of the sequence. If the CCV and/or CCB fail to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV and/or CCB must be re-analyzed. If the calibration blanks contain target analyte concentrations exceeding the acceptance limits, the cause must be determined and corrected.

General Inorganic Analyses: General inorganic (non-metal) analyses involve a variety of instrumental and wet chemistry techniques. While calibration procedures vary depending on the type of instrumentation and methodology, the general principles of calibration apply universally. Each system or method is initially calibrated using standards prior to analyses being conducted with continual verification that the calibration remains acceptable throughout analytical processing. If continual calibration verification fails to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV must be re-analyzed.

o) Procedures to be followed for feedback and corrective action whenever testing discrepancies are detected, or departures from documented policies and procedures occur;

These procedures may be found in SOP-T015 (Correction/Prevention of Errors in Test Records) and SOP-T022 (Corrective/Preventive Actions).

p) The laboratory management arrangements for permitting exceptions and departures from documented policies and procedures or from standard specifications;

ECl's SOPs are in substantial conformity with their corresponding published method references. Departure from approved SOPs shall be approved if necessary or appropriate due to the nature or composition of the sample or otherwise based on the reasonable judgment of ECl's Laboratory Director, Technical Director, or QA Manager.

Departures shall be made on a case-by-case basis consistent with recognized standards of the industry. In no case shall departures be approved without written communication between EC land the affected client.

q) Procedures for dealing with complaints;

Procedures for dealing with complaints may be found in SOP-T018, Handling of Inquiries and Complaints.

r) Procedures for protecting confidentiality (including national security concerns) and proprietary rights;

ECI is sensitive to the fact that much of the analytical work performed for clientele may be subject to litigatory processes. ECI, therefore, holds all information in strict confidence with laboratory release only to the client or designee. Information released to entities other than the client is performed only upon written, facsimile or e-mail request from the client.

Due to the investigative nature of most site assessments, analytical information may become available to regulatory agencies or other evaluating entities during site assessment of the laboratory for the specific purpose of attaining laboratory certifications, accreditations, or evaluation of laboratory qualification for future work. During these occurrences, the laboratory will make its best effort to maintain the confidence of client specific information.

s) Procedures for audits;

ECI participates in a wide variety of system and performance audits conducted by numerous federal and state agencies, as well as through its major clientele. These audits are conducted to verify that analytical data produced conforms to industry standards on a routine basis.

A System Audit is a qualitative evaluation of the measurement systems utilized at ECI, specifically, that ECI has, in place, the necessary facilities, staff, procedures, equipment, and instrumentation to generate acceptable data. This type of audit typically involves an on-site inspection of the laboratory facility, operations, and interview of personnel by the auditing agency.

A Performance Audit verifies the ability of ECI to correctly identify and quantitate compounds in blind check samples. This type of audit normally is conducted by the auditing agency through laboratory participation in round robin Performance Evaluation (PE) programs. Examples of current PE program involvement include those offered by commercial suppliers like ERA (WS/WP/SOIL and DMR-QA), or other inter-laboratory studies not required for certification but done to ensure laboratory performance, as well as programs administered by major industry.

Outliers in required PE samples will be investigated and corrective actions documented using the Corrective/Preventive Action Record.

Should the result of any audit detect a significant error, which has been identified to adversely affect released data, the situation shall be thoroughly investigated. Corrective measures shall be enacted to include system re-evaluation, the determined affect on released data and client notification, as necessary. These measures shall be documented using the Corrective/Preventive Action Record.

t) Processes/procedures for establishing that personnel are adequately experienced in the duties they are expected to carry out and are receiving any needed training;

Quality control begins prior to sample(s) receipt at the laboratory. The selection of well qualified personnel, based upon education and/or experience is the first step in successful laboratory management. A thorough screening of job applicants and selection of the best candidate to fulfill a well-defined need is as important an aspect of a successful QA/QC program as a careful review of analytical data.

Employee training and approval procedures used at ECI are specified in SOP-T010, "Employee Training", and includes but is not limited to the following:

- A thorough understanding of the applicable regulatory method and ECI SOP;
- A review of ECI's QA Program Manual and thorough understanding of the specifics contained therein that are directly related to the analysis to be performed;
- Instruction by the applicable Group Leader on all aspects of the analytical procedure;
- Performance of analyses under supervision of experienced laboratory personnel, which shall include analysis of blind QC check samples, when deemed appropriate;
- Participation in in-house seminars on analytical methodologies and procedures;
- Participation in job related seminars outside of the laboratory; and
- Participation in conventions and meetings, i.e., ACS, etc.

u) Ethics policy statement developed by the laboratory and processes/procedures for educating and training personnel in their ethical and legal responsibilities including the potential punishments and penalties for improper, unethical, or illegal actions;

A vital part of ECI's analytical laboratory services is their Laboratory Ethics Training Program. An effective program starts with an Ethics Policy Statement that is supported by all staff, and is reinforced with initial and ongoing ethics training.

"It shall be the policy of ECI to conduct all business with integrity and in an ethical manner. It is a basic and expected responsibility of each staff member and manager to hold to the highest ethical standard of professional conduct in the performance of all duties."

A proactive ethics training program is the most effective means of deterring and detecting improper, unethical, or illegal actions in the laboratory. There are six facets to the program: (1) clearly define improper, unethical, and illegal actions; (2) outline elements of prevention and detection programs for improper, unethical, or illegal actions; and (3) identify examples of inappropriate (i.e., potentially fraudulent) laboratory practices; (4) Annual Ethics and Data Integrity Training to be documented and maintained in the personnel file of each employee., (5) Documented training on new revisions of the Quality Systems Manual (QSM) and for new employees as needed. (6) Signed Ethics and Data Integrity Agreement (to be completed for new employees and annually thereafter)

Definition of Improper, Unethical, and Illegal Actions

Improper actions are defined as deviations from contract-specified or method-specified analytical practices and may be intentional or unintentional.

Unethical or illegal actions are defined as the deliberate falsification of analytical or quality assurance results, where failed method or contractual requirements are made to appear acceptable.

Prevention of laboratory improper, unethical, or illegal actions begins with a zero-tolerance philosophy established by management. Improper, unethical, or illegal actions are detected through the implementation of oversight protocols.

Prevention and Detection Program for Improper, Unethical, or Illegal Actions

ECI management has implemented a variety of proactive measures to promote prevention and detection of improper, unethical, or illegal activities. The following components constitute the basic program:

- Data Integrity Standard Operating Procedure (SOP) T065
- Data Integrity Documentation Procedures
- An Ethics and Data Integrity Agreement that is read and signed by all personnel;
- Initial and annual ethics training;

- Internal audits;
- Inclusion of anti-fraud language in subcontracts;
- Analyst notation and sign-off on manual integration changes to data;
- Active use of electronic audit functions when they are available in the instrument software; and
- A "no-fault" policy that encourages laboratory personnel to come forward and report fraudulent activities. Alternately, employees may report ethics violations to a third party agent contracted by Eurofins USA c/o reports@lighthouse-services.com/eurofinsus

A proactive, "beyond the basics" approach to the prevention of improper, unethical, or illegal actions are a necessary part of laboratory management. As such, in addition to the requirements above, ECI has a designated ombudsman (data integrity officer) to whom laboratory personnel can report improper, unethical, or illegal practices, or provide routine communication of training, lectures, and changes in policy intended to reduce improper, unethical, or illegal actions.

Examples of Improper. Unethical, or Illegal Practices

Documentation that clearly shows how all analytical values were obtained are maintained by ECI and supplied to the data user as needed. To avoid miscommunication, ECI clearly documents all errors, mistakes, and basis for manual integrations within the project file and case narrative as applicable. Notification is also made to the appropriate supervisor so that appropriate corrective actions can be initiated. Gross deviations from specified procedures are investigated for potential improper, unethical, or illegal actions, and findings of fraud are fully investigated by senior management. Examples of improper, unethical, or illegal practices are identified below:

- Improper use of manual integrations to meet calibration or method QC criteria (for example, peak shaving or peak enhancement are considered improper, unethical, or illegal actions if performed solely to meet QC requirements);
- Intentional misrepresentation of the date or time of analysis (for example, intentionally resetting a computer system's or instrument's date and/or time to make it appear that a time/date requirement was met);
- Falsification of results to meet method requirements;
- Reporting of results without analyses to support (i.e., dry-labbing);
- Selective exclusion of data to meet QC criteria (for example, initial calibration points dropped without technical or statistical justification);
- Misrepresentation of laboratory performance by presenting calibration data or QC limits within data reports that are not linked to the data set reported, or QC control limits presented within QAPP that are not indicative of historical laboratory performance or used for batch control;
- Notation of matrix inference as basis for exceeding acceptance limits (typically without implementing corrective actions) in interference-free matrices (for example, method blanks or laboratory control samples);
- Unwarranted manipulation of computer software (for example, improper background subtraction to meet ion abundance criteria for GC/MS tuning, chromatographic baseline manipulations);
- Improper alteration of analytical conditions (for example, modifying EM voltage, changing GC temperature program to shorter analytical run time) from standard analysis to sample analysis;
- Misrepresentation of QC samples (for example, adding surrogates after sample extraction, omitting sample preparation steps for QC samples, over- or under-spiking); and
- Reporting of results from the analysis of one sample for those of another.

v) Reference to procedures for reporting analytical results;

Standard operating procedures pertaining to the reporting of results are available to all laboratory personnel. They are: SOP-T009, Significant Figures, Rounding, and Reporting of Results; SOP-T025, Reporting of Tentatively Identified Compounds (TICs); and T-026, Reporting of Data Qualifiers.

All analytical data generated within ECI is thoroughly checked for accuracy and completeness. The data validation process consists of data generation, reduction, and four levels of review as described below.

The analyst generating the analytical data has the primary responsibility for its correctness and completeness. All data is generated and reduced following protocols specified in the appropriate SOPs. Each analyst reviews the quality of his or her work based upon an established set of guidelines specified in the SOPs or as specified by project requirements. The analyst reviews the data package to ensure that:

c> Holding times have not been exceeded;
c> Sample preparation information is correct and complete;
c> Analysis information is correct and complete;
c> The appropriate procedures were employed;
c> Analytical results are correct and complete;
c> All associated QC is within established control limits and, if not, out-of-control forms are completed thoroughly explaining the cause and corrective action taken;
c> Any special sample preparation and analytical requirements have been met; and
c> Documentation is complete, i.e., all anomalies in the preparation and analysis have been documented; out-of-control forms, if required, are complete, etc.

The data reduction and validation steps are documented, signed, and dated by the analyst on the QC Review coversheet accompanying each data package. This initial review step, performed by the analyst, is designated as primary review. The analyst then forwards the data package to his or her Group Leader, or designated data reviewer, who performs a secondary review. Secondary reviews consist of an independent check equivalent to that of the primary review and are designed to ensure that:

c> Calibration data is scientifically sound, appropriate to the method, and completely documented;
c> QC data is within established guidelines or reported with appropriate clarification/qualification;
c> Qualitative identification of sample components is correct;
c> Quantitative results are correct;
c> Documentation is complete and any anomalies properly addressed and documented;
c> The data is ready for incorporation into the final report package; and
c> The data package is complete and ready for archiving.

A significant component of the secondary review is the documentation of any errors that have been identified and corrected during the review process. ECI believes that the data package that is submitted for a secondary review should be free from errors. Errors that are discovered are documented and formally transmitted to the appropriate Group Leader. The cause of the errors is then addressed by additional training or clarification of procedures (SOP revisions) to ensure that similar errors do not recur and high quality data will be generated.

Signature of Data Reviewer and the date of review document the completion of secondary reviews on the QC Review coversheet. These constitute approval for data release and generation of analytical report.

During both of the QC review processes, 100% of the raw data associated with the entire project is available to the reviewer. Data packages are checked back to the raw data as deemed necessary by the reviewer.

Following draft report generation, the report is reviewed by the Project Manager to ensure that the data set and quality control data is complete and meets the specific requirements of the project. When available, the data is also evaluated against historical site information. Once all requested analytical work has been verified as complete, a final report is generated and signed by the Project Manager.

Following approval for release by the Project Manager, the Quality Assurance Manager or other qualified personnel may review 10% of the project files back to the raw data as an additional check, if a situation so warrants.

A variety of reporting formats, from Portable Document File (PDF), normal typed reports to computerized data tables to complex reports discussing regulatory issues are available. In general, ECIreports contain the following information.

Analytical Data

Analytical data is reported by sample identification (both client and laboratory) and test. Pertinent information including date(s) sampled, received, prepared, and analyzed; any required data qualifiers are included on each results page. The reporting limit for each method analyte is also listed. Additional data may include Method Detection Limits (MDLs).

QC Data

A QC Summary is provided with each final report. Unless otherwise specified in a QAPP or requested by the client, QC Summaries include results for method blanks, matrix spikes, matrix spike duplicates, and surrogate spikes. Laboratory control sample and method blank surrogates are routinely included if matrix interference results in a QC outlier. The effective control limits for the reported QC values are also provided on the QC Summary as well as explanations for any QC outliers. Case Narratives may be included as appropriate.

As required for the project, data reports from "results only" through "full CLP-like" will be generated and provided. Included in this range are reports for the major DOD/DOE programs including NFESC, AFC EE, and USAGE.

Methodology

References for the preparative and analytical methodology employed is included on all preliminary or final analytical reports.

Signatory

Final reports are ready for release to the client following review and approval by the Project Manager, as evidenced by his/her signature on the final report cover page. An approved signatories listing shall be maintained by the QA office.

Preliminary Data

Upon client request, preliminary data shall be released prior to completion of a full QC review. Preliminary data is subject to change pending QC review and, therefore, shall be clearly marked as "Preliminary". This qualification is provided as notification to the client that the data review process has not been completed yet and that the data is subject to possible modification resulting therefrom.

Revised Data

Analytical reports that have been revised for any reason from the original sent report shall be noted as being revised with a report note, case narrative or indication as to the revision.

Formatting

At a minimum, an analytical report shall consist of the Report Cover Page, Analytical Results, QA/QC Data (Default), Footnotes/Comments Page, Sample Receipt Form and COG. Paginated reports shall be employed for all reports unless used for non-NELAP analysis.

w) A Table of Contents and applicable lists of references and glossaries, and appendices.

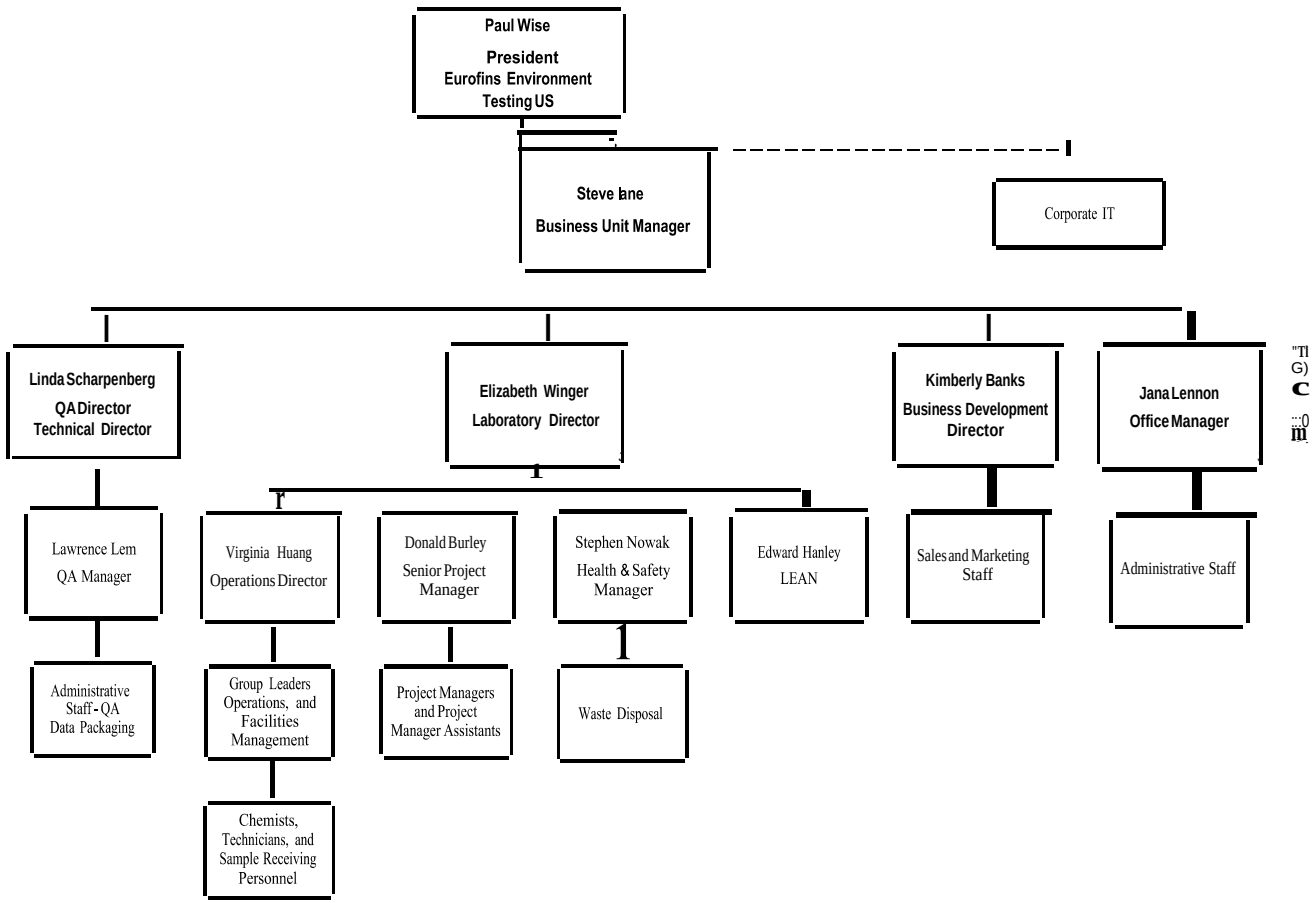
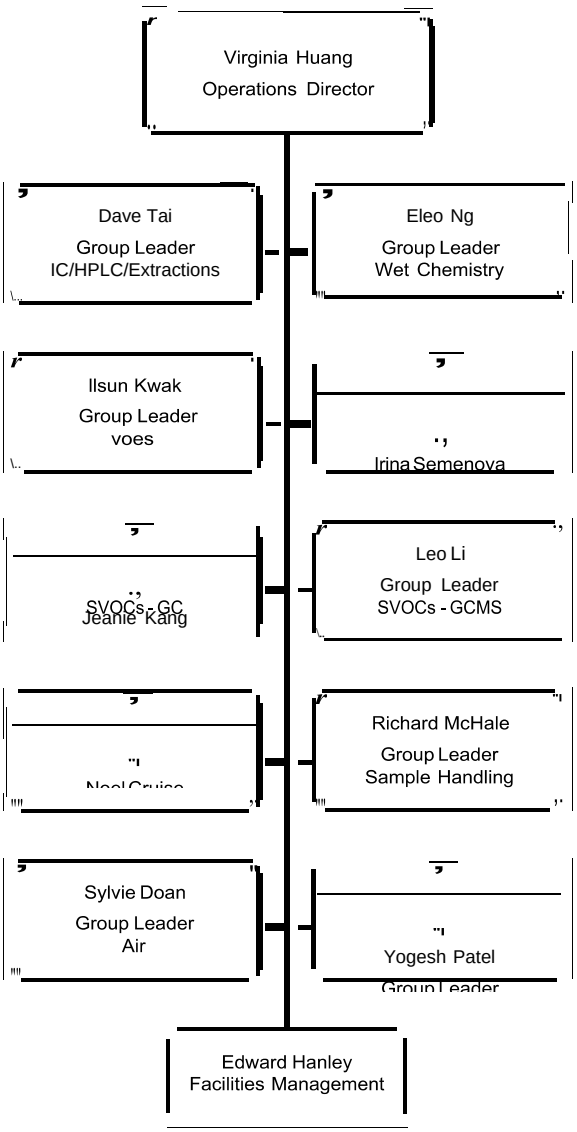

Paul Wise
President
Eurofins Environment Testing US
Steve Lane
Business Unit Manager
Corporate IT
Linda Scharpenberg
QA Director
Technical Director
Elizabeth Winger
Laboratory Director
Kimberly Banks
Business Development Director
Jana Lennon
Office Manager
Lawrence Lem
QA Manager
Virginia Huang
Operations Director
Donald Burley
Senior Project Manager
Stephen Nowak
Health & Safety Manager
Edward Hanley
LEAN
Sales and Marketing Staff
Administrative Staff
Administrative Staff - QA
Data Packaging
Group Leaders
Operations, and Facilities Management
Project Managers and Project Manager Assistants
Waste Disposal
Chemists, Technicians, and Sample Receiving Personnel

FIGURE 2:


Virginia Huang
Operations Director
Dave Tai
Group Leader
IC/HPLC/Extractions
Eleo Ng
Group Leader
Wet Chemistry
Ilsun Kwak
Group Leader
voes
Irina Semenova
SVOCs - GC
Jeanie Kang
Leo Li
Group Leader
SVOCs - GCMS
Richard McHale
Group Leader
Sample Handling
Sylvie Doan
Group Leader
Air
Yogesh Patel
Edward Hanley
Facilities Management

5.4 Audits

5.3.1 Internal Audits

The laboratory arranges comprehensive annual internal audits to verify that its operations continue to comply with the requirements of the laboratory's said quality system. The Quality Assurance Manager or the Quality Assurance Assistant plans and organizes audits as required by a predetermined schedule and requested by management. The internal audits are buttressed by regular and scheduled Test Method Assessments (TMA).

The Quality Assurance Assistant or other qualified personnel, independent of the activity to be audited, will carry out such audits following the procedures noted in SOP T028, Internal Audit Procedures.

Personnel do not audit their own activities except when it can be demonstrated that an effective audit will be carried out.

Where the audit findings cast doubt on the correctness or validity of the laboratory's calibrations or test results, the laboratory takes immediate corrective action and immediately notifies, in writing, any client whose work was involved.

i. List of available qualified personnel for internal audits include:

- QA Director
- QA Manager
- QA Assistant
- Department Manager
- Assistant Department Manager
- Group Leader (For departments other than their own)
- Program Manager
- Health and Safety Manager (For non-analytical departments)
- Any Senior Chemist (With documented training in proper internal auditing procedures from a qualified source).

ii. The minimum qualifications for an internal auditor shall be:

- Education: A Bachelors (BS) Degree in an applied science with 16 semester hours in chemistry.
- Experience: Two years' experience in an instrumental analytical technique for environmental analysis of representative environmental samples. Training to the most current revision of ECISOP T028 (Internal Audits). The training to be overseen by an individual that is ISO 17025 / 9001 trained in internal auditing procedures, or equivalent.
- An advanced (MS, PhD.) degree may be substituted for one year of experience.

Any outside audit findings will also be included in the Internal Audits.

5.3.2 Management Review

ECI management conducts an annual review of its quality system and its testing and calibration activities to ensure its continuing suitability and effectiveness and to introduce any necessary changes or improvements in the quality system and laboratory operations.

This review takes account of reports from managerial and supervisory personnel, the outcome of recent internal audits, assessments by external bodies, the results of inter-laboratory comparisons or proficiency tests, any changes in the volume and type of work undertaken, feedback from clients, senior lab personnel, corrective actions, and other relevant factors.

The laboratory shall have a procedure for review by management, and maintain records of review findings and actions. For more detailed descriptions Reference section 18.1 of this QSM and SOP T030.

5.3.3 Audit Review

All audit and review findings and any corrective actions that arise from them are documented. The laboratory management ensures that these actions are discharged within the agreed time frame as indicated in the quality manual and/or SOPs.

5.3.4 Performance Audits

In addition to periodic audits, the laboratory ensures the quality of results provided to clients by implementing checks to monitor the quality of the laboratory's analytical activities. Examples of such checks are:

a) Internal quality control procedures using statistical techniques (see Section 5.4 below);

b) Participation in proficiency testing or other inter-laboratory comparisons;

c) Use of certified reference materials and/or in-house quality control using secondary reference materials as specified in ECIQSM Section 5.4;

d) Replicate testing using the same or different test methods;

g) Re-testing of retained samples;

h) Correlation of results for different but related analysis of a sample (for example, total phosphorus should be greater than or equal to orthophosphate).

5.3.5 Corrective / Preventive Actions

a) In addition to providing acceptance criteria and specific protocols for corrective/preventive actions in SOP-T022, the laboratory implements general procedures to be followed to determine when departures from documented policies, procedures and quality control have occurred. These procedures include but are not limited to the following:

   1) Identify the individual(s) responsible for assessing each QC data type;

   2) Identify the individual(s) responsible for initiating and/or recommending corrective/preventive actions;

   3) Define how the analyst shall treat a data set if the associated QC measurements are unacceptable;

   4) Specify how out-of-control situations and subsequent corrective actions are to be documented; and

   5) Specify procedures for management (including the QA officer) to review corrective/preventive action reports.

b) To the extent possible, sample results are reported only if all quality control measures are acceptable. If a quality control measure is found to be out of control, and the data are to be reported, all samples associated with the failed quality control measure are reported with the appropriate data qualifier(s).

5.4 Essential Quality Control Procedures

These general quality control principles apply, where applicable, to all testing at ECI. The manner in which each is implemented is dependent on the types of tests performed by the laboratory and is further described in Appendix D and in SOP-T020, Internal Quality Control Checks. The standards for any given test type assures that the applicable principles are addressed:

a) All laboratories have detailed written protocols in place to monitor the following quality controls:

1) Positive and negative controls (blanks, spikes, reference toxicants, etc.) to monitor tests;

2) Tests to define the variability and/or repeatability of the laboratory results such as replicates;

3) Measures to assure the accuracy of the test method including calibration and/or continuing calibrations, use of certified reference materials, proficiency test samples, or other measures;

4) Measures to evaluate test method capability, such as detection limits and quantitation limits or range of applicability such as linearity;

5) Selection of appropriate formulae to reduce raw data to final results such as regression analysis, comparison to internal/external standard calculations, and statistical analyses;

6) Selection and use of reagents and standards of appropriate quality;

7) Measures to assure the selectivity of the test for its intended purpose; and

8) Measures to assure constant and consistent test conditions (both instrumental and environmental) where required by the test method, such as temperature, humidity, light or specific instrument conditions.

b) All quality control measures are assessed and evaluated on an on-going basis, and quality control acceptance criteria are used to determine the usability of the data. (See Appendix D.)

c) The laboratory has procedures for the development of acceptance/rejection criteria where no method or regulatory criteria exist. (See ECI QSM Section 11.2, Sample Acceptance Policy.)

d) The quality control protocols specified in the method manual (ECI QSM Section 10.1.2) is followed. ECI ensures that the essential standards outlined in NELAC 5, Appendix D, or mandated methods or regulations (whichever are more stringent) are incorporated into the method manuals. When it is not apparent which is more stringent the QC in the mandated method or regulations is to be followed.

The essential quality control measures for testing are found in Appendix D.

6.1 PERSONNEL

6.2 General Requirements for Laboratory Staff

ECI's testing departments have a sufficient level of personnel with the necessary education, training, technical knowledge and experience to perform the assigned functions.

All personnel are responsible for complying with all quality assurance/quality control requirements that pertain to their organizational/technical function. Each technical staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular function and a general knowledge of laboratory operations, test methods, quality assurance/quality control procedures and records management.

6.3 Laboratory Management Responsibilities

In addition to ECI QSM Section 4.2.d, the laboratory management:

a) Defines the minimum level of qualification, experience and skills necessary for all positions in the laboratory. In addition to education and/or experience, basic laboratory skills such as using a balance and quantitative techniques, are considered.

b) Ensures that all technical laboratory staff members demonstrate capability in the activities for which they are responsible. Such demonstration is documented (See Appendix C). Note: In departments with specialized "work cells" (a well-defined group of analysts that together perform the method analysis), the group as a unit meets the above criteria and this demonstration is fully documented.

c) Ensures that the training of each member of the technical staff is kept up-to-date (on-going) by the following:

   1) Keeping evidence on file that demonstrates that each employee has read, understood, and is using the latest version of the laboratory's in-house quality documentation that relates to his/her job responsibilities.

   2) Documenting training courses or workshops on specific equipment, analytical techniques, or laboratory procedures.

   3) Documenting employee attendance at training courses on ethical and legal responsibilities including the potential punishments and penalties for improper, unethical or illegal actions. Keeping on file evidence that demonstrates that each employee has read, acknowledges, and understands their personal ethical and legal responsibilities including the potential punishments and penalties for improper, unethical or illegal actions.

   4) Maintains up-to-date analyst training records that contain a certification that technical personnel have read, understood and agreed to perform the most recent version of the test method (the approved method or SOP as defined by the laboratory document control system, ECI QSM Section 5.2.d) and documentation of continued proficiency by at least one of the following once per year:

      i. Acceptable performance of a blind sample (single blind to the analyst);

      ii. Another demonstration of capability;

      iii. Successful analysis of a blind performance sample on a similar test method using the same technology (e.g., GC/MS volatiles by purge and trap for Methods 524.2, 624, or 5035/8260) would only require documentation for one of the test methods;

      iv. At least four consecutive laboratory control samples with acceptable levels of precision and accuracy;

      v. If subsections i-iv cannot be performed, analysis of authentic samples with results statistically indistinguishable from those obtained by another trained analyst.

d) Documents all analytical and operational activities of the laboratory;

e) Supervises all personnel employed by the laboratory;

f) Ensures that all sample acceptance criteria (ECI QSM Section 11.0) are verified and that samples are logged into the sample tracking system and properly labeled and stored.

g) Documents the quality of all data reported by the laboratory.

h) Develops a proactive program for the prevention and detection of improper, unethical, or illegal actions. Components of this program could include: internal proficiency testing (single and double blind); post-analysis electronic and magnetic tape audits; effective reward program to improve employee vigilance and co-monitoring; and separate SOPs identifying appropriate and inappropriate laboratory and instrument manipulation practices.

6.2.1 Ownership Transfer / Out of Business

a) In the event that the laboratory transfers ownership or goes out of business, ECI will ensure that the records are maintained or transferred according to client instruction.

b) Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives will be clearly established. In cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records will be followed.

c) In the event that the laboratory goes out of business, all records will revert to the control of the client or regulatory agency, as applicable. As much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

6.3 Personnel Records

Records on the relevant qualifications, training, skills and experience of the technical personnel are maintained by the laboratory (see EC IQSM Section 6.2.c), including records on demonstrated proficiency for each laboratory test method, such as the criteria outlined in ECI QSM Section 10.5 for chemical testing.

7.1 PHYSICAL FACILITIES - ACCOMMODATION AND ENVIRONMENT

7.2 Environment

a) Laboratory accommodations, test areas, energy sources, lighting, heating and ventilation are such that they facilitate proper performance of tests.

b) The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of the measurements. Particular care shall be taken when such activities are undertaken at sites other than the permanent laboratory premises.

c) The laboratory shall provide for the effective monitoring, control and recording of environmental conditions as appropriate. Such environmental conditions may include biological sterility, dust, electromagnetic interference, humidity, main voltage, temperature, and sound and vibration levels.

d) In instances where monitoring or control of any of the above-mentioned items is specified in a test method or by regulation, the laboratory meets and documents adherence to the laboratory facility requirements.

7.2 Work Areas

a) There is effective separation between neighboring areas when the activities therein are incompatible including volatile organic chemicals handling areas.

b) Access to and use of all areas affecting the quality of these activities are defined and controlled.

c) Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality.

d) Workspaces are available to ensure an unencumbered work area. Work areas include:

1) Access and entryways to the laboratory;

2) Sample receipt areas;

3) Sample storage areas;

4) Chemical and waste storage areas; and

5) Data handling and storage areas.

8.0 EQUIPMENT AND REFERENCE MATERIALS

a) ECI is furnished with all items of equipment (including reference materials) required for the correct performance of tests for which accreditation is maintained. Note that ECI does not use equipment outside its permanent control.

b) All equipment is properly maintained, inspected, and cleaned. Maintenance procedures are documented.

c) Any equipment item that has been subjected to overloading or mishandling, or that gives suspect results, or has been shown by verification or otherwise to be defective, is taken out of service, clearly identified and wherever possible stored at a specified place until it has been repaired and shown by calibration, verification or test to perform satisfactorily. The laboratory shall examine the effect of this defect on previous calibrations or tests.

d) When appropriate, each item of equipment, including reference materials, is labeled, marked, or otherwise identified to indicate its calibration status.

e) Records are maintained of each major item of equipment and all reference materials significant to the tests performed. These records include documentation on all routine and non-routine maintenance activities in assigned log books and reference material verifications.

The records include:

1) The name of the item of equipment;

2) The manufacturer's name, type identification, and serial number or other unique identification;

3) Date received and date placed in service (if available);

4) Current location, where appropriate;

5) If available, condition when received (e.g., new, used, reconditioned);

6) Copy of the manufacturer's instructions, where available;

7) Dates and results of calibrations and/or verifications and date of the next calibration and/or verification;

8) Details of maintenance carried out to date and planned for the future; and

9) History of any damage, malfunction, modification or repair.

9.1 MEASUREMENT TRACEABILITY AND CALIBRATION

9.2 General Requirements

All measuring operations and testing equipment having an effect on the accuracy or validity of tests are calibrated and/or verified before being put into service and on a continuing basis. The laboratory has an established program for the calibration and verification of its measuring and test equipment. This includes balances, thermometers and control standards.

9.3 Traceability of Calibration

a) The overall program of calibration and/or verification and validation of equipment is designed and operated so as to ensure that measurements made by the laboratory are traceable to national standards of measurement.

b) Calibration certificates indicate the traceability to national standards of measurement and provide the measurement results and associated uncertainty of measurement and/or a statement of compliance with an identified metrological specification. The laboratory maintains records of all such certification in the QA office.

c) Where traceability to national standards of measurement is not applicable, the laboratory provides satisfactory evidence of correlation of results, for example, by participation in a suitable program of inter-laboratory comparisons, proficiency testing, or independent analysis.

9.3 Reference Standards

a) Reference standards of measurement held by the laboratory (such as Class S or equivalent weights, or traceable thermometers) are used for calibration only and for no other purpose, unless it can be demonstrated that their performance as reference standards has not been invalidated. A body that can provide traceability calibrates reference standards of measurement. Where possible, this traceability is to a national standard of measurement.

b) There is a program of calibration and verification for reference standards.

   i. Two weeks prior to their date of calibration expiration, individual thermometers are removed from service and replaced by newly calibrated units from the supplier.

   ii. ECI keeps two sets of Class S weights on hand for use in the laboratory. One set is used for daily calibration checks, and the second set is kept for back up use should the first set be damaged, lost or otherwise compromised. The second set of weights is also place in service when the daily use set is shipped off site for recalibration.

iii. Analytical balances are serviced and calibrated on a routine, annual schedule.

c) Where relevant, reference standards and measuring and testing equipment are subjected to in-service checks between calibrations and verifications. Reference materials are traceable. Where possible, traceability is to national or international standards of measurement, or to national or international standard reference materials.

d) NIST-Traceable Weights and Thermometers

i. Reference standards of measurement shall be used for the purposes of calibration only. NIST traceable thermometers and NIST-traceable weights shall not be used for routine testing. If NIST traceable reference sources are used for routine testing they shall not be used for calibration purposes unless it can be shown that their performance as reference standards would not be invalidated.

ii. For NIST-traceable weights and thermometers, ECI requires that all calibrations be conducted by a calibration laboratory accredited by ACLASS, A2LA or other recognized accrediting body.

a. The calibration laboratory must hold ISO 17025 or ISO 9001 accreditation for the services rendered. Prior to use, QA verifies that the selected vendor holds the appropriate scope of accreditation for the services required.

b. The calibration certificate or report supplied by the calibration laboratory must contain a traceability statement, the conditions under which the calibrations were made, a compliance statement with an identified metrological specification and the pertinent clauses when applicable, and a clearly identified record of the quantities and functional test results before and after re-calibration.

c. The certificate and scope of accreditation is kept on file at the laboratory and is reviewed yearly.

iii. If significant amendments are made to a calibration certificate, it must have its own unique report identifier and must reference the one it is replacing. The piece of equipment must be identified in the amended report using its unique serial number or other laboratory defined identifier. The amended report is maintained with the original calibration report.

iv. Laboratory balances are recalibrated annually by an external, certified vendor that is certified to ISO 17025 / ISO 9001 standards for calibration. Prior to use, QA verifies that the selected vendor holds the appropriate scope of accreditation for the services required. This service is documented on each balance with a signed and dated certification sticker.

v. NIST mercury thermometers are sent out for recalibration every five years, or are replaced. All working mercury thermometers are calibrated annually against a NIST-traceable reference thermometer. All digital temperature measuring devices (min/max thermometers, IR guns) are calibrated quarterly. Equipment that does not meet acceptance criteria is removed from service and repaired or replaced. Calibration reports are maintained by the QA Manager

vi. Balance calibrations and temperature readings of ovens, refrigerators, and incubators are checked on each day of use. Min/Max thermometers are used for refrigerators and freezers to continually monitor temperature performance.

e) Traceable Reference Standards and Materials

i. Reference standards and materials are traceable to certified reference materials, where available. Commercially prepared standard materials are purchased from vendors accredited by A2LA, NVLAP (National Voluntary Lab Accreditation Program) or other recognized vendor, and come with a Certificate of Analysis that documents the purity of the standard and expiration date, if assigned. If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis against a known reference.

ii. Analytical reagents must be at a minimum the purity required by or stated in the test method. Commercial materials that are purchased for the preparation of calibration, verification or spiking solutions, are usually accompanied by an assay certificate or the purity is noted on the label. If the purity is _::96%, the weight provided by the vendor may be used without correction. If the purity is <96%, a correction will be made to solution concentrations prepared from that material.

iii. The receipt of all reference standards and materials, including received date and expiration date, is documented by the laboratory at the time of receipt, in chemical receiving logbooks. All documentation received with the reference standard or material (Certificate of Analysis or Purity Certificates) is retained by the laboratory. To prevent contamination and/or deterioration in quality, all standards and materials are handled and stored according to the method or manufacturer's requirements.

iv. Preparation of standard or reference materials are documented in Standard Preparation Logbooks maintained in each department. These records show the traceability to the purchased standards or materials, and include the method of preparation, date of preparation, expiration date, and preparer's initials, at a minimum. Reference standards are assigned a unique identifier and are then labeled with the identifier and expiration date. Refer to ECISOP, T003, Standards and Reagents Login, Preparation, Storage and Disposal, for additional information.

v. All standards, reference, primary and working, whether purchased from a commercial vendor or prepared by the laboratory, must be checked regularly to ensure that the variability of the standard from the 'true' value does not exceed method requirements. Calibration standards are checked by comparison with a standard from a second source, usually another manufacturer and vendor. In cases where a second manufacturer is not available, a different lot, with vendor certification, may be used as a second source.

vi. Quality control (QC) criteria for primary and second source standards are defined in laboratory SOPs. The Reagent and Chemicals SOP, T107, gives a general overview of the requirements with the determinative SOPs for each process further defining the QC acceptance criteria. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS/LCSD (where there is no sample preparation) is used as the second source verification of a primary calibration source.

9.4 Calibration

Calibration requirements are divided into two parts: (1) requirements for analytical support equipment, and (2) requirements for instrument calibration. In addition, the requirements for instrument calibration are divided into initial calibration and second source or initial calibration verification, and continuing calibration verification.

9.4.1 Support Equipment

These standards apply to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, thermometers, and volumetric dispensing devices (such as Eppendorf®, or automatic dilutor/dispensing devices) if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume.

a) All support equipment is maintained in proper working order. The records of all repair and maintenance activities, including service calls is kept.

b) All support equipment is calibrated or verified at least annually, using NIST traceable references when available, over the entire range of use. The results of such calibration are within the specifications required of the application for which this equipment is used or:

   1) The item is removed from service until repaired; or

   2) The laboratory maintains records of established correction factors to correct all measurements.

c) Raw data records are retained to document equipment performance.

d) Prior to use on each working day, balances, ovens, refrigerators, freezers, and water baths are checked in the expected use range, with NIST traceable calibrated references. The acceptability for use or continued use is according to the needs of the analysis or application for which the equipment is being used.

e) Mechanical volumetric dispensing devices including burettes (except Class A glassware) are checked for accuracy on at least a quarterly use basis. Glass microliter syringes are to be considered Class A glassware, and come with a certificate from the manufacturer attesting to established accuracy or the accuracy is initially demonstrated and documented by the laboratory.

9.4.2 Instrument Calibration

This manual specifies the essential elements that define the procedures and documentation for initial instrument calibration and continuing instrument calibration verification to ensure that the data are of known quality and be appropriate for a given regulation or decision. This manual does not specify detailed procedural steps ("how to") for calibration, but establishes the essential elements for selection of the appropriate technique(s). This approach allows flexibility and permits the employment of a wide variety of analytical procedures and statistical approaches currently applicable for calibration. If more stringent standards or requirements are included in a mandated test method or by regulation, the laboratory demonstrates that such requirements are met. If it is not apparent which standard is more stringent, then the requirements of the regulation or mandated test method are to be followed.

Note: In the following sections, initial instrument calibration is directly used for quantitation and continuing instrument calibration verification is used to confirm the continued validity of the initial calibration, unless otherwise stipulated by the analytical method.

9.4.2.1 Initial Instrument Calibrations

The following items are essential elements of initial instrument calibration:

a) The details of the initial instrument calibration procedures including calculations, integrations, acceptance criteria and associated statistics are included or referenced in the test method SOP. When initial instrument calibration procedures are referenced in the test method, the referenced material is retained by the laboratory and is available for review.

b) Sufficient raw data records are retained to permit reconstruction of the initial instrument calibration, e.g., calibration date, test method, instrument, analysis date, each analyte name, analyst's initials or signature; concentration and response, calibration curve or response factor; or unique equation or coefficient used to reduce instrument responses to concentration.

c) Sample results are quantitated from the initial instrument calibration and may not be quantitated from any continuing instrument calibration verification unless specifically stated in a mandated test method.

d) All initial instrument calibrations are verified with a standard obtained from a second manufacturer or lot. Traceability shall be to a national standard, when available.

e) Criteria for the acceptance of an initial instrument calibration is established, e.g., correlation coefficient or relative percent difference. The criteria used are appropriate to the calibration technique employed.

f) Results of samples not bracketed by initial calibration standards (within calibration range) are reported as having less certainty, e.g., defined qualifiers or flags or explained in the case narrative. As determined by the method, the lowest calibration standard is at or above the method detection limit and at or below the reporting limit.

g) If the initial instrument calibration results are outside established acceptance criteria, corrective actions are performed. Data associated with an unacceptable initial instrument calibration is not reported.

h) Calibration standards include concentrations at or below the regulatory limit/decision level, if the laboratory knows these limits/levels, unless these concentrations are below the laboratory's demonstrated detection limits (See ECI QSM Section Appendix D.1.5 Detection Limits).

i) If a reference or mandated method does not specify the number of calibration standards, the minimum number is two, not including blanks or a zero standard. The laboratory's standard operating procedure defines the number of points for establishing the initial instrument calibration.

9.4.2.2 Continuing Instrument Calibration Verification

When an initial instrument calibration is not performed on the day of analysis, the validity of the initial calibration is verified prior to sample analyses by analyzing a continuing calibration verification standard with each analytical batch. The following items are essential elements of continuing calibration verification:

a) The details of the continuing calibration procedure, calculations and associated statistics must be included or referenced in the test method SOP.

b) A continuing calibration verification standard must be analyzed at the beginning and end of each analytical batch, and where required by method or project, at a specific frequency, every 1O or 20 samples or 12 hours, within the batch. The concentrations of the calibration verification shall be varied within the established calibration range. If an internal standard is used, only one continuing calibration verification standard must be analyzed, prior to sample or QC analysis, per analytical batch.

c) Sufficient raw data records must be retained to permit reconstruction of the continuing calibration verification, e.g., test method, instrument, analysis date, each analyte name, concentration and response, calibration curve or response factor, or unique equations or coefficients used to convert instrument responses into concentrations. Continuing calibration verification records must explicitly connect the continuing calibration verification data to the initial calibration.

d) Criteria for the acceptance of a continuing calibration verification must be established, e.g., relative percent difference.

e) If the continuing calibration verification results obtained are outside established acceptance criteria, corrective actions must be performed. If routine corrective action procedures fail to produce a second (consecutive and immediate) calibration verification within acceptance criteria, then the laboratory shall demonstrate performance after corrective action with two consecutive successful calibration verifications, or a new instrument calibration must be performed. If the laboratory has not demonstrated acceptable performance, sample analyses shall not occur until a new initial calibration curve is established and verified.

As an exception, sample data associated with an unacceptable continuing calibration verification may be reported as qualified data under the following special conditions:

i. When the acceptance criteria for the continuing calibration verification are exceeded high, i.e., high bias and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise the samples affected by the unacceptable calibration verification are reanalyzed after a new calibration curve has been established, evaluated and accepted.

ii. When the acceptance criteria for the continuing calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable verification are reanalyzed after a new calibration curve has been established, evaluated and accepted.

10.1 TEST METHODS AND STANDARD OPERATING PROCEDURES

10.2 Methods Documentation

a) The laboratory has documented instructions on the use and operation of all relevant equipment, on the handling and preparation of samples and for calibration and/or testing, where the absence of such instructions could jeopardize the calibrations or tests.

b) All instructions, standards, manuals, and reference data relevant to the work of the laboratory are maintained up-to-date and be readily available to the staff.

10.1.1 Standard Operating Procedures (SOPs) Administrative

ECI maintains standard operating procedures that accurately reflect all phases of current laboratory activities such as instrument operation, assessing data integrity, corrective actions, handling customer complaints, reporting of test results, etc.

a) These documents, for example, may be equipment manuals provided by the manufacturer or internally written documents.

b) The test methods may be copies of published methods as long as any changes or selected options in the methods are documented and included in the SOP (See 10.1.2.)

c) Copies of all SOPs are accessible to all personnel.

d) The SOPs are organized.

e) Each SOP clearly indicates the effective date of the document, the revision number and the signatures of the approving authorities.

10.1.2 Standard Operating Procedures (SOPs) Analytical

a) The laboratory has and maintains SOPs for each accredited analyte or test method.

b) This SOP may consist of copies of published or referenced test methods or standard operating procedures that have been written by the laboratory. In cases where modifications to the published method have been made by the laboratory or where the referenced test method is ambiguous or provides insufficient detail, these changes or clarifications are clearly described. Each test method includes or references where applicable:

1) Identification of the test method;
2) Applicable matrix or matrices;
3) Detection limit;
4) Scope and application, including components to be analyzed;
5) Summary of the test method;
6) Definitions;
7) Interferences;
8) Safety;
9) Equipment and supplies;
10) Reagents and standards;
11) Sample collection, preservation, shipment, and storage;
12) Quality control;
13) Calibration and standardization;
14) Procedure;
15) Calculations;
16) Method performance;
17) Pollution prevention;
18) Data assessment and acceptance criteria for quality control measures;
19) Corrective actions for out-of-control data;
20) Contingencies for handling out-of-control or unacceptable data;
21) Waste management;
22) References; and
23) Any tables, diagrams, flowcharts, and validation data.
24) Modifications
25) Revision History

Laboratory procedures other than preparative or analytical procedure may use a shortened format as outlined in SOP T001.

10.2 Exceptionally Permitting Departures from Documented Policies / Procedures

a) If it is necessary to depart from a documented procedure or policy due to circumstances outside of ECI's control or due to conditions encountered while preparing or analyzing a sample, the following will be documented.

1) The nature of the exception
2) How the data or procedure may be impacted
3) Any Corrective Action that may be needed.
4) Any approval from a client that may be required.
5) Approval by management to report or proceed with the exception.
6) A Case Narrative with the Final Report explaining the exception.

10.3 Test Methods

The laboratory uses appropriate test methods and procedures for all tests and related activities within its responsibility (including, as applicable, sample collection, sample handling, transport and storage, sample preparation and sample analysis). The method and procedures shall be consistent with the accuracy required, and with any standard specifications relevant to the calibrations or tests concerned.

a) When the use of specific test methods for a sample analysis is mandated or requested, only those methods are used.

b) Where test methods are employed that are not required, as in the Performance Based Measurement System approach, the methods are fully documented and validated (see ECIQSM Section 10.1.2 and Appendix C), and are available to the client and other recipients of the relevant reports.

10.4 Test Method Assessment

The laboratory will periodically conduct a Test Method Assessment (TMA) on the analytical methods in use. These TMAs will be conducted under the guidance of SOP T029. The purpose is to evaluate the compliance between bench performances of the method versus the current ECI Standard Operating Procedure versus the promulgated or published method. Discrepancies will need to be addressed and resolved. Note that some methods are totally prescriptive while others may contain prescriptive aspects, and still others are performance based. In many cases, modifications to the published method may be required due to circumstances outside the laboratories' control.

10.5 Demonstration of Capability

a) Prior to acceptance and institution of any test method, satisfactory demonstration of method capability is required. (See ECI QSM Section Appendix C and 6.2.b.) This demonstration does not test the performance of the method in real world samples, but in the applicable and available clean matrix (sample of a matrix is which no target analytes or interferences are present at concentrations that impact the results of a specific test method), e.g., water, solids and air. In addition, for analytes that do not lend themselves to spiking, the demonstration of capability may be performed using quality control samples.

b) Continuing demonstration of method performance, as per the quality control requirements in Appendix D (such as laboratory control samples) is required.

c) In all cases, the appropriate forms, such as the Certification Statement (Appendix C), is completed and retained by the laboratory to be made available upon request. The laboratory retains all associated supporting data necessary to reproduce the analytical results summarized in the Certification Statement. (See Appendix C for an example of a Certification Statement.)

d) Demonstration of capability is completed each time there is a significant change in instrument type, personnel, or test method.

e) In departments with specialized "work cell(s)" (a group consisting of analysts with specifically defined tasks that together perform the test method), the group as a unit must meet the above criteria and this demonstration of capability is fully documented.

f) When a work cell is employed, and the members of the cell change, the new employee(s) must work with an experienced analyst in that area of the work cell where they are employed. This new work cell must demonstrate acceptable performance through acceptable continuing performance checks (appropriate sections of Appendix D, such as laboratory control samples). Such performance is documented and the four preparation batches following the change in personnel must not result in the failure of any batch acceptance criteria, e.g., method blank and laboratory control sample, or the demonstration of capability must be repeated. In addition, if the entire work cell is changed or replaced, the new work cell must perform the demonstration of capability (Appendix C).

g) Performance of the work cell is linked to the training records of the individual members of the work cell (See ECI QSM Section 6.2).

10.6 Sample Aliquots

Where sampling (as in obtaining sample aliquots from a submitted sample) is carried out as part of the test method, the laboratory shall use documented procedures and appropriate techniques to obtain representative subsamples. Reference SOP M230, Homogenization and Compositing of Solid, Soil and Sediment Samples for further guidance.

10.7 Data Verification

Calculations and data transfers are subject to appropriate checks.

a) The laboratory has Standard Operating Procedures that ensure that the reported data are free from transcription and calculation errors.

b) The laboratory has Standard Operating Procedures that ensure that all quality control measures are reviewed, and evaluated before data are reported. Refer to SOPs T020, internal Quality Control Checks and T062, Project Management and Analytical Report Review

c) The laboratory has Standard Operating Procedures that address manual calculations including manual integrations. Refer to SOPs T065, Data Integrity and T023, Peak Integration Procedures.

10.8 Documentation and Labeling of Standards and Reagents

Documented procedures exist for the purchase, receipt and storage of consumable materials used for the technical operations of the laboratory.

a) The laboratory retains records for all standards, reagents and media including the manufacturer/vendor, the manufacturer's Certificate of Analysis or purity (if supplied), the date of receipt, recommended storage conditions, and an expiration date after which the material is not used, unless the laboratory verifies its suitability for testing use.

b) Original containers (such as those provided by the manufacturer or vendor) are labeled with an expiration date.

c) Records are maintained on reagent and standard preparation. These records indicate traceability to purchased stocks or neat compounds, reference to the method of preparation, date of preparation, expiration date and preparer's initials.

d) All containers of prepared reagents and standards bear a unique identifier and expiration date and are linked to the documentation requirements in ECIQSM Section 10.8.c above.

10.9 Computers and Electronic Data Related Requirements

Where computers, automated equipment, or microprocessors are used for the capture, processing, manipulation, recording, reporting, storage or retrieval of test data, ECI ensures that:

a) All requirements of the NELAC Standard (i.e., Chapter 5 of NELAC) are met;

b) Computer software is tested and documented to be adequate for use, e.g., internal audits, personnel training, focus point of QA and QC;

c) Procedures are established and implemented for protecting the integrity of data. Such procedures include, but are not limited to, integrity of data entry or capture, data storage, data transmission and data processing;

d) Computer and automated equipment are maintained to ensure proper functioning and provided with the environmental and operating conditions necessary to maintain the integrity of calibration and test data; and,

e) It establishes and implements appropriate procedures for the maintenance of security of data including the prevention of unauthorized access to, and the unauthorized amendment of, computer records.

11.1 SAMPLE HANDLING, SAMPLE ACCEPTANCE POLICY AND SAMPLE RECEIPT

While ECI does not have control of field sampling activities, the following are essential to ensure the validity of the laboratory's data.

11.2 Sample Tracking

a) The laboratory has a documented system for uniquely identifying the items to be tested, to ensure that there can be no confusion regarding the identity of such items at any time. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates. The laboratory assigns a unique identification (ID) code to each sample container received in the laboratory. (The use of container shape, size, or other physical characteristic, such as amber glass, or purple top, is not an acceptable means of identifying the sample.)

b) This laboratory code is maintained as an unequivocal link with the unique field ID code assigned each container.

c) The laboratory ID code is placed on the sample container as a durable label.

d) The laboratory ID code is entered into the laboratory records (see ECIQSM Section 11.3.d) and is the link that associates the sample with related laboratory activities such as sample preparation or calibration.

e) In cases where the sample collector and analyst is the same individual or the laboratory pre-assigns numbers to sample containers, the laboratory ID code may be the same as the field ID code.

11.3 Sample Acceptance Policy

The laboratory has a written sample acceptance policy that clearly outlines the circumstances under which samples are accepted or rejected. Data from any samples that do not meet the following criteria are flagged in an unambiguous manner, and the nature of the variation is clearly defined. The sample acceptance policy is available to sample collection personnel and includes, but is not limited to, the following areas of concern:

a) Proper, full, and complete documentation, that includes sample identification, the location, date and time of collection, collector's name, preservation type, sample type and any special remarks concerning the sample;

b) Proper sample labeling that includes a unique identification and a labeling system for the samples with requirements concerning the durability of the labels (water resistant) and the use of indelible ink;

c) Use of appropriate sample containers;

d) Adherence to specified holding times;

e) Adequate sample volume. Sufficient sample volume must be available to perform the necessary tests; and,

f) Procedures to be used when samples show signs of damage, contamination or inadequate preservation.

g) Samples are NOT accepted if classified as extremely hazardous, reference section 5.2 k for examples.

11.4 Sample Acceptance Policy (Posted)

This sample acceptance policy outlines the circumstances in which received samples are accepted or rejected by Eurofins Calscience, Inc. (ECI). If any of the below criteria are not met, it may delay ECI's processing of samples, possibly compromising "short" holding time analyses. Where received

samples do not meet these criteria, ECI will contact the client. If immediate client contact cannot be made, and hold times are not an issue, samples will be appropriately stored until the situation is clarified with the client. If a delay in sample processing will result in missed holding times, and ECI deems there is sufficient information provided on the Chain-of-Custody (COC), the lab will proceed with sample log-in and processing; however, ECI will not assume any liability for samples processed under these circumstances.

Data from samples that do not meet the sample acceptance criteria are flagged and/or addressed in a case narrative, with the nature of the deviation clearly defined. Samples must have written authorization to proceed if not in compliance with this guidance.

1. Complete COC with the following information:

   Unique sample identification, date and time of collection, sample matrix, analysis requested, sampler's name, preservation type (if applicable), client name and address, any additional comments, signature of relinquishing party and date and time that samples were relinquished.

2. Sample temperature upon receipt of >0°C to 6°C, as applicable to the method.

   In the event that samples are collected on the same day that they are received by the laboratory, they are deemed acceptable if they are received on ice and the cooling process has begun.

3. Sample containers and preservatives must be appropriate for the test and method being requested on the COC.

4. Sample labels must include a unique identification written with indelible ink on water resistant labels that correspond with the COC.

5. Adequate sample volume must be provided for the analyses requested on the COC, and containers for volatile analyses must be free of headspace. This includes Tedlar bags and Summa canisters.

6. Sufficient holding time available to perform the analyses requested:

   Samples shall be received at the laboratory within 72 hours of sampling, or with at least 1/2 of the holding time left for the analysis, whichever is less. ECI always makes a best effort to ensure that holding times are not exceeded under these circumstances. In the event that a preparation or analysis is performed outside of the associated holding time, the data will be qualified in the report.

7. Coolers and samples must be received in good condition, with no obvious signs of damage or tampering.

8. Received with a copy of ECI's Foreign Soil Permit, if applicable.

9. Please note, mixed waste, or samples classified as extremely hazardous are **NOT** accepted.

If you require additional information or clarification, please do not hesitate to contact ECI, or your Project Manager at (714) 895-5494.

11.5 Sample Receipt Protocols

a) Upon receipt, the condition of the sample, including any abnormalities or departures from standard condition as prescribed in the relevant test method, is recorded. All items specified in ECIQSM Section 11.2 above are checked.

   1) All samples that require cold temperature preservation are considered acceptable if the arrival temperature is within 2°c of the required temperature or the method-specified range. For samples with a specified temperature of 4°C, samples with a temperature ranging from just above the freezing temperature of water to 6°C shall be acceptable. Samples that are hand delivered to the laboratory

immediately after collection may not meet these criteria. In these cases, the samples shall be considered acceptable if there is evidence that the chilling process has begun, such as arrival on ice.

2) The laboratory shall implement procedures for checking chemical preservation using readily available techniques, such as pH or free chlorine, prior to or during sample preparation or analysis.

With the exception of residual chlorine measurements in aquatic toxicity samples, certain measurements, such a pH, are performed and recorded just prior to analysis.

Field filtration for dissolved metals, Perchlorate and others may also be required. If there is no documentation of field filtration on the Chain of Custody when required, the Project Manager is notified and the client asked. If samples are not field filtered, they are sent to the lab for filtration within 24 or 48 hours depending on the analysis.

b) The results of all checks are recorded on Sample Receipt and, as needed, Sample Anomaly forms.

c) When there is any doubt as to the item's suitability for testing, when the sample does not conform to the description provided, and when the test required is not fully specified, the laboratory makes every attempt to consult the client for further instruction before proceeding. The laboratory establishes whether the sample has received all necessary preparation, or whether sample preparation has yet to be performed. If the sample does not meet the sample receipt acceptance criteria listed in this standard, the laboratory:

1) Retains correspondence and/or records of conversations concerning the final disposition of rejected samples; or

2) Fully documents any decision to commence with the analysis of samples not meeting acceptance criteria.

i. The condition of these samples is, at a minimum, noted on the chain of custody record or transmittal form, and laboratory receipt documents.

ii. The analysis data is/are appropriately "qualified" on the final report.

d) The laboratory utilizes a permanent chronological record such as a logbook or electronic database to document receipt of all sample containers.

1) This sample receipt log records the following:

i. Client/Project Name;

ii. Date and time of laboratory receipt;

iii. Unique laboratory ID code (see ECIQSM Section 11.1); and

iv. Signature or initials of the person making the entries.

2) During the login process, the following information is linked to the log record or included as a part of the log. If such information is recorded/documented elsewhere, that document becomes part of the laboratory's permanent records, easily retrievable upon request, and readily available to individuals who will process the sample. Note: The placement of the laboratory ID number on the sample container is not considered a permanent record.

i. The field ID code that identifies each container is linked to the laboratory ID code in the sample receipt log.

ii. The date and time of sample collection is linked to the sample container and to the date and time of receipt in the laboratory.

iii. The requested analyses (including applicable approved test method numbers) are linked to the laboratory ID code.

iv. Any comments resulting from inspection for sample rejection are linked to the laboratory ID code.

e) All documentation (i.e., memos or transmittal forms) that are conveyed to the laboratory by the sample submitter is retained.

f) A complete chain of custody record form is maintained.

11.6 Storage Conditions

The laboratory has documented procedures and appropriate facilities to avoid deterioration, contamination, and damage to the sample during storage, handling, preparation, and testing; any relevant instructions provided with the item are followed. Where items must be stored or conditioned under specific environmental conditions, these conditions are maintained, monitored, and recorded.

a) Samples are stored according to the conditions specified by preservation protocols:

1) Samples that require thermal preservation are stored under refrigeration at +/-2° of the specified preservation temperature unless method-specified criteria exist. For samples with a specified storage temperature of 4°C, storage at a temperature above the freezing point of water to 6°C is acceptable.

2) Samples are stored away from all standards, reagents, food, and other potentially contaminating sources. Samples are stored in such a manner to prevent cross contamination.

b) Sample fractions, extracts, leachates, and other sample preparation products are stored according to ECIQSM Section 11.4.a above or according to specifications in the test method.

c) When a sample or portion of a sample needs to be held secure (for example, for reasons of record, safety or value, or to enable check calibrations or tests to be performed later), the laboratory has storage and security arrangements that protect the condition and integrity of the secured items or portions concerned.

11.7 Sample Disposal

The laboratory has standard operating procedures for the disposal of samples, digestates, leachates and extracts or other sample preparation products. Refer to SOP T005, Disposal of Laboratory Samples and Wastes.

12.0 RECORDS

The laboratory maintains a record system to suit its particular circumstances and comply with any applicable regulations. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the test report for a minimum of five years.

There are two levels of sample handling: 1) sample tracking and 2) legal chain of custody protocols that are used for evidentiary or legal purposes. All essential requirements for sample tracking (e.g., chain of custody form) are outlined in ECIQSM Sections 12.1, 12.2 and 12.3. ECI details the Legal/Evidentiary and Internal Chain of Custody procedures in SOP T100, Sample Receipt and Log-In Procedures.

12.1 Record Keeping System and Design

The ECI record keeping system allows historical reconstruction of all laboratory activities that produced the analytical data. The history of the sample is readily understood through the documentation. This includes inter-laboratory transfers of samples and/or extracts.

a) The records include the identity of personnel involved in sampling, sample receipt, preparation, and calibration or testing.

b) All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification, are documented.

c) The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes, e.g., set format for naming electronic files.

d) All changes to records are signed or initialed by responsible staff. The reason for the signature or initials is clearly indicated in the records such as "sampled by," "prepared by," or "reviewed by."

e) All generated data, except those that are generated by automated data collection systems, are recorded directly, promptly, and legibly in permanent ink.

f) Entries in records are not be obliterated by methods such as erasures, overwritten files or markings. All corrections to record-keeping errors are made by one line marked through the error. The individual making the correction signs (or initials) and dates the correction. These criteria also apply to electronically maintained records.

g) Refer to 10.9 for Computer and Electronic Data.

12.2 Records Management and Storage

a) All records (including those pertaining to calibration and test equipment), certificates and reports are safely stored, and held secure and in confidence to the client. NELAP-related records are available to the accrediting authority.

b) All records, including those specified in ECIQSM Section 12.3, are retained for a minimum of five years from generation of the last entry in the records. The laboratory maintains all information necessary for the historical reconstruction of data. Records stored only on electronic media are supported by the hardware and software necessary for their retrieval.

c) Records that are stored or generated by computers or personal computers have hard copy or write-protected backup copies.

d) The laboratory has an established record management system for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation storage and reporting.

e) Access to archived information is documented with an access log. These records are protected against fire, theft, loss, environmental deterioration, vermin, and in the case of electronic records, electronic or magnetic sources.

f) The laboratory has a plan to ensure that the records are maintained or transferred according to the clients' instructions (see 4.1.8.e of NELAC) in the event of Laboratory Transfer of Ownership, Going out of Business or Bankruptcy. In all cases, appropriate regulatory and state legal requirements concerning laboratory records will be followed. For detailed policies and procedures for handling of client records and data in these situations, reference QSM Section 6.2.1 and SOP T-002, Document Control.

12.3 Laboratory Sample Tracking

12.3.1 Sample Handling

A record of all procedures to which a sample is subjected while in ECl's possession is maintained. These include but are not limited to all records pertaining to:

a) Sample preservation, including appropriateness of sample container and compliance with holding time requirement;

b) Sample identification, receipt, acceptance or rejection, and log-in;

c) Sample storage and tracking, including shipping receipts, sample transmittal forms (chain of custody form); and

d) Documentation procedures for the receipt and retention of test items, including all provisions necessary to protect the integrity of samples.

12.3.2 Laboratory Support Activities

In addition to documenting all the above-mentioned activities, the following is retained:

a) All original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts work sheets and data output records (chromatograms, strip charts, and other instrument response readout records);

b) A written description or reference to the specific test method used, which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value;

c) Copies of final reports;

d) Archived standard operating procedures;

e) Correspondence relating to laboratory activities for a specific project;

f) All corrective/preventive action reports, audits and audit responses;

g) Proficiency test results and raw data; and,

h) Results of data review, verification, and cross-checking procedures.

12.3.3 Analytical Records

The essential information associated with analyses, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:

a) Laboratory sample ID code;

b) Date of analysis and time of analysis if the method-specified holding time is 72 hours or less, or when time critical steps are included in the analysis, e.g., extractions, and incubations;

c) Instrument identification and instrument operating conditions/parameters (or reference to such data);

d) Analysis type;

e) All manual calculations e.g., manual integrations;

f) Analyst's or operator's initials/signature or chemist ID number;

g) Sample preparation including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;

h) Sample analysis;

i) Standard and reagent origin, receipt, preparation, and use;

j) Calibration criteria, frequency and acceptance criteria;

k) Data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;

l) Quality control protocols and assessment;

m) Electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and,

n) Method performance criteria including expected quality control requirements.

12.3.4 Administrative Records

The following are maintained:

a) Personnel qualifications, experience and training records;

b) Ethics Statements;

c) Records of demonstration of capability for each analyst; and

d) A log of names, initials and signatures for all individuals who are responsible for signing or initialing any laboratory record.

13.0 LABORATORY REPORT FORMAT AND CONTENTS

The results of each test, or series of tests carried out by the laboratory must be reported accurately, clearly, unambiguously and objectively. The results normally reported in a test report and include all the information necessary for the interpretation of the test results and all information required by the method used. Some regulatory reporting requirements or formats, such as monthly operating reports may not require all items listed below, however, ECI will provide all the required information to their client for use in preparing such regulatory reports.

a) Except as discussed in 13.b, each report to an outside client includes at least the following information (those prefaced with "where relevant" are not mandatory):

   1) A title, e.g., "Analytical Report," or "Test Certificate," "Certificate of Results" or "Laboratory Results";

   2) Name and address of laboratory, and location where the test was carried out if different from the address of the laboratory and phone number with name of contact person for questions;

3) Unique identification of the certificate or report (such as serial number) and of each page, and the total number of pages;

   This requirement may be presented in several ways:

   i. The total number of pages may be listed on the first page of the report as long as the subsequent pages are identified by the unique report identification and consecutive numbers, or

   ii. Each page is identified with the unique report identification, the pages are identified as a number of the total report pages (example: 3 of 10, or 1 of 20).

   Other methods of identifying the pages in the report may be acceptable as long as it is clear to the reader that discrete pages are associated with a specific report, and that the report contains a specified number of pages.

4) Name and address of client, where appropriate and project name if applicable;

5) Description and unambiguous identification of the tested sample including the client identification code;

6) Identification of test results derived from any sample that did not meet NELAC sample acceptance requirements such as improper container, holding time, or temperature;

7) Date of receipt of sample, date and time of sample collection, date(s) of performance test, and time of sample preparation and/or analysis if the required holding time for either activity is less than or equal to 72 hours;

8) Identification of the test method used, or unambiguous description of any nonstandard method used;

9) If the laboratory collected the sample, reference to sampling procedure;

10) Any deviations from (such as failed quality control), additions to or exclusions from the test method (such as environmental conditions), and any nonstandard conditions that may have affected the quality of results, and including the use and definitions of data qualifiers.

11) Measurements, examinations and derived results, supported by tables, graphs, sketches, and photographs as appropriate, and any failures identified; identify whether data are calculated on a dry weight or wet weight basis; identify the reporting units such as µg/l or mg/kg;

12) When required, a statement of the estimated uncertainty of the test results;

13) A signature and title, or an equivalent electronic identification of the person(s) accepting responsibility for the content of the certificate or report (however produced), and date of issue;

14) At the ECl's discretion, a statement to the effect that the results relate only to the items tested or to the sample as received by the laboratory;

15) At the ECl's discretion, a statement that the certificate or report shall not be reproduced except in full, without the written approval of the laboratory;

16) Clear identification of all test data provided by outside sources, such as subcontracted laboratories, clients, etc.; and

17) Clear identification of numerical results with values outside of quantitation limits.

b) Where the certificate or report contains results of tests performed by subcontractors, these results are clearly identified by subcontractor name or applicable accreditation number and the entirety of the subcontract report is included with the final ECI report.

c) After issuance of the report, the laboratory report remains unchanged. Material amendments to a calibration certificate, test report or test certificate after issue may be made only in the form of a further document, or data transfer, including the statement "Supplement to Test Report or Test Certificate, serial number . . . [or as otherwise identified]", or equivalent form of wording. Such amendments meet all the relevant requirements of the NELAC Standard.

d) ECI notifies clients promptly, in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any calibration certificate, test report or test certificate or amendment to a report or certificate.

e) The laboratory will, where clients require transmission of test results by telephone, telex, facsimile or other electronic or electromagnetic means, follow documented procedures that ensure that the requirements of this Standard are met and that confidentiality is preserved.

f) ECI will certify that all its NELAC-certified test results reported meet all requirements of NELAC or provide reasons and/or justification if they do not.

14.0 SUBCONTRACTING ANALYTICAL SAMPLES

When ECI subcontracts work whether because of unforeseen circumstances (e.g. workload, need for further expertise or temporary incapacity) or on a continuing basis (e.g. through client direction, contractual arrangement or permanent subcontracting), this work shall be placed with a laboratory accredited under NELAP, or other appropriate certification, for the tests to be performed or with a laboratory that meets applicable statutory and requirements for performing the tests and submitting the results of tests performed. All subcontracted work shall be referenced and so noted in the final ECI analytical report.

Subcontract laboratories will provide or make available, current copies of the following documents prior to ECI submitting samples. This information will be updated annually or on an as needed basis.

a) Laboratory accreditations / certifications

b) Upon request, any Proficiency Testing (PT) or Performance Evaluation (PE) results relevant to the subcontracted samples.

c) Insurance Certificates

d) Quality Assurance Manual

e) Subcontract laboratories will also submit statements affirming that ECI will be notified if any of the following occur.

- There is a change or loss in accreditation for the applicable analysis.
- Most recent PT or PE study results for the applicable analysis are unacceptable *AND* are not able to be addressed via Corrective Action.
- There is a need to subcontract ECI project samples. Prior ECI approval is required in writing for subcontracting samples.

f) The client project requirements will be used to evaluate the subcontract laboratories and to determine their acceptability. Approval by either: the QA Manager, Laboratory Director or Client Services Director (or designee) is required.

g) A master list of approved laboratories will be created and distributed to Sample Control and all Project Managers. All subcontracting must utilize a laboratory from this list.

The procedure for subcontracting samples will follow these guidelines:

a) ECI will advise its client via written, facsimile or e-mail notification of its intention to subcontract any portion of the testing to another party in cases when unforeseen circumstances occur. ECI shall gain approval by the client in writing, facsimile or via e-mail response.

b) ECI may subcontract samples on a continuing basis without written, facsimile or e-mail notification under the following (but not limited to) cases:

- Standing Client direction or instruction
- Contractual specification or requirement
- Project historical precedent

c) A separate Chain of Custody will be created specifically for the subcontracted sample(s). This (or a copy) will be included with the full and complete subcontract report in the final ECI analytical report.

d) ECI shall retain records demonstrating that the above requirements have been met.

e) If the samples to be subcontracted are submitted to ECI under special regulatory, agency or governmental accreditation, Example: Department of Defense / Energy, that have more comprehensive or differing quality criteria, Example: DOD/DOE QSM for Environmental Laboratories Version 5.0 July 2013, then the subcontract laboratory MUST have certification for the subcontracted analysis from the same entity and MUST have undergone similar assessment as the primary laboratory for the subcontracted component. Written authorization from the client or authorizing body must be obtained prior to usage of each subcontract laboratory.

15.0 OUTSIDE SUPPORT SERVICES AND SUPPLIES

ECI does not procure outside services and supplies, other than those referred to in this Manual.

Service providers and vendors are evaluated in accordance with ISO/IEC 17025:2005 or ISO 9001 guidelines prior to use by ECI, reference SOP T019 and T107 for additional information.

16.0 INQUIRIES AND COMPLAINTS

ECISOP-T018 addresses the policies and procedures for the resolution of inquiries and complaints received from clients or other parties about the laboratory's activities. Where an inquiry or complaint, or any other circumstance, raises doubt concerning the laboratory's compliance with the laboratory's policies or procedures, or with the requirements of this manual or otherwise concerning the quality of the laboratory's calibrations or tests, the laboratory shall ensure that those areas of activity and responsibility involved are promptly audited in accordance with NELAC Section 5.3.1. Records of the complaint and subsequent actions are maintained and are available for audits.

17.0 REVIEW OF WORK REQUESTS, CONTRACTS AND TENDERS

ECI has established procedures for the review of work requests contracts and tenders. Projects, proposals and contracts are reviewed for adequately defined requirements and the ability of ECI to meet those requirements. A thorough review of all technical and quality control requirements contained in these requests is performed to ensure a project's success. The appropriateness of requested methods, and the lab's capability to perform them must be established. A review of the laboratory's capability to analyze non-routine analytes is also part of this review process. Additionally, alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, detection and reporting levels, and quality control limits. During the review process, the laboratory determines whether it has the necessary physical, personnel and information resources to meet the project requirements, and if the personnel have the expertise needed to perform the required testing. Each proposal is also checked for its impact on the overall capacity of the laboratory. The proposed turnaround time will be checked for feasibility. Electronic or hard copy deliverable requirements are evaluated against the laboratory's ability to produce such documentation.

This review process ensures that the laboratory's test methods are suitable to achieve regulatory and/or client requirements and that the laboratory holds the appropriate certifications to perform the work. In the event that the use of a subcontract laboratory is needed, also confirming that they meet all project requirements and maintain the appropriate certifications for the proposed subcontract analyses. If the laboratory cannot provide all services and therefore intends to use the services of a subcontract laboratory, this will be documented and discussed with the client prior to project or contract approval.

Following the review process, the laboratory informs the client of the results of the review and notes any potential conflict, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and the capability of the laboratory to meet those requirements is resolved in writing before acceptance of the project or contract. It is necessary that the project requirements or contract be acceptable to both the client and the laboratory prior to the start of the work. The review process is repeated when there are amendments to the original contract by the client.

All contracts, Quality Assurance Project Plans (QAPPs), Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

Review Personnel

Depending upon the scope of a project or contract, one or more key persons may review and accept work on behalf of the laboratory. For routine projects, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has the necessary certifications, that it can meet the clients' data quality, reporting and turn-around time requirements.

For new, complex or large projects, the proposed project proposal or contract is given to the Business Development Director for an initial review that encompasses all facets of the operation. The scope of work is then distributed to the following personnel, as needed based on scope of contract, to evaluate all of the project related requirements:

- Laboratory Director
- Operations Director
- Technical Director
- Quality Assurance Director
- Quality Assurance Manager
- Group Leaders

Project Manager(s)

Appropriate records are maintained for every contract or work request. Copies of the agreed-upon contract will be distributed to key personnel as needed and the signed copies maintained by the Business Development Director and/or Laboratory Director.

Project Kick-off and Status Meetings

For routine project work, project managers ensure that specific technical and QC requirements are effectively evaluated and communicated to laboratory personnel through the use of the LIMS system: special requirements section of the chemist's worksheet.

Prior to work on a new or complex project, project managers or key personnel will hold meetings with operations personnel to discuss schedules and any unique aspects of the project. Items discussed include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, and any other special requirements.

Project requirements are given to the laboratory staff during project kick-off meetings or the daily status meetings. Information disseminated during these meetings provides direction to the laboratory staff in order to maximize production, maintain high quality and ensure client satisfaction.

During the project, changes to the scope of work may occur due to client, sampling or regulatory reasons. If these changes impact the laboratory's role in the project (use of a non-standard method or modification of a method to comply with revised requirements) then the changes need to be discussed with and agreed upon with the client prior to continuing with the work. These changes must be documented prior to implementation and communicated to the laboratory staff during a status or project specific meeting. Documentation of the modification is made in the analytical report narrative.

And at all times, records of all pertinent discussions with a client relating to the project or contract are documented and maintained as a part of the project record.

18.1 MANAGEMENT REVIEW, MANAGEMENT OF CHANGE AND CONTINUOUS IMPROVEMENT

18.2 Management Review

A comprehensive Management Review of the entire ECI Quality System will be conducted by the Laboratory Director on an annual basis, no later than the end of the first quarter for the previous year's review. The SOP T-030 may be consulted for detailed guidance. All major stakeholders will be given an opportunity to provide comment or input for the review. These will include:

Laboratory Director
Client Services Director
Operations Director
Technical Director
Senior Project Manager
Other Operational / Project Management personnel as appropriate.
Clients

The purpose and goal of the Management Review will identify weaknesses, areas requiring more resources or oversight, opportunities for continuous improvement and follow up on previous recommendations.

The final completed review is part of the NELAP laboratory documentation requirements and may be submitted to ECI authorized auditing agencies or clients upon request.

18.3 Management of Change

Whenever a change is made in a controlled environment (not just production) the laboratory is put at risk. However, one needs to constantly make changes to keep pace with business / regulatory requirements. The challenge to the laboratory is to minimize the risk and impact of that change.

An organization must have an operating process in place for which an evaluation has been conducted, and that allows proper lead times and approvals to ensure that the laboratory is unaffected when changes are made. But to successfully implement a change, one also needs to have a comprehensive understanding of the infrastructure that supports the services to determine the overall impact. The Management of Change process will facilitate, as referenced in SOP T030, this evaluation.

The Management of Change process will track and implement the following types of changes:

a) Permanent Change: – A change that is considered long term and durable. Any change which is not categorized as a Temporary Change.

b) Temporary Change: – A change which has a defined lifetime and which will be removed before a defined date (usually no more than six months). All temporary changes must have a specified removal date that is documented on the approved MOC form.

c) Emergency Change: – An emergency change path that allows the change to be implemented and commissioned immediately in order to address an immediate safety, operational, health, environmental, or product quality situations.

The functional categories that will be managed include:

a) Laboratory Facility Acquisition
b) Laboratory Instrument Acquisition
c) Analytical Method Development and Validation
d) Laboratory Operations Process Change
e) Department Relocation
f) Activation of Analytical Method
g) Information Technology (Major Initiatives)
h) New Accreditation or Certification

18.4 Continuous Improvement

In order for ECI to be proactive and a leader in the industry, the entire ECI Quality system is designed to ensure the production of scientifically sound, legally defensible data of known and proven quality. The addition of the Management Review and Management of Change processes enhances ECI's ability to foster continuous improvement.

Continuous improvement is an ongoing effort to improve data integrity, services or processes. These efforts can seek "incremental" improvement over time or "breakthrough" improvement all at once. All staff at ECI participates in continuous improvement, from the Laboratory Director down to the beginning technician, as well as external stakeholders when applicable.

The following procedures / inputs have direct involvement in the continuous improvement process:

a) External Audits (Regulatory and Client Based)
b) Internal Audits
c) Corrective / Preventive Actions
d) Statistical Quality Control (SQC) Monitoring
e) Proficiency Testing Performance
f) Client Feedback - Complaints and Commendations
g) Management Review
h) Management of Change

The Management of Change process will guide and document the major improvements. The Corrective / Preventive Action procedure will enable and record the more incremental changes.

The principal elements are commitment to quality, focused effort, involvement of all employees, willingness to change, and communication.

NELAC APPENDICES

APPENDIX A - REFERENCES

NELAC Standards, Chapters 1-6. Adopted September 8, 2009, Effective July 01, 2010

40 CFR Part 136, Appendix A, paragraphs 8.1.1 and 8.2.

American Association for Laboratory Accreditation April 1996. General Requirements for Accreditation.

"American National Standards Specification and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs (ANSI/ASQC E-4)," 1994.

ASTM E1598-94 Conducting Early Seedling Growth Tests, American Society for Testing and Materials, West Conshocken, PA 1999.

ASTM E11676-97 Conducting a Laboratory Soil Toxicity Test with Lumbricid Earthworm *Eisenia foetida,* American Society for Testing and Materials, West Conshocken, PA 1999.

Catalog of Bacteria, American Type Culture Collection, Rockville, MD.

EPA 2185 - Good Automated Laboratory Practices, 1995 available at www.epa.gov/docs/etsdwe1/irm_galp/

EPA/600/3-89/013 Ecological Assessment of Hazardous Waste Sites, Office of Research and Development, Washington, DC, 1991.

EPA/503/8-91/001 Evaluation of Dredged Material Proposed for Ocean Disposal – Testing Manual. Office of Water, Washington, DC, 1991.

EPA/600/4-90/031 Manual for Evaluation of Laboratories Performing Aquatic Toxicity Tests, Office of Research and Development, Washington, DC, 1991.

EPA/600/3-88/029 Protocol for Short-term Toxicity Screening of Hazardous Wastes, Office of Research and Development, Washington, DC, 1991.

EPA/600/4-90/027F Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, 4th Ed., Office of Research and Development, Washington, DC, 1993.

EPA/823/8-98/004 Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Inland Testing Manual. Office of Water, Washington, DC, 1994.

EPA/600/R-94/025 Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods, Office of Research and Development, Washington, DC, 1994.

EPA/600/R-94/024 Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Office of Research and Development, Washington, DC, 1994.

EPA/600/4-91/002 Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, 3rd Ed., Office of Research and Development, Washington, DC, 1994.

EPA/600/4-91/003 Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Marine and Estuarine Organisms, 2nd Ed., Office of Research and Development, Washington, DC, 1994.

"Glossary of Quality Assurance Terms and Acronyms," Quality Assurance Division, Office of Research and Development, USEPA.

"Guidance on the Evaluation of Safe Drinking Water Act Compliance Monitoring Results from Performance Based Methods," September 30, 1994, Second draft.

ISO/IEC 17025: 2005. General requirements for the competence of calibration and testing laboratories.

"Laboratory Biosafety Manual," World Health Organization, Geneva, 1983.

Manual for the Certification of Laboratories Analyzing Drinking Water, Revision 4, EPA 815-B-97-001.

Performance Based Measurement System, EPA EMMC Method Panel, PBMS Workgroup, 1996.

APPENDIX B - GLOSSARY

The following definitions are used in the text of Quality Systems. In writing this document, the following hierarchy of definition references was used: ISO 8402, ANSI/ASQC E-4, EPA's Quality Assurance Division Glossary of Terms, and finally definitions developed by NELAC. The source of each definition, unless otherwise identified, is the Quality Systems Committee.

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (NELAC)

Accrediting Authority: The Territorial, State, or Federal agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation. (NELAC) [1.5.2.3]

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analysis Duplicate: The second measurement of the target analyte(s) performed on a single sample or sample preparation.

Analyst: The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (NELAC)

Analytical Reagent (AR) Grade: Designation for the high purity of certain chemical reagents and solvents given by the American Chemical Society. (Quality Systems)

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of NELAC). (NELAC)

Audit: A systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity. (EPA-QAD)

Batch: Environmental samples, which are prepared and/or analyzed together with the same process and personnel using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same NELAC-defined matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples. (NELAC Quality Systems Committee)

Blank: A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Blind Sample: A sub-sample for analysis with a composition known to the submitter. The analyst/ laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process. (NELAC)

Calibration: To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements. (NELAC)

Calibration Curve: The graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (NELAC)

Calibration Method: A defined technical procedure for performing a calibration. (NELAC)

Calibration Standard: A substance or reference material used to calibrate an instrument. (QAMS)

Certified Reference Material (CRM): A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30 - 2.2)

Chain of Custody Form: A record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; collector; time of collection; preservation; and requested analyses. (NELAC)

Compromised Samples: Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions compromised samples are not analyzed. If emergency situations require analysis, the results must be appropriately qualified. (NELAC)

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

- Second column confirmation;
- Alternate wavelength;
- Derivatization;
- Mass spectral interpretation;
- Alternative detectors; or
- Additional cleanup procedures. (NELAC)

Conformance: An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ ASQC E4-1994)

Corrective Action: The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality (i.e., that they meet specified acceptance criteria). (NELAC)

Data Reduction: The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (EPA-QAD)

Deficiency: An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC)

Demonstration of Capability: A procedure to establish the ability of the analyst to generate acceptable accuracy. (NELAC)

Desorption Efficiency: The mass of target analyte recovered from sampling media, usually a sorbent tube, divided by the mass of target analyte spiked on to the sampling media expressed as a percentage. Sample target analyte masses are usually adjusted for the desorption efficiency. (NELAC)

Detection Limit: The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit. (NELAC)

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

Duplicate Analyses: The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA- QAD)

Holding Times (Maximum Allowable Holding Times): The maximum times that samples may be held prior to analysis and still be considered valid or not compromised. (40 CFR Part 136)

Inspection: An activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic. (ANSI/ ASQC E4-1994)

Internal Standard: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method. (NELAC)

Instrument Blank: A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Laboratory: A body that calibrates and/or tests. (ISO 25)

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system. (NELAC)

Laboratory Duplicate: Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently. (NELAC)

Limit of Detection (LOO): Limit of Detection (LOO): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOO, the false negative rate (Type II error) is 1%. (NELAC)

Limit of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. (NELAC)

Manager (however named): The individual designated as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual. (NELAC)

Matrix: The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

- Aqueous: Any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.
- Drinking Water: Any aqueous sample that has been designated a potable or potential potable water source.
- Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.
- Non-aqueous Liquid: Any organic liquid with <15% settleable solids.
- Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.
- Solids: Includes soils, sediments, sludges and other matrices with >15% settleable solids.
- Chemical Waste: A product or by-product of an industrial process that results in a matrix not previously defined.
- Air: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter or other device. (NELAC)

Matrix Spike {spiked sample or fortified sample): A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency. (QAMS)

Matrix Spike Duplicate {spiked sample or fortified sample duplicate): A second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte. (QAMS)

May: Denotes permitted action, but not required action. (NELAC)

Media: Material that supports the growth of a microbiological culture.

Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. (NELAC)

Method Detection Limit: The minimum concentration of a substance (an analyte) 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. (40 CFR Part 136 Appendix B)

Must: Denotes a requirement that must be met. (Random House College Dictionary)

National Accreditation Database: The publicly accessible database listing the accreditation status of all laboratories participating in NELAP. (NELAC)

National Environmental Laboratory Accreditation Conference {NELAC): A voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP. (NELAC)

National Environmental Laboratory Accreditation Program {NELAP): The overall National Environmental Laboratory Accreditation Program of which NELAC is a part. (NELAC)

Negative Control: Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (NELAC)

Objective Evidence: Any documented statement of fact, other information, or record, either quantitative or qualitative, pertaining to the quality of an item or activity, based on observations, measures, or tests that can be verified. (ASQC)

Performance Audit: The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (NELAC)

Performance Based Measurement System (PBMS): A set of processes wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner. (NELAC)

Positive Control: Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects. (NELAC)

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (NELAC)

Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample. (NELAC)

Proficiency Testing: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (NELAC) [2.1]

Proficiency Testing Program: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (NELAC)

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (QAMS)

Protocol: A detailed written procedure for field and/or laboratory operation (e.g., sampling, and analysis) which must be strictly followed. (EPA- QAD)

Pure Reagent Water: Shall be water (defined by national or international standard) in which no target analytes or interferences are detected as required by the analytical method. (NELAC)

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

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

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

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

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (NELAC)

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC. (ANSI/ ASQC E-41994)

Quantitation Limits: Levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported at a specific degree of confidence. (NELAC)

Range: The difference between the minimum and the maximum of a set of values. (EPA-QAD)

Raw Data: Any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, data and verified accurate by signature), the exact copy or exact transcript may be submitted. (EPA-QAD)

Reagent Blank (method reagent blank): A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (QAMS)

Record Retention: The systematic collection, indexing and storing of documented information under secure conditions. (EPA-QAD)

Reference Material: A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30- 2.1)

Reference Method: A method of known and documented accuracy and precision issued by an organization recognized as competent to do so. (NELAC)

Reference Standard: A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM-6.08)

Reference Toxicant: The toxicant used in performing toxicity tests to indicate the sensitivity of a test organism and to demonstrate the laboratory's ability to perform the test correctly and obtain consistent results (see Chapter 5, Appendix D, Section 2.1.f). (NELAC)

Replicate Analyses: The measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)

Requirement: Denotes a mandatory specification; often designated by the term "shall". (NELAC)

Sampling Media: Material used to collect and concentrate the target analytes(s) during air sampling such as solid sorbents, filters, or impinger solutions.

Selectivity: (Analytical chemistry) The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. (EPA-QAD)

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

Shall: Denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled. (ANSI)

Should: Denotes a guideline or recommendation whenever noncompliance with the specification is permissible. (ANSI)

Spike: A known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes. (NELAC)

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies. (ASQC)

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

Standardized Reference Material (SRM): A certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method. (EPA-QAD)

Supervisor (however named): The individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses. (NELAC)

Surrogate: A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes. (QAMS)

Systems Audit (also Technical Systems Audit): A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Director: Individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory. (NELAC)

Test: A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate. (ISO/IEC Guide 2-12.1, amended)

Test Method: An adoption of a scientific technique for a specific measurement problem, as documented in a laboratory SOP. (NELAC)

Testing Laboratory: Laboratory that performs tests. (ISO/ IEC Guide 2 - 12.4)

Test Sensitivity/Power: The minimum significant difference (MSD) between the control and test concentration that is statistically significant. It is dependent on the number of replicates per concentration, the selected significance level, and the type of statistical analysis (see Chapter 5, Appendix D, Section 2.4.a). (NELAC)

Tolerance Chart: A chart in which the plotted quality control data is assessed via a tolerance level (e.g. +/- 10% of a mean) based on the precision level judged acceptable to meet overall quality/data use requirements instead of a statistical acceptance criteria (e.g. +/- 3 sigma) (applies to radiobioassay laboratories). (ANSI)

Traceability: The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM - 6.12)

Validation: The process of substantiating specified performance criteria. (EPA- QAD)

Verification: Confirmation by examination and provision of evidence that specified requirements have been met. (NELAC)

NOTE: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment.

The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.

Work Cell: A well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented. (NELAC)

Sources:

American Society for Quality Control (ASQC), Definitions of Environmental Quality Assurance Terms, 1996

American National Standards Institute (ANSI), Style Manual for Preparation of Proposed American National Standards, Eighth Edition, March 1991

ANSI/ASQC E4, 1994

ANSI N42.23- 1995, Measurement and Associated Instrument Quality Assurance for Radiobioassay Laboratories

International Standards Organization (ISO) Guides 2, 30, 8402

International Vocabulary of Basic and General Terms in Metrology (VIM): 1984. Issued by BIPM, IEC, ISO and OIML

National Institute of Standards and Technology (NIST)

National Environmental Laboratory Accreditation Conference (NELAC), July 1998 Standards

Random House College Dictionary

U.S. EPA Quality Assurance Management Section (QAMS), Glossary of Terms of Quality Assurance Terms, 8/31/92 and 12/6/95

U.S. EPA Quality Assurance Division (QAD)

40 CFR, Part 136

Webster's New World Dictionary of the American Language

APPENDIX C - DEMONSTRATION OF CAPABILITY

C.1 PROCEDURE FOR DEMONSTRATION OF CAPABILITY

A demonstration of capability (DOC) must be made prior to using any test method, and at any time there is a change in instrument type, personnel or test method. (See NELAC 10.2.1.)

Note: Where tests are performed by specialized "work cells" (a well-defined group of analysts that together perform the method analysis), the work cell as a unit meets the above criteria and this demonstration is fully documented.

In general, this demonstration does not test the performance of the method in real world samples, but in the applicable and available clean matrix (a sample of a matrix in which no target analytes or interferences are present at concentrations that impact the results of a specific test method), e.g., water, solids and air. However, before any results are reported using this method, actual sample spike results may be used to meet this standard, i.e., at least four consecutive matrix spikes within the last twelve months. In addition, for analytes that do not lend themselves to spiking, e.g., TSS, the demonstration of capability may be performed using quality control samples.

All demonstrations shall be documented through the use of the form in this appendix.

The following steps, which are adapted from the EPA test methods published in 40 CFR Part 136, Appendix A, are performed if required by mandatory test method or regulation. Note: For analytes for which spiking is not an option and for which quality control samples are not readily available, the 40 CFR approach is one way to perform this demonstration. The laboratory documents that other approaches to DOC are adequate, and this is documented in the laboratory's Quality Manual.

a) A quality control sample is obtained from an outside source. If not available, the QC sample may be prepared by the laboratory using stock standards that are prepared independently from those used in instrument calibration.

b) The analyte(s) is diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified, or if unspecified, to a concentration approximately 10 times the method-stated or laboratory-calculated method detection limit.

c) At least four aliquots are prepared and analyzed according to the test method either concurrently or over a period of days.

d) Using all of the results, the mean recovery ($\bar{X}$) is calculated in the appropriate reporting units (such as µg/L) and the standard deviations of the population sample (n-1) (in the same units) for each parameter of interest. When it is not possible to determine mean and standard deviations, such as for presence/absence and logarithmic values, the laboratory will assess performance against established and documented criteria.

e) Compare the information from (d) above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory-generated acceptance criteria (if there are no established mandatory criteria). If all parameters meet the acceptance criteria, the analysis of actual samples may begin. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

f) When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to 1) or 2) below.

1) Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with c) above.

2) Beginning with c) above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with c).

C.2 CERTIFICATION STATEMENT

The following certification statement shall be used to document the completion of each demonstration of capability. A copy of the certification statement shall be retained in the personnel records of each affected employee (see ECIQSM Section 6.3 and 12.3.4.b.).

Demonstration of Capability
Certification Statement

Date: Page_of__
Laboratory Name:
Laboratory Address:
Analyst(s) Name(s):

Matrix:_____
Examples: laboratory pure water, soil, air, solid, biological tissue)

Method number, SOP#, Rev #, and Analyte, or Class of Analytes or Measured Parameters:
_____ (examples: barium by 200.7, trace metals by 6010, benzene by 8021, etc.)

We, the undersigned, CERTIFY that:

1. The analysts identified above, using the cited test method(s), which is in use at this facility for the analyses of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

2. The test method(s) was performed by the analyst(s) identified on this certification.

3. A copy of the test method(s) and the laboratory-specific SOPs are available for all personnel on-site.

4. The data associated with the demonstration capability are true, accurate, complete and self-explanatory (1).

5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized assessors.

Technical Director's Name and Title	Signature	Date
Quality Assurance Officer's Name	Signature	Date

This certification form must be completed each time a demonstration of capability study is completed.

(1) True: Consistent with supporting data.
Accurate: Based on good laboratory practices consistent with sound scientific principles/practices.
Complete: Includes the results of all supporting performance testing.
Self-explanatory: Data properly labeled and stored so that the results are clear and require no additional explanation.

(Note: Form may be modified so Jong as the essential items are included in the revised form)

APPENDIX D - ESSENTIAL QUALITY CONTROL REQUIREMENTS

Th.e quality control protocols specified by the laboratory's method manual (10.1.2) shall be followed. The laboratory shall ensure that the essential standards outlined in Appendix D are incorporated into their method manuals.

All quality control measures shall be assessed and evaluated on an ongoing basis and quality control acceptance criteria shall be used to determine the validity of the data. The laboratory shall have procedures for the development of acceptance/rejection criteria where no method or regulatory criteria exists.

The requirements from the body of Chapter 5, e.g., Section 5.4, apply to all types of testing. The specific manner in which they are implemented is detailed in each of the sections of this Appendix, i.e., chemical testing.

The Standard Operating Procedure (SOP) T020 "Internal Quality Control Checks" and the specific analytical method SOPs have a more detailed outline of the quality control procedures.

D.1 CHEMICAL TESTING

D.1.1 Positive and Negative Controls

a) Negative Controls

1) Method Blanks - Shall be performed at a frequency of one per preparation batch of samples per matrix type. The results of this analysis shall be one of the QC measures to be used to assess the batch. The source of contamination must be investigated and measures taken to correct, minimize or eliminate the problem if

   i) the blank contamination exceeds a concentration greater than 1/10 of the measured concentration of any sample in the associated sample batch or

   ii) the blank contamination exceeds the concentration present in the samples and is greater than 1/10 of the specified regulatory limit.

Any sample associated with the contaminated blank shall be reprocessed for analysis or the results reported with appropriate data qualifying codes.

b) Positive Controls

1) Laboratory Control Sample (LCS) - (QC Check Samples) Shall be analyzed at a minimum of 1 per preparation batch of 20 or less samples per matrix type, except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to assess the batch. NOTE: The matrix spike (see 2 below) may be used in place of this control as long as the acceptance criteria are as stringent as for the LCS.

   a. The NELAC requirements (2009 Standard, Section 1.7.4.2 b) allow the usage of LCS Marginal Exceedance control limits for those analyses with multiple reporting analytes.

   b. The NELAC standards state that if a large number of analytes are in the LCS, it becomes statistically likely that a few will be outside control limits. This may not indicate that the system is out of control; therefore, corrective action may not be necessary. Upper and lower marginal exceedance (ME) limits can be established to determine when corrective action is necessary. ME is defined as being beyond the LCS control limit but within the ME limits. ME limits are between 3 and 4 standard deviations around the mean.

c. The number of allowable marginal exceedance is based on the number of analytes in the LCS. If there is any analyte that exceed the LCS control limits, it does not necessary mean the LCS fails. The NELAC standard states if the number of analytes fails LCS control limits but is within the ME limits, it is acceptable.

2) Matrix Spikes (MS) - Shall be performed at a frequency of one out of every 20 samples per matrix type prepared over time, except for analytes for which spiking solutions are not available such as, total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in a matrix spike may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the spike.

3) Surrogates - Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with the sample composition and shall be reported to the client whose sample produced the poor recovery.

4) If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene, and PCBs in Method 608), the test method has an extremely long list of components or components that are incompatible, a representative number (minimum of 10%) of the listed components may be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit-specified analytes, and other client-requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

D.1.2 Analytical Variability/Reproducibility

Matrix Spike Duplicates (MSDs) or Laboratory Duplicates - Shall be analyzed at a minimum of 1 in 20 samples per matrix type per sample extraction or preparation method. The laboratory shall document its procedure to select the use of appropriate type of duplicate. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in the duplicates may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the duplicate.

D.1.3 Method Evaluation

In order to ensure the accuracy of the reported result, the following procedures shall be in place:

a) Demonstration of Analytical Capability - (Section 10.5) shall be performed initially (prior to the analysis of any samples) and with a significant change in instrument type, personnel, matrix or test method.

b) Calibration - Calibration protocols specified in Section 9.4 shall be followed.

c) Proficiency Test Samples - The results of such analyses (4.2.j or 5.3.4) shall be used by the laboratory to evaluate the ability of the laboratory to produce accurate data.

D.1.4 Analytical Measurement Uncertainty Estimation

Uncertainty is "a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand" (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1).

Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. For environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error.

Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to have a Gaussian distribution, and be reducible by increasing the total number of measurements.

Knowledge of the uncertainty of a measurement provides additional confidence in the validity of a result as its value accounts for all the factors which could possibly affect the result. Certain test methods will specify limits to the values of sources of uncertainty of measurement (EPA 500 series methods, etc.) and will specify the form of presentation of calculated results.

When the method makes these stipulations, there is no need to provide a mechanism for calculating the uncertainty. Where this information is not provided within a method or other regulatory device, the uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte because LCS recoveries incorporate all of the laboratory-related variables associated with a given test over time. It is recognized that other approaches exist; however, ECI's standard for estimating analytical data uncertainty uses this approach.

D.1.4.1 Using the Laboratory Control Sample (LCS) to Estimating Analytical Uncertainty

a) The estimated measurement uncertainty can be expressed as a range (±) around the reported analytical results at a specified confidence level. For methods that use statistically-derived LCS control limits based on historical LCS recovery data to assess the performance of the measurement system, these limits are considered an estimate of the minimum laboratory contribution to measurement uncertainty at a 99% confidence interval, The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

- Uncertainty values may be reported for specific projects upon request. In absence of alternate client-specified approaches or confidence levels,

  ECI will use the following procedure:

  To calculate the uncertainty value of a reported analytical result, the lower uncertainty range value is calculated by subtracting the product of the result and the lower LCS percent recovery from the result; and the upper uncertainty value result is calculated by adding the product of the result and the upper LCS percent recovery.

  These calculated values represent approximately a 99% confidence level. In other words, approximated 99% of the measured values for the analyte will fall within this calculated range.

- Example: If the reported result is 1.0 mg/l, and the LCS percent recovery range is 75 to 125%. The uncertainty range would be 0.75 to 1.25 mg/l, which could also be written as 1.0 +/- 0.25 mg/l.

- The Laboratory Quality and Accreditation Office has made available to the public both a spreadsheet that calculates analytical measurement uncertainty and an SOP describing how to use it. This SOP applies to test methods that are within the scope of ISO/IEC 17025-1999 Standard: General Requirements for the Competence of Testing and Calibration Laboratories and it is based on the general rules outlined in Guide to the Expression of Uncertainty in Measurement (GUM).

The spreadsheet provides a QC-based nested approach for estimating measurement uncertainty using laboratory generated calibration and QC spike results. This spreadsheet has been authorized to be used on DOD/DOE projects, if requested.

D.1.4.2 Additional Components to Estimating Analytical Uncertainty

When estimating analytical measurement uncertainty, all significant components of uncertainty must be identified and quantified. Components that affect analytical measurement uncertainty include sampling, handling, transport, storage, preparation and testing. A typical environmental laboratory will have the greatest contribution to uncertainty in the storage, preparation and testing portion of the analytical train, hence the estimation can be limited to those three areas, assuming all other factors are within recommended guidelines for sample size, container type, preservation (chemical, temperature, temporal) and handling/transport. If the latter are *NOT* within guidelines then these additional estimations of variability must be accounted for, and may supersede the laboratory contribution to uncertainty.

Definitive references and procedural manuals for calculating Analytical Measurement Uncertainty are listed below. Note that there are different theories on the "best" way to estimate uncertainty, it is up to the end user to determine that which best meets their project needs.

a) "Environmental Analytical Measurement Uncertainty Estimation – Nested Hierarchical Approach", William Ingersoll, Defense Technical Information Center # ADA396946, 2001

b) "Quantifying Uncertainty in Analytical Measurement", EuraChem / CITAC Guide CG 4, Second Edition, QUAM 2000.1

c) "Quantifying Measurement Uncertainty in Analytical Chemistry – A Simplified Practical Approach", Thomas W. Vetter, National Institute of Standards and Technology

d) ISO Guide to the Expression of Uncertainty in Measurement (GUM), 1993

e) "Estimation of Analytical Measurement Uncertainty - Laboratory Quality and Accreditation Office Uncertainty Calculator Standard Operating Procedure. Downloaded from http://www.denix.osd.mil/edqw/upload/UNCERTAINTY-SOP.**PDF**, 2013

f) QC-based Nested Approach for Estimating Measurement Uncertainty Spreadsheet, Microsoft Excel Spreadsheet, Ingersoll, William Stephen, 2002

The process in general involves the following steps:

1. Specify the Measurand – Write down a clear statement of what is being measured, including the relationship between the measurand and the input quantities, i.e., measured quantities, constants, calibration standard values, etc.

2. Identify uncertainty sources – This will include sources that contribute to the uncertainty on the parameters in the relationships identified in step 1, but may include other sources and must include sources arising from chemical assumptions.

3. Quantify uncertainty components – Measure or estimate the size of the uncertainty component associated with each potential source of uncertainty identified. It is often possible to estimate or determine a single contribution to uncertainty from the aggregate of multiple sources.

4. Calculate combined uncertainty – The information obtained in step 3 will consist of a number of quantified contributions to overall uncertainty, whether associated with individual sources or with the combined effects of several sources.

The process outlined above relates to the measurement of uncertainty for the preparative / analytical laboratory procedure. However, there are uncertainty contributions from other factors outside the preparative / analytical procedure. These can be controlled to a great extent by specifying uniform and standardized training or conditions.

Examples:

Human Factors

a) All personnel at ECI undergo documented training in the method and / or instrument used. Minimum levels of education or experience are required.

b) Initial and continuing Demonstrations of Capability (DOC) must be performed and documented prior to and in continuance of analytical work related to their areas of responsibilities.

c) Blind Proficiency Testing samples are analyzed twice a year to gauge each department, matrix and method.

d) Data Integrity and Ethics Training are provided to new employees and on an annual basis to all employees.

Accommodation and Environmental Conditions

a) ECI has standardized operating procedures for transport, storage and tracking of samples, extracts and digests throughout the laboratory. All incoming orders are logged into a Laboratory Information System that assigns a specific identifier code to each work order, sample container and analytical result.

b) The sample control areas are secured with restricted access using card key portals. Internal chain of custody is available if the project requires.

c) The laboratory has over 35,000 sq ft of laboratory space with temperature controlled and air positive or negative environmental controls.

d) Regular safety inspections are performed to identify potentially hazardous conditions and to ensure general cleanliness.

Environmental Test Methods and Method Validation

a) All methods in use have Standard Operating Procedures (SOPs) based upon published methods from the EPA, ASTM, Standard Methods or other established body. These are controlled documents assigned to each department. An annual review is performed.

b) Each method has internal and external quality control criteria for preparative efficiency, instrument performance, calibration, continuing method performance and possible matrix effects as appropriate.

c) Ongoing Proficiency Testing program.

Equipment and Instrumentation

a) Each instrument in use has performance parameters that must be evaluated to specific standards based on the established method prior to any analytical use.

b) Routine and preventative maintenance is performed to maintain optimum operational performance.

c) Complex instrument systems are covered under manufacturer service contracts as appropriate.

Measurement Traceability

a) Every reagent used must meet the indicated purity and fitness for usage as referenced in the method SOPs.

b) All calibration standards are certified by the manufacturer to meet or exceed purity levels as recorded in the accompanying Certificate of Traceability to NIST or other standards verification.

c) Each reagent, standard or working standard is recorded, assigned a tracking identifier. This is referenced in the analytical log book as needed to assure traceability to the original source.

d) All Balances, Dispensers, Pipettors, Refrigerators, Freezers and Thermometers are checked on a daily or other routine basis to specified tolerances.

D.1.5 Detection Limits

The laboratory shall utilize a test method that provides a detection limit that is appropriate and relevant for the intended use of the data. Detection limits shall be determined by the protocol in the mandated test method or applicable regulation, e.g., Method Detection Limit (MDL). If the protocol for determining detection limits is not specified, the selection of the procedure must reflect instrument limitations and the intended application of the test method. Refer to SOP T006, Determination of Detection Limits.

a) A detection limit study is not required for any component for which spiking solutions or quality control samples are not available such as temperature.

b) The detection limit shall be initially determined for the compounds of interest in each test method in a matrix in which there are not target analytes nor interferences at a concentration that would impact the results or the detection limit must be determined in the matrix of interest (see definition of matrix).

c) Detection limits must be determined each time there is a change in the test method that affects how the test is performed, or when a change in instrumentation occurs that affects the sensitivity of the analysis.

d) All samples processing steps of the analytical method shall be included in the determination of the detection limit.

e) All procedures used must be documented. Documentation must include the matrix type. All supporting data must be retained.

f) The laboratory must have established procedures to relate detection limits with quantitation limits.

g) The test method's quantitation limits must be established and must be above the detection limits.

D.1.6 Data Reduction

The procedures for data reduction, such as use of linear regression, shall be documented.

D.1.7 Quality of Standards and Reagents

a) The source of standards shall comply with 9.3.

b) Reagent Quality, Water Quality and Checks:

1) Reagents - In methods where the purity of reagents is not specified, analytical reagent grade shall be used. Reagents of lesser purity than those specified by the test method shall not be used. The labels on the container should be checked to verify that the purity of the reagents meets the requirements of the particular test method. Such information shall be documented.

2) Water - The quality of water sources shall be monitored and documented and shall meet method specified requirements.

3) The laboratory will verify the concentration of titrants in accordance with written laboratory procedures.

D.1.8 Selectivity

a) Absolute retention time and relative retention time aid in the identification of components in chromatographic analyses and to evaluate the effectiveness of a column to separate constituents. The laboratory shall develop and document acceptance criteria for retention time windows.

b) A confirmation shall be performed to verify the compound identification when positive results are detected on a sample from a location that has not been previously tested by the laboratory. Such confirmations shall be performed on organic tests such as pesticides, herbicides, or acid extractable or when recommended by the analytical test method except when the analysis involves the use of a mass spectrometer. Confirmation is required unless stipulated in writing by the client. All confirmation shall be documented.

c) The laboratory shall document acceptance criteria for mass spectral tuning.

D.1.9 Constant and Consistent Test Conditions

a) The laboratory shall assure that the test instruments consistently operate within the specifications required of the application for which the equipment is used.

b) Glassware Cleaning - Glassware shall be cleaned to meet the sensitivity of the test method.

Any cleaning and storage procedures that are not specified by the test method shall be documented in laboratory records and SOPs.

D.1.10 Method Validation - Modified Procedures, Non-Standard Methods, Additional Analytes

Often times, modifications to published methods are promulgated to allow the laboratory flexibility, increased productivity and, in some cases, it allows for better hazardous waste management, all while maintaining the quality of the data generated. But, this cannot be done without following standard method validation procedures to guarantee that the results achieved from the modified version are equal to or greater than the actual published or routinely accepted method.

Validation procedures are done to make sure that the sensitivity and selectivity of the process is appropriate for the method or analytes chosen. Interference checks are performed to show that the changes or additions will not contribute interferences to previous analytes or on-going processes. Accuracy and precision requirements are established, or previously defined, and used to demonstrate the capability of an analyst to perform the method, initially and on-going.

In the event that a non-standard method (significantly modified or newly-developed) is needed to meet client requirements, the method specifications and how they impact the project requirements must be relayed to the client for approval prior to beginning work on project samples. The client must understand the limits of the method, why it was developed and when it will be used on their project samples, and they must agree to its use.

Any significantly modified or newly-developed method (including the addition of analytes to established procedures) must be fully defined in a Standard Operating Procedure. The validation must be performed by qualified personnel, using appropriate reagents, standards and equipment/instrumentation and that process must be documented. The following items must be performed (as applicable to the method) and the completed documentation with all raw data provided to the Operations Manager and QA Manager for review prior to granting approval for use. A new method cannot be put into production without Operations and QA approval. For situations where NELAP approval is being sought, the method cannot be used for client samples until the certification has been received from the State, unless approval is given by the client

D.1.10.1 Significant Modification / New Method / Additional Analyte Documentation:

Prior to the acceptance of client samples for analysis, the following documentation, as applicable to the type of modification or method status, must be provided to both Operations and QA for review and approval.

1. Approved Standard Operating Procedure for Analytical or Preparation Processes. Include all related raw data for the SOP revision with the draft version.

    a) Modification of existing method: - Revised SOP with modifications clearly spelled out:

    b) New Method: - New SOP in NELAC format - QA will assign SOP number

    c) Additional Analytes: - Revised SOP with modifications clearly spelled out:

2. Method Detection Limit (MDL) Study: Compliant with 40CFR, Part 136.

    a) Include summary form and all raw data for the review

3. MDL Verification Standard spiked at 1-4x the MDL, or the level specified by the specific program or contract Example: 1-2x the MDL, reference specific program requirements.

    b) Recovery within 30 -150%, or a minimum response distinguishable from the established instrument noise level.

4. Reporting Limit Verification (when an MDL verification is not performed)

    a) For analytical methods, reprocess the low calibration standard as percent recovery – recovery between 50% and 150% is acceptable.

    b) For extraction methods, or where required by project or program, spike a blank matrix at the reporting limit and process through all steps of the procedure. Note the spike level and percent recoveries. Method defined control limits are used for recovery evaluation, or default recoveries between 40% and 160% if method defined limits are not available.

5. Tuning Check (as applicable to the method)

6. Degradation Check (as applicable to the method)

7. A Valid Initial Calibration and Verification

    a) Minimum of 5 sequential points, unless otherwise stated in the method or in-house SOP.

    b) Low calibration standard at or below the Reporting/Quantitation Limit

    c) Initial Calibration Verification Standard

8. Retention Time Window Study

9. Second Column Confirmation for all analytes (as applicable to the method)

10. Inter-element Correction (as applicable to the method)

11. Linear Range Study (as applicable to the method)

12. GCMS Spectral Profile(s) (as applicable to the method)

13. Interference Check - Method Blank

    a) Analysis of a blank matrix that has gone through all related steps, preparation and /or analysis, as applicable.

14. Acceptable PT Sample required for all new analytes where NELAP accreditation is being sought.

    a) At least one PT sample (preferably two) required for all new methods

    b) Where a PT sample is not available, or accreditation is not needed, accuracy can be measured through the use of a second source standard.

15. For California ELAP or State NELAP, process a real world sample for MS and MSD. The sample does not have to contain any target analytes but recoveries for surrogates, internal standards and spikes must be within lab or method defined criteria.

    a) Use Tap Water for drinking water only methods, tap or other clean water source for ground, surface, etc. methods

    b) Local Soil sample for SW-846 methods (if applying for soil or soil/water)

16. Initial Demonstration of Capability (IDOC) per analyst

    a) 4 LCS for each matrix, spiked with all associated new analytes – most acceptance criteria are in the methods, if none, use an initial recovery range of 40-160% and an RPD of 30%.

    b) Non-Standard methods - Follow the procedure in the 2003 NELAC Standards, Chapter 5 appendix C.3.3 (b).

17. Certification / Approval from Regulatory Agency where available.

APPENDIX E - LIST OF ACCREDITED METHODS

- Arizona Department of Health Services - Laboratory ID AZ0781

  a) View at: http://www.eurofinsus.com/media/1.61879/arizona-cert_scope_031216.pdf

- California SWRCB ELAP - Laboratory ID 2944

  a) View at: http://www.eurofinsus.com/media/162063/ca-elap_calscience.pdf

- Guam Environmental Protection Agency - Laboratory ID E971101

  a) View at: http://www.eurofinsus.com/media/161875/guam-cert_foas_103115.pdf

- Hawaii Department of Health - Laboratory ID (None)

  a) View at: http://eurofinsus.com/media/161878/hawaii-cert_093015.pdf

- Kansas Department of Health & Environment - Laboratory ID E-10409

  a) View at: http://www.eurofinsus.com/media/16055/kansas1.pdf
  b) View at: http://www.eurofinsus.com/media/16056/kansas2.pdf

- Nevada Department of Conservation and Natural Resources – Laboratory ID CA001112013-1

  a) View at: http://www.eurofinsus.com/media/162008/nevada-cert-2015.pdf

- Oklahoma Department of Environmental Quality - Laboratory ID 1311

  a) View at: http://www.eurofinsus.com/media/161882/oklahoma-cert_083115.pdf

- Oregon Environmental Laboratory Accreditation Program (NELAP Primary) - Laboratory ID CA300001

  a) View at: http://www.eurofinsus.com/media/161877/oregon-state-primary-nelap-cert_012916.pdf

- Texas Commission of Environmental Quality – Laboratory ID T104704499-14-4

  a) View at: http://www.eurofinsus.com/media/161881/texas-cert_073115.pdf

- United States Department of Agriculture Certificate No. P330-10-00403, Permit to Receive Soil

  a) View at: http://eurofinsus.com/media/16042/usda_soil_permit.pdf

- United States Department of Agriculture - Authorization to Receive Plant Material

  b) View at: http://www.eurofinsus.com/media/162229/usda-plant-import-authorization_050615.pdf

- United States Army Corp of Engineers - Approval (EPA 8270 SIM - PCB Congeners)

  a) View at: http://www.eurofinsus.com/media/16039/dmmo_epa8270sim.pdf

- **United States Department of Defense / Energy ANAB/ACLASS ELAP Certificate ADE-1864 and Fields of Accreditation**

  a) View at: http://www.eurofinsus .com/media/16049/dod elap .pdf

- **United States Department of the Interior - Approval**

  b) View at: http://www.eurofinsus .com/media/16067 /usbor .pdf

- **Utah Department of Health - Laboratory ID CA00111**

  a) View at: http://www .eurofinsus .com/media/161880/utah -cert foas 103115.pdf

- **Washington Department of Ecology - Laboratory ID C916**

  a) View at: http://www.eurofinsus .com/media/16070/washington1 .pdf
  b) View at: http://www.eurofinsus.com/media/16069/washington2 .pdf

APPENDIX F-LIST OF PHYSICAL LOCATIONS

F.1 Main Laboratory

- 7440 Lincoln Way, Garden Grove, CA 92841-1427
- 714-895-5494 Fax 714-894-7501

F.2 Satellite Laboratory 1

- 7445 Lampson Avenue, Garden Grove, CA 92841-2903
- Fax 714-898-2036

F.3 Satellite Laboratory 2

- 11380 Knott Street, Garden Grove, CA 92841-1400

F.4 Concord, CA Service Center

- 5063 Commercial Circle, Suite H, Concord, CA 94520-8577
- 925-689-9022 Fax 925-689-9023

APPENDIX G - SPECIAL PROGRAM REQUIREMENTS

F.1 United States Department of Defense / Energy Environmental Laboratory Accreditation Program

1. ECI participates and is accredited in the United States Department of Defense / Energy Environmental Laboratory Accreditation Program (DOD/DOE-ELAP).

2. The DOD/DOE ELAP will provide a means for laboratories to demonstrate conformance to the DOD/DOE Quality Systems Manual for Environmental Laboratories (DOD/DOE QSM) as authorized by DOD/DOE Instruction 4715.15, Environmental Quality Systems, December 2006 and as required by the DOD/DOE Policy and Guidelines for Acquisitions Involving Environmental Sampling or Testing, December, 2007. The DOD/DOE QSM is based on the National Environmental Laboratory Accreditation Conference (NELAC) Quality Systems standard (Chapter 5), which provides guidelines for implementing the international standard, ISO/IEC 17025, General Requirements for the Competence of Testing and Calibration Laboratories.

3. The DOD/DOE ELAP will apply to environmental programs / projects at DOD/DOE operations, activities, and installations, including Government-owned, contractor-operated facilities and formerly used defense sites, where testing is being performed in support of environmental restoration programs. The program will apply to all laboratories, including permanent, temporary, or mobile facilities, that generate definitive data, regardless of their size, volume of business, or field of accreditation; the collection of screening data will be governed by project specific requirements.

4. The current DOD/DOE Quality Systems Manual for Environmental Laboratories is Version 5.0, dated June 2013

5. Implementation of the DOD/DOE Quality Systems Manual for Environmental Laboratories Version 5.0, dated July 2013, will be phased in over the 2014-2015 time period.

6. The ECI Management will provide sufficient training, resources and other measures to ensure compliance with the DOD/DOE QSM as appropriate. (including but not limited to):

   a. Specific Standard Operating Procedures (SOPs) and / or Appendicles
   b. DOD/DOE compliant Laboratory Information Management System (LIMS) analytical test codes
   c. Specialized technician and chemist training
   d. Enhanced Quality Assurance (QA) oversight
   e. Project specific instruments
   f. Assigned Project Management personnel
   g. Quality Assurance Project Plans (QAPP)
   h. DOD/DOE analytical data reporting qualifiers
   i. Calibration and reference materials that meet DOD/DOE requirements.

APPENDIX H - LISTING OF MAJOR ANALYTICAL INSTRUMENTATION

GC/MS SYSTEMS

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
GC/MS-K	**HP** 6890	US00024158	1998	**Air**	XP
	HP5973	US82311263	1998		
	Entech 71OOA	0063	1998		
	Entech 7016CA	00142	1998		
GC/MS-L	HP 6890	US00023714	1998	Volatiles	XP
	Agilent 5973	US82311287	1998		
	Tekmar Atomx	US09163001	2009		
GC/MS-M	HP 6890	US00028876	1999	Volatiles	XP
	HP 5973	US9192601	1999		
	Tekmar Stratum	US08283015	2010		
	Varian Archon	MS0903W013	2010		
GC/MS-0	Agilent 6890N	US00034260	2000	**LUFT-TPPH**	XP
	Agilent 5973	US94240048	2000		
	Tekmar 3100	US02261003			
	Varian Archon	13863	2002		
GC/MS-P	Agilent 6890	US00034661	2000	Semivolatiles	XP
	Agilent 5973N	US94240038	2000		
	Agilent G2613A (Injector)	CN35234549	2000		
	Agilent G2614A (Tray)	US04109505	2000		
GC/MS-Q	Agilent 6890	US00037519	2000	Volatiles	XP
	Agilent 5973	US03340458	2000		
	Tekmar Stratum	US13099007	2013		
	Varian Archon	13386	2000		
GC/MS-R	Agilent 6890	US00037782	2000	Volatiles	XP
	Agilent 5973	US03340489	2000		
	Tekmar Stratum	US12111001	2012		
	Varian Archon	14040	2003		
GC/MS-S	Agilent 6890	US00030897	2000	Summa QC	XP
	Agilent 5973	US03340414	2000		
	Tekmar Autocan	US06047025	2006		
GC/MS-T	Agilent 6890	US00039185	2000	Volatiles	XP
	Agilent 5973	US03940628	2000		
	Tekmar Atomx	US11048001	2011		
GC/MS-U	Agilent 6890	US00036171	2001	Summa QC	XP
	Agilent 5973	US02450134	2001		
	Tekmar Autocan	US08169005	2002		
GC/MS-V	Agilent 6890	US00036172	2001	Air	XP

	Agilent 5973	US02450131	2001		
	Entech 71OOA	1092	2005		
	Entech 7016CA	1041	2005		
GC/MS-W	Agilent 6890	US00036170	2001	Volatiles	XP
	Agilent 5973	US02450128	2001		
	Tekmar Stratum	US09154005	2010		
	Varian Archon	13573	2001		
GC/MS-X	Agilent 6890N	US10203064	2002	Air	XP
	Agilent 5973	US10462129	2002		
GC/MS-Y	Agilent 6890	US10203153	2002	Semivolatiles	XP
	Agilent 5973	US10442209	2002		
	Agilent G2613A (Injector)	US00211064	2002		
	Agilent G2614A (Tray)	CN64942239	2002		
GC/MS-Z	Agilent 6890N	US10225110	2002	Volatiles	XP
	Agilent 5973	US21842958	2002		
	Tekmar Stratum	US12115008	2012		
	Varian Archon	15278	2008		
GC/MS-AA	Agilent 6890N	US10225149	2002	Air	XP
	Agilent 5973N	US21843250	2002		
	Entech 71OOA	1045	2003		
	Entech 7016CA	1183	2004		
	Entech 7016CA	1212	2004		
GC/MS-BB	Agilent 6890N	US1023004	2002	Volatiles	XP
	Agilent 5973N	US21843288	2002		
	Tekmar Stratum	US08283014	2012		
	Varian Archon	15208	2007		
GC/MS-CC	Agilent 6890N	US10233039	2002	Volatiles	XP
	Agilent 5973N	US21843272	2002		
	Tekmar Stratum	US10272001	2011		
	Varian Archon	13431	2002		
GC/MS-DD	Agilent 6890N	US10239018	2002	Air	XP
	Agilent 5973N	US21843913	2002		
	Entech 71OOA	1432			
	Entech 7016CA	1018	2002		
	Entech 7016CA	1187			
GC/MS-EE	Agilent 6890N	US10248096	2003	Summa QC	XP
	Agilent 5973N	US21844395	2003		
	Tekmar Autocan	US99362027	1999		
GC/MS-GG	Agilent 6890N	CN10337014	2003	Marine Lab	XP
	Agilent 5973N	US33246020	2003		

	Agilent GC 80 SPME	CH00213565	2011		
GC/MS-HH	Agilent 6890N	CN10337015	2003	Air	XP
	Agilent 5973	US30945837	2003		
	Entech 71OOA	1081	2003		
	Entech 7016CA	1012	2003		
	Entech 7016CA	1038	2003		
GC/MS-11	Agilent 6890	CN10517039	2005	Air	XP
	Agilent 5973	US44647341	2005		
	Entech 71OOA	1458	2008		
	Entech 7016CA	1098	2005		
	Entech 7016CA	1225	2008		
GC/MS-JJ	Agilent 6890N	CN10547073	2005	Volatiles	XP
	Agilent 5973	US53941344	2005		
	Tekmar Stratum	US10230002	2010		
	Varian Archon	14529	2005		
GC/MS-KK	Agilent 6890	CN10545117	2005	Air	XP
	Agilent 5973	US53941343	2005		
	Entech 71OOA	1221	2005		
	Entech 7016CA	1207			
	Entech 7016CA	1210			
GC/MS-LL	Agilent 6890N	CN10651084	2007	Volatiles	XP
	Agilent 59758	US63214670	2007		
	Tekmar 3100	US01317008	2002		
	Varian Archon	MS0902W026	2006		
GC/MS-MM	Agilent 6890N	CN10651076	2007	Semivolatiles	XP
	Agilent 59758	US62715103	2007		
	Agilent G2913A (Injector)	CN51825044	2007		
	Agilent G2614A (Tray)	CN51833057	2007		
GC/MS-NN	Agilent 7890A	CN10717056	2007	Air	XP
	Agilent 5975C	US71215995	2007		
	Entech 71OOA	1291	2012		
	Entech 7016CA	1211			
	Entech 7150	45	2010		
	Entech 7410	138	2010		
GC/MS-00	Agilent 7890A	CN10745139	2007	Volatiles	XP
	Agilent 5975C	US73317841	2007		
	Tekmar Stratum	US07277008	2009		
	Varian Archon	14697	2008		
GC/MS-PP	Agilent 7890A	CN10744086	2007	Volatiles	XP
	Agilent 5975C	US73317584	2007		

	Tekmar Stratum	US07277012	2009		
	Tekmar SOLATek	US09051008	2009		
GC/MS-QQ	Agilent 7890A	CN10742034	2007	Volatiles	XP
	Agilent 5975C	US71216778	2007		
	Tekmar Stratum	US07277018	2008		
	Tekmar SOLATek	US08032004	2008		
GC/MS-RR	Agilent 7890A	CN10730015	2007	Volatiles	XP
	Agilent 5975C	US73317844	2007		
	Tekmar Stratum	US08032004	2008		
	Tekmar SOLATek	US08032006	2008		
GC/MS-SS	Agilent 7890A	CN10803049	2007	Semivolatiles	XP
	Agilent 5975C	US80618497	2007		
	Agilent G2613A (Injector)	US81801206	2007		
	Agilent G2614A (Tray)	CN80246945	2007		
GC/MS-TT	Agilent 7890A	CN10806032	2007	Semivolatiles	XP
	Agilent 5975C	US80618456	2007		
	Agilent G2613A (Injector)	CN80246390	2007		
	Agilent G2614A (Tray)	CN80246936	2007		
GC/MS-UU	Agilent 7890A	CN10805004	2007	Volatiles	XP
	Agilent 5975C	US71215984	2007		
	Tekmar Stratum	US08087006	2008		
	Varian Archon	15287	2008		
GC/MS-W	Agilent 7890A	CN10805094	2007	Volatiles	XP
	Agilent C5975	US80118376	2007		
	Tekmar 3100	US02203002	2001		
	Tekmar SOLATek	US09050003	2008		
GC/MS-WW	Agilent 7890A	CN10803015	2007	Volatiles	XP
	Agilent 5975C	US80118375	2007		
	Tekmar Atomx	US11034002	2011		
GC/MS-XX	Agilent 7890A	CN10815050	2008	Volatiles	XP
	Agilent 5975C	US80828968	2008		
	Tekmar Stratum	US14097001	2014		
	Varian Archon	15273	2008		
GC/MS-YY	Agilent 7890A	CN10814115	2008	Air	XP
	Agilent C5975	US80828967	2008		
	Entech 71OOA	1431	2008		
	Entech 7016CA	1208	2008		
	Entech 7016CA	1214	2008		
GC/MS-ZZ	Agilent 7890A	CN10814050	2008	Air	XP
	Agilent 5975C	US80828953	2008		

	Markes TD-100	G800K10173	2011		
GC/MS-AAA	Agilent 7890A	CN10812068	2008	Semivolatiles	XP
	Agilent 5975C	US80828988	2008		
	Agilent G2613A (Injector)	CN70438717	2008		
	Agilent G2614A (Tray)	CN64942222	2008		
GC/MS-888	Agilent 7890A	CN10947130	2009	Semivolatiles	XP
	Agilent 5975C	US93414124	2009		
	Agilent 7693 (Tray)	CN94701470	2009		
	Agilent 7693 (Injector)	CN11200098	2009		
GC/MS-CCC	Agilent 7890A	CN10947129	2009	Semivolatiles	XP
	Agilent 5975C	US93414097	2009		
	Agilent 7693 (Tray)	CN94901515	2009		
	Agilent 7693 (Injector)	CN95002678	2009		
GC/MS-DDD	Agilent 7890A	CN10031142	2009	Semivolatiles	XP
	Agilent 5975C	US10197302	2009		
	Agilent 7693 (Tray)	CN10210002	2009		
	Agilent 7693 (Injector)	CN10140077	2009		
GC/MS-EEE	Agilent 7890A	CN10241112	2009	Semivolatiles	XP
	Agilent 5975C	US10257401	2009		
	Agilent 7693 (Tray)	CN10210100	2009		
	Agilent 7693 (Injector)	CN10230009	2009		
GC/MS-FFF	Agilent 7890A	CN10391179	2010	Volatiles	XP
	Agilent 5975C	US10407502	2010		
	Tekmar Atomx	US10200002	2010		
GC/MS-GGG	Agilent 7890A	CN10401096	2010	Volatiles	XP
	Agilent 5975C	US10287508	2010		
	Tekmar Atomx	US10246002	2010		
GC/MS-HHH	Agilent 7890A	CN10521074	2010	Semivolatiles	Win ?
	Agilent 5975C	CN11030007	2010		
	Agilent 7693 (Tray)	US11077507	2010		
	Agilent 7693 (Injector)	CN11050288	2010		
GC/MS-111	Agilent 7890A	CN10521075	2010	Semivolatiles	Win ?
	Agilent 5975C	US11077506	2010		
	Agilent 7693 (Tray)	CN11030009	2010		
	Agilent 7693 (Injector)	CN11050291	2010		
GC/MS-JJJ	Agilent 7890A	CN11441070	2011	Semivolatiles	Win ?
	Agilent 5975C	US11447702	2011		
	Agilent 7693 (Tray)	CN11440045	2011		
	Agilent 7693 (Injector)	CN11390136	2011		
GC/MS-KKK	Agilent 7890A	CN11441059	2011	Air	Win ?
	Agilent 5975C	US11447704	2011		

	Entech 71OOA	1384	2008		
	Entech 7016CA	1212	2008		
	Entech 7016CA	1183	2007		
GC/MS-LLL	Agilent 7890A	CN12031151	2012	Air	Win ?
	Agilent 5975C	US12097802	2012		
	Entech 71OOA	1290	2012		
	Entech 7016CA	1041	2005		
GC/MS-MMM	Agilent 7890A	CN12261027	2012	Air	Win ?
	Agilent 5975C	US12262A09	2012		
	Markes TD-100	G800k10257	2012		
GC/MS-NNN	Agilent 7890A	CN14073088	2014	Semivolatiles	Win ?
	Agilent 5975C	US14052222	2014		
	Agilent 7693 (Tray)	CN13500019	2014		
	Agilent 7693 (Injector)	CN14020017	2014		
GC/MS-000	Agilent 78908	CN14103035	2014	Air	Win ?
	Agilent 5977A	US1410J201	2014		
	Entech 7200	1161	2014		
	Entech 70160	1421	2014		

GC TRI PLEQUAD SYSTEMS

Designation	Manufacturer/Model	Serial Number	Acquired	Department	0S
GC/T0-1	Agilent 7890A	US11041024	2011	Marine Lab	Win ?
	Agilent 7000 TO/MS	US11046401	2011		
	Agilent 7693 (Tray)	CN11030015	2011		
	Agilent 7693 (Injector)	CN11050297	2011		
GC/T0-2	Agilent 7890A	US11291011	2011	Marine Lab	Win ?
	Agilent 7000 TO/MS	US11196604	2011		
	Agilent 7693 (Tray)	CN11180027	2011		
	Agilent 7693 (Injector)	CN95002669	2011		

GC SYSTEMS

Designation	Manufacturer/Model	Serial Number	Acquired	Department	0S
GC-1	HP 5890 Series II Detector(s): PID/FID	3310A48771	1987	LUFT-GRO	2000
	Tekmar 3100	US01362002	2004		
	Varian Archon	15301	2008		
GC-4	HP 5890 Detector(s): PID/FID	2750A17251	1989	LUFT-GRO	XP
	014560	8239040			
	Varian Archon	13142	1999		

GC-8	HP 5890 Series II PID/FID	3033A31219	1990	LUFT-GRO	XP
	Tekmar 3100	US02249008	2002		
	Varian Archon	MS1010W015	2008		
GC-9	HP 5890 Series II Detector(s): FID/FID	3033A32951	1991	Semivolatiles	NT
GC-12	HP 5890 Series II Detector(s): FID/TCD	3118A35448	1991	Semivolatiles	NT
GC-13	HP 5890 Series II FID/TCD	3033A32929	1990	Air	XP
GC-14	HP 5890 Series II Detector(s): FPO	3126A36770	1991	Air	XP
GC-18	HP 5890 Series II Detector(s): PID/FID	3235A44156	1992	LUFT-GRO	2000
	EST Encon	512080906			
	Varian Archon	15307	2008		
GC-21	HP 5890 Series II Detector(s): PID/FID	3336A51475	1994	LUFT-GRO	XP
	Tekmar 3100	US02331005	2007		
	Varian Archon	MS0902W025	2008		
GC-22	HP 5890 Series II+ Detector(s): PID/FID	3336A61360	1994	LUFT-GRO	XP
	Tekmar 3100	US02233006	2008		
	Varian Archon	14699	2006		
GC-24	HP 5890 Series II+ Detector(s): PID/FID	3336A53949	1994	LUFT-GRO	2000
	Tekmar 3000	98194007	1998		
	Varian Archon	13864	2004		
GC-25	HP 5890 Series II+ Detector(s): PID/FID	2921A23805	1994	LUFT-GRO	XP
	Tekmar 3100	314009			
	Varian Archon	13470	2001		
GC-26	HP 6890 Detector(s): NPD/NPD	US00001017	1995	Semivolatiles	XP
	G1513A (Injector)	CN12620285	1995		
	G1514A (Tray)	US83304659	1995		
GC-29	HP 5890 Series II Detector(s): PID/FID	3310A47430	2000	LUFT-GRO	XP
	Tekmar 3100	US02249004	2002		
	Varian Archon	13874	2002		
GC-31	HP 6890 Detector(s): ECO/ECO	US00037979	2000	Semivolatiles	XP
	G2613A (Injector)	CN43138313	2000		
	G2614A (Tray)	CN71543642	2000		

GC-34	HP 5890 Series II Detector(s): FID	3033A32699	2000	Air	XP
GC-35	Agilent 6890N Detector(s): NPD/NPD	US10206061	2002	Semivolatiles	XP
	G2613A (Injector)	US81501043	2002		
	G2614A (Tray)	US83501663	2002		
GC-36	Agilent 6890N Detector(s): FID/TCD	US10346058	2004	Air	XP
GC-37	Agilent 6890N Detector(s): ECD/ECD	CN10350094	2004	Marine Lab	XP
GC-38	HP 5890 Series II Detector(s): FID	3029A30188	1995	Air	XP
GC-40	Agilent 7890N Detector(s): ECD/ECD	CN10647089	2007	Semivolatiles	XP
	G2913A (Injector)	CN715400009	2007		
	G2614A (Tray)	CN64842106	2007		
GC-41	Agilent 7890N Detector(s): ECD/ECD	CN10650013	2007	Semivolatiles	XP
	G2913A (Injector)	CN70538721	2007		
	G2614A (Tray)	CN43130148	2007		
GC-42	Agilent 6890N Detector(s): PID/FID	CN10647056	2007	LUFT-GRO	XP
	Tekmar 3100	US01274007			
	Varian Archon	14370	2004		
GC-43	Agilent 6890N Detector(s): FID	CN10720004	2007	Air	XP
GC-44	Agilent 6890N Detector(s): FID/FID	CN10721103	2007	Semivolatiles	XP
	G2913A (Injector)	CN71840418	2007		
	G2614A (Tray)	CN71843829	2007		
GC-45	Agilent 7890A Detector(s): FID/FID	CN10808107	2007	LUFT-ORO	XP
	G2913A (Injector)	CN81949025	2007		
	G2614A (Tray)	CN80747427	2007		
GC-46	Agilent 7890A Detector(s): FID/FID	CN1080815	2007	LUFT-ORO	XP
	G2913A (Injector)	CN81949036			
	G2614A (Tray)	US83201509			
GC-47	Agilent 7890A Detector(s): FID/FID	CN10819056	2008	LUFT-ORO	XP
	G2913A (Injector)	CN81748778	2008		
	G2614A (Tray)	CN81748307	2008		
GC-48	Agilent 7890A Detector(s): FID/FID	CN10819057	2008	LUFT-ORO	XP

	G2913A (Injector)	CN64837502	2008		
	G2614A (Tray)	CN64541796	2008		
GC-49	Agilent 7890A Detector(s): FID/FID	CN10820151	2008	LUFT-ORO	XP
	G2913A (Injector)	CN71549035	2008		
	G2614A (Tray)	CN82048589	2008		
GC-50	Agilent 7890A Detector(s): FID/FID	CN10820150	2008	LUFT-ORO	XP
	G2913A (Injector)	CN80546905	2008		
	G2614A (Tray)	CN82048581	2008		
GC-51	Agilent 7890A Detector(s): ECD/ECD	CN10822026	2008	Semivolatiles	XP
	G2913A (Injector)	CN82049336	2008		
	G2614A (Tray)	CN82148694	2008		
GC-52	Agilent 7890N Detector(s): FID	CN10824005	2008	Air	XP
GC-53	Agilent 6890N Detector(s): FID	US00002691	2000	Air	XP
GC-54	Agilent 7890A Detector(s): FPD	US10840051	2008	Air	XP
GC-55	Agilent 7890N Detector(s): TCD	CN10844112	2008	Air	XP
GC-56	Agilent 7890N Detector(s): FID	CN10847124	2009	LUFT-GRO	XP
	01 Eclipse	D647466449P			
	Varian Archon	15139	2007		
GC-57	Agilent 7890N Detector(s): ECD/ECD	CN10847113	2009	LUFT-GRO	XP
	01 Eclipse	D81466987P			
	Varian Archon	15140	2007		
GC-58	Agilent 7890N	CN10942196	2009	Semivolatiles	XP
	Agilent 7693 (Tray)	CN64937563	2009		
	Agilent 7693 (Injector)	CN81748311	2009		
GC-59	Agilent 7890N Detector(s): FID	CN10041127	2009	Air	XP
GC-60	Agilent 6890N Detector(s): FID	US10247091	2003	Air	XP
GC-61	Agilent 6890N Detector(s): FID	US00007963	1998	Air	XP
GC-62	Agilent 6890N Detector(s): FID	US00036172	2001	Air	XP
GC-63	Agilent 7890A Detector(s): ECD/ECD	CN12151152	2012	Marine	XP

GC-64	Agilent 6890A Detector(s): FID	US00030941	1999	Air	XP
GC-65	Agilent 7890A Detector(s): TCD	CN12111151	2012	Air	XP
GC-66	Agilent 7890A Detector(s): FID Agilent 7693 (Tray) Agilent 7693 (Injector)	CN12421146 CN12320016 CN12300140	2012	Semivolatiles	XP

Inductively Coupled Plasma Spectrophotometers (ICP)

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
ICP-7	PE Optima 7300 DV	077C8120401	2008	Metals	XP
	ESI SC FAST	4DX-F1-TSP	2013		
ICP-8	PE Optima 8300		2014	Metals	Win ?
	ESI SC4 optiFAST Dxi		2014		

Inductively Coupled Plasma/Mass Spectrometers (ICP/MS)

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
ICP/MS-3	PE ELAN DRC-e	AH 14610812	2009	Metals	XP
	ESI SC4 DX	X4DX5HSTSP16110413			
ICP/MS-4	PE ELAN DRC-e	AH 13440801	2009	Metals	XP
	ESI SC4 DX	X4DX5HSTSP16110603			
ICP/MS-5	PE NexION 300D	81DN1120502	2011	Metals	XP
	ESI SC4 DX	FST04-TSP-091203	2001		

Flame Atomic Absorption Spectrometers (FAA)

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
FAA-3	PE PinAAcle 900F	PFAS11090701	2011	Metals	Win ?

Mercury Analyzers

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
HG-4	PE FIMS-400	401S2030103	2005	Metals	XP
HG-5	PE FIMS-400	401S5070901	2005	Metals	XP
HG/AF-1	Teledyne Hydra II	1095	2011	Metals	Win ?

High Performance Liquid Chromatographs (HPLC)

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
HPLC-5	Variable Wave. Det.	JP116144U1	2001	Semivolatiles	XP

Agilent 1100 HPLC	Column Compartment	DE11120911	2001		
	Quat. Pump	DE11114727	2001		
	Degasser	JP05029389	2001		
	Autosampler	DE11115637	2001		
HPLC-6 Agilent 1100 HPLC	Variable Wave. Det.	JP11414177	2001	Semivolatiles	XP
	Quat. Pump	DE11114712	2001		
	Degasser	JP05029404	2001		
	Autosampler	DE11115492	2001		
HPLC-7 Agilent 1100 HPLC	Variable Wave. Det.	DE43602867	2004	Semivolatiles	XP
	Isa Pump	DE409006799	2004		
	Column Compartment	DE111210117	2004		
	Autosampler	DE33225927	2004		
Pickering	Pinnacle PCX	513305	2013		
HPLC-8 Agilent 1200 HPLC	Multi. Wave. Det.	DE60555324		Semivolatiles	XP
	Isa Pump	DE62956826			
	Fraction Collector	DE60555134			
	Autosampler	DE63055195			

Liquid Chromatography/Mass Spectrometry (LC/MS/MS)

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
LC/TQ-1	Varian 1200L Triple Quad	3060	2005	Inorganics	XP
	Varian Prostar 210	4151	2005		
	Varian Prostar 210	4152	2005		
	Varian 410 Autosampler	50062	2005		
LC/TQ-2	Agilent 6430 LC/MS Triple Quad	SG11077104	2013	Inorganics	7
	Agilent 1260 Quat Pump	DEAB707001	2013		
	Agilent 1260 ALS	DEAAC17936	2013		
TOC-4	01 Soil Module Detector(s): IR	C339776273	2003	Inorganics	XP
TOC-5	01 Soil Module Detector(s): IR	C726776952	2007	Inorganics	XP
TOC-6	01 Aurora 1030	J025730749P	2011	Inorganics	XP
	OI 1088 NS	J025730749P	2011		
TOC-8	01 Aurora 1030	N248731638P	2012	Inorganics	XP
	01 1088 *N S*	E248788640	2012		
IC-7	Dionex ICS-1000 Detector(s): Conductivity	3100486	2003	Inorganics (Anions)	XP
IC-8	Dionex ICS-2000 Detector(s): Conductivity	4100279	2004	Inorganics (Perchlorate)	XP

IC-9	Dionex ICS-1000 Detector(s): Conductivity	8120823	2008	Inorganics (Anions)	XP
IC-10	Dionex ICS-1000 Detector(s): Conductivity	8120822	2008	Inorganics (Anions)	XP
IC-11 Dionex ICS-3000	Variable Wave. Detector	8120958	2009	Inorganics (Cr(VI))	XP
	Single Pump	9010071	2009		
	Column Comp.	8120362	2009		
	AS-DV Autosampler	10100586	2009		
IC-12 Dionex ICS-3000	Variable Wave. Detector	9060673	2009	Inorganics (Cr(VI))	XP
	Single Pump	9060616	2009		
	Column Comp.	9010928	2009		
IC-13	Dionex ICS-1100 Detector(s): Conductivity	9120764	2009	Inorganics	XP
IC-14 Dionex ICS-5000	Variable Wave. Detector	9100584		Inorganics	XP
	Single Pump	10100152			
	Column Comp.	10100022			
	AS-DV Autosampler	10100586			
IC-15	Dionex ICS-1100 Detector(s): Conductivity	14038039	2014	Inorganics	XP
	AS-DV Autosampler	14037446	2014		
ACA1	01 3360 Flow Analyzer Detector(s): UV	751893730	2007	Inorganics	XP
UV-4	Thermo Detector(s): UV	3DUK232006	2007	Inorganics	XP
UV-5	Thermo Detector(s): UV	3DUK228001	2007	Inorganics	XP
UV-7	Agilent 8453 Detector(s): Diode Array	CN22807187	2008	Inorganics	XP
UV-8	Agilent 8453 Detector(s): Diode Array	CN22808466	2010	Inorganics	XP
UV-9	Agilent 8453 Detector(s): Diode Array	CN22809400	2013	Inorganics	XP

FT-IR Spectrometer

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
IR-2	P.E. Spectrum Two	89327	2011	LUFT-DRO	Win ?

Automated Extractors

Designation	Manufacturer/Model	Serial Number	Acquired	Department
ASE-1	Dionex ASE-200	98120515	1999	Marine Lab
ASE-2	Dionex ASE-200	99090112	1999	Extractions

ASE-3	Dionex ASE-300	1100597	2002	Extractions
ASE-4	Dionex ASE-300	1100598	2002	Extractions
ASE-5	Dionex ASE-200	07040191	2007	Marine Lab
ASE-6	Dionex ASE-200	07010483	2007	Extractions
ASE-7	Dionex ASE-350	08080167	2010	Extractions
ASE-8	Dionex ASE-350	09020620	2010	Extractions
ASE-9	Dionex ASE-350	10090204	2012	Extractions
ASE-10	Dionex ASE-350	10090546	2012	Extractions

Solid Phase Extraction Unit

Designation	Manufacturer/Model	Serial Number	Acquired	Department
SPE-1	Horizon Tech/ 4790	11-1576	2010	Extractions
SPE-2	Horizon Tech/ 4790	11-1577	2010	Extractions
SPE-3	Horizon Tech/ 4790	11-1578	2010	Extractions
SPE-4	Horizon Tech/ 4790	11-1579	2010	Extractions
SPE-5	Horizon Tech/ 4790	11-1580	2010	Extractions
SPE-6	Horizon Tech/ 4790	11-1581	2010	Extractions
SPE-7	Horizon Tech/ 4790	11-1582	2010	Extractions
SPE-8	Horizon Tech/ 4790	11-1583	2010	Extractions

Misc. Shaker/Rotators

Designation	Manufacturer/Model	Serial Number	Acquired	Department
Rotator 7	Associated Design	3740-12BRE-11	?	Extractions
Rotator 9	Heidolf/REAX 20	120702298	?	Extractions
Rotator 3	Associated Design	1897	?	Extractions
Rotator 2	Associated Design	1282	?	Extractions
Rotator 8	Associated Design	2171	?	Extractions
Rotator 1	Associated Design	1697	?	Extractions
	Thermo MAXQ 2508	105253-3	?	Extractions
	Thermo MAXQ 3000	185905-68	?	Extractions
	Thermo MAXQ 3000	1411080905883	?	Extractions
	Southwest Sci. lncuShaker	1411080905883	?	Extractions
	Thermo MAXQ 3000	1411080398252	?	Extractions
	Thermo MAXQ 3000	141071288276	?	Extractions

Extraction Equip.

Designation	Manufacturer/Model	Serial Number	Acquired	Department
DVP001	Horizon DryVap Cone.	1131	?	Extractions
DVP001	Horizon DryVap Cone.	1377	?	Extractions

	Gerhardt SoxTherm	1803	2014	Extractions
	Gerhardt SoxTherm	1849	2014	Extractions
	Gerhardt SoxTherm	1555	2014	Extractions
	Gerhardt SoxTherm	2032	2014	Extractions
	FMS PowerVap Cone.	E-0235	2014	Extractions
	FMS PowerVap Cone.	E-0236	2014	Extractions

Particle Size Analyzer

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
PSA-1	B.C. LS13320	AT39390	2011	Marine Lab	XP

Gas Mixer

Designation	Manufacturer/Model	Serial Number	Acquired	Department
Mixer 1	Environics Series 2000	1490	1995	Air
Mixer 2	Environics Series 2000	4618	2009	Air

Wet Chemistry

Designation	Manufacturer/Model	Serial Number	Acquired	Department
PH 1	Fisher Accumet Basic	176	1997	10
PH 4	Fisher Accumet Basic	AB81210901	2004	10
ISE1	Thermo Sci. Orion Star	E03578	2011	10
SC 2	Amber Science 3082	108039	2001	10
SG S	Amber Science 2052	1106043	2011	10
TUR 3	HF Scientific Micro 100	301269	2003	10
10 01	Fisher ISOTemp Oven	40300024	2005	10
10 07	Fisher ISOTemp 6509 Oven	1580080398315	2012	10
10 08	Fisher ISOTemp 6509 Oven	1580080398313	2012	10
10 10	Fisher ISOTemp 6509 Oven	613128-624	2013	10
10 13	Fisher ISOTemp 6509 Oven	612568-551	2013	10
Thermo 01	Thermo Sci. FD1535M	152991101110630	2013	10
BOD 1	Thermo Auto. 10060000	A0067	2003	10
IC 04	Fisher 11-679-25C Incubator	2018080505659	2012	10
Balance 13	Fisher A-250	25275	1997	10
Balance 14	Ohaus E02140	11120030978	1998	10
Balance 13	Sartorious ME 235P	16503597	2004	10

	Fisher low temp incubator	2018080505659	10

Referigerators/Incubators

Designation	Manufacturer/Model	Serial Number	Acquired	Department
	Fisher low temp incubator	2018080505659	?	10
FG-23	True Manufacturing T-23	7251068	?	Extractions
FG-24	True Manufacturing T-23	1-3453096	?	Extractions
FG-25	True Manufacturing T-23	1-3496118	?	Extractions

Lab Water Systems

Designation	Manufacturer/Model	Serial Number	Acquired	Department
	Barnstead EasyPure RoDi	1332060134165		LUFT
	Barnstead Diamond RO	1266071286485		VOA
	Barnstead NANOpure 7143	491510-421		VOA
	Barnstead E-Pure 04641	1090090114250		10
	Barnstead E-Pure 04641	229758-32		LUFT D

Glassware Drying Kilns

Designation	Manufacturer/Model	Serial Number	Acquired	Department
Kiln-1	LL Kilns DaVinci	T3427-D-480-3P	2013	
Kiln-2	LL Kilns DaVinci	090111-F-CKG	2012	

Misc. Ovens

Designation	Manufacturer/Model	Serial Number	Acquired	Department
VOA-1	VWR 1325F	4094404		VOA
VOA-2	VWR 1350FM	400503		VOA
VOA-3	VWR 1325F	6109006		VOA
10-06	VWR 1350FM	1101302		VOA

IT Equip.

Designation	Manufacturer/Model	Serial Number	Acquired	Department
NAS-1	EMC CLARiiON Array	AMP00103500986	2010	Lincoln
NAS-2	EMC CLARiiON Array	AMP00103500987	2010	Lampson
	HP ProCurve switch 5406zl	SG04SU23M		Lampson
	HP ProCurve switch 5406zl	1N030TI1YZ		Lincoln
	Cisco 3800 router	FTX1143A4GP		Lampson
	Cisco 3800 router	FTX1143A4GQ		Lincoln
Server	Dell PowerEdge R900	FQBFDFl		Lampson

Server	Dell PowerEdge R900	3T8TKH1		Lincoln
Server	Dell PowerEdge 2650	JZR6F61		Lincoln
Server	Dell PowerEdge 2950	8MJWKH1		Lincoln
Server	Dell PowerEdge R720	5JB2TW1		Lincoln
UPS Batt. B/U	APC Symetra LX	ZA0624031279		Lampson
UPS Batt. B/U	Powerware PW9170	660C120AAAAAAAP		Lincoln

END OF DOCUMENT

ENGINEERING CONTROLS PLAN

CLOSURE PLAN

Prepared For:

EXIDE TECHNOLOGIES
Vernon, California

Prepared By:

ADVANCED GEOSERVICES
West Chester, Pennsylvania

Project No. 2013-2993-21
May 15, 2015
Revised July 28, 2015

1.0 INTRODUCTION

1.1 PURPOSE

This plan describes engineering controls to minimize release of liquids and fugitive emissions of lead and other toxic metals in air during closure of the Exide facility in Vernon, California. This document presents the general engineering control requirements for closure activities, as well as specific requirements for anticipated work activities for Phase 1 and Phase 2 closure.

1.2 SCOPE OF CLOSURE ACTIVITIES

The scope of closure activities, including work tasks, locations and estimated quantities, is provided in the Closure Plan. The scope of closure activities is not reiterated in this plan.

1.3 RCRA FACILITY INVESTIGATION

The RCRA Facility Investigation (RFI) may be implemented at the facility concurrent with closure activities. Engineering controls for the RFI are addressed in separate AQMD-approved mitigation plans and are not addressed in this plan.

2.0 ENGINEERING CONTROLS FOR LIQUID INFILTRATION

Closure activities generally include decontamination of equipment, areas and buildings with pressure washers. Engineering controls are intended to minimize infiltration of decontamination liquid into existing floors or pavement and sumps. Prior to wet decontamination, the concrete or asphalt floor surface will be vacuum cleaned to remove accumulated dirt, inspected for cracks and other damaged areas where liquids could infiltrate. Cracks will be vacuum cleaned to remove loose dust and dirt from within the cracks/damaged area. Vacuum cleaning will be performed using a SCAQMD permitted HEPA vacuum. The cracks/damaged areas will be sealed by installing MasterSeal (Sonolastic) ® SL1™ or equivalent.

Concrete sumps will also be inspected for cracks and other areas where liquids could infiltrate. Cracks will be cleaned using a SCAQMD permitted HEPA vacuum. HETRON® 922 Corrosion/Heat Resistant Epoxy Vinyl Ester Resin, or equivalent, will be applied to the bottom and interior sidewalls of concrete sumps with cracks, damage or exposed concrete in accordance with manufacturer's instructions.

Wet decontamination of equipment within the floor and sump area will occur following completion of curing in accordance with manufacturer's recommendations.

3.0 ENGINEERING CONTROLS FOR FUGITIVE EMISSIONS IN AIR

3.1 GENERAL

The goal of the engineering controls for fugitive emissions in air is to meet standard South Coast Air Quality Management District (SCAQMD) requirements pertaining to dust and emission controls to prevent emissions of lead and other toxic metals during the closure activities.

The closure activities for Phase 1 and assumed activities for Phase 2 are provided in the Closure Plan. Closure activities generally include the following potentially lead-dust generating activities:

Phase 1 (Closure)

- Inventory removal;
- Unit and equipment decontamination;
- Unit and equipment removal;
- Removal of emission control equipment filters;
- Emission control equipment (including ducts) decontamination and deconstruction;
- Building decontamination;
- Building gutting;
- Concrete milling, scarification and/or hydroblasting;
- Building deconstruction; and,
- Concrete, pavement, soil and soil gas sampling.

Phase 2 (Contingent Closure)

- Pavement removal;
- Soil excavation;
- Soil stabilization;
- ~~Concrete crushing and stockpiling;~~
- Backfill;
- Grading;
- Cap installation;
- Paving;
- Monitoring well maintenance;
- Lysimeter installation; and,
- Soil gas sampling probe installation.

The closure activities will be conducted in accordance with the requirements of SCAQMD Rule 1420.1 (h) (Housekeeping) and (i) (Maintenance Activity).

3.2 DEFINITIONS

High Efficiency Particulate Air (HEPA) Filter - a filter capable of trapping and retaining at least 99.97 percent of all monodispersed particles of 0.3 micrometer in diameter or larger (SCAQMD Rule 1403).

AQMD Business Days – Tuesday through Friday, excluding holidays.

3.3 WORK LOCATIONS

The location of closure activities is provided in the Closure Plan. Closure activities occur in one of two types of locations: (1) within an existing Total Enclosure Building, and (2) outside of an existing Total Enclosure Building.

3.3.1 Existing Total Enclosure Buildings

The existing Total Enclosure Buildings are as follows:

- Desulfurization Building (Mud Tank Building);
- RMPS Building;
- Reverb Feed Room Containment Building;
- Blast Feed Room Containment Building
- Baghouse Building; and,
- Smelter Building.

The following emission control equipment is currently operating at the facility and provides negative pressure for the aforementioned Total Enclosure Buildings. This emission control equipment is expected to remain in operation during closure with typical maintenance and repair until the equipment must be turned off, decontaminated and deconstructed as part of closure:

- Soft Lead Baghouse;
- Hard Lead Baghouse;
- Material Handling Baghouse;
- East and West MAC Baghouses;
- MAPCO Scrubber; and,
- North and South Torit Baghouses.

The existing operating air handling equipment will continue to operate to maintain negative pressure while decontaminating units and equipment, dismantling equipment, decontaminating building interiors, building gutting, and removal of metal wall and roof panels (i.e., de-skinning). The existing emission control equipment will not be operated while removing structural steel or concrete walls. The operating level of the equipment will be reduced as the size of the service area decreases to achieve negative pressure that meets the minimum requirements while

maintaining a safe work environment (i.e., excessive negative pressure could pull the enclosure in on itself, putting personnel within at risk).
The air handling equipment at the existing Total Enclosures will maintain a negative pressure of at least 0.02 mm of Hg (0.011 inches of H_2O). Measurements will be conducted using the existing monitoring system or a temporary monitoring system. As required by SCAQMD 1420.1, the in-draft velocity will be maintained at greater than 300 feet/minute and will be determined by placing an anemometer at the center of the plane of any opening of the Total Enclosure.

If the sequence of closure prevents existing emission control equipment from providing negative pressure for the aforementioned buildings, then existing equipment will be re-ducted to provide negative pressure, or a temporary negative air system with a SCAQMD permitted HEPA filtration will be used. It is expected that the Torit and MAC Baghouses will provide negative pressure through building deconstruction.

An area for personnel to remove soiled personal protective equipment (PPE) and decontaminate boots will be located at each main entry point in the Total Enclosure.

The closure tasks occurring within Total Enclosure Buildings with existing operating emission control equipment and the associated engineering controls are summarized on the attached table.

3.3.2 Temporary Enclosures

Closure activities outside of Total Enclosure Buildings with existing operating emission control equipment will be conducted within temporary enclosures with a negative air system with SCAQMD permitted HEPA filtration. The size of the enclosure will be dictated by the work task and size of equipment. The temporary enclosure will be constructed of a frame covered with heavy fire resistant reinforced plastic sheeting. The negative air unit will be sized to provide a minimum of 4 complete air changes per hour based on the size of the enclosure. The tent will be inspected hourly to ensure that there are no tears or leaks. Work inside the temporary enclosure will be suspended if a tear or leak is found until the tear or leak is repaired. Deconstruction of concrete and masonry walls may be performed without the use of enclosures if characterization chip sampling for the interior and exterior of the wall has been performed and the results demonstrate that the concrete has total lead concentrations less than 320 mg/kg. However, effective dust control and air monitoring measures will be used throughout the course of the work regardless of total lead concentrations.

A protective clothing change area will be established at the ingress/egress into the area. The change area will consist of a small tent placed immediately adjacent to the temporary enclosure. Poly sheeting will be installed between the temporary enclosure and the tent to seal off any openings and provide positive ventilation thru the change area. Personnel entering the work area will don PPE prior to entry and will remove the soiled PPE upon exit. Multiple layers of poly sheeting will be installed on the floor of the change area. The uppermost layer will be removed and bagged for disposal once personnel have removed their soiled PPE. The soiled PPE and plastic sheeting will be placed into a properly labeled container for offsite disposal.

The air handling equipment at the temporary enclosures will maintain a negative pressure of at least 0.02 mm of Hg (0.011 inches of H_2O). Measurements will be conducted using a temporary monitoring system. As required by SCAQMD 1420.1, the in-draft velocity will be maintained at greater than 300 feet/minute (fpm) and will be determined by placing an anemometer at the center of the plane of any opening of the temporary enclosure.

If access into the temporary enclosure is required, an airlock-type temporary door with at least 300 fpm draft, verified using a handheld anemometer, will be constructed to provide access into and out of the temporary enclosure.

The work area will be vacuumed using a vacuum equipped with a SCAQMD permitted HEPA filtration prior to the start of work and, at a minimum, at the end of each shift. More frequent cleaning using the SCAQMD permitted HEPA vacuum will be performed if dust is present on the floor.

Once the work is complete, the roof and interior of the temporary enclosure will be cleaned using SCAQMD permitted HEPA-equipped vacuums to remove any dust prior to removal. - The interior of the temporary enclosure will be wiped down and sprayed with an encapsulant such as Fiberlock or similar before dismantling a temporary enclosure or removing plastic sheeting.

In the event that a temporary full enclosure is not physically feasible, work will be conducted within a partial enclosure (a structure comprised of walls or partitions on at least three sides or ¾ of the perimeter) in accordance with Rule 1420.1.

It is anticipated that free-standing temporary enclosures will be constructed for the Oxidation Tank Area, Former WWTP, and WWTP. Where possible, temporary enclosures will be re-used. For example, the temporary enclosure for the Former WWTP may be sized so that it can be re-used at the WWTP.

The existing roof and columns at the Container Storage Areas, Drop Out System area, and West Yard Truck Wash will be used to support temporary enclosure walls. A temporary enclosure wall will separate the Central Container Storage Area (Unit 1) and the Drop Out System area.

Smaller moveable temporary enclosures will be used for activities outside of these areas, such as cleaning an individual inlet structure or sump, as they will be limited in size.

The closure tasks occurring within temporary enclosures are summarized on the attached table.

3.4 GENERAL ENGINEERING CONTROLS

3.4.1 General Methods

Exide and its contractors will implement the following general engineering controls at all locations to minimize emissions during implementation of the Closure Plan.

- At the start of closure activities in a particular work area, accumulated dust in the work area that may contain lead or other toxic metals will be removed from horizontal surfaces, such as building columns, upper rafters and supports, and from equipment using wet wash down methods and/or SCAQMD permitted HEPA- equipped vacuums. The dust will be collected and recycled at a secondary lead smelter or disposed off-site. –Any large debris generated during the work shall be placed into bags or wrapped in poly sheeting prior to removal from the work area. At the Total Enclosure Building, the roll-up doors in the vicinity of the dust collection will be closed during dust removal.
- Any dust, dirt or sediment accumulations will be removed with a SCAQMD permitted HEPA-equipped vacuum or wet methods. Brooms will not be used for dry sweeping, but may be used for scrubbing/cleaning a surface if the broom and the surface are wet. Use of shovels will be limited to those materials which cannot successfully be removed with a SCAQMD permitted HEPA-equipped vacuum.
- During the actual work of removing the dust, dirt, sediment accumulations or waste material, the material shall be kept wetted or vacuumed to mitigate fugitive emissions produced at the work surface. All materials cleaned up from this work shall be collected and transported to a designated area inside the Total Enclosure for storage and disposal.
- The liquid run off from areas that are wetted shall be contained or directed into drains and collected for treatment so as not to allow the liquid run off to evaporate and cause a secondary means of dust to be entrained into the air
- All lead-contaminated equipment and materials will be stored in a manner that does not generate fugitive lead-dust, or will be cleaned by wet wash or a SCAQMD permitted HEPA filter-equipped vacuum. Large piles of material will not be stored near the Total Enclosure roll-up doors to minimize the release of fugitive emissions through the rollup doors when open.
- Equipment and vehicles shall be decontaminated inside the Total Enclosure Building prior to exiting the building.
- No outside work will be performed when sustained winds exceed 12 MPH or instantaneous wind gusts exceed 20 MPH as measured by the stationary upwind and downwind dust monitors as well as by the Dust Mitigation Oversight representative with a Pocket Weather Tracker 4500NV.
- No work inside the Total Enclosures will be performed if the negative air system for the work area is not operating, and it is intended to be operating.
- All equipment, including SCAQMD permitted HEPA-equipped vacuums and negative air pressure equipment, will have current SCAQMD permits to construct/operate for a facility subject to Rule 1420.1. The permits shall be held by the Contractor or subcontractor conducting the work. Exide will not hold the permits.

- The established plant speed limit of 5 mph as required by the Basic Safety Orientation Form HS002, Rev 3.19.2014 shall be required of every employee, contractor and visitor.
- Exide will designate an environmental staff person whose responsibility it is to assure ongoing and sustained compliance with applicable SCAQMD Rules and Regulations. This environmental designee shall be trained and knowledgeable of Rule 1420.1 and Rule 1420 and be empowered to expeditiously employ sufficient mitigation measures and stop work to gain facility compliance.
- All facility trash and debris designated for offsite disposal will be placed in covered containers prior to transfer to a rolloff container within the Total Enclosure Building.
- All personnel shall ensure that all spent PPE (i.e., ~~–~~gloves, boots and Tyvek coveralls) are disposed in containers within the Total Enclosure.
- The preferred method for metal cutting will be cold cutting. Cutting with torches will be conducted only if necessary. When the work includes "hot" techniques like cutting torches, welders, burners, etc., Exide's HOT WORK PERMIT will be used.
- All r~~R~~ecords will be maintained by Exide and its contractors for 5 years. In addition, copies of all records will be furnished to DTSC at the end of construction activities.

3.4.2 Total Enclosure Buildings

The following activities will be performed inside the Total Enclosure Buildings.

Each overhead door location at the Total Enclosure Buildings will be equipped with potable water for decontamination of materials and equipment prior to transfer outside of the enclosure building. The overhead door will remain closed during all decontamination activities for material and equipment transfer to prevent the release of contaminated overspray out of the building. The decontamination area floor will be cleaned prior to removal of the piece of equipment to ensure lead residue is not transferred outside of the Total Enclosure Building.

It is anticipated that the Corridor will be used as a decontamination area for materials, equipment and vehicles to the extent possible during Phase 1.

Rollup doors of the Total Enclosure Buildings will be kept closed as much as possible during the closure activities. Additional detail is noted in Section 3.5.

3.4.3 Work Within Temporary Enclosures

All removed debris at temporary enclosure work areas shall be placed and sealed in 55-gallon drums or a lined hopper and taken to the Total Enclosure Building and deposited into the roll-off container. The exterior surfaces of the 55-gallon drums and hoppers shall be rinsed or wet cleaned prior to being taken outside of the temporary enclosure. Oversized debris not fitting

within drums or hoppers shall be wrapped in plastic tarps or sheeting and sealed using adhesive tape. The plastic tarp or sheeting shall be rinsed or wet cleaned prior to removal from the temporary enclosure.

3.4.4 Drilling, Pavement Removal and Placement and Soil Activities

Drilling (excluding direct push and roto-sonic techniques), pavement removal and soil handling activities will be completed in an enclosure (total enclosure or temporary enclosure) with negative air and SCAQMD permitted HEPA filtration. Direct push (geoprobe) and roto-sonic drilling techniques do not generate cuttings and may be performed without the use of an enclosure, although the sample extraction area shall be located within an enclosure.

Concrete or asphalt cutting/drilling may be performed outside Total Enclosure Buildings and will be conducted using wet methods to minimize generation of dust. The concrete being removed will be kept damp to minimize the generation of dust. —Additional dust control will include applying a fine water mist directly on the work surface during the deconstruction activities. A fine water mist will also be applied to the concrete and soil as it is being excavated to minimize the generation of dust.

For areas where pavement must be removed, including drilling locations, grading of soils prior to pouring concrete or asphalt paving shall only be performed if soil surface that will be disturbed has a minimum 12% moisture content. Newly imported crushed aggregate or sand used as subgrade for new paving is not required to meet the 12% moisture requirement.

Any soil grading/leveling project with total lead concentrations over 320 mg/kg which has the potential to generate any dust shall be performed under temporary negative pressure enclosures maintained through the use of a SCAQMD permitted HEPA negative air machines. Regardless of whether or not the grading is performed under temporary negative pressure enclosures, water or a stabilizing agent will be applied in sufficient quantities to prevent the generation of visible dust plumes when the work area is not immediately to be covered by plastic sheeting, geotextile fabric, newly imported subgrade, concrete, asphalt, or paving material. Effective dust control and air monitoring measures will be employed during all portions of the work regardless of total lead concentrations.

Any drilling, pavement removal and soil disturbing activities outside of the Total Enclosure Buildings will be performed only when sustained wind velocities are less than as noted in Section 3.4.1.

3.4.5 Waste Management

3.4.5.1 **Roll-off Containers**

All materials intended for off-site disposal or recycling will be washed as indicated in the Closure Plan prior to placement in a roll-off container. Roll-offs will be staged within the Total Enclosure to minimize trips into and out of the building as well as minimize the possibility of

dust being released into the environment that could be generated when placing materials into the roll-off container. The roll-off will be similar to roll-offs currently in use at the facility. The roll-off container shall have metal or hard plastic covers and will be covered when not in use (i.e., when materials are not being actively placed into it). The exterior of the roll-off container will be decontaminated with potable water and tarped prior to removal from the Total Enclosure Building. Along with the tarping, shrink wrap plastic shall be applied over the tarp that shall extend from the top of the container to below the tarp on the container sides to further reduce the chance for fugitive emissions.

Roll-off Containers will be totally contained where no dust or liquid leaking is allowed during transport. Containers used for debris collection, storage and transport, including but not limited to the roll-off containers, shall be completely sealed prior to transport across open areas of the facility outside of Total Enclosure Buildings.

3.4.5.2 **Truck Trailers**

The following procedures shall be used for loading of bulk waste material into truck trailers, including but not limited to feed material, plastic chips, sediment, residue, concrete or soil.

- The material shall be carefully loaded with front end loaders into leak proof / end dump trailers in a manner to prevent or minimize any fugitive dust generation during the loading operation. The use of water sprays on dusty stockpile material shall be utilized to help in fugitive dust control during loading. Also, water misting sprays shall be utilized at the loading point of the end dump trailers while the material is transferred into the trailers.
- Each end dump trailer shall be first inspected and examined to ensure there are no cracks or holes in the container prior to lining the containers in preparation for loading of the trailers. This inspection shall be noted on the pre-loading checklist (see attached Pre-Loading checklist).
- The end dump trailers are a leak-proof design and after inspection for cracks or holes in the container shall be lined at the facility with a single ten~~6~~-mil poly propylene liner prior to loading any material. This will enhance the existing gasketed rear door.
- The ten~~6~~-mil poly propylene liner shall be of such a dimension in length and width in order to make a “burrito” type enclosure around the loaded material using industrial type duct tape after the material has been loaded. This procedure mimics that used to transport material containing asbestos.
- The rib structure on top of the end dump trailers shall be rotated out of the way prior to lining, loading and completion of the burrito wrap. The rib structure shall then be rotated back into position for cleanup and securely covering the trailer with tarp material.

- The rib structure above the end dump trailer and the top edges of the trailer shall be completely wiped clean with wet cloth after completion of loading of the material into the trailer in order to remove any dust or debris collected on the ribs structure or top edges during the loading operation.
- After cleaning of the rib structure and top edges of the trailer, the outside of the trailer will be pressure washed to remove any dust or debris from the loading operations.
- Each end dump trailer shall be securely covered with a tarp system in a manner to cover all gaps and to provide for a sealed trailer during removal and shipment.
- The tarped trailer and truck shall be first inspected to ensure that there are no gaps and that the container is fully secured and sealed and then power spray washed with city water to remove exterior dust from the trailer, tarp and truck.
- All of the above activities shall be conducted in the Reverb Feed Room Corridor section (with the door to the Corridor closed during loading and decontamination, and will be opened only during entry and exit) inside the Total Enclosure Building which is under negative pressure and which is vented to air pollution control system which is permitted by SCAQMD and is in full operation and is equipped with SCAQMD permitted HEPA filtration.
- The truck and trailer will be inspected for adequacy of decontamination and complete a Decon Checklist (see attached Decon checklist).
- Trucks used for off-site shipments of material shall go through Unit 87, West Yard Truck Wash before leaving the facility. The trucks with the end dump trailers shall not be stored at the facility. Exide shall maintain records of washed trucks on the Truck Wash Log/Spread Sheet and records maintained inside the Bandini Street guard station, or other appropriate location at Exide, and made available to SCAQMD and DTSC staff, upon request.
- The transport trucks shall be dry and not dripping water from the trailer prior to leaving the facility. There can be no uncertainty regarding existence of any leaks vs. dripping of water from the West Yard Truck wash. Dripping of liquid ~~hazardous~~ waste during offsite transport is not allowed.

3.4.6 Scrap Metal Management

All scrap metal materials (pipe, ducting, panels) which are too large for the scrap roll-offs shall be cut down to shipping size within the remaining portions of the Total Enclosure Building or a temporary enclosure per Section 3.3.2. Sized scrap metal will be washed with potable water as indicated in the Closure Plan, and placed in roll-offs using the procedures in Section 3.4.5.

3.4.7 Electrical Supply

The facility's existing electrical service will be used to the extent possible during closure. If the existing electrical service is not available during a particular work task, temporary electrical power generators will be used.

3.4.8 Modifications

Even with good planning and engineering controls implementation, elevated readings may occur at the ambient monitors. The work activities will be assessed and procedures modified as needed prior to resuming work.

3.5 SPECIFIC ENGINEERING CONTROLS

The following engineering controls will be implemented for the tasks shown.

3.5.1 Inventory Removal

Removal of waste inventory shall be done either manually, with no tools, or with a variety of tools (such as shovels, bars, jack hammers and pumps) and utilizing mobile equipment to transport the materials. The removed materials shall be transported to the appropriate location for loading into a shipping container. The work area, including the floors adjacent to and around the specific material to be cleaned up, shall be cleaned of any dust by wet methods or vacuumed with a vacuum equipped with an SCAQMD permitted HEPA filtration prior to the start of work. During the actual work of removing the material, the material shall be kept wetted to mitigate fugitive emissions produced at the point of impact.

3.5.2 Stack Capping

The stacks associated with existing emission control equipment shall be capped and sealed prior to decontamination and deconstruction of existing emission control equipment. The capping/sealing will be completed by installing a gasketed, steel plate to the top of the stack. The plate is secured to the stack by bolted flanges to tightly seal the plate and to prevent the plate from sliding off the stack in a windy condition. Since the stack is outside and above the roof of the Total Enclosure Building, the capping will occur outside of the Total Enclosure Building.

3.5.3 Stack and Ventilation A-Pipe Removal

The work will include the removal of the existing emission control equipment A-pipe, stacks and stack support structures which extend through the roof of the Total Enclosure Building. The stacks begin near the ground surface within the Total Enclosure Building, and extend upward through the roof and project above the roof to varying heights. A scaffold system will be installed on the roof to provide a means to construct a temporary enclosure per Section 3.3.2 around each existing stack support structure prior to their removal. The temporary enclosure will be large enough to enclose the roof opening required to remove the stack. The scaffold will be totally enclosed using reinforced fire resistant poly sheeting. The temporary enclosure will be operated under negative pressure and vented to a SCAQMD permitted HEPA filtration control device. The roof in the area of the scaffolding will be cleaned using SCAQMD permitted HEPA vacuums and washed prior to installation of the scaffolding. All water used for washing the roof

areas shall be captured and treated properly to prevent a secondary means of fugitive emissions into the air.

Once the exterior scaffold has been erected and enclosed, the structure that supports the A-pipe or stack will also be wrapped with fire resistant poly sheeting to provide secondary protection. The installation of the secondary enclosure will be completed by accessing the pipe support structure from inside of the building. The support structure will be removed within the temporary enclosure. Roof sheet metal and roof structural steel will be removed within the temporary enclosure as needed to allow removal of the stack.
Lifting lugs will be welded to the top of the stack. A 9 mil plastic sheeting tube will be placed over the stack section which projects above the temporary enclosure. A crane will be used to hold the weight of the stack. The stack will be cut using cold methods near the roof line and within the temporary enclosure. The cut section of stack will be lifted up and the end of the stack covered. The cut section will be lifted up above the roof and lowered to the ground. The hole in the roof will be covered until the next section of stack is ready to be removed. Additional sections of stack within the building will be removed using similar methods (i.e., cut, cover the end, lifted to above roof, lowered onto the ground). It is anticipated that each stack will be removed in approximately 3 sections. The roof of the temporary enclosure will be covered after all stack sections have been removed. Structural roof steel and sheet metal will be installed over the opening in the roof. The temporary enclosure will be removed.

3.5.4 Emission Control Equipment Removal

Spark arrestors or equivalent precautions will be employed when hot work will be vented to dry filter media. All materials removed will be washed with potable water prior to placement into a container for proper offsite disposal or recycling. Scrap metal management procedures in Section 3.4.6 will be used.

3.5.5 Baghouse Bag Removal

A temporary enclosure equipped with a SCAQMD permitted HEPA-filter will be erected within the Total Enclosure across the top compartment doors of the baghouse and around the bottom collection hoppers of the baghouse. This enclosure is being put in place to prevent any fugitive dust from leaving the baghouse unit cells and lower hopper sections. These engineering controls shall prevent fugitives from the removal of old bags. Service platforms will be covered with plastic sheeting and extend up and over the handrails in order to contain any dust that may fall when removing the filters.

Filter bags will be removed from each cell and placed into a leak tight plastic bag and sealed. These bags shall be placed in a roll-off container that is staged inside of the Total Enclosure Building.

Accumulated dust will be removed from horizontal surfaces using wet wash down methods and/or SCAQMD permitted HEPA vacuums. All collection hoppers and screw housings will be cleaned out using collection screws and SCAQMD permitted HEPA vacuums. The plastic

sheeting on the service platform will be rolled up after use and placed into a leak tight plastic or other impermeable material and then placed in a covered roll-off container. Equipment will be decontaminated by pressure washing and deconstructed.

3.5.6 Brick Removal

If the equipment containing brick can be moved (i.e., blast furnace crucible), the equipment will be moved to the decontamination area at the Corridor for removal of brick. The brick will be removed using wet deconstruction techniques, which will include pre-wetting the refractory brick and applying a fine water mist onto the surface being demolished. The brick will be transferred into a roll-off container or suitable shipping vehicle staged within the Total Enclosure Building. Once the brick has been removed, the remaining equipment will be cleaned by washing with potable water.

If the equipment containing brick cannot be moved, the brick will be pre-wetted at its current location and a fine water mist will be applied to the surface being demolished. The brick will be transferred into a roll-off container or suitable shipping vehicle staged within the Total Enclosure Building.

3.5.7 Crack Sealing

Floor cracks will be cleaned and sealed prior to area or building decontamination as noted in Section 2.0. Cracks will be cleaned using a SCAQMD permitted HEPA-vacuum and will have caulk applied. When sealing floor cracks in the Total Enclosure Building, the roll-up door in closest proximity to the work area shall remain fully closed during the activity to prevent any cross draft and for a period of one hour after completion of the repairs. Due to concerns with water infiltration into unsealed cracks, the floor surfaces will not be wetted down prior to the work.

3.5.8 Sump Sealing

Sumps will be cleaned and sealed prior to area or building decontamination as noted in Section 2.0. Depending on the sump condition, work may include wet cutting and jack hammering of coating and surface concrete, abrasive preparation of concrete surface, and application of chemical resistant coating. Work will be conducted in the Total Enclosure Building or in a temporary enclosure. All removed debris shall be placed and sealed in 55-gallon drums or a lined hopper and taken to the Total Enclosure Building and deposited into the roll-off container. The 55-gallon drums or hoppers shall be rinsed or wet cleaned prior to being taken outside of the temporary enclosure.

3.5.9 Decontamination

Engineering controls during decontamination of area and building walls, ceilings and floors will be provided by the negative pressure equipment associated with the Total Enclosure Building or temporary enclosure.

3.5.10 Deconstruction

The exact sequence of deconstruction of the RMPS Building, Reverb Feed Room, Baghouse Building and Smelter Building will be established during closure based on the Deconstruction Engineering Survey. The Baghouse Building will likely be deconstructed first as it is structurally dependent on the RMPS Building, Reverb Feed Room and Smelter Building. Existing operating emission control equipment associated with these areas (Soft Lead, Hard Lead, Material Handling, MACs, MAPCO Scrubber, Torits) will continue to operate until they are shut down, decontaminated and deconstructed in conjunction with the building deconstruction sequence. The Torits and the MACs will likely be used to maintain negative pressure during deconstruction.

Negative pressure will be maintained on the building while de-skinning (i.e., removing wall and roof panels) using existing emission control equipment or temporary equipment. A windbreak will be constructed on outside walls by putting heavy duty 10 mil minimum plastic sheeting on scaffolding or supported by structural building elements. The wall skin will be removed panel by panel using the following methods:

- Spray panel to be removed with water to control dust expected at panel overlaps.
- Cut the fasteners and maintain panel in its original position.
- Vacuum dust accumulations within panel overlaps with SCAQMD permitted HEPA vacuum.
- Wipe the overlaps and face of structural members with a damp rag or pressure wash the overlap to remove dust accumulations.
- Remove the panel and lower to the ground in a controlled fashion.

Following wall skin removal, the roof skin will be removed panel by panel using the following methods:

- Within an approximately 10 ft by 10 ft by 10 ft mobile negative pressure tent on top of the roof, remove 50% of the roof panel screws while vacuuming with a SCAQMD permitted HEPA vacuum. Seal holes with silicone as the screws are removed.
- Cover roof panels with 10 mil plastic sheeting and seal to the perimeter scaffolding and structures. Use rope or sand bags to hold the plastic sheeting in place as needed. This procedure will completely enclose the section of the roof to be removed with plastic sheeting.
- Use standoff supports with rounded ends to separate the plastic sheeting from roof panels without damaging the plastic sheeting. The standoff supports will be approximately 4 to 6 inches tall.

- Remove roof panels in small sections by cold cutting from inside the building while ensuring the 10-mil plastic sheeting is not damaged. Remove the cut section and lower to the ground in a controlled fashion. It is anticipated that the roof panels will be removed in a row along the peak of the roof, parallel to the girt line, and then downwards row by row towards the roof/wall interface.
- As roof panels are removed, remove remaining screws connecting the roof panel to the structural steel from above or below the roof.
- As panels are removed, allow plastic sheeting to lay on structural steel. Use rope or cables between structural girts and trusses to create a grid to support the plastic sheeting.

Panels will be sorted by material type, and containerized for off-site recycling or disposal. The wall windbreak and roof plastic will be removed. Once the work is complete, the scaffolding and plastic will be cleaned using SCAQMD permitted HEPA-equipped vacuums to remove any dust prior to removal. The interior of the windbreak will be wiped down and sprayed with an encapsulant such as Fiberlock or similar before dismantling the windbreak or removing plastic sheeting.

Negative pressure equipment will be shut down.

Structural steel for the walls and roof will be removed to the top of concrete wall using cold cutting and conventional equipment. The buildings will be systematically dismantled from the roof level down to the ground level. It is anticipated that gross deconstruction will be performed using large-tracked excavators (operating weight greater than 50,000 lbs) equipped with rotating shear or grapple attachments to cut and remove structural members down to the concrete slab/foundation level.

Concrete walls will be sampled on both sides to determine the lead content of the concrete. If the total lead concentration is above 320 mg/kg, then deconstruction must be performed within an enclosure operated under negative pressure. If total lead concentration is below 320 mg/kg, then enclosure and negative pressure are not required, but dust control and air monitoring measures will be used throughout the course of the work regardless of total lead concentrations. ~~.~~ Concrete wall deconstruction to surrounding grade shall be performed using hydraulic hammers or concrete shears attached to standard construction equipment. Hydraulic hammers and shears shall be operated with continuous water spray/misting techniques to prevent generation of concrete dust.

High pressure water deconstruction techniques may be performed in limited areas in lieu of hydraulic hammers and concrete shears with water spray/misting techniques. High pressure water deconstruction can include the use of a “water knife” to cut concrete apart or high pressure nozzles to pulverize the concrete. By its very nature, deconstruction with high pressure water prevents the generation of dust, but requires the collection and management of large amount of water. This method also provides the ability to remove concrete surfaces to very discrete depths and horizontal limits.

3.5.12 Drilling

Soil sampling, soil gas sampling, lysimeter installation and soil gas probe installation will occur using drilling. Drilling techniques are expected to include direct push technology (i.e. Geoprobe), Rotosonic and/or hollow stem auger, and the specific technique for each location will be selected based on several factors, including: depth of required sampling, type of samples required, and contaminants of concern. Geoprobe and Rotosonic drilling have little to no potential for generation of dust because both techniques allow advancement of the boring without the creation of cuttings and collect a continuous sample in a plastic sleeve. Hollow stem auger drilling causes greater potential for fugitives, and its use will be minimized.

3.5.12.1 **Drilling Inside Total Enclosure Building**

Prior to the start of drilling activities within the Total Enclosure Building, the floor surfaces where the soil sampling is to take place shall be wetted down or power washed depending on how clean the concrete surface is. Water misting and wet dust suppression shall be done through the entirety of the project including but not limited to all concrete cutting, and jack hammering. The rollup door in proximity to the work area shall be closed at all times during sampling.

Concrete sections from the drilling not retained for laboratory analysis shall be placed into a roll-off container that is staged inside of the Total Enclosure Building. Roll-off management shall be as discussed in Section 3.4.5.

To identify subsurface utilities, the sample location will be spray-painted or otherwise marked. At least 48 hours prior to drilling, Underground Service Alert (USA) will be called to identify subsurface utilities in public areas. A combination of previous utility locations, facility knowledge, hand augering the upper most 5 feet and/or private utility location will be used to identify subsurface utilities in privately owned areas.

3.5.12.2 **Drill Site Preparation Outside Total Enclosure**

The mitigation measures in this section are designed for drilling outside of the Total Enclosure Building. Drill site preparation will involve identifying subsurface utilities; coring or sawing through pavement materials; verifying the absence of subsurface utilities at the boring locations; setting up work zones; providing the containers required to contain waste materials; laying down polyethylene sheeting or equivalent to minimize the post-drilling cleanup operation; and setting up a sample examination area.

To identify subsurface utilities, the sample location will be spray-painted or otherwise marked. At least 48 hours prior to drilling, Underground Service Alert (USA) will be called to identify subsurface utilities in public areas. A combination of previous utility locations, facility knowledge, hand augering the upper most 5 feet and/or private utility location will be used to identify subsurface utilities in privately owned areas.

If the drill site is paved with concrete or asphalt, it will be cored or saw-cut to provide access to the underlying soil. The dimensions of the opening in the pavement will be large enough to accommodate the drill rig's auger/stem and/or lysimeter surface finishing, whichever is appropriate for the location. Coring or saw-cutting will be conducted as noted in Section 3.4.1.

Hand augering to clear the boring location for utilities will take place within the temporary enclosure equipped with SCAQMD-permitted HEPA filtration device for lead and operated under negative pressure. The clearance diameter should be at least as wide as the largest diameter hole that will be mechanically drilled. Location-specific conditions may require deeper clearance. The ground surface will first be covered with plastic sheeting, at least 10 mil or greater, extending to at least six feet beyond the boring location. The temporary enclosure will then be set into place over the boring location. No hand auger work will take place unless inside an enclosure with a SCAQMD-permitted HEPA filtration device for lead which is operating under negative pressure. The hand auger will be removed from the hole taking care to retain the subsurface material in the auger and a disposable aluminum pan placed under it. The subsurface material will be examined and logged, and any required samples collected for analysis. The excess material and the disposable pan will be placed in a sealed 55-gallon drum or lined hopper which is completely covered or tarped, except during loading. The drum or hopper is taken into the Total Enclosure where it is dumped into the roll-off. The roll-off is washed with potable water and shrink wrapped before being taken outside the Total Enclosure Building as noted in Section 3.4.5.1. After the boring location is cleared for utilities, the plastic sheeting will be vacuumed with a vacuum equipped with a SCAQMD-permitted HEPA filter for lead.

The work support zone will be delineated in the field using a combination of orange traffic cones, barricades, and yellow caution tape as necessary. The dimensions of the zone will be established in the field based on site-specific geography. At a minimum, the work zone will be large enough to accommodate the drill rig, any required support vehicles, waste containers, and a sample processing area. The sample processing area may be located at a location near the work zone if adequate space is not present at the drilling location.

The area around the boring site, underneath the drill rig, connected support truck, sample processing area, and the waste containers will be protected by laying down heavy-gauge (10 mil or greater) polyethylene sheeting. The edges of the plastic sheeting will be secured to prevent unintended uplift from wind. A second layer of sheeting will be placed over the primary layer and will generally extend at least 6 feet from the boring location. Second layers of sheeting will not be used in walking areas due to slippery conditions. A wind screen will be set up on the upwind side of the proposed boring between 5 and 10 feet from the boring location. At the end of each working day, the plastic sheeting will be vacuumed with a vacuum equipped with a SCAQMD-permitted HEPA filter for lead. On completion of drilling operations, the polyethylene sheeting will be rolled up and disposed of along with other miscellaneous solid wastes in sealed drums or lined hopper, and the borings will be grouted.

3.5.12.3 **Direct-Push Drilling**

Shallow soil borings, including soil gas probes, proposed to be drilled to depths up to 72 ft bgs (below ground surface) are expected to be completed by direct push drilling methods with a truck-mounted rig. Direct push refers to tools and sensors that are "pushed" into the ground without the use of drilling to remove soil or to make a path for the tool. A Geoprobe® direct-push rig relies on a relatively small amount of static (vehicle) weight combined with percussion as the energy for advancement. Direct push drilling is one of the faster methods of drilling and sampling shallow borings and does not generate soil cuttings. The Geoprobe® system uses hollow, steel push rods ranging from 1-inch to 3.25-inches in diameter and are typically four feet in length. As the push rod is advanced into the ground, additional lengths of rod are added. Various sampling tools can be attached to the rods to allow for continuous or depth-discrete soil sampling.

3.5.12.4 **Rotosonic Drilling**

Rotosonic drilling is typically used for monitoring well installation. Monitoring well installation is not anticipated during the closure activities; however, the procedures have been provided in the event they are needed.

Rotosonic drilling utilizes high-frequency resonant energy to advance an outer, temporary conductor casing(s) and an internal core barrel into the underlying formation(s). Hydraulic motors on the drill head oscillate internal unbalanced weights. As a result of the weights being unbalanced, extreme vibrations are created in the drill stem allowing the drill to penetrate virtually any material with minimal side wall disturbance. In addition to the vibration, rotosonic drilling uses both rotation and down pressure of the drill casing to advance the borehole. The core barrel provides a continuous core of subsurface materials, while the conductor casing stabilizes the boring and provides a temporary seal of water-bearing unit(s) during coring. Rotosonic drilling also allows for telescoping of multiple outer conductor casings to seal-off multiple water-bearing units as needed.

MATERIALS AND EQUIPMENT: The following materials and equipment are required for implementation:

1. Rotosonic drill rig and associated equipment and materials;
2. Plastic Sheeting (10-mil min.);
3. Duct tape;
4. Flat shovel;
5. Hose and spray nozzle;
6. Hand auger;
7. Covered containment vessel for soil cuttings (drums, hopper or roll-off bin);
8. Plastic sleeves (socks) for core samples;
9. Portable safety/windscreen (4-ft high and 10-ft long min);
10. Four-sided temporary enclosure constructed of fire resistant poly sheeting fitted over a PVC frame and equipped with a SCAQMD-permitted HEPA filtration

device for lead and operated under negative pressure while work is being performed; and,

11. Absorbent booms or pads.

The following procedures are based upon ASTM D6914-04 (2010) "Standard Practice for Sonic Drilling for Site Characterization and the Installation of Subsurface Monitoring Devices."

Preliminary Set up

1. Spread double layer of 10-mil reinforced plastic sheeting over work area with proposed boring no closer than 6-ft from any edge. Secure edges using duct tape or sand bags to prevent unintended uplift from wind or equipment. Spread a single layer of plastic sheeting of 10-mil in any area of foot traffic including the path to and beneath the enclosure for examination of soil samples if one is being used and secure edges with duct tape or sand bags. Spread double layer of 10-mil reinforced plastic sheeting over work area with proposed boring no closer than 6-ft from any edge. The second layer of plastic is not used in walking areas due to slippery conditions. Secure edges using duct tape or sand bags to prevent unintended uplift from wind or equipment. Spread a single layer of 10-mil plastic sheeting in any area of foot traffic including the path to and beneath the enclosure for examination of soil samples if one is being used and secure edges with duct tape, unless the soil examination area is a significant distance away and facility traffic crosses the path. In this situation, the samples will be double-lined with two layers of plastic socks.

2. Erect safety/wind screen on upwind side of proposed boring between 5 and 10 feet from location of boring. Distance may be greater than 10 feet if lead driller believes proximity will create a safety hazard for proposed drilling operations. (Note plastic sheeting is not expected to extend to safety/wind screen, although efforts shall be made to limit foot traffic beyond plastic sheeting).

3. Connect hose with nozzle to water source and activate water source and confirm sprayer is operational.

4. Examination of soil samples outside of the Total Enclosure Building will be done within the temporary enclosure equipped with SCAQMD-permitted HEPA air filtration device for lead and operated under negative pressure while soil examination is taking place.

5. Utility Clearance will be conducted as noted in Section 3.5.12.1.

6. If excess soil comes in contact with the exterior ground surface, it shall be immediately removed by means of a vacuum equipped with a SCAQMD-permitted HEPA filter for lead. I n the event that a large amount of soil comes in

contact with the ground surface, it shall be removed using a flat shovel or similar tool that will minimize damage to the plastic sheeting and then vacuumed using a SCAQMD-permitted HEPA filter for lead. Constant and direct water spray shall be applied as the soil is removed and placed in the appropriate waste containment vessel. If excess water begins to pond, the driller shall reduce the amount of water being applied and deploy absorbent booms or pads to control runoff.

Drilling

1. Once the borehole has been adequately cleared, the outer temporary conductor casing (drill casing) and inner core barrel are alternately advanced. The outer drill casing, constructed of flush-threaded carbon steel in 5 and 10-foot lengths, will be used as a temporary conductor casing and remain in the ground to prevent borehole collapse and to prevent cross communication between water-bearing units as the inner core barrel is advanced and then retracted for the collection of lithologic samples. The length of individual retrieved lithologic cores may vary between a few feet and ten feet, depending upon recovery percentages.

2. The diameter of the outer drill casing and core barrel will be determined by location-specific goals and the need for temporarily sealing of shallow water-bearing units, but the planned 4-inch diameter wells will be set in nominally 8-inch diameter casings. The inner core barrel diameter is generally one to two inches smaller than the outer drill casing.

3. Once the inner core barrel is retracted, a clear plastic sock shall be placed over the core barrel and slight resonance shall be applied to reduce the friction between the core sample and the inside wall of the core barrel. The sample will then slowly extrude from the core barrel into the plastic sock for examination by the field geologist. The top of the plastic sock will be tied tightly to prevent the release of any of the subsurface material prior to being carried to the sample examination enclosure. Once the inner core barrel is retracted, two layers of clear plastic sock shall be placed over the core barrel and slight resonance shall be applied to reduce the friction between the core sample and the inside wall of the core barrel. The sample will then slowly extrude from the core barrel into the plastic sock for examination by the field geologist. The top of the plastic sock will be tied tightly to prevent the release of any of the subsurface material prior to being carried to the sample examination enclosure.

4. A temporary, above ground containment area filled with water shall be maintained surrounding the borehole, such that any excess spoils that may fall into the containment area would be submerged. When cleaning slough from the boring, soil shall be wetted, or placed directly in 10-mil plastic liners, and transferred to a suitable waste containment vessel. Soil temporarily placed in hoppers shall be routinely wetted and covered with 10-mil plastic sheeting.

5. When the borehole is advanced through artificial fill soil and penetrates approximately 5 feet into native sediments, and all spoils have been containerized, the top layer of plastic sheeting covering the borehole area shall be removed and placed in the waste containment vessel. Removal shall be performed by gently folding the plastic over on itself to contain any residual soil and to prevent dust dispersion. The underlying layer of plastic sheeting shall remain in-place until completion of drilling.

6. In general, experienced field geologists can visually examine and manually manipulate soil materials within the plastic sock such that the soil can be adequately described and classified. When closer examination of soil cores is deemed necessary by the field geologist, or if the core sample must be subsampled, it shall first be carried into the temporary enclosure before being cut open. Any slough present in the soil cores will be logged accordingly.

7. When relatively undisturbed soil samples are required, a California-modified, split spoon sampler may be used. Such samplers are advanced using a standard automatic hammer. Soil samplers shall only be opened within the temporary enclosure.

8. Upon completion of the drilling and management of soil cuttings, the work zone shall be cleaned up. The remaining layer of plastic sheeting shall be removed using techniques described above for the top layer. The resulting ground surface shall be vacuumed using a SCAQMD-permitted HEPA filter-equipped vacuum for lead and then inspected by on-site field representatives to ensure that materials associated with the drilling have been removed. If residual materials are still present, the area shall be vacuumed again and then washed down with water. Wash water shall be flushed into the on-site storm water management system or removed using a SCAQMD-permitted HEPA filter-equipped vacuum for lead.

9. Sealed 55-gallon drums containing soils will be placed in either the Central Container Storage Area (Unit 1) or placed into a roll-off located within the Total Enclosure Building as directed by Exide. For drums placed in the Central Container Storage Area, they will be washed with potable water and staged until there are a sufficient number to be placed on a trailer or truck and taken to a landfill for proper disposal. For soils placed into a roll-off, the procedures in Section 3.4.5.1 will be used.

10. Drums containing plastic sheeting, absorbent booms and non-soil debris generated by the drilling operations may be taken to the Total Enclosure Building and placed into the tarped roll-off designated for such materials. The procedures in Section 3.4.5.1 will be used.

11. No work will be performed if sustained wind speeds exceed the speeds noted in Section 3.4.1.

Preparation for Well Construction

1. When the targeted aquitard is encountered, the outer casing will be advanced into the aquitard and soil cuttings will be removed from the casing using the core barrel.

2. The outer casing will then be retracted approximately one foot and the borehole gauged to ensure that it had remained open.

3. Upon confirmation of an open borehole, medium bentonite chips will be emplaced, extending from the bottom of the borehole to at least five feet up into the outer casing.

4. The outer casing will then be retracted an additional foot to allow the chips to completely fill the boring annulus.

5. Finally, the outer casing will be keyed into the aquitard by advancing the casing through the bentonite seal and at least one foot into the undisturbed aquitard materials.

6. To verify the efficacy of the seal, standing groundwater will be bailed from the conductor casing and a Solinst™ water level meter will be used to record the rate of water level recovery. If the rate of recovery is less than 6 inches in two hours, the seal will be considered effective and drilling will be allowed to resume with a smaller diameter casing.

7. Upon reaching final depth, the well will be constructed following the Monitoring Well Installation and Field Sieve SOP's that are part of the approved RFI Work Plan. Typical proposed well construction diagrams are attached for reference.

3.5.12.5 **Well Construction**

Shallow

Rotosonic drilling techniques with temporary conductor casing shall be used to drill and install the shallow monitoring wells.

A continuous core of soil (ASTM D 1586) shall be collected to document lithologic conditions. The well screen (typically 10 to 20 feet maximum saturated length) shall be set at the uppermost water-bearing zone (approximately 75 to 80 feet below ground surface (BGS)). The well screen length will also be based on the thickness of the aquifer of interest. The on-site geologist shall

determine the final depth of the monitoring well by trying to finish drilling on top of a silty or clay unit.

To help ensure successful screening in the perched water bearing zone, the Geologist shall review boring logs from adjacent wells. Pilot boring at the location of proposed wells shall be completed prior to installation of the wells. The pilot borings shall be continuously sampled, the results compared against the previous boring logs and particular attention paid to the gradation and moisture beginning at 60 feet BGS. At the sign of first water, drilling will be advanced under the direction of the Geologist stopping periodically as deemed necessary by the Geologist to observed the accumulation of water in the boring. The bottom of the boring will be called by the Geologist when, based on professional judgment, a saturated zone capable of producing sufficient water for groundwater sampling using low flow techniques is encountered. The pilot boring shall penetrate at least 2 feet into the confining layer. Soil samples from the water bearing zone will be submitted for expedited gradation analysis and utilized to select the sand pack and screen materials. Temporary conductor casings shall remain in the hole while awaiting results of the gradation analysis unless it is more feasible to grout the hole in and drill a collocated boring to construct the well at a later time.

The wells shall be constructed with 4-inch diameter schedule 40 polyvinyl chloride (PVC) with factory slotted screens and riser casing. Wells installed during the Phase 3 RFI (MW-16 and MW-17) were both constructed using 20 feet of No. 0.010-in slot PVC screen and 2/16 sand. The well screens will be sand packed to approximately two feet above the top of the screen with No. 1 sand. A minimum two-foot thick bentonite seal will be installed on top of the sand pack. The remaining annulus of each borehole will be tremie-grouted to the surface using a 95 percent cement/5 percent bentonite grout.

Each shallow monitoring well will be completed with a minimum six-inch ID steel protective casing with a locking cap. The protective casing will extend from a depth of three to five feet BGS to approximately 2.5 feet above ground. A small drain hole in the protective casing will be located just above the surface seal. A neat cement or concrete seal will be placed around the protective casing to a depth of three to five feet BGS. A three-foot square well pad will be installed so that the surface slopes away from the well. Bumper guards consisting of cement or

concrete-filled steel casing may be placed around the monitoring wells if the possibility of damage by vehicles exists. Wells completed in traffic and parking areas, or in visually obtrusive areas will be equipped with water-tight, 1-inch raised covers that will be set in a concrete pad as described above.

Deep

Rotosonic drilling techniques shall be used to drill and install the deep monitoring wells. A continuous core of soil (ASTM D 1586) shall be collected to document lithologic conditions. Deep wells will be temporarily cased into low permeability soil layers beneath the completion

depth of the shallow wells. The boring will be initially advanced using 10-inch diameter temporary conductor casing to a minimum of 20 feet through the low permeability soil layer beneath the shallow wells. Once this targeted depth is reached, the shallow water bearing zone will be temporarily sealed.

Drilling into the underlying aquifer will be completed with 9-inch diameter temporary conductor casing. Drilling will be advanced under the direction of the Geologist stopping periodically as deemed necessary by the Geologist to observed the accumulation of water in the boring. The bottom of the boring will be called by the Geologist when, based on professional judgment, a saturated zone capable of producing sufficient water for groundwater sampling using low flow techniques is encountered. The wells shall be constructed with 4-inch diameter schedule 40 polyvinyl chloride (PVC) with factory slotted screens and riser casing. The sand pack and slot size of the well screen will be based on the results of field sieve analysis obtained from the pilot boring. However, based on recently constructed wells at the site, it is anticipated that the wells will be constructed using 2/16 sand with 0.010-in slotted screen. The well screens will be sand packed to approximately two feet above the top of the screen, with at least 1 foot of No. 1 sand as a transition sand pack. A minimum two-foot thick bentonite seal will be installed on top of the sand pack. The remaining annulus of each borehole will be tremie-grouted to the surface using a 95 percent cement/5 percent bentonite grout.

Each deep monitoring well will be completed with a minimum six-inch ID steel protective casing with a locking cap. The protective casing will extend from a depth of three to five feet bgs to approximately 2.5 feet above ground. A small drain hole in the protective casing will be located just above the surface seal. A neat cement or concrete seal will be placed around the protective casing to a depth of three to five feet bgs. A three-foot square well pad will be installed so that the surface slopes away from the well. Bumper guards consisting of cement or concrete-filled steel casing may be placed around the monitoring wells if the possibility of damage by vehicles exists. Wells completed in traffic areas, parking areas or in visually obtrusive areas will be equipped with water-tight, 1-inch raised covers that will be set in a concrete pad as described above.

The wells shall be completed and protected by traffic-rated well boxes (installed slightly above the ground surface to encourage surface drainage away from the well) or steel well protector (for "stick-up" wells).

3.5.12.6 **Well Development**

Upon completion, but not sooner than 48 hours following completion of well construction, each well shall be developed to remove fine-grained material from the well casing, sand pack, and the adjacent formation. Development shall consist of the following steps:

1. Record static water level and total well depth.

2. Insert pump to mid-point of screened interval and begin pumping, or begin bailing, while recording turbidity and depth to water, until turbidity levels have

stabilized. The pumping rate shall be selected so that the average entrance velocities exceed those anticipated during investigation and sampling activities (ideally 0.5 to 3.0 gpm). Water level measurements recorded at intervals during pumping shall be used to estimate the specific capacity and sustainable extraction rates of the wells for constant discharge aquifer testing, if such tests are judged necessary.

3. Discontinue pumping and perform surging. The wells shall be surged using tight-fitting, vented surge blocks to agitate the sand pack and draw fines from the sand pack and surrounding formation into the well casing. Do not use backwashing, surging, jetting or air lifting for well development. Do not add water to speed up the well development unless an approval is first obtained from DTSC.

4. Re-measure total well depth and repeat pumping and surging until turbidity levels at start of pumping are typically <5 nephelometric turbidity units (NTU).

5. The pH, electrical conductivity (EC), temperature, dissolved oxygen, turbidity, and oxygen reducing potential (ORP) of the extracted ground water shall be monitored periodically during well development. Well development data shall be recorded on well development log forms.

6. Complete a boring log and well construction log for the completed well providing date and time of construction, approximate location, well designation, materials of construction and dimensions (including diameter, total depth, etc.) and completion configuration.

3.5.12.7 Well Surveying

Each monitoring well will be surveyed for location and elevation. Well locations will be surveyed to the nearest 0.5 feet relative to the California State Plane Coordinate System. Wellhead elevations will be surveyed to the nearest 0.01 foot at a marked reference point on each well casing. The newly installed monitoring well will be surveyed within 30 days of the installation using conventional techniques utilizing the control points as reference points. If the impoundment is free of liquid at the time of the monitoring well survey, the location of each sump will also be surveyed and tied into the California State Plane Coordinate System. The surveying activities will be conducted under the direct supervision of a State of California licensed Professional Surveyor. The location of all benchmarks used in the survey, as well as the date(s) of the survey, will be documented in annual monitoring reports.

All wells should be re-surveyed as needed (e.g., re-surfacing, well head is modified or repaired, abnormal data, etc.).

3.5.12.8 Supplemental Dust Mitigation Measures

All backfill materials (sand, bentonite, and cement) may be contaminated with lead and hexavalent chromium. The mixing of cement with water will generate dust. This mixing activity shall be subject to mixing in the temporary enclosure equipped with SCAQMD-permitted HEPA filtration for lead and operated under negative pressure.

3.5.12.9 **Boring Abandonment**

Direct-push soil borings completed to 20 feet bgs or less will be abandoned using granular bentonite. Bentonite will be placed by hand into the boring from grade and hydrated in place with potable water. Borings that are drilled beyond 20 feet bgs will be abandoned using neat cement grout by the tremie method. A 0.5- to 1-inch diameter tremie pipe will be placed in the borehole, filled with cement grout, and removed in 5- to 10-foot sections to allow the cement to fill the vacated space at the base of the boring. This procedure will be repeated until the boring is backfilled to grade. The following day, the borings will be topped off should the cement within the borings settle overnight.

3.5.13 Well Maintenance

Prior to maintenance, the area around the well will be cleaned with a SCAQMD permitted HEPA-vacuum. The well lid will be removed and the vault area cleaned with a SCAQMD permitted HEPA-vacuum. Required maintenance will be conducted. If concrete removal is necessary, work will be conducted in a temporary enclosure per Section 3.4.4. Debris will be collected into a sealed plastic container/bag and disposed off-site.

3.5.14 Welding

Welding is not anticipated to occur during closure; however, the procedures are provided in the event they are needed. The areas to be welded will be cleaned by wiping with clean disposable wipes wet with a D-Lead Solution®. A wipe test will then be performed on the area to be welded using a Lead Wipe Test Kit (ESCA Tech Inc. Lead Test Kit). The test solution will be applied to the test kit supplied wipe. A wipe sample will be performed on 4 separate locations on each area to be welded using a new wipe wetted with the test solution. A yellow color indicates lead is present and additional cleaning is required. No color change indicates no lead is present. All 4 test locations must have a negative result prior to proceeding with the welding using standard welding techniques. The MSDS for the specific welding rod to be utilized will be reviewed. A welding rod will be utilized that does not contain lead. This process will be completed for each of the 4 areas that require additional welding. The welding will be completed immediately following the wipe testing.

3.6 AIR MONITORING

3.6.1 Perimeter

Perimeter air monitoring will be conducted by Exide as indicated in the Air Monitoring Plan (Closure Plan Appendix H).

If at any time any of the perimeter air monitors obtain laboratory results showing a daily excursion of lead greater than than the performance standards provided in the Air Monitoring Plan (Closure Plan Appendix H), all activities shall stop. Exide will review the activities which were occurring during the excursion, and submit further engineering controls to SCAQMD for review and approval.

3.6.2 Real-Time

Real-time work area air monitoring will be conducted as indicated in the Air Monitoring Plan (Closure Plan Appendix H) by the Dust Mitigation Oversight representative.

As observing personnel note an increase in concentration of 50 ug/m3 of PM10, using DustTrack Devices, above background averaged over a minute and measured every 15 minutes at a location near the activity that is being conducted~~potentially adverse dust evolution using the DustTrak devices (i.e., increasing levels)~~ in conjunction with visual observation and experience, they shall direct work stoppage and then direct adjustments in the work practices and/or the applied control measures as appropriate. In response to adverse visual observations or DustTrak results, Exide and its contractors shall implement the following increased dust suppression activities. These increased dust suppression abatement activities will include, but are not limited to the following:

- Stop all work outside of any Total Enclosure Building that has the potential to generate lead or other toxic metals containing dust. Negative air filtration units installed on enclosures will remain in operation for the duration of the stop work order. Equipment that was being used inside of the Total Enclosure Building shall remain in place during the stop work period.
- Immediately begin application of water on all paved areas.
- Stop all onsite vehicle traffic outside of all Total Enclosure Buildings.
- All overhead doors on any Total Enclosure Building are to remain closed.
- Determine if there are any activities within any Total Enclosure Building that could be contributing to the increase in dust concentration. If so, these activities will be stopped.
- Determine if there are any offsite activities that are being conducted by others that are contributing to the increase in dust concentration. If so, suspend all activities outside of Total Enclosure Building that have the potential to generate lead and other toxic metals containing dust until additional dust mitigation has been implemented or the activity completed and the areas both on-site and off-site are cleaned.

The abatement activities described above will remain in effect until Exide and the Dust Mitigation Oversight representative determine the cause of the adverse readings and additional

dust mitigation for the activity that caused the increase in dust concentration has been implemented.

If the cause of the adverse Dust Trak readings cannot be attributed to any one activity outside of Total Enclosure Buildings and no activity within any Total Enclosure Building, the work outside of the Total Enclosure Building will be restarted on a rolling basis with the activity that would be expected to generate the least amount of lead containing dust starting first. No work may resume until DustTrak readings show that the adverse dust condition does not exist anymore.

The real time data from the DustTraks will be continuously monitored during this rolling start to determine if there is an increase in the dust concentrations following the restart of any one activity. If an increase is noted after restarting any activity, that activity will be stopped until additional dust suppression measures have been implemented. The rolling start activities following the activity that caused the increase in dust consideration may be restarted using the basis described above with continuous monitoring of the real time particulate data to insure none of the follow on activities causes an increase in the total particulate concentration. If after work resumes, DustTrak readings show adverse dust conditions, the dust suppression and abatement activity described above shall be implemented.

3.7 1420.1 HOUSEKEEPING

Housekeeping activities required by 1420.1, including sweeping of on-site paved areas, will be conducted as noted in the Closure Plan.

4.0 OVERSIGHT

Exide will retain a third party consultant to oversee implementation of the engineering controls for liquid infiltration. The name and qualifications of the third party consultant will be provided to DTSC and AQMD 10 business days in advance of retaining the consultant. The third party consultant(s) will provide weekly reports to Exide, DTSC and AQMD regarding the engineering controls, Closure activities and progress on Friday of each week.

The Dust Migitation Oversight representative discussed in Section 1.3.6.3 of the Closure Plan will oversee implementation of engineering controls for fugitive emissions in air and will perform real-time air monitoring. The Dust Mitigation Oversight representative will provide weekly reports to Exide, DTSC and AQMD regarding the engineering controls, Closure activities and progress on Friday of each week.

The third party consultant performing oversight of engineering controls for liquid infiltration may be the same as the consultant providing dust mitigation oversight.

5.0 VARIATIONS FROM PLAN

Though appropriate efforts have been made to anticipate closure-related activities and engineering controls, unanticipated conditions may arise from time to time that may need to be addressed. The appropriate general engineering control requirements presented within the Engineering Controls Plan will be implemented for any such activities with notification to DTSC and AQMD field representatives. If additional engineering controls are necessary for unanticipated activities or varying conditions, then, unless an emergency requires a faster response, the additional activities will be submitted to DTSC and AQMD for review and approval two (2) AQMD business days in advance of the work.

Variations from the Engineering Controls Plan must be approved by DTSC and AQMD. Operations associated with the variance from the plan will stop until DTSC and AQMD have approved the variation, unless ceasing operation while awaiting approval creates a worse environmental situation.

TABLE OF CONTENTS

PAGE NO.

1.0 Introduction 1-1

1.1 Purpose 1-1
1.2 Scope of Closure Activities 1-1
1.3 RCRA Facility Investigation 1-1

2.0 Engineering Controls for Liquid Infiltration 2-1

3.0 Engineering Controls for Fugitive Emissions in Air 3-1

3.1 General 3-1
3.2 Definitions 3-2
3.3 Work Locations 3-2

3.3.1 Existing Total Enclosure Buildings 3-2
3.3.2 Temporary Enclosures 3-3

3.4 General Engineering Controls 3-4

3.4.1 General Methods 3-4
3.4.2 Total Enclosure Buildings 3-6
3.4.3 Work Within Temporary Enclosures 3-6
3.4.4 Drilling, Pavement Removal and Placement and Soil Activities ..... 3-7~~6~~
3.4.5 Waste Management 3-7

3.4.5.1 Roll-off Containers 3-7
3.4.5.2 Truck Trailers 3-8

3.4.6 Scrap Metal Management 3-9
3.4.7 Electrical Supply 3-9
3.4.8 Modifications ..... 3-10~~9~~

3.5 Specific Engineering Controls ..... 3-10~~9~~

3.5.1 Inventory Removal ..... 3-10~~9~~
3.5.2 Stack Capping 3-10
3.5.3 Stack and Ventilation A-Pipe Removal 3-10
3.5.4 Emission Control Equipment Removal 3-11
3.5.5 Baghouse Bag Removal 3-11
3.5.6 Brick Removal ..... 3-12~~11~~
3.5.7 Crack Sealing 3-12

3.5.8 Sump Sealing 3-12

TABLE OF CONTENTS
(Continued)

PAGE NO.

3.5.9 Decontamination 3-12
3.5.10 Deconstruction ..... 3-13~~12~~
3.5.12 Drilling ..... 3-15~~14~~

3.5.12.1 Drilling Inside Total Enclosure Building ..... 3-15~~14~~
3.5.12.2 Drill Site Preparation Outside Total Enclosure 3-15
3.5.12.3 Direct-Push Drilling 3-16
3.5.12.4 Rotosonic Drilling ..... 3-17~~16~~
3.5.12.5 Well Construction 3-21
3.5.12.6 Well Development 3-23
3.5.12.7 Well Surveying ..... 3-24~~23~~
3.5.12.8 Supplemental Dust Mitigation Measures 3-24
3.5.12.9 Boring Abandonment 3-24

3.5.13 Well Maintenance ..... 3-25~~24~~
3.5.14 Welding ..... 3-25~~24~~

3.6 Air Monitoring 3-25

3.6.1 Perimeter 3-25
3.6.2 Real-Time ..... 3-26~~25~~

3.7 1420.1 Housekeeping ..... 3-27~~26~~

4.0 Oversight 4-1

5.0 Variations from Plan 5-1

TABLE

INSPECTION FORMS

MATERIAL INFORMATION

APPENDIX G

Engineering Control Plans

Table 5-6. Sample Collection, Preservation and Analysis for Water Quality Samples

Constituent	Analytical Method	Minimum Sample Volume	Sample Containers	Sample Preservation	Reporting Limit	Maximum Holding Time
Aluminum, Total	EPA 200.8	500 mL	Plastic	Acid	0.75 mg/L	180 Days
Antimony, Total	EPA 200.8	500 mL	Plastic	Acid	0.64 mg/L	180 Days
Arsenic, Total	EPA 200.8	500 mL	Plastic	Acid	0.15 mg/L	180 Days
Cadmium, Total (H)	EPA 200.8	500 mL	Plastic	Acid	0.0053 mg/L	180 Days
COD	SM 5220C	500 mL	Glass	Acid	120.0 mg/L	~~180~~28 Days
Copper, Total (H)	EPA 200.8	500 mL	Plastic	Acid	0.0332 mg/L	180 Days
Iron, Total	EPA 200.7	500 mL	Plastic	Acid	1.0 mg/L	180 Days
Lead, Total (H)	EPA 200.8	500 mL	Plastic	Acid	0.262 mg/L	180 Days
Oil & Grease, Total	EPA 1664A	500 mL	Glass	~~Refrigeration~~Acid	15.0 mg/L	28 Days
pH	Litmus Paper	NA	Plastic	None	6.0 – 9.0SU	15 Minutes
Total Suspended Solids, Total	SM 2540-D	500 mL	Glass or Plastic	Refrigeration	100.0 mg/L	7 Days
VOCs	SW-846 Method 8260B	20 mL	Glass	Refrigeration	**No Standard**	7 Days
Zinc, Total (H)	EPA 200.8	500 mL	Plastic	Acid	0.26 mg/L	180 Days
Notes: (H) – Hardness Dependent						

APPENDIX X

Quarterly Groundwater Sampling and Analysis Plan

ADVANCED GeoServices
E1Igil1ccril1g for the E111irol1111e11t. Pla1111il1g for People.
1055 Andrew Drive, Suite A
\Vest Chester, PA 19380-4293
tel 610.840.9100 fax 610.840.9199
www.advancedgeoservices.corn

May 26, 2015 2013-2993-06

Peter Ruttan, Project Manager
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, CA 95826-3200

RE: Quarterly Groundwater Sampling and Analysis Plan
Exide Technologies, Vernon, California; EPA ID. NO. CAD097854541

Dear Mr. Ruttan:

Advanced GeoServices, on behalf of Exide Technologies, submits the Quarterly Groundwater Sampling and Analysis Plan in response to your General Comment No. 3 in DTSC's comment letter dated April 24, 2015 on the Quarterly Groundwater Monitoring Report, Fourth Quarter 2014 submitted by E2 Environmental, Inc. (E2).

If you have any questions on this response, please contact Barbara Forslund at 610-840-9145 or me at 610-840-9122.

Respectfully submitted,

ADVANCED GEOSERVICES CORP.

Paul G. Stratman, P.E.
Consultant

PGS:vm

cc: Tom Strang, Exide
Fred Ganster, Exide
Barbara Forslund, Advanced GeoServices
Dennis England, E2 Environmental
Deke Siren, P.G., Avocet Environmental
Randy Visser, Sheppard Mullin
Todd Walborn, DTSC
Nicolas Serieys, Alta Environmental

QUARTERLY GROUNDWATER SAMPLING AND ANALYSIS PLAN
EXIDE TECHNOLOGIES
VERNON, CALIFORNIA

Prepared For:
EXIDE TECHNOLOGIES, INC.
Vernon, California

QUARTERLY GROUNDWATER SAMPLING AND ANALYSIS PLAN
EXIDE TECHNOLOGIES
VERNON, CALIFORNIA

Prepared For:

EXIDE TECHNOLOGIES, INC.
Vernon, California

Prepared By:

ADVANCED GEOSERVICES
West Chester, Pennsylvania

Project No. 2013-2993-06
May 26, 2015

QUARTERLY GROUNDWATER SAMPLING AND ANALYSIS PLAN
EXIDE TECHNOLOGIES
VERNON, CALIFORNIA

Prepared For:

EXIDE TECHNOLOGIES, INC.
Vernon, California

Prepared By:

ADVANCED GEOSERVICES
West Chester, Pennsylvania

Project No. 2013-2993-06
May 26, 2015

REGISTERED PROFESSIONAL ENGINEER
PAUL GERARD STRATMAN
NO. C61595
EXP. 6/30/15
CIVIL
STATE OF CALIFORNIA

Paul G. Stratman, P.E.
Senior Project Consultant
California P.E. No. C61595

TABLE OF CONTENTS

PAGE NO.

1.0 Introduction 1-1

2.1 Facility Background 2-1

2.2 Site Location 2-1
2.3 Site Description 2-1
2.4 Operational History 2-2
2.5 Geology and Hydrogeology 2-3

2.5.1 Geologic Setting 2-3
2.5.2 Site Hydrogeology 2-5

2.6 Environmental and/or Human Impact 2-6

3.1 Project Data Quality Objectives 3-1

3.2 Project Definition 3-1
3.3 Data Quality Objectives and Indicators 3-1

3.3.1 Precision 3-2
3.3.2 Accuracy 3-2
3.3.3 Representativeness 3-3
3.3.4 Completeness 3-3
3.3.5 Comparability 3-3

3.4 Data Validation and Usability 3-4

3.4.1 Data Review, Validation, and Verification Requirements 3-4

3.4.1.1 Verification and Validation Methods 3-4

3.4.2 Reconciliation with Data Quality Objectives 3-5
3.4.3 Documentation and Records 3-6

3.5 Data Management 3-7

3.5.1 Document Collection and Organization 3-7
3.5.2 File Preservation 3-8

TABLE OF CONTENTS
(Continued)

PAGE NO.

3.6 Assessment/Oversight 3-8

3.6.1 Corrective Action 3-9

3.6.1.1 Corrective Action Resulting from Routine Activities 3-10
3.6.1.2 Corrective Action Resulting from QA Audits 3-11

3.6.2 Quality Assurance Reports to Management 3-11

4.1 Groundwater Sampling Rationale 4-1

4.2 Quarterly Groundwater Monitoring 4-1
4.3 Additional Groundwater Monitoring 4-1

5.1 Request for Analyses 5-1

5.2 Groundwater Sampling and Analysis Narrative 5-1
5.3 Analytical Laboratory 5-1

6.1 Field Methods and Procedures 6-1

6.2 Field Testing 6-1
6.3 Decontamination Procedures 6-1

7.0 Sample Containers Preservations and Storage 7-1

8.0 Disposal of Residual Material 8-1

9.1 Sample Documentation and Shipment 9-1

9.2 Field Notes 9-1
9.3 Sample Labels 9-2
9.4 Chain of Custody 9-3
9.5 Sample Packaging and Shipment 9-3

9.5.1 Laboratory Custody Procedures 9-4
9.5.2 Sample Storage and Disposal 9-5

TABLE OF CONTENTS
(Continued)

PAGE NO.

10.1 Quality Control....10-1

10.2 Field Quality Control Samples....10-1

10.2.1 Field Duplicate Samples....10-1
10.2.2 Equipment Decontamination Blanks....10-1

10.3 Laboratory Quality Control Samples....10-2

10.3.1 Method Blank/Reagent Blank....10-2

10.3.1.1 Calibration Standards (Initial Calibration)....10-3
10.3.1.2 Check Standard (Continuing/Daily Calibration)....10-4

10.3.2 Laboratory Duplicates....10-4
10.3.3 Laboratory Control Sample (LCS)....10-5
10.3.4 Matrix Spike and Matrix Spike Duplicate (MS/MSD)....10-5
10.3.5 Surrogate Spikes....10-6

11.0 Field Variance....11-1

12.0 References....12-1

LIST OF TABLES

TABLE

Table 3-1 Summary of Laboratory Methods and QA Goals
Table 3-2 Reporting Limits
Table 5-1 Monitoring Well Construction Summary
Table 7-1 Sample Preservation and Holding Times
Table 10-1 Quality Assurance/Quality Control Samples

LIST OF FIGURES

FIGURE

1-1 Organization Chart
2-1 Facility Location Map
2-2 General Site Layout

LIST OF ATTACHMENTS

ATTACHMENT

A Low Flow Sampling Standard Operating Procedure
B Cal Science QA Manual
C Sample Label and Chain of Custody

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been prepared to document the objectives, rationale, and procedures for environmentally-related measurements performed as part of the quarterly groundwater monitoring activities currently underway at the Exide Technologies (Exide) facility located at 2700 South Indiana Street in Vernon, California (the site). Quarterly groundwater sampling has been conducted as part of a 1986 directive from the Regional Water Quality Control Board (RWQCB). In February 2009 MW-16 was added to the list of wells subject to quarterly sampling and quarterly sampling at MW-17 began in January 2011 MW-17. MW-16 and MW-17 were installed as part of the Phase 3 RFI. Groundwater monitoring wells SI-1 and SI-5, installed in anticipation of including the Surface Impoundment to the RCRA Hazardous Waste Permit, have been included in the list of wells for quarterly sampling September 2014.

This SAP has been prepared by Advanced GeoServices Corp. (Advanced GeoServices) on behalf of Exide at the request of the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) to create a document that acknowledges the relationship between the quarterly groundwater sampling and the SAP requirements for groundwater sampling contained in the Comprehensive RCRA Facility Investigation Work Plan, and capable of generating data that is useable for the groundwater RFI. The SAP will be periodically updated, as appropriate, subsequent to significant revisions to the scope of activities associated with the quarterly groundwater monitoring activities. The purpose of this SAP is threefold:

- Implement standardized field methods that will periodically be used to collect environmental samples;
- Identify the anticipated chemical parameters that may be analyzed; and,
- Identify laboratory methods that will be used for sample analysis.

Figure 1-1 shows the project organization chart that identifies individuals and entities responsible for completing the objectives and procedures detailed in this SAP. Key project personnel and project responsibilities are summarized below:

Exide Project Manager: Overall responsibility and authority for project coordination among the consultants, Exide, and regulatory agencies.

Project Manager: Responsible for project coordination between Exide and the regulatory agencies. Responsibilities include overall project quality, technical oversight, schedule and budget management, and report preparation. The Project Manager will be responsible to ensure all project personnel and contractors are qualified and adequately trained to perform the work to which they are assigned. Documentation from contractors may be requested by the Project Manager prior to their starting work. The Project Manager is responsible to ensure all documentation is appropriately filed and maintained. The Project Manager may be the project professional (California Licensed Professional Civil Engineer or Professional Geologist) or the Project Manager may delegate the role of project professional and technical oversight to an appropriately licensed professional experienced in groundwater sampling and data evaluation.

Project Quality Assurance (QA) Officer: Responsible for ongoing review, monitoring, auditing, and evaluation of the field and laboratory QA/QC program. The QA Officer is also responsible for development and supervision of QA/QC procedures for data management and analysis, and report preparation and review.

Field Operations Manager: Responsible for the maintenance and calibration of field equipment. All field personnel should have completed current 40-hour OSHA HAZWOPER training with 8-hour refresher requirements and respiratory training and fit test. Field personnel should be briefed on site-specific technical and quality issues and procedures as related to their duties. Examples include project objectives and quality requirements, chain-of-custody requirements, sampling and shipping protocols, and

project safety. Personnel training will be periodically reviewed by the Project Manager to ensure the training is appropriate, adequate, and current. Personnel who have allowed their training to expire will not be allowed to work until training is updated. Beginning during the second quarterly groundwater sampling event for 2015 and extending through submission of the groundwater RCRA RFI report, the Field Operations Manager shall possess at least 4 years of groundwater sampling experience and report directly to the Project Manager or the Project Manager's delegated project professional.

QA/QC problems or deficiencies, if any, identified by the Project QA Officer during the review, monitoring, and auditing process will be brought to the attention of the Project Manager, as appropriate. If QA/QC problems or deficiencies require corrective action, such action will be recommended by the Project Manager and/or the Project QA Officer and the Exide Project Manager.

The remainder of this SAP is organized into the following sections. Section 2.0 presents background information pertaining to the site's location and physiographic setting, its geologic and hydrogeologic characteristics, and a summary of know existing environmental conditions. Section 3.0 is the Project Data Quality Objectives which will be used to monitor and control data quality. Section 4.0 is the Sampling Rationale, which presents the rationale for the individual tasks and detailed procedures for sampling and data gathering. Section 5.0 is the Request for Analysis and Section 6.0 is Field Methods and Procedures. Sections 7.0, 8.0 and 9.0 are for Sample Containers, Management of Investigation Derived Waste and Sample Documentation and Shipping, respectively. Section 10.0 is Quality Control and Section 11.0 is Field Variances. The SAP is supported by a list of references, tables, figures, and attachments, all of which follow the text.

2.1 FACILITY BACKGROUND

This section summarizes background information including site description, site history, regional geology and hydrogeology, and a summary of the past site investigation activities and analytical results. Additional details regarding site history, environmental setting, and the degree and extent of contamination identified during previous investigations have been presented in the Revised Current Conditions Report (AGC, 2012).

2.2 SITE LOCATION

The Exide facility is located at 2700 South Indiana Street in Vernon, California as shown on Figure 2-1. The property occupies a total area of approximately 15 acres, which is bounded by 26th Street towards the north and Bandini Avenue towards the south. A 1.5 +/- acre parcel, with approximately 190-ft of frontage along the north side of Bandini Boulevard and 345 ft of frontage along the east side of Indiana Street, is occupied by the Main Office Building. The remaining 13.5 +/- acres, extends along the west side of Indiana Street between Bandini Avenue and 26th Street (a distance of approximately 900 ft) and includes the active manufacturing areas. The 13.5-acre parcel has approximately 1000 ft of frontage along Bandini Boulevard and 450 ft of frontage along 26th Street. Two concrete lined flood channels (one open and the other covered) bisects the Site in a north-south direction and a railroad right of way intersects the Site in an east-west direction, as shown on Figure 2-2. Coordinates for the Site are 34º 00’22” north latitude and 118º 11’48” west longitude. The Site is located approximately 1 mile west of the Long Beach Freeway (I-710).

2.3 SITE DESCRIPTION

The Site is characteristic of the heavy industrial nature of the facility and surrounding land uses. Pavement, buildings and structures cover nearly the entire facility, with the only exceptions being a small grass area near the main office, a few small isolated areas of landscaping or exposed soil. The Site is relatively flat with an average elevation of 175 to 180 feet above sea

level and topography that generally slopes from the northwest to the southeast. Notable landmarks include the main office (east of Indiana Street), the existing smelter building (near the intersection of Indiana Street and 26th Street) and the lined impoundment north of Bandini Boulevard.

2.4 OPERATIONAL HISTORY

In 1922, Morris P. Kirk & Sons, Inc. initiated lead smelting and metals processing operations at the Site. They continued operation until 1973 when NL Industries took control of the operation. In 1979, Gould, Inc. took control of the facility and maintained operations until 1984. In 1984, GNB Technologies bought the facility from Gould. In September 2000, Exide Technologies acquired GNB, including the Vernon facility.

Site operations from 1922 through 1973 included a battery breaking process for the purpose of recovering lead from lead-acid batteries, production of lead sheeting, the production of zinc alloys and the manufacturing of extruded metal components. Discussions of the location of these operations are provided in the Revised Current Conditions Report (Advanced GeoServices, 2012).

In 1982 the facility was the subject of a major modernization and reconstruction project that resulted in construction of the main smelter and battery breaking operations. The lined storm water retention basin was constructed in 1984.

Prior to 1922 the Site was reportedly the “boneyard” for a meat rendering plant and before that, the Site west of Indiana Street and additional areas towards the west, were quarried for gravel.

2.5 GEOLOGY AND HYDROGEOLOGY

2.5.1 Geologic Setting

The Site is located within the Los Angeles Basin, a deep structural depression largely filled with late Cretaceous through Pleistocene sediments. Coarse, hydraulically conductive materials within these sediments comprise aquifers serving the Los Angeles Basin. Numerous aquicludes and aquitards separate these aquifers. Aquifers present beneath the subject site include the Exposition, Gage, Gardena, Hollydale, Jefferson, Lynwood, Silverado, and Sunnyside aquifers. The coastal plain of Los Angeles County has been divided into four groundwater basins on the basis of geological and physiographic features. The Site is located near the northeastern margin of the Central Basin within the Los Angeles Forebay Area.

Known water-bearing sediments beneath the Los Angeles Forebay Area range in age from Recent to late Pleistocene and extend to an approximate depth of 1,000 feet. The principal water-bearing stratigraphic units include recent alluvium, the early Pleistocene Lakewood Formation and the late Pleistocene San Pedro Formation. Non-water bearing rocks of the Pliocene Pico Formation underlie the San Pedro Formation and are exposed in the Repetto Hills to the north (California Department of Water Resources [DWR], Bulletin 104, 1961). Recent alluvial deposits cover a large portion of the Los Angeles Basin. The alluvium thins northward toward the Repetto Hills (DWR, Bulletin, 104, 1961).

The water-bearing zones within these units are separated by aquicludes or aquitards of varying thicknesses of relatively impermeable silt and clay. The only named aquiclude and the most significant of the region is the near-surface Bellflower aquiclude. In the northern part of the Los Angeles Forebay, the aquifers thin and merge along the thinning margin of the basin. Where the Bellflower aquiclude is missing within the Forebay Area, the aquifers are in direct hydraulic continuity with the surface (DWR, Bulletin 104, 1961).

Lakewood Formation

According to the geologic map published by the DWR (Bulletin 104, 1961), the site and surrounding area are immediately underlain by early Pleistocene deposits of the Lakewood Formation. The Lakewood Formation beneath the site consists of four members: the Bellflower aquiclude, the Exposition aquifer, the Gage-Gardena aquifer, and the unnamed aquiclude that separates the aquifers. The Exposition and Gage-Gardena aquifers merge in the vicinity of the site.

In the upper part of the Lakewood Formation, lithologic changes are rapid with discontinuous permeable zones and considerable variation in particle size. These features represent typical stream-type alluviation with floodplain sediments comprising from 40 to 80 percent of the total deposits. The predominantly fine-grained sediments that comprise the upper part of the formation are referred to as the Bellflower aquiclude. The Bellflower aquiclude thins northward and is thin or absent in the vicinity of the site.

The Exposition aquifer underlies the Bellflower aquiclude and is composed of coarse gravel, coarse to fine sand, silt, and clay and is most likely equivalent to the upper water-bearing zone identified in previous investigations and described throughout this report. The average thickness of the Exposition aquifer in the site vicinity is about 65 feet. The Gage and Gardena aquifers underlie and are separated from the Exposition aquifer by a relatively thin aquitard less than 15 feet thick. The Gage aquifer, which likely correlates with the intermediate zone beneath the site, extends over most of the Coastal Plain of Los Angeles County (DWR, Bulletin 104, 1961) and is composed of variable amounts of gravel, sandy silt, and clay. The Gardena aquifer is primarily composed of coarse sand and gravel that represent an ancestral river that incised a channel and eroded away the sediments comprising the Gage aquifer (DWR, Bulletin 104, 1961). Coarse fluvial deposits filled the channel during a subsequent rise in sea level. Because the Gardena aquifer is similar in thickness, at the same stratigraphic horizon, and in direct continuity with the Gage aquifer (DWR, Bulletin 104, 1961), they are sometimes referred to as the Gage-Gardena

aquifer. The base of the Gage-Gardena aquifer varies considerably as shown in the regional cross-section, but on average it is estimated to be at a depth of 200 feet beneath the site.

San Pedro Formation

The Lakewood Formation is immediately underlain by lower Pleistocene deposits of the San Pedro Formation. The San Pedro Formation contains most of the important aquifers used for groundwater production in the Los Angeles coastal plain region.

In the type area, the San Pedro Formation is composed largely of stratified and cross-bedded sand, but includes some beds of fine gravel, silty sand and silt. Within the subject area, extensive impermeable beds of silt and clay occur in the San Pedro Formation separating the coarser water-bearing deposits into several distinct aquifers: the Hollydale, Jefferson, Lynwood (400-foot gravel), Silverado, and Sunnyside aquifers. The principal water-producing aquifers of the region are the Lynwood and Silverado aquifers. The base of the Sunnyside aquifer in the vicinity of the site is estimated to be on the order of 975 feet bgs.

2.5.2 Site Hydrogeology

Groundwater elevation measurements collected at the Site indicate groundwater is first present at isolated locations at a typical depth of 85 to 90 feet below the ground surface and is reported to coincide with the Bellflower Aquiclude. Groundwater at this depth is not encountered consistently throughout the site, and some of the wells in this saturated zone are now dry. Underlying the Bellflower Aquiclude from approximately 95 to 175 feet is the middle portion of the Lakewood formation designated as the Exposition Aquifer. The Exposition Aquifer is underlain by the lower portion of the Lakewood formation, which includes (in descending order) the Lower Aquiclude, occurring from approximately 175 to 225 feet, followed by the Gage Aquifer from approximately 225 to 280 feet.

2.6 ENVIRONMENTAL AND/OR HUMAN IMPACT

The entire Exide facility west of South Indiana Street and nearly the entire surrounding area, except for areas of landscaping and a few isolated bare soil areas within railroad right–of-ways and utility easements is covered with buildings and pavement preventing direct contact with subsurface soils and historic fill materials with very limited areas of exposed soil. Shallow perched groundwater beneath the site is not utilized. At this time the degree of interconnection between shallow perched groundwater and regional groundwater is unknown and is being investigated as part of the ongoing RFI.

3.1 PROJECT DATA QUALITY OBJECTIVES

3.2 PROJECT DEFINITION

The objective of the quarterly groundwater monitoring is to generate sufficient data to enable assessment of the lateral and vertical distribution of chemical compounds in groundwater.

Constituents of Concern as determined during previous RFI activities are primarily inorganics and waste acids/acidic wastewater associated with the long term operation of the site as a metals recycling facility. In addition, previous sampling has identified localized impacts associated with the use of chlorinated solvents (primarily TCE in the vicinity of SWMU-11) and VOCs associated with diesel fuel and gasoline (possibly leakage from USTs).

Procedures for sampling and other data gathering activities are presented in the following sections. The following procedures will be conducted in accordance with the site-specific Health and Safety Plan (HASP) presented as Appendix B of the Comprehensive RFI Work Plan, as revised.

3.3 DATA QUALITY OBJECTIVES AND INDICATORS

The Data Quality Objectives and Indicators relative to sampling and analysis for the project are to continue to obtain and evaluate data that are representative of site conditions. The data collected must be accurate, precise, and complete. The evaluation of the data must involve an assessment of representativeness of site conditions and comparability to previously collected data. The definitions for accuracy, precision, completeness, comparability, and representativeness are defined in the following sections.

Table 3-1 presents levels for accuracy and precision established for the results of chemical analyses of both field and laboratory QC samples.

3.3.1 Precision

Precision is the mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision will be determined with analysis of matrix spike duplicates and field duplicates. Precision is measured with the Relative Percent Difference (RPD) between the original sample result and the duplicate sample result using the following calculation:

$$\text{Precision} = \text{RPD} = \frac{\left| \text{difference between the original and duplicate result} \right|}{\text{average of the original and duplicate result}} \times 100$$

RPDs will not be calculated in cases where one analyte of the duplicate pair was not detected.

3.3.2 Accuracy

Accuracy measures the bias in a measurement system. Sources of error are the sampling process, field contamination, preservation, handling, sample matrix, sample preparation and analysis techniques. Sampling accuracy may be assessed by evaluating the results of field blanks (trip blanks, equipment blanks, decon water source blanks) to assess if contamination was introduced during the field activity. Laboratory blanks will be analyzed to determine if contamination was introduced in the laboratory. Matrix spikes will be conducted and analyzed to assess the analytical accuracy. For spiked samples, accuracy is measured as percent recovery (%R) of the spike added using the following calculation:

$$Accuracy = \%R = \frac{(spiked\ sample\ result - sample\ result\ without\ the\ spike}{amount\ of\ spike\ added} \times 100$$

3.3.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter, which is most concerned with the proper design of the sampling program. The representativeness of the data will be maintained by following appropriate and consistent procedures for drilling, well installation, sample collection, aquifer testing, and other types of data collection, and by the application of approved, standard analytical methods. Field QA/QC samples will be used to provide information on the representativeness of the field sampling effort.

3.3.4 Completeness

Completeness is the amount of valid data obtained from a measurement system compared to the amount that was expected to meet the project data goals. A goal of 90 percent completeness has been established for the project chemical data. However, the required level of completeness will vary with the data quality needs of different aspects of the site characterization. In the event that all expected data are not available or suitable to support an aspect of the site characterization, the available data will be specifically assessed for adequacy, or if additional data should be acquired. Measurement completeness (*C*) can be described as the ratio of acceptable measurements obtained for the total number of planned measurements for an activity. For this extended meaning, completeness is defined as:

$$Completeness = \frac{number\ of\ acceptable\ items}{total\ number\ of\ planned\ items} \times 100$$

3.3.5 Comparability

Comparability expresses the confidence with which one data set can be compared to another. Sample data should be comparable with other measurement data for similar samples and sample

conditions. This goal is achieved through using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units.

3.4 DATA VALIDATION AND USABILITY

The following sections address the QA activities that occur after the data collection phase of the project is completed. Implementation of these elements determines whether the data conform to the specified criteria, thus satisfying the project objectives.

3.4.1 Data Review, Validation, and Verification Requirements

The first level of review and consequent data validation and verification reporting is done at the laboratory. Data reduction, validation, and reporting at the laboratory will be implemented in accordance with standard EPA methods for analytical and QA protocols. Refer to the laboratory's QA Manual for QA/QC procedures. The data are reduced and validated by the laboratory in accordance with individual analytic methodology, quality control procedures, and the use of appropriate standards and correct transcription.

The second level of data review is conducted by the Quality Assurance Manager. All data packages are reviewed for precision, accuracy, representativeness, completeness and comparability. If any issues or inconsistencies are encountered, they are investigated and corrective action is implemented, if necessary.

3.3.1.1 **Verification and Validation Methods**

Verification concerns the process of examining a result of a given activity to determine conformance to the stated requirements for that activity. Validation concerns the process of examining a product or result to determine conformance to user needs.

Data Verification

Verification will consist of reviewing data packages for completeness and consistency to confirm that QC parameter values fall within acceptable limits and to identify any samples that require data qualification.

Data Validation

Validation is the process of evaluating the available data against the project DQOs to make sure that the objectives are achieved. The available data reviewed will include analytical results, field QC data and lab QC data, and may include field records. As defined in SW-846, data validation may be very rigorous or cursory, depending on project DQOs. For this project, data validation will be rigorous to ensure DQOs are met.

All analytical data, upon arrival from the laboratory, will receive an initial QA check by a qualified QA Scientist. This QA check will include verification of receipt of all samples, verification that all sample analyses were performed and a scan for extreme values in the results reported. Upon completion of this initial QA check, a more comprehensive review will be conducted. The information examined during this data review process will consist of, but not be limited to: chain-of-custody completeness; holding time limitations; blank contamination; instrument initial and continuing calibration; matrix spike/matrix spike duplicate accuracy; laboratory and field duplicate precision internal standards, serial dilutions; and overall system performance. The data review also verifies proper quality assurance/quality control samples were collected and analyzed. A validation report will be completed indicating any problems associated with the sample analyses.

3.4.2 Reconciliation with Data Quality Objectives

When the data validation indicates that a control parameter is not within limits specified in this SAP, the impact of the outlier on the usability of the associated data will be assessed. Based on

the results of the data validation, qualifiers will be applied to analytical data to indicate the usability of the data. When the reviewed data do not meet quality control requirements specified in this document the data will be flagged with qualifiers. Commonly used qualifiers include:

- J – The analyte was positively identified and detected; however, the concentration is an estimated value because the result is less than the detection limit or quality control criteria were not met.

- R - Reject, unusable. The data are qualitatively and quantitatively unacceptable.

- U – The analyte was not detected at the given detection limit.

- No qualifier - Data are acceptable for use as reported.

3.4.3 Documentation and Records

Upon successful completion of the data validation process and assessment of usability of the data, new data generated for the project will be entered/loaded into the project database. Copies of all analytical data and/or final reports are retained in the laboratory files and, at the discretion of the laboratory manager. Subsequent to completion of the project, the files will be transferred to data archives. Data may be retrieved from archives upon request. Exide will be ultimately responsible for record retention on completion of the quarterly monitoring activities.

All reports generated during the quarterly groundwater monitoring will be provided to DTSC in both paper and electronic formats. These submittals, to the extent applicable, could include the following:

- Presentation of analytical results in tables, figures, and graphs, as needed

- Summaries of field data from field measurements such as well discharge, water levels, and water quality parameters
- Copies of field data forms and laboratory reports

Raw data from field measurements and other sample collection activities will be appended to the reports, as appropriate. Where field data have been reduced or summarized, the method of reduction will be documented in the reports. All documents will be kept for a minimum of six years from termination of the Consent Order.

3.5 DATA MANAGEMENT

The document control system (DCS) for the project is designed to meet the following objectives.

- Establish and maintain a repository for project documents and data.
- Establish an inventory of documents contained in the DCS.
- Facilitate efficient retrieval of information.

The content and organization of the DCS are discussed below, along with a description of the file indexing method, a computer-based document inventory system, and a discussion of document preservation.

3.5.2 Document Collection and Organization

All records, documents, and other information relating to the project will be located in Exide's Vernon facility and will be preserved as physical or electronic documents, or both. Those preserved as physical documents will be kept in file cabinets in a secure office setting. Alternatively, documents may be converted to electronic format. Specifically, portable document format (PDF) files of the documents may be generated using Adobe Acrobat® software. Documents to be preserved will include, but not limited to, the following:

- Field activity records (i.e., logbooks, notebooks, chain-of-custody records, air bills, surveys, laboratory reports, photographs, etc.)
- Final deliverables submitted to DTSC
- Incoming and outgoing correspondence
- Transmittals
- Photographs
- Waste manifests
- Project memoranda
- Project notes
- Meeting agendas and minutes

3.5.3 File Preservation

In accordance with the Consent Order, all data, records, and documents shall be maintained in the project database and document management system described above for a period of at least six years from the date of termination of the Consent Order. The DTSC shall be notified in writing a minimum of 90 days prior to the destruction of any of the records, and shall be provided with the opportunity to take possession of any such records. The Exide Project Manager will be responsible to ensure all project documents are appropriately stored and maintained.

Project documents include electronic data and database of field and analytical measurements. Daily backups of electronic data will be performed and appropriately stored. The Project Manager is responsible to ensure all individuals on the distribution list receive current copies of all documents.

3.6 ASSESSMENT/OVERSIGHT

This section describes the activities associated with assessing the effectiveness of the project QA/QC procedures in terms of audit procedures, corrective action, and reports to management.

Internal audits will also be performed and will be the responsibility of the Project Manager. Performance and system audits will be conducted as presented in the following paragraphs with additional audits performed if problems are discovered. System audits are qualitative reviews of project activities to check that the overall QA program is functioning. Performance audits are quantitative checks on different aspects of internal support or project work, and are most appropriate for environmental sampling and analysis activities. It is anticipated that one internal system audit and two field performance audits will be conducted as part of the project audit program.

Advanced GeoServices' Project Manager will also be directly responsible for the internal system and field performance audits anticipated during the project. The internal system audit will involve checking that project documentation is complete. The field audits will involve observing field activities to check that the QA/QC procedures described in this SAP and other related work plans are being followed and that the required field documentation is complete. Problems or deviations from the procedures will be brought to the attention of, and discussed with, field personnel so that corrections can be made immediately.

On completion of each internal and field audit, the Project Manager will document any deficiencies or problems encountered and the proposed corrective measures. It will be the Project Manager's responsibility to make sure that all of the recommended corrective actions are implemented in a timely manner. Copies of the audit memoranda and any follow-up correspondence will be included in the project files.

3.6.1 Corrective Action

An important part of a QA program is a well-defined, effective policy for correcting problems. The QA program is established to prevent problems, but it also serves to identify and correct those that exist. Usually these problems require either on the spot, immediate corrective action or long term corrective action.

The corrective action system used during the field activities is designed to quickly identify problems, and solve them efficiently. The Project Manager is responsible for the direction of this system and receives full support from management for its implementation. The essential steps are:

- Identify and define the problem.
- Assign responsibility for investigating the problem.
- Determine a corrective action to eliminate the problem.
- Assign and accept responsibility for implementing the corrective action.
- Implement the corrective action.
- Verify that the corrective action has eliminated the problem.
- Document the problem identified, the corrective action taken and its effectiveness in eliminating the problem.

Corrective action procedures that will be used to resolve deficiencies found during routine activities or QA audits of field, laboratory, or office activities are as described in the following section.

3.5.1.1 **Corrective Action Resulting from Routine Activities**

Deficiencies found during routine activities will be resolved by implementing corrective action as part of normal operating procedures by staff. Corrective actions of this type will be noted in the field or laboratory logbook; no other formal documentation is necessary unless further corrective action is required. If normal procedures do not solve the problem, the staff will verbally inform the Project Manager of the problem and, if significant, the problem will be documented in a formal memo addressed to the Project Manager and copied to the project file. The Project Manager will be responsible for implementing or assigning personnel to problem resolution.

3.5.1.2 **Corrective Action Resulting from QA Audits**

Deficiencies encountered during a QA audit will be corrected as soon as possible. The Project Manager is responsible for completion of appropriate corrective action. The procedures used to expedite corrective action are as follows:

- Auditor verbally notifies the Project Manager and field personnel immediately during audits of deficiencies found.
- The Project Manager institutes corrective action as soon as possible.
- The Project Manager distributes the audit report promptly.

3.5.2 Quality Assurance Reports to Management

Reports that present field or laboratory measurements will contain a QA section addressing the quality of the data and its limitations. The QA section will address the following points as appropriate:

- Adherence to the work plan. Deviations from the work plan and DQOs will be explained and documented.
- Precision, accuracy, and completeness of the data reported, in quantitative terms, as compared with the objectives set for those parameters.
- Representativeness and comparability of data in qualitative terms as compared with objectives set for those parameters.
- Changes and revisions to the documents governing field work.
- Summary of QC activities, including development of standard operating procedures (SOPs) and QC procedures.
- Summary of QA activities.
- Results of performance and/or system audits.

- Description of quality problems found.
- Description of corrective actions taken.

Any deviations from the plans that may have generated results inconsistent with the DQOs will be discussed with the decision-makers and users and reconciled appropriately. Any limitations of the data and the corresponding final resolutions will be included in the QA section of the reports.

4.1 GROUNDWATER SAMPLING RATIONALE

4.2 QUARTERLY GROUNDWATER MONITORING

Existing wells are being sampled quarterly for a select range of parameters to identify contaminants of potential concern (COPC) for groundwater at the site. Current groundwater sampling consists of the following:

- Field Parameters (pH, eH, temp, conductivity, dissolved oxygen, and turbidity);
- VOCs using USEPA Method 8260B;
- Dissolved Title 22 metals; and,
- Sulfate and pH.

Volatile organic analyses will be performed to assess past releases associated with underground storage tanks containing gasoline and diesel fuel, and with the use of chlorinated solvents at the site. Dissolved metals analysis will be performed on filtered samples to provide an understanding of the occurrence of inorganic constituents in the wells. Sulfate and pH will be measured to monitor the effects of the battery recycling operations on the groundwater.

4.3 ADDITIONAL GROUNDWATER MONITORING

Pursuant to the approved Sampling and Analysis Plan contained in the Comprehensive RFI Work Plan, groundwater sample analysis for the first two consecutive quarters of groundwater sampling following completion of the RFI groundwater monitoring wells will be expanded to include the following:

- Field Parameters (pH, eH, temp, conductivity, dissolved oxygen, and turbidity)
- Appendix IX Parameter List (excluding herbicides, pesticides, dioxins and furans)
- Alkalinity, chloride, nitrate-N, sulfide, sulfate, and total dissolved solids

Note: Appendix IX metals analysis shall be performed on filtered and unfiltered samples

After the first two rounds (proposed as consecutive quarters) of sampling the Appendix IX Parameter List will be replaced with a reduced list of parameters based on observed results and proposed in the Report presenting the results of the Comprehensive RFI. Field parameters will be collected as part of standard procedures for low flow sampling.

5.1 REQUEST FOR ANALYSES

5.2 GROUNDWATER SAMPLING AND ANALYSIS NARRATIVE

Wells currently being sampled on a quarterly basis are as follows: MW-5, MW-7R, MW-8, MW-9R, MW-10R, MW-11R, MW-12, MW-13, MW-14, MW-15, MW-16, MW-17, PW-1, and PW-2. As noted above, Surface Impoundment wells SI-1 and SI-5 are also being included in the quarterly groundwater sampling and proposed wells SI-2 through SI-4 will be added to the quarterly sampling list following their installation. Well construction information is presented in Table 5-1. Additional wells may be sampled as directed by Exide.

Groundwater sample analysis for the quarterly groundwater sampling will include the following:

- VOCs using United States Environmental Protection Agency (USEPA) Method 8260B
- Dissolved Title 22 metals using USEPA Method 6020/7470A on lab-filtered samples
- Sulfate using USEPA Method 300.0
- pH using SM 4500 H+B

Other analyses such as 1,4-Dioxane (USEPA Method 8270C (M) Isotope Dilution) may be conducted as directed by Exide. Additional information is provided in Table 3-1. The groundwater sampling procedures are presented in Attachment A.

5.3 ANALYTICAL LABORATORY

Primary laboratory analyses for the project will be performed by Eurofins Calscience Inc. (Calscience), of Garden Grove, California. The laboratory Project Manager will be responsible for assuring that all samples are analyzed in accordance with approved QA/QC procedures. A copy of Calscience's Quality Assurance Manual can be found in Attachment B.

6.1 FIELD METHODS AND PROCEDURES

6.2 FIELD TESTING

During groundwater sampling activities, groundwater will be field monitored on a continuous basis for pH, eH, specific conductivity, temperature, dissolved oxygen, and turbidity. Procedures for groundwater screening are provided in Attachment A.

6.3 DECONTAMINATION PROCEDURES

This section describes the equipment decontamination procedures to be used during the field activities for reusable groundwater monitoring equipment. The liquid wastes will be contained and handled as described in Section 8.0.

Sampling equipment that will be in direct contact with groundwater samples for chemical analyses, including groundwater sampling pumps and associated equipment, will be disassembled and thoroughly cleaned by the following procedure:

- wash and scrub the equipment with tap water;
- manual scrub with non-phosphate soap solution;
- distilled/de-ionized water rinse.

Decontaminated equipment will be wrapped in new plastic if they will not be immediately used.

7.0 SAMPLE CONTAINERS PRESERVATIONS AND STORAGE

Sample quantities, types, and locations will be determined before the actual fieldwork commences. The field sampler will be responsible for the care and custody of the samples until properly transferred. Protective gloves will be worn at all times when handling samples and are required to be changed prior to handling different samples.

Sample custody begins with the shipment of the empty sampling containers to the site. All sample containers are shipped from the laboratory in sealed coolers or cartons with appropriate tamper-proof seals and custody documentation. Custody transfer will be documented on the chain-of-custody form. Each sample will be labeled and properly sealed immediately upon collection.

Containers, preservatives and holding times for collection of groundwater samples are summarized in Table 7-1. Groundwater sampling procedures are provided in Attachment A.

8.0 DISPOSAL OF RESIDUAL MATERIAL

Investigation-derived wastes (IDWs) likely to be generated during groundwater sampling activities include VOC and metals containing water. Decontamination rinsate and groundwater will likely be stored in 55-gallon drums. Disposal options will be considered by Exide based on the results of these analyses and subsequent profiling of the wastes. Exide will arrange transportation and disposal of the IDWs, as appropriate.

9.1 SAMPLE DOCUMENTATION AND SHIPMENT

This section describes procedures for sample custody that will be followed for sample collection, transfer, analysis, and disposal throughout the quarterly groundwater monitoring activities. The purpose of these procedures is to assure that the integrity of samples is maintained during their collection, transportation, and storage prior to analysis. Sample identification documents will be carefully prepared so that identification and chain-of-custody records can be maintained and sample disposition can be controlled. Forms and labels will be filled out with waterproof ink. Identification documents that will be used during the investigations are sample labels and chain-of-custody forms samples of the documents are presented in Attachment C.

9.2 FIELD NOTES

Field logbooks will be used to record daily activities as they relate to the progress of the quarterly groundwater monitoring activities. Completed field logbooks will be provided to the Project Manager in a timely manner and will be retained in the project files according to the project number for that task. All entries must be legible, in ink, and primarily factual in content. Field observations can be entered but should be noted accordingly. At a minimum, field logs will include the following:

- Project name and number
- Site name and location
- Arrival and departure date/time
- Name and affiliation of personnel onsite, and personnel contacted
- Author name and date
- Field instrument calibration methods and identification number
- Chronology and location of activities
- Sampling locations on site map
- Sample identification numbers, amount collected, sampling method, and container (size/type) for each sample collected, including QC samples.

Sample processing techniques such as filtration, compositing, and preservation techniques should be noted.

- Date and time of sample collection
- Name of sampler
- Field observations and applicable comments
- Number of shipping coolers packaged and sent
- Name and address of all receiving laboratories

The calibration data included on the daily field log should include the date and time that each instrument was calibrated, name of the person performing the calibration, the type and model number of the instrument being calibrated, the strength of the calibration media (if applicable), and the instrument readings during the calibration.

9.3 SAMPLE LABELS

Sample labels are necessary to prevent misidentification of samples. Preprinted sample labels will be provided. Where necessary, the label will be protected from water and solvents with clear label-protection tape. Each label contains the following information:

- Project name
- Project number
- Name of collector
- Date and time of collection
- Field identification number or sample identification number
- Preservative used (if applicable)
- Analyses required

9.4 CHAIN OF CUSTODY

A chain-of-custody record will be filled out and accompany every sample to the laboratory to establish the documentation necessary to trace sample possession from the time of collection. A copy of the chain-of-custody form will be retained in the investigation files according to project/task number. An example chain-of-custody form is shown in Attachment C. The following information will be recorded on the form:

- Sample number or identifications
- Name of sampler(s)
- Signature of collector, sampler, or recorder
- Location of project
- Project manager's name
- Date of collection
- Place of collection (site location)
- Sample type
- Analyses requested
- Inclusive dates of possession
- Signature of person receiving sample
- Laboratory sample number, where applicable
- Date and time of sample receipt

9.5 SAMPLE PACKAGING AND SHIPMENT

Samples will always be accompanied by a chain-of-custody record. When transferring samples, the individuals relinquishing and receiving the samples will sign and date the chain-of-custody record. During the sampling procedure, the sample coolers and samples will remain in the control of the field sampling team at all times. Should the samples be left unattended, the samples will be stored in a secure area of the site to which only the field sampling team has access.

Samples will be packaged properly for shipment, including isolation of samples thought to have high chemical concentrations, and dispatched to the appropriate laboratory for analysis. Samples will be placed on ice, if necessary, using double-bagged ice. Ice should also be placed on top of the samples. Label coolers correctly with "Fragile" and "This-End-Up" labels, as appropriate.

Custody seals are not deemed necessary when the samples will be in continuous possession of technical or laboratory personnel. Custody seals will be used when samples are shipped via courier service. The chain-of-custody record will accompany each shipment. The method of shipment, courier name(s), and other pertinent information will be entered in the chain-of-custody record. A copy of the chain-of-custody record will be retained by the sampler and forwarded to the Project QA Manager for review and filing. The project personnel or designated couriers will transport the coolers to the analytical laboratories.

9.5.1 Laboratory Custody Procedures

A laboratory designated sample custodian will accept custody of the shipped samples and verify that the information on the sample label matches that on the chain-of-custody form(s). Pertinent information as to sample condition upon receipt, method of shipment, pickup and delivery, and courier will also be checked on the chain-of-custody form(s). The custodian will then enter the appropriate data into the laboratory sample tracking system. The laboratory custodian will use the sample number on the sample label or assign a unique laboratory number to each sample. The custodian will then transfer the sample(s) to the proper analyst(s) or store the sample(s) in the appropriate secure area. The laboratory will also check the temperature of the sample cooler upon arrival. The laboratory will ensure that all laboratory analysis is performed within the prescribed holding times.

Laboratory personnel will be responsible for the care and custody of samples from the time they are received until they are exhausted. Data sheets and laboratory records will be retained by the laboratory as part of the permanent documentation for a period of at least 3 years.

9.5.2 Sample Storage and Disposal

Samples and extracts will be retained by the analytical laboratory for up to 30 days after the data are reported by the laboratory. Unless notified otherwise by the Project Manager, excess or unused samples should be disposed by the laboratory in a manner consistent with appropriate methods adopted by the laboratory.

10.1 QUALITY CONTROL

10.2 FIELD QUALITY CONTROL SAMPLES

This section describes procedures for collecting QC samples in the field. Other field QC procedures, such as field instrument calibration and equipment decontamination, are described elsewhere in this SAP. A QA/QC sample summary is presented in Table 10-1.

10.2.1 Field Duplicate Samples

At a minimum, field duplicates of groundwater samples will be collected at a rate of 5 percent of the samples collected per sampling event. Field duplicate samples will be collected, preserved, packaged, labeled, and sealed in a manner identical to the other samples being collected. Field duplicates will be collected from areas where moderate to high levels of contamination are anticipated. Duplicate samples will be analyzed for the same target analytes as the original sample.

10.2.2 Equipment Decontamination Blanks

Equipment decontamination blanks will be collected from the final rinse water from equipment decontamination. The blank is prepared in the field by pouring or pumping deionized water through the sampling equipment and into the appropriate sample containers after equipment decontamination. The decontamination blank serves as a check to verify the effectiveness of the decontamination procedures. An equipment decontamination blank will be collected at a target frequency of one per day. Decontamination blanks will be analyzed for all target analytes submitted for analysis on that day.

10.2.3 Trip Blanks

Trip blanks will consist of a container of organic-free water supplied by the analytical laboratory in the cooler in which the empty sample containers are shipped. The trip blank sample accompanies the empty sample containers to the field and is then returned, unopened, to the laboratory along with the field samples. One trip blank will be placed in each cooler that contains water quality samples for VOC analyses. Trip blanks will be submitted for VOC analyses only.

10.3 LABORATORY QUALITY CONTROL SAMPLES

Two types of QC checks will be employed to evaluate the performance of a laboratory's analytical procedures. The QC checks represent the controlled samples introduced into the sample analysis stream and are used to evaluate the accuracy and precision of the chemical analysis program. The QC check samples will be introduced or analyzed based on the size of sample lots. A sample lot or batch will consist of greater than zero but fewer than 20 samples that are extracted and analyzed as a batch by the laboratory. Laboratory quality control (QC) samples will be collected in double volume at a frequency of 1 per 20 samples. These additional sample containers will be labeled "for matrix spike/matrix spike duplicate (MS/MSD) analysis" and will be used by the laboratory for their internal quality control. Samples for laboratory QC will be selected from locations where low levels of contamination are expected based on the available historical data. Samples with low levels of contamination are preferred for laboratory QC samples to minimize the possibility of diluting out the spike to a concentration below the quantitation limit. Laboratory QC samples will be designated on the chain-of-custody record and in the field logbook.

10.3.1 Method Blank/Reagent Blank

A laboratory-grade water blank is analyzed, along with all aqueous and non-aqueous samples submitted for analyses. The method/reagent blank is processed through all procedures,

materials, reagents, and labware used for sample preparation and analysis. The frequency for method blank preparation and analysis is a minimum of 1 per 20 field samples or per analytical batch, whichever is most frequent. For VOC analysis by EPA Method 8260, the frequency for method blanks is 1 per every 12 hours of sample analysis, or 1 per 20 samples, whichever is more frequent. An analytical batch is defined as a maximum of 20 samples from one project that are analyzed together with the same method sequence, the same lots of reagents, and with the manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch are to be of similar composition or matrix. Calibration blanks are required for metals analysis to establish the analytical curve.

10.3.1.1 **Calibration Standards (Initial Calibration)**

The calibration standard is prepared in the laboratory by dissolving a known amount of pure (nominally 100 percent) analyte in an appropriate matrix. The final concentration calculated from the known quantity is the true value of the standard. All calibration standards must be traceable to certified reference materials or certified check standards. The results obtained from these standards are used to generate a standard curve, which can be used to quantify the compound in the environmental sample. Calibration standards at a minimum of five concentration levels and a blank will be used in generating a calibration curve for all organic analyses. With the exception of the mercury analysis, a minimum of three calibration standards and a blank will be used to generate a calibration curve for all inorganic analyses. A four-point calibration curve is required for mercury analysis. For organic analyses, a relative standard deviation (RSD) of the calibration factor (defined in method) of less than 20 percent over the working range of the curve is required before initial calibration is accepted. For inorganic analyses, a minimum correlation coefficient of 0.995 (using linear regression analysis) must be achieved before the initial calibration curve is considered linear and accepted.

10.3.1.2 **Check Standard (Continuing/Daily Calibration)**

The check standard is prepared in the same manner as a calibration standard. The final concentration calculated from the known quantity is the true value of the standard. The check standard result is used to monitor the continuing validity of an existing calibration curve or concentration calibration standard file. The check standards are known as the "continuing calibration verification standards". Continuing calibration standards must satisfy method-specific QC requirements prior to initiation of sample analysis.

To verify the accuracy of the analytical system at the low concentration end of the calibration curve, a second type of check standard is prepared at a concentration of two to five times the instrument detection limit and analyzed at the beginning (after calibration) and end of the day or analytical "run". The laboratory will have the option of analyzing two low-level standards as described above or analyzing a mid-level standard every 10 samples as described in SW-846 Method 8000 for GC analysis. The criteria for the two low-level standards are that the response for each analyte must not exceed a 15 percent difference when compared to the continuing/daily response.

For inorganic analysis, the check standards outlined in the associated methods must be analyzed and the standards must pass the criteria outlined in the associated methods.

10.3.2 Laboratory Duplicates

Aliquots (e.g., subsamples) are made in the laboratory from the same sample, and each aliquot is treated exactly the same throughout the analytical method. The RPD between the values of the duplicates, as calculated below, is taken as a measure of the precision (reproducibility) of the analytical method:

$$RPD = \frac{2(D_1 - D_2)}{D_1 - D_2} \times 100$$

Where:

RPD = relative percent difference

D_1 = first sample value

D_2 = second sample value (duplicate)

The duplicate is a measure of the precision of the laboratory sampling (i.e., aliquoting) and analysis procedure and of the homogeneity of the sample matrix as provided to the laboratory. Laboratory duplicates will be analyzed at a minimum frequency of 1 per 20 samples or per analytical batch.

10.3.3 Laboratory Control Sample (LCS)

LCS analyses (sometimes referred to as Method Control Samples (MCS)) are spikes on blank matrix to assess accuracy independent of matrix effects. These matrices are deionized water for water samples and reagent sand for soil samples. The LCS is prepared by adding a known amount of target analyte to the matrix. If LCS analyses do not meet the recovery criteria, the LCS sample will be reanalyzed to determine if the failure is due to a transient instrumental condition. If the second analysis does not meet the recovery criteria, the LCS and the entire analytical batch will be re-extracted and reanalyzed within the holding time.

10.3.4 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

A sample matrix spike is prepared by adding a known amount of the pure analyte to the environmental sample before extraction/digestion. The added analyte is the same as the analyte being assayed for in the environmental sample. An analytical spike is prepared by adding a known amount of analyte(s) to a known amount of sample digestate or extract. Background and interferences having an effect on the actual sample analyte will have a similar effect on the spike. The calculated percent recovery of the matrix spike is considered to be a measure of the relative accuracy of the total analytical method (i.e., sample preparation and analysis). The calculated percent recovery of the analytical spike is considered to be a measure of the relative accuracy of

the sample analysis procedure only. The matrix spike, the surrogate spike, and the analytical spike are also measures of the effect of the sample matrix on the ability of the methodology to detect specific analytes. When there is no change in volume due to the spike, percent recovery is calculated as follows:

$$R = 1OO(A-X)/T$$

Where:

R = percent recovery

A = measured analyte concentration after the spike is added

X = measured analyte concentration in the sample before the spike is added

T = value of spike

Tolerance limits for acceptable percent recoveries are established in the referenced methods. Project-specific QC acceptance limits may be established on a parameter-specific basis for each analysis method if, after sufficient data have been compiled, it is apparent that different limits than those specified in the referenced methodology should be applied. Matrix spikes will be analyzed at a minimum frequency of 1 per 20 samples of similar matrix or analytical batch. Analytical spikes and surrogate spikes are required for every sample for some analysis routines and specific methods.

For organic analyses, matrix spike duplicate samples are required at a specified frequency of 1 per 20 samples. A matrix spike duplicate is prepared from a second aliquot of the sample that was analyzed as the matrix spike. The relative percent difference (RPD) between the matrix spike and the matrix spike duplicate for each spike analyte must be reported.

10.3.5 Surrogate Spikes

Surrogate spikes are used to evaluate whether laboratory equipment is operating within the prescribed limits of laboratory QC and are checked by the laboratory for accuracy and proper

chemical identification. Surrogate spikes will be added, as appropriate, for organic analyses to all blanks, standards, and environmental samples.

11.0 FIELD VARIANCE

Any deviations from the SAP that may have generated results inconsistent with the DQOs will be discussed with the decision-makers and users and reconciled appropriately. Any limitations of the data and the corresponding final resolutions will be included in the QA section of the reports.

12.0 REFERENCES

Advanced GeoServices, 2012. *Revised Current Conditions Report.* October 5, 2012.

California Department of Water Resources [DWR], Bulletin 104, 1961

California Department of Water Resources, 1990. Water Well Standards: State of California Bulletin 74-81 and Supplement 74-90.

U.S. Environmental Protection Agency, 2001. *EPA Requirements for Quality Assurance Project Plans*, (EPA QA/R-5), EPA/240/B-01/002, Office of Environmental Information.

U.S. Environmental Protection Agency, 2000a. *Guidance for Data Quality Assessment: Practical Methods for Data Analysis* (QA/G-9), EPA/600/R-96/084, Office of Environmental Information

U.S. Environmental Protection Agency, 2000b. *Guidance for the Data Quality Objectives Process (QA/G-4)*, EPA/600/R-96/055, Office of Environmental Information.

U.S. Environmental Protection Agency, 1999a. *National Functional Guidelines for Organic Data Review*, EPA540/R-99/008, Office of Emergency and Remedial Response

U.S. Environmental Protection Agency, 1998, *EPA Guidance for Quality Assurance Project Plans (EPA QA/G-5)*, EPA/600/R-98/018, Office of Research and Development.

TABLES

TABLE 3-1
SUMMARY OF LABORATORY METHODS
AND QUALITY ASSURANCE GOALS
QUARTERLY GROUNDWATER SAMPLING AND ANALYSIS PLAN
Exide Technologies
Vernon, California

SAMPLE TYPE	ANALYSIS	METHOD	PRECISION[1]	ACCURACY[1]
Groundwater	VOCs	SW-846 Method 8260B/C	20	in-house limits
	1,4-Dioxane	Method 8270C/D (M) Isotope Dilution	20	75 - 125
	pH	SM 4500 H+ B	20	75 - 125
	Sulfate	USEPA Part 136 Method 300.0	20	75 - 125
	Title 22 Metals	Method 6020/A/7470A	20	75 - 125
	Turbidity	SM 2130B (EPA 180.1)	20	90 - 110
Aqueous Samples Equipment Blank	Metals	SW-846 Method 6010B/C, 7470A~~, 7196A~~	20	75 - 125
	pH	SM 4500 H+ B	20	75 - 125
	Sulfate	USEPA Part 136 Method 300.0	20	75 - 125
	VOCs	SW-846 Method 8260B/C	20	in-house limits

Notes
SW-846 - USEPA "SW-846 Test Methods for Evaluating Solid Wastes - Physical/Chemical Methods" Revision 6, November 2004.
Part 136 - Section 304(h) of the Clean Water Act (40 CFR Part 136)
SM - Standard Methods for the Examination of Water and Wastewater
A percent completeness goal of 90% has been set for the laboratory analytical results.
[1] Check the methods for the values of specific species.

TABLE 3-2
REPORTING LIMITS
Quarterly Groundwater Sampling and Analysis Plan
Exide Technologies, Vernon, California

COMPOUND	METHOD	CAS	AQUEOUS		
			UNIT	MDL	RL
Volatile Organic Compounds					
1,1,1,2-Tetrachloroethane	EPA 8260B	630-20-6	ug/L	0.4	1
1,1,1-Trichloroethane	EPA 8260B	71-55-6	ug/L	0.3	1
1,1,2,2-Tetrachloroethane	EPA 8260B	79-34-5	ug/L	0.41	1
1,1,2-Trichloroethane	EPA 8260B	79-00-5	ug/L	0.38	1
1,1-Dichloroethane	EPA 8260B	75-34-3	ug/L	0.28	1
1,2,3-Trichloropropane	EPA 8260B	96-18-4	ug/L	0.64	5
1,2,4-Trichlorobenzene	EPA 8260B	120-82-1	ug/L	0.5	1
1,2-Dibromo-3-Chloropropane	EPA 8260B	96-12-8	ug/L	1.2	5
1,2-Dibromoethane	EPA 8260B	106-93-4	ug/L	0.36	1
1,2-Dichlorobenzene	EPA 8260B	95-50-1	ug/L	0.46	1
1,2-Dichloroethane	EPA 8260B	107-06-2	ug/L	0.24	0.5
1,3,5-Trimethylbenzene	EPA 8260B	108-67-8	ug/L	0.28	1
1,3-Dichlorobenzene	EPA 8260B	541-73-1	ug/L	0.4	1
1,4-Dichlorobenzene	EPA 8260B	106-46-7	ug/L	0.43	1
1,4-Dioxane	EPA 8270C	123-91-1	ug/L	0.28	1
2-Butanone	EPA 8260B	78-93-3	ug/L	2.2	10
2-Hexanone	EPA 8260B	591-78-6	ug/L	2.1	10
4-Methyl-2-Pentanone	EPA 8260B	108-10-1	ug/L	4.4	10
Acetone	EPA 8260B	67-64-1	ug/L	10	20
Acetonitrile	EPA 8260B	75-05-8	ug/L	1.1	20
Acrolein	EPA 8260B	107-02-8	ug/L	14	50
Acrylonitrile	EPA 8260B	107-13-1	ug/L	8	20
Allyl Chloride	EPA 8260B	107-05-1	ug/L	0.81	20
Benzene	EPA 8260B	71-43-2	ug/L	0.14	0.5
Bromodichloromethane	EPA 8260B	75-27-4	ug/L	0.21	1
Bromoform	EPA 8260B	75-25-2	ug/L	0.5	1
Bromomethane	EPA 8260B	74-83-9	ug/L	3.9	10
Carbon Disulfide	EPA 8260B	75-15-0	ug/L	0.41	10
Carbon Tetrachloride	EPA 8260B	56-23-5	ug/L	0.23	0.5
Chlorobenzene	EPA 8260B	108-90-7	ug/L	0.17	1
Chloroethane	EPA 8260B	75-00-3	ug/L	2.3	5
Chloroform	EPA 8260B	67-66-3	ug/L	0.46	1
Chloromethane	EPA 8260B	74-87-3	ug/L	1.8	10
Chloroprene	EPA 8260B	126-99-8	ug/L	7.5	20
Dibromochloromethane	EPA 8260B	124-48-1	ug/L	0.25	1
Dibromomethane	EPA 8260B	74-95-3	ug/L	0.46	1
Dichlorodifluoromethane	EPA 8260B	75-71-8	ug/L	0.46	1
Hexachloro-1,3-Butadiene	EPA 8260B	87-68-3	ug/L	0.32	20
Iodomethane	EPA 8260B	74-88-4	ug/L	9	20
Isobutyl Alcohol	EPA 8260B	78-83-1	ug/L	4.8	20
Methacrylonitrile	EPA 8260B	126-98-7	ug/L	3.8	20
Methyl Methacrylate	EPA 8260B	80-62-6	ug/L	1.1	20
Methylene Chloride	EPA 8260B	75-09-2	ug/L	0.64	10
Naphthalene	EPA 8260B	91-20-3	ug/L	2.5	10
o-Xylene	EPA 8260B	95-47-6	ug/L	0.23	1
p/m-Xylene	EPA 8260B	179601-23-1	ug/L	0.24	1
Propionitrile	EPA 8260B	107-12-0	ug/L	5.9	20
Styrene	EPA 8260B	100-42-5	ug/L	0.17	1
t-1,4-Dichloro-2-Butene	EPA 8260B	764-41-0	ug/L	2.2	20
Tetrachloroethene	EPA 8260B	127-18-4	ug/L	0.39	1
Toluene	EPA 8260B	108-88-3	ug/L	0.24	1
Trichloroethene	EPA 8260B	79-01-6	ug/L	0.37	1
Trichlorofluoromethane	EPA 8260B	75-69-4	ug/L	1.7	10
Vinyl Acetate	EPA 8260B	108-05-4	ug/L	2.8	10
Vinyl Chloride	EPA 8260B	75-01-4	ug/L	0.3	0.5

TABLE 3-2
REPORTING LIMITS
Quarterly Groundwater Sampling and Analysis Plan
Exide Technologies, Vernon, California

COMPOUND	METHOD	CAS	AQUEOUS		
			UNIT	MDL	RL
Inorganics					
Aluminium	EPA 6010B	7429-90-5	mg/L	0.0124	0.05
Antimony	EPA 6010B	7440-36-0	mg/L	0.00787	0.015
Arsenic	EPA 6010B	7440-38-2	mg/L	0.00438	0.01
Barium	EPA 6010B	7440-39-3	mg/L	0.00296	0.01
Beryllium	EPA 6010B	7440-41-7	mg/L	0.000561	0.01
Cadmium	EPA 6010B	7440-43-9	mg/L	0.00269	0.01
Chromium	EPA 6010B	7440-47-3	mg/L	0.00271	0.01
Cobalt	EPA 6010B	7440-48-4	mg/L	0.00295	0.01
Copper	EPA 6010B	7440-50-8	mg/L	0.00267	0.01
Lead	EPA 6010B	7439-92-1	mg/L	0.00406	0.01
Mercury	EPA 7470A	7439-97-6	mg/L	0.0000453	0.0005
Nickel	EPA 6010B	7440-02-0	mg/L	0.00298	0.01
Selenium	EPA 6010B	7782-49-2	mg/L	0.00699	0.015
Silver	EPA 6010B	7440-22-4	mg/L	0.00139	0.005
Thallium	EPA 6010B	7440-28-0	mg/L	0.00291	0.015
Tin	EPA 6010B	7440-31-5	mg/L	0.00193	0.05
Vanadium	EPA 6010B	7440-62-2	mg/L	0.00244	0.01
Zinc	EPA 6010B	7440-66-6	mg/L	0.00352	0.01
Conventionals					
Sulfate	EPA 300.0	14808-79-8	mg/L	0.32	1
pH	EPA 9045D	--	--	--	--
Turbidity	SW 2130B (EPA 180.1)	--	NTU	0.044	0.05

Formatted Table

TABLE 3-2
REPORTING LIMITS
Quarterly Groundwater Sampling and Analysis Plan
Exide Technologies, Vernon, California

F:\Projects\2013\20132993 - Exide Vernon Permitting Assistance\Sec Files\Reports\2015 Quarterly Groundwater SAP\Table 3-2 reporting limits

TABLE 5-1
MONITORING WELL CONSTRUCTION SUMMARY
Quarterly Groundwater Sampling and Analysis Plan
Exide Technologies, Vernon, California

WELL ID	INSTALLED BY	EAST (X) COORDINATE	NORTH (Y) COORDINATE	COMPLETION DATE	DRILLING METHOD	TYPE OF WELL	WELL CASING TYPE/DIAMETER (IN)	PVC SCREEN SLOT SIZE (IN)	BORING LENGTH (FT)	TOP OF CASING ELEVATION (FT MSL)	LENGTH OF CASING (FT)	TOP OF SCREEN (MSL)	BOTTOM OF SCREEN (MSL)	SCREEN LENGTH (FT)	FILTER PACK TYPE & THICKNESS	SEAL TYPE & THICKNESS	APPROXIMATE DEPTH TO WATER AT INSTALLATION	SOURCE
SHALLOW WELLS																		
MW-1	Kleinfelder & Associates	6502478.915	1824337.654	9/18/1984	H S A	stickup	2" SCH 40 PVC	0.02	33	173.77	32	160.77	140.77	20	#3 Sand, 20 ft	1 ft bentonite	none encountered	Current Conditions Report 5-24-02
MW-2	Kleinfelder & Associates	6502580.18	1824296.288	9/18/1984	H S A	stickup	2" SCH 40 PVC	0.02	33	173.19	32	160.19	140.19	20	#3 Sand, 20.5 ft	1 ft, unknown	none encountered	Current Conditions Report 5-24-02
MW-3	Kleinfelder & Associates	6503306.929	1824375.467	9/19/1984	H S A	stickup	2" SCH 40 PVC	0.02	33	173.75	32	160.75	140.75	20	#3 Sand, 20.5 ft	1 ft bentonite	none encountered	Current Conditions Report 5-24-02
MW-4	Kleinfelder & Associates	6502451.008	1824514.592	9/19/1984	H S A	stickup	2" SCH 40 PVC	0.02	33	175.05	27	167.05	148.05	20	#3 Sand, 22.5 ft	1.5 ft bentonite	none encountered	Current Conditions Report 5-24-02
DEEP WELLS																		
MW-5	Kleinfelder & Associates	6502478.915	1824337.654	1/21/1985	H S A	stickup	4" SCH 40 PVC	0.02	155	173.65	84	105.29	85.29	20	sand, 36 ft	2 ft bentonite	unknown	Current Conditions Report 5-24-02
MW-6	Kleinfelder & Associates	6503445.804	1824221.468	1/25/1985	H S A	flush	2" SCH 40 PVC	0.02	80	172.74	75	112.86	92.86	20	sand, 16 ft	2 ft bentonite	68 ft	Current Conditions Report 5-24-02
MW-7	Kleinfelder & Associates	6502312.855	1824423.68	1/28/1985	H S A	flush	2" SCH 40 PVC	0.02	88	177.33	87	103.95	83.95	20	sand, 21 ft	3 ft bentonite	74 ft	Current Conditions Report 5-24-02
MW-7R	E2 Environmental, Inc.	6502335.21	1824427.28	3/17/2014	H S A	flush	4" SCH 80 PVC	0.01	90	178.71	88	100.71	90.71	10	#2 Monterey sand, 14 ft	5 ft bentonite chips	80.5 ft	E2 Environmental, Inc.
MW-8	Woodward-Clyde Consultants	6501972.255	1824568.271	1/25/1985	H S A	stickup	2" SCH 40 PVC	0.02	90	177.54	89	104.19	84.19	20	sand, 24 ft	2 ft bentonite	73 ft	Current Conditions Report 5-24-02
MW-9	Woodward-Clyde Consultants	6502007.523	1824865.873	9/25/1986	H S A	flush	2" SCH 40 PVC	0.02	89	180.22	88	108.01	88.01	20	#12 silica sand, 35 ft	bentonite pellet, 6 ft	76 ft	Current Conditions Report 5-24-02
MW-9R	E2 Environmental, Inc.	6502038.5	1824873.52	3/7/2014	H S A	flush	4" SCH 80 PVC	0.01	100	181.76	90	101.76	91.76	10	#2 Monterey sand, 27 ft	5 ft bentonite chips	unknown	E2 Environmental, Inc.
MW-10	Woodward-Clyde Consultants	6502600.494	1824720.866	9/29/1986	H S A	flush	2" SCH 40 PVC	0.02	89	173.95	88	101.58	81.58	20	#12 silica sand, 35 ft	bentonite pellet, 5 ft	75 ft	Current Conditions Report 5-24-02
MW-10R	E2 Environmental, Inc.	6502626.25	1824717.85	3/12/2014	H S A	stickup	4" SCH 80 PVC	0.01	90	177.68	85	102.68	92.68	10	#2 Monterey sand, 12 ft	5 ft bentonite chips	79.5 ft	E2 Environmental, Inc.
MW-11	Woodward-Clyde Consultants	6502864.831	1824211.434	9/3/1986	H S A	stickup	2" SCH 40 PVC	0.02	90	174.03	89	100.69	80.69	20	native soil, 44.5 ft	bentonite pellet, 5.5 ft	85 ft	Current Conditions Report 5-24-02
MW-11R	E2 Environmental, Inc.	6502886.03	1824210.24	3/20/2014	H S A	flush	4" SCH 80 PVC	0.01	90	174.12	86	98.12	88.12	10	#2 Monterey sand, 16 ft	5 ft bentonite chips	35 ft	E2 Environmental, Inc.
MW-12	Woodward-Clyde Consultants	6502978.588	1824486.487	9/26/1986	H S A	stickup	2" SCH 40 PVC	0.02	89.5	172.53	89	99.17	79.17	20	# 12 silica sand, 29.5 ft	bentonite pellet, 6 ft	75 ft	Current Conditions Report 5-24-02
MW-13	Woodward-Clyde Consultants	6501978.781	1824668.007	6/24/1987	H S A	flush	2" SCH 40 PVC	0.01	91.5	176.29	91	100.99	80.99	20	unknown, 26.5 ft	unknown, 3 ft	unknown	Current Conditions Report 5-24-02
MW-14	Woodward-Clyde Consultants	6502846.633	1824373.474	6/25/1987	H S A	flush	2" SCH 40 PVC	0.01	91.5	172.97	90	98.74	78.74	20	unknown, 27 ft	unknown, 4 ft	unknown	Current Conditions Report 5-24-02
MW-15	Woodward-Clyde Consultants	6502947.31	1824176.165	9/29/1987	H S A	flush	2" SCH 40 PVC	0.01	91.5	171.06	91	95.81	75.81	20	unknown, 27.5 ft	unknown, 3.5 ft	unknown	Current Conditions Report 5-24-02
MW-16	E2 Environmental, Inc.	6501952.547	1824729.234	12/9/2008	H S A	flush	2" SCH 40 PVC	0.01	94	177.04	93	68	88	20	2/16 sand, 25.5 ft	bentonite chips, 3 ft	79 ft	Phase 3 RFI Report 4-18-11
MW-17	E2 Environmental, Inc.	6503064.194	1823957.242	12/22/2010	H S A	flush	2" SCH 40 PVC	0.01	154.5	172.92	152.5	45.92	25.92	20	2/16 Sand, 30'	Bentonite, 6.5'	139 ft	Phase 3 RFI Report 4-18-11
SI-1	Avocet Environmental, Inc.	6502576.97	1824483.76	3/13/2014	H S A	flush	4" SCH 40 PVC	0.01	83	176.12	82	104.12	94.12	10	2/16 sand, 12 ft and #1 c sand, 1 ft	bentonie chips, 3 ft	79 ft	Avocet Environmental, Inc.
SI-5	Avocet Environmental, Inc.	6502670.65	1824391.62	3/11/2014	H S A	flush	4" SCH 40 PVC	0.01	83.6	175.22	82	103.22	93.22	10	2/16 sand, 12 ft and #1 c sand, 1 ft	bentonite chips, 3 ft	80.5 ft	Avocet Environmental, Inc.
PUMPING WELLS																		
PW-1	Woodward-Clyde Consultants	6501882.613	1824616.792	9/24/1987	H S A	flush	4" SCH 40 PVC	0.01	89	175.76	88	103.51	83.51	20	unknown, 24.5 ft	unknown, 6 ft	79.5	Current Conditions Report 5-24-02
PW-2	Woodward-Clyde Consultants	6502871.818	1824327.853	9/26/1987	H S A	flush	4" SCH 40 PVC	0.01	91.5	172.27	90	96.81	76.81	20	unknown, 27.5 ft	unknown, 4 ft	unknown	Current Conditions Report 5-24-02

NOTES
1. Shading indicates wells have been decommissioned.

TABLE 7-1
SAMPLE PRESERVATION, HOLDING TIMES,
AND CONTAINER REQUIREMENTS
QUARTERLY GROUNDWATER SAMPLING AND ANALYSIS PLAN
Exide Technologies
Vernon, California

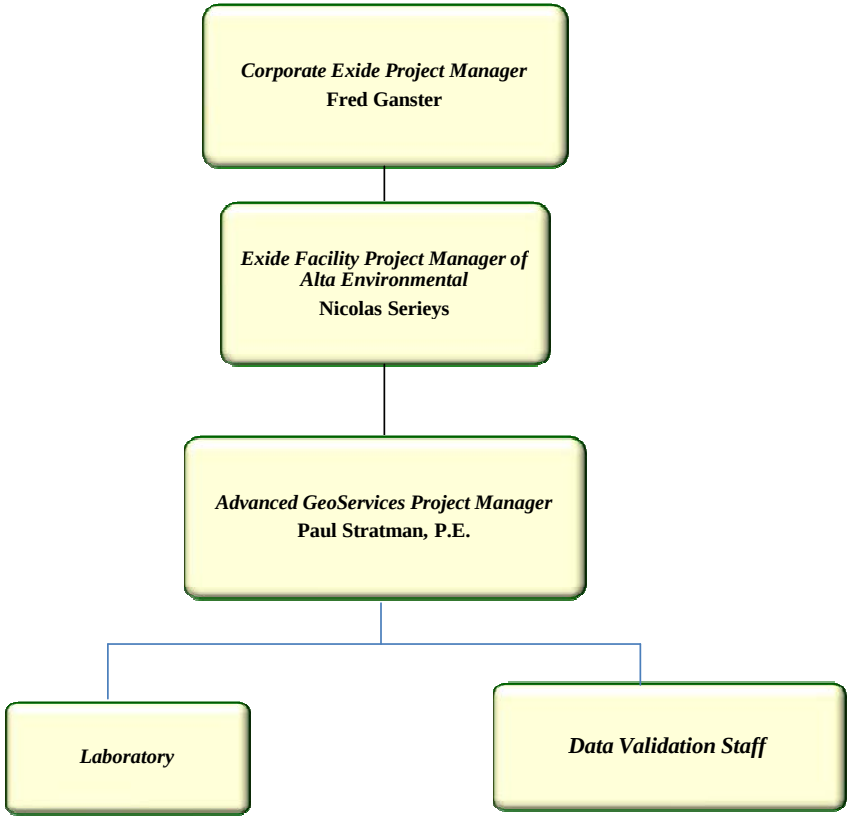
ANALYSIS	MATRIX	CONTAINER	PRESERVATIVE	HOLDING TIME LIMIT
VOCs	Aqueous	3 40 ml VOA vials	HCL, pH<2, cool ±4ºC	14 days
Metals	Aqueous	1 liter HDPE	Cool ±4ºC	180 days (except mercury, 28 days)
pH	Aqueous	500 ml HDPE	Cool ±4ºC	ASAP
Sulfate	Aqueous	500 ml HDPE	Cool ±4ºC	28 days
1,4-Dioxane	Aqueous	500 ml Amber	Cool ±4ºC	7 days for extraction, 40 days after extraction
Turbidity	Aqueous	1 liter HDPE	Cool ±4ºC	48 hours

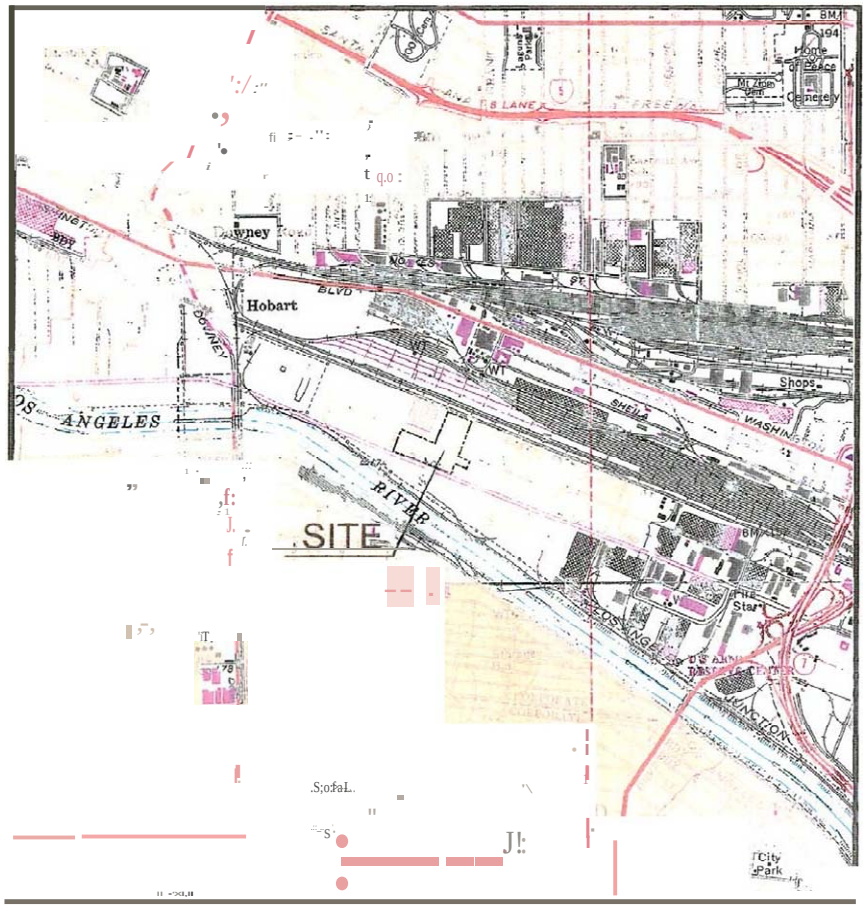
TABLE 10-1
QA/QC SAMPLE SUMMARY
QUARTERLY GROUNDWATER
SAMPLING AND ANALYSIS PLAN
Exide Technologies
Vernon, California

QA/QC Sample Type	Frequency	Analysis
Field Duplicate	1 per 20 per event	Same as parent sample, see Table 3-1
Equipment Decontamination Blanks	1 per day	Analytes submitted for analysis on that day
Field Blank	1 per day	Analytes submitted for analysis on that day
Trip Blank	1 per cooler containing samples for VOC analysis	VOCs
Water Supply Blank	1 per water source	VOCs, SVOCs, PCBs
Matrix Spike/Matrix Spike Duplicate	1 per 20 samples	Same as parent sample, see Table 3-1

FIGURES

FIGURE 1-1
ORGANIZATION CHART
COMPREHENSIVE RFI WORK PLAN
SAMPLING AND ANALYSIS PLAN





SCALE 124000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

GN MN

0°40' 12 MILS

14° 249 MILS

South Gate, California, 7.5 Minute
Contour interval: 20 feet
Source: Composite of Los Angeles
&
Series, U.S.G.S. Topographic Maps

NOIE: QUADRANGLE LOCATION

ADVANCED GeoServices

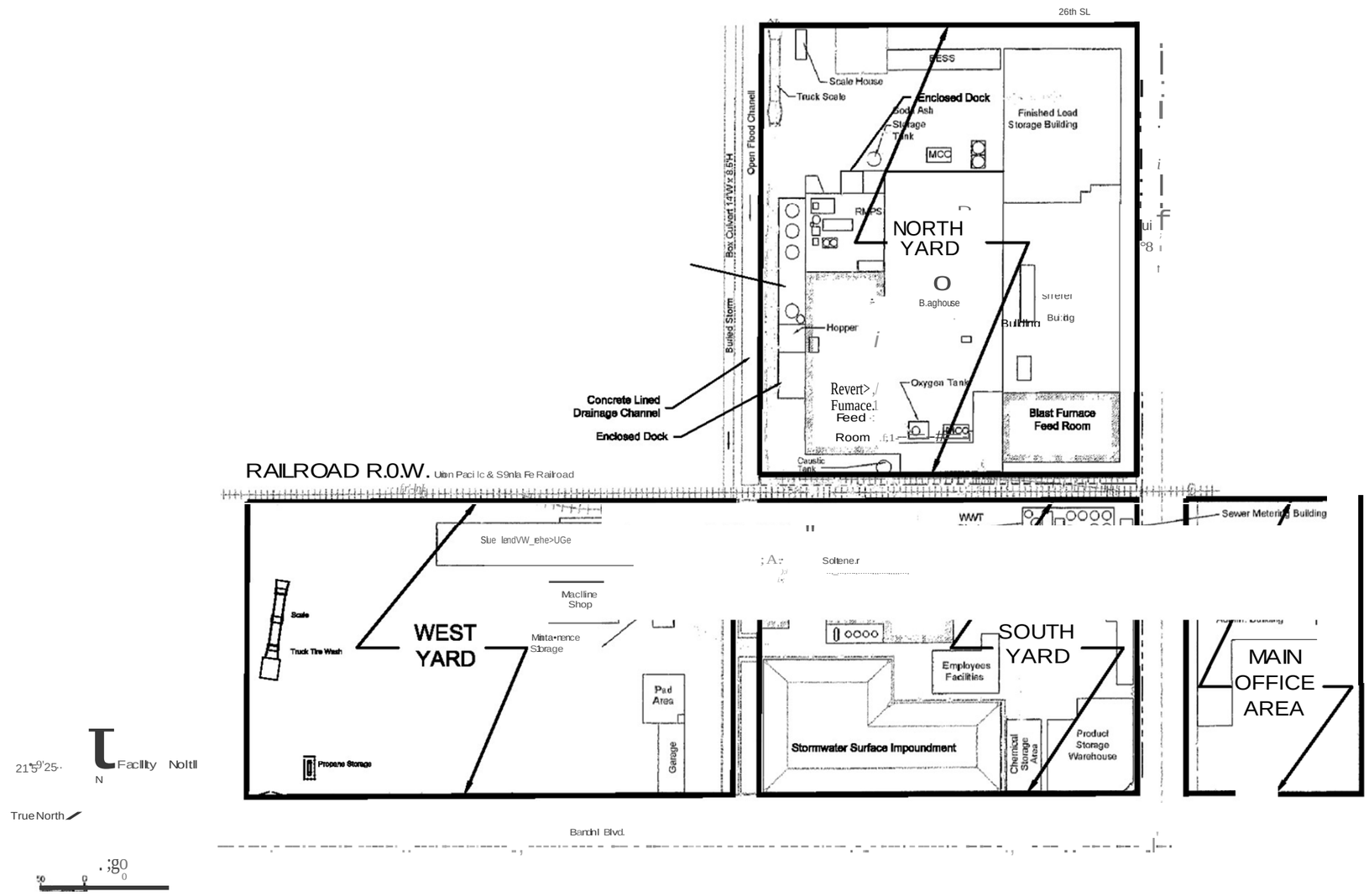
Enginming for the Environment Planning for People.

1056 ANDREW DRI\'E. SUIIE A, ¥EST CHESTER PA, 19380
bl 810.840.9100 fax 810.840.9199 madvan cam

fACILITY LOCATION IBP

EXIDE TBCBNOLOGIBS
'VERNON, CALIl'OHIUA

111'.T.S.	2-1
PROJECT NUMBER: 2006-1299-17	
DA'IB:	



NOTE:

1. ADAPTED FROM LAKE ENGINEERING FIGURE 2.8 FROM PART B APPLICATION, MAY 2002.

ADVANCED GeoServices

Engineering for the Environment. Planning for People.

1055 ANDREW DRIVE, SUITE A. WEST CHESTER PA, 19380
tel 610.840.9100 fax 610.840.9199 www.Cldvon lllnlleea.eam

GENERAL SITE LAYOUT

Ezlde Technolopea
Vernon, California

11T.S.

PIIDIBC'I' IRJIDID:: 8006-1191-17

IU.Tlz

2-2

F:\Projects\2005\20051299-Vernon RIR Eddie Nt\Cad\2005-1299Figure 2-1.dwg

ATTACHMENT A

Low Flow Sampling Standard Operating Procedure

LOW-FLOW (MICROPURGING) PURGING AND SAMPLING PROTOCOL USING NON-DEDICATED PUMPS STANDARD OPERATING PROCEDURE

TABLE OF CONTENTS

Page

1.0 GENERAL CONSIDERATIONS 2

2.0 SUMMARY OF PROCEDURES 2

3.0 GROUND WATER SAMPLE DOCUMENTATION 4

4.0 EQUIPMENT AND SUPPLIES 5

5.0 GROUND WATER FIELD TESTS AND MEASUREMENTS 5

5.1 Water-Level Measurements 6

5.2 Water Quality Parameters Measurements 6

1.0 GENERAL CONSIDERATIONS[1]

Low-flow purging is intended to promote a flow of fresh, representative ground water from the surrounding aquifer, while minimizing disturbance of the water column and solids in suspension. Low pumping rates are used to minimize the amount of drawdown during purging, which ensures fresh formation water enters the well at the pump. During purging, water quality parameters and depth to water are measured to monitor the inflow of fresh water, with stabilization of water quality parameters indicating that purging is completed and sampling can commence. Note that low-flow purging is ineffective and should not be used if pump is not placed within the screened interval. Site and off-site ground water well locations are shown on the attached Figure 2.

All sampling equipment is thoroughly cleaned before purging and sampling of each monitoring well. Prior to purging, water-level measurements are obtained from each monitoring well. Ground water quality monitoring equipment is calibrated using manufacturer's recommended procedures and recorded on the attached test equipment calibration log form. The wells are purged using a positive-displacement pump or a submersible bladder pump, depending on individual well conditions.

The standard low-flow purging procedure consists of purging the well while collecting qualitative ground water parameters and depth to water. The ground water quality parameters such as pH, temperature, conductivity, dissolved oxygen (DO), and oxidation-reduction potential (ORP) are measured using a flow-through cell to verify that fresh ground water is flowing into the well. Turbidity shall be measured using a LaMotte 2020 (or equivalent equipment) from the pump discharge. The purging rate should be maintained sufficiently low to ensure a minimal amount of drawdown. Typical purging rates are 0.1 to 0.5 liters per minute (l/m) (0.025 to 0.13 gallons per minute [gpm]), with rates as high as 1.0 l/m (0.26 gpm) depending on site hydrologic characteristics. After the water quality parameters have stabilized, ground water samples will be collected directly into laboratory-supplied containers. Wells observed to contain product are not purged.

2.1 SUMMARY OF PROCEDURES

The procedure described below is for low-flow purging and sampling using non-dedicated sampling equipment:

- Decontaminate all monitoring and sampling equipment according to procedures in the Quarterly Groundwater Sampling and Analyses Plan.

[1] Sampling protocol based on ASTM D6771-02, *Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground Water Quality Investigations*.

- Calibrate monitoring equipment per manufacturer recommendation and record on daily field activity form.
- Measure depth to water from surveyed reference mark on the wellhead and record measurement on the depth to water and product sheet. When lowering sounder in well, take precaution not to disturb or agitate water.
- Record depth to water on the attached well gauge data form and calculate the well casing volume. Also conduct a wellhead inspection at each well and record the information on the attached wellhead inspection checklist form.
- Prior to field activities, the Project Manager will prepare a sampling plan for the field technicians which will include the appropriate pump placement depth in feet below top of casing. In general, for wells completed across homogenous water-bearing formations, place the pump in the middle of the well screen interval. For wells completed across heterogeneous water-bearing formations, place pump adjacent to zone(s) of the highest hydraulic conductivity.
- Measure tubing and pump length to place pump at designated interval. Cut fresh tubing for each well and connect tubing to pump.
- Carefully lower pump into well to minimize the amount to disturbance of the water column.
- Connect the pump effluent to the flow-through cell.
- Project Manager will specify base purging rate at the start of purging, until well specific rates are established. Start purging at the specified rates and adjust flow rates based on drawdown. The optimal purging rate is between 0.1 to 0.5 l/m with a minimal amount of drawdown.
- Measure depth to water during purging and adjust purging rate to minimize the amount of drawdown in the well. In wells screened near the water table drawdown should not generally exceed 25 percent of the distance between the top of the well screen and the pump intake.
- When using a flow-though cell, the time between measuring the water quality parameter and depth to water measurement should be based on the amount of time it takes to evacuate one volume of the cell.
- Purging should continue until the following water quality parameters have stabilized:
    - pH - ±0.2 pH units
    - Conductivity - ±3 percent of the reading
    - Turbidity - ±10 percent of the reading or ±1.0 nephelometric turbidity units (NTU), whichever is greater

- DO - ±10% of the reading or ±0.2 milligram per liter (mg/l), whichever is greater
- ORP - ±20 millivolt (mV)

- After the drawdown and water quality parameters have stabilized, sampling can begin immediately per the site's sampling and analysis plan. The samples are to be collected from the pump effluent line prior to the flow-through cell.
- Water samples for laboratory analyses must be collected before water has passed through the flow-through cell (use a by-pass assembly or disconnect cell to obtain sample). VOC samples should be collected first, directly into pre-preserved sample containers. Dissolved metal samples shall be collected directly into nonpreserved sample containers and filtered at the laboratory prior to preserving and analyses. Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence. During purging and sampling, the tubing should remain filled with water so as to minimize possible changes in water chemistry upon contact with the atmosphere. It is recommended that 1/4 inch or 3/8 inch (inside diameter) tubing be used to help ensure that the sample tubing remains water filled.

3.1 GROUND WATER SAMPLE DOCUMENTATION

The following information is entered on the attached low flow well monitoring data sheet form at the time of sampling:

1. Name of sampler and time and date of sample collection;
2. Site conditions during sampling;
3. Well and sample identification numbers;
4. Water-level measurements before purging;
5. Calculate well casing volume;
6. Purge volume and purge times;
7. Water quality parameter measurements (pH, conductivity, temperature, turbidity, DO, and ORP);
8. Final depth to water prior to sampling;
9. Sample collection or measurement method(s);
10. Number and volume of sample(s) taken;
11. Sample preservation; and
12. Sample distribution (e.g., laboratory).

Each sample is packaged and transported appropriately as described in the following protocol:

1. Collect samples in appropriate containers and add preservative as necessary.
2. Clearly print in waterproof ink on the label the sample number, the E2 project number, the preservative added to each aliquot, and the date and time the sample was collected. Label the sample according to the well identification.

3. Seal and package sample containers as appropriate.
4. Fill out ground water purging and sampling forms and chain-of-custody form.
5. Place samples into coolers containing blue ice.
6. Deliver cooler to the analytical laboratory at the end of each work day, or store the samples in the sample refrigerator overnight until pickup by the laboratory courier.

4.1 EQUIPMENT AND SUPPLIES

- Health and Safety Plan (HASP)
- Work Plan
- Copies of Previous Field Data Sheets
- Personal Protection Equipment (PPE)
- Field Book or Daily Field Activity (DFA) Log
- Chain of Custody (for appropriate laboratory)
- Custody Seals
- Sample Containers
- Decontamination Equipment
- Low-Flow Sampling Pump with Controller and Energy Source (generator, air compressor, or nitrogen tanks)
- Tubing
- Multi-Parameter Water Quality Meter with Flow Through Cell
- Calibration Fluids
- Test Equipment Calibration Log Form
- Well Gauge Data Form
- Wellhead Inspection Checklist Form
- Low Flow Well Monitoring Data Sheet Form
- Depth to Water and Interface Probes
- Buckets
- DOT Approved Drums
- Transfer Pump
- Extension Cord
- Camera
- Cooler(s)
- Ice, ice packs, or dry ice as appropriate to the COCs and laboratory requirements

5.0 GROUND WATER FIELD TESTS AND MEASUREMENTS

Measurements of ground water conditions are collected during the various sampling and monitoring activities conducted during phases of site assessment. This section describes routine procedures followed by personnel performing field measurements. The methods presented are

intended to assure that field measurements are consistent and reproducible when performed by different individuals.

All reusable field equipment shall be properly decontaminated and calibrated following the manufactures recommendations.

5.1 WATER-LEVEL MEASUREMENTS

Water-level measurements are made using an electric well sounder. As directed in the site's sampling and analysis plan, field personnel may first calibrate the instrument according to the manufacturer's specifications. At each location during each monitoring episode, a minimum of two measurements of the depth to water is recorded. The most representative of the measurements is determined by the judgment of the field technician and recorded to the nearest 0.01-foot on the attached well gauge data form .

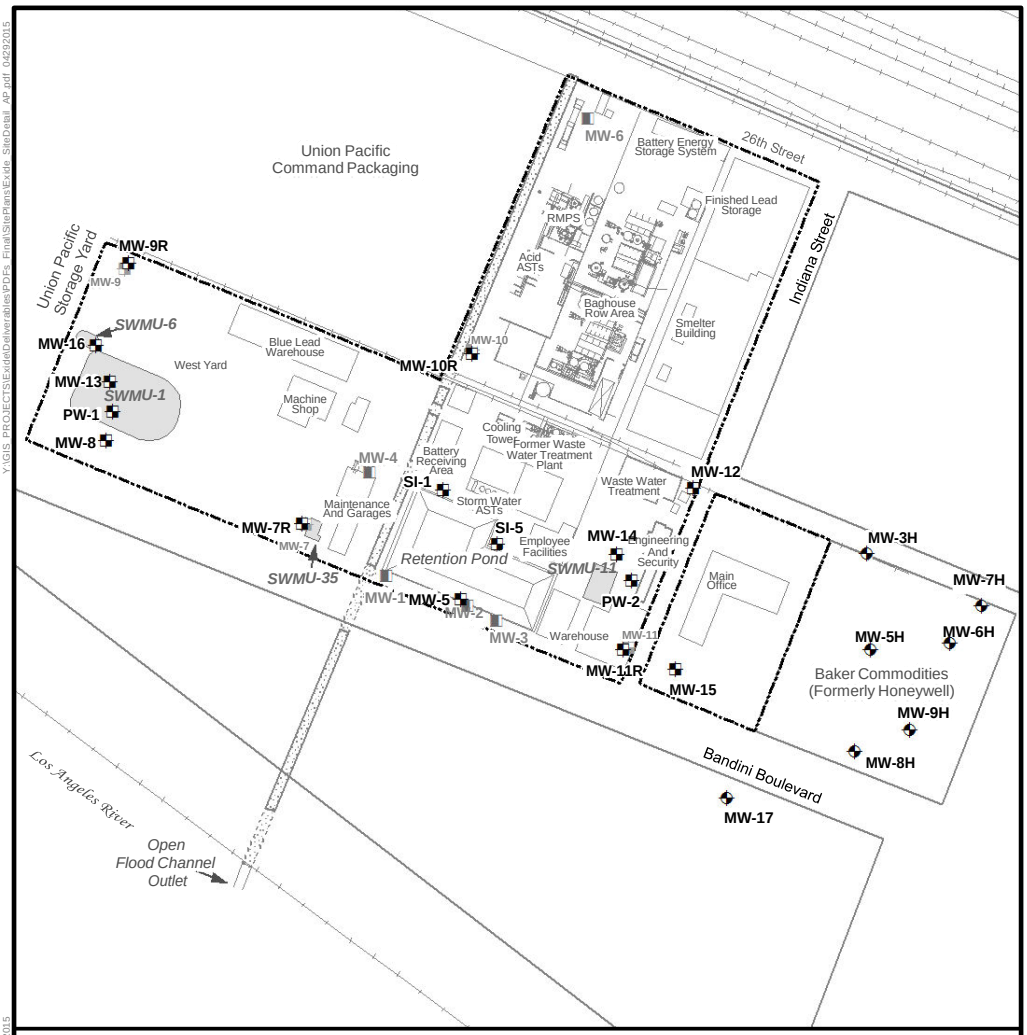
5.2 WATER QUALITY PARAMETERS MEASUREMENTS

Specific conductivity, water temperature, turbidity, pH, DO, and ORP measurements are made during well purging activities and prior to sampling. For low-flow sampling, measurements are made using a flow through cell with a combination instrument capable of measuring the water quality parameters. A separate instrument may be used to measure turbidity. Water quality parameters are recorded on attached low flow well monitoring data sheet form. When available, historical sampling data shall be provided to ensure consistent sampling procedures and final stabilized water quality parameters.

All instruments are calibrated according to the manufacturer's specifications. The values for conductivity standards and pH buffers used in calibration are recorded on the daily field activity form. All probes are thoroughly cleaned and rinsed with tap water before and after measurements.

Attachment 1

Well Location Figure and Monitoring Forms



EXPLANATION

- Shallow Ground Water Monitoring Well
- Deep Ground Water Monitoring Well
- Inactive Vadose Zone Well
- Abandoned Shallow Ground Water Monitoring Well
- Solid Waste Management Unit (SWMU)
- Approximate Property Boundary
- Railroads (Historic and Existing)
- Open LA Flood Control Channel, Dashed Where Underground

Notes:

1. AST - Aboveground storage tank
2. Dimensions and locations are approximate
3. RMPS - Raw materials processing system
4. Wells with "H" suffix are Honeywell-owned

0 120 240 480
Approximate Scale in Feet

1

FIGURE 2

Site Plan

Exide Technologies
2700 South Indiana Street
Vernon, California

Prepared For

Exide Technologies

E2 ENVIRONMENTAL INC
Dedicated to Client CARE

Y:\GIS_PROJECTS\Exide\Deliverables\PDFs_Final\SitePlans\Exide_SiteDetail_AP.pdf 04292015

Y:\GIS_PROJECTS\Exide\Maps\Files\v10\Published\Exide_SiteDetail_AP.mxd 04292015

WELL GAUGING DATA

Project #_____Date_____Client _____

Site _____

Well ID	Well Size (in.)	Time Gauged	Sheen / Odor	Depth to Immiscible Liquid (ft.)	Thickness of Immiscible Liquid (ft.)	Volume of Immiscibles Removed (ml)	Depth to water (ft.)	Depth to well bottom (ft.)	Survey Point: TOB or TOC

LOW FLOW WELL MONITORING DATA SHEET

Project #:	Client:
Sampler:	Gauging Date:
Well I.D.:	Well Diameter (in.) : 2 3 4 6 8 ____
Total Well Depth (ft.) :	Depth to Water (ft.) :
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: PVC Grade	Flow Cell Type:_____

Purge Method: 2" Grundfos Pump Peristaltic Pump Bladder Pump
Sampling Method: Dedicated Tubing New Tubing Other_____

Start Purge Time:_____ Flow Rate: _____ Pump Depth:_____

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)

Did well dewater? Yes No	Amount actually evacuated:
Sampling Time:	Sampling Date:
Sample I.D.:	Laboratory:
Analyzed for: TPH-G BTEX MTBE TPH-D	Other:
Equipment Blank I.D.: @ Time	Duplicate I.D.:

WELLHEAD INSPECTION CHECKLIST

Client_____Date _____

Site Address _____

Job Number _____ Technician _____

Well ID	Well Inspected - No Corrective Action Required	WELL IS SECURABLE BY DESIGN (12"or less)	WELL IS CLEARLY MARKED WITH THE WORDS "MONITORING WELL" (12"or less)	Water Bailed From Wellbox	Wellbox Components Cleaned	Cap Replaced	Lock Replaced	Other Action Taken (explain below)	Well Not Inspected (explain below)	Repair Order Submitted

NOTES: _____

_____

_____

_____

_____

TEST EQUIPMENT CALIBRATION LOG

PROJECT NAME				PROJECT NUMBER			
EQUIPMENT NAME	EQUIPMENT NUMBER	DATE/TIME OF TEST	STANDARDS USED	EQUIPMENT READING	CALIBRATED TO: OR WITHIN 10%:	TEMP.	INITIALS

ATTACHMENT B

Cal Science QA Manual

Uncontrolled Copy

QUALITY SYSTEMS MANUAL FOR ENVIRONMENTAL ANALYTICAL SERVICES

eurofins | Calscience

Version 5.7
June 2015

Prepared By

Eurofins Calscience, Inc.
7440 Lincoln Way
Garden Grove, CA 92841-1427
Telephone: 714-895-5494
Facsimile: 714-894-7501
Internet: www.calscience.com

Based On

The NELAC Institute (TNI)
National Environmental Laboratory Accreditation Program (NELAP)
Management and Technical Requirements for Laboratories Performing Environmental Analysis
TNI Standard (EL-V1-2009) Effective Septe er 09, 2009

Larry Lem
QUALITY ASSURANCE MANAGER

Linda Scharpenberg
QUALITY ASSURANCE / TECHNICAL DIRECTOR

Virginia Huang
OPERATIONS DIRECTOR

Elizabeth Winger
LABORATORY DIRECTOR

Steven L. Lane
VICE-PRESIDENT / BUSINESS UNIT MANAGER

TABLE OF CONTENTS
QUALITY SYSTEMS MANUAL

PREFACE TO THE QUALITY SYSTEMS MANUAL 5

ACROYNM LIST 7

QUALITY SYSTEMS 8

1.0 SCOPE 8

2.0 REFERENCES 8

3.0 DEFINITIONS 8

4.1 ORGANIZATION AND MANAGEMENT 9
4.2 Legal Definition of Laboratory 9
4.3 Organization 9

5.1 QUALITY SYSTEM - ESTABLISHMENT, AUDITS, ESSENTIAL QUALITY CONTROLS, AND DATA VERIFICATION 10
5.2 Establishment. 10
5.3 Quality Systems Manual (QSM) Elements 11
a) Policy Statement 11
b) Organization and Management Structure
c) Relationships 12
d) Records Procedures 12
e) Job Descriptions, Roles and Responsibilities 13
f) Approved Signatories 21
g) Policies on Traceability of Measurements 21
h) List of Methods 21
i) Review of New Work 21
j) Calibration Procedures 21
k) Sample Receiving and Handling 22
l) Major Equipment 23
m) Calibration, Verification and Maintenance of Equipment 23
n) Verification Practices 23
o) Corrective Actions 24
p) Permitting Exceptions and Departures 24
q) Complaints 25
r) Confidentialty / Proprietary Rights 25
s) Audits and Data Review 25
t) Personnel Experience and Training 25
u) Ethics Policy Statement 26
v) Reporting of Results 27
w) Table of Contents, References, Glossaries and Appendice 30
Figure 1 -- Organization Chart 1 31
Figure 2 -- Organization Chart 2 32

5.4 Audits 33
5.3.1 Internal Audits 33
5.3.2 Management Review 33
5.3.3 Audit Review 34
5.3.4 Performance Audits 34
5.3.5 Corrective / Preventive Actions 34
5.4 Essential Quality Control Procedures 35

Formatted: Centered, Indent: Hanging: 0.33", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.46"

Formatted: Centered, Indent: Left: 0.12", Hanging: 0.51", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.46"

Formatted: Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.13" + Indent at: 0.46"

Formatted: Centered, Indent: Left: 0.13", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.13" + Indent at: 0.46"

Formatted: Outline numbered + Level: 3 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.05"

Formatted: Indent: Left: 0.63", Hanging: 0.39", Outline numbered + Level: 3 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.05"

Formatted: Outline numbered + Level: 3 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.05"

Formatted: Indent: Left: 0.62", Hanging: 0.41", Outline numbered + Level: 3 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.05"

Formatted … [1]
Formatted … [2]
Formatted … [3]
Formatted … [4]
Formatted … [5]
Formatted … [6]
Formatted … [7]
Formatted … [8]
Formatted … [9]
Formatted … [10]
Formatted … [11]
Formatted … [12]
Formatted … [13]
Formatted … [14]
Formatted … [15]
Formatted … [16]
Formatted … [17]

6.1 PERSONNEL 35
6.2 General Requirements for Laboratory Staff 35
6.3 Laboratory Management Responsibilities 36
6.2.1 Transfer of Ownership / Out of Business 37
6.4 Personnel Records 37

7.1 PHYSICAL FACILITIES – ACCOMMODATION AND ENVIRONMENT 37
7.2 Environment 37
7.3 Work Areas 38

8.0 EQUIPMENT AND REFERENCE MATERIALS 38

9.1 MEASUREMENT TRACEABILITY AND CALIBRATION 39
9.2 General Requirements 39
9.3 Traceability of Calibration 39
9.4 Reference Standards 39
9.5 Calibration 41
9.5.1 Support Equipment. 41
9.5.2 Instrument Calibration 42

10.1 TEST METHODS AND STANDARD OPERATING PROCEDURES 44
10.2 Methods Documentation 44
10.2.1 Standard Operating Procedures (SOPs) Administrative 44
10.2.2 Standard Operating Procedures (SOPs) Analytical 44
10.3 Exceptionally Permitting Departures from Documented Policies / Procedures 45
10.4 Test Methods 46
10.5 Test Method Assessment. 46
10.6 Demonstration of Capability 46
10.7 Sample Aliquots 46
10.8 Data Verification 47
10.9 Documentation and Labeling of Standards and Reagents 47
10.10 Computers and Electronic Data Related Requirements 47

11.1 SAMPLE HANDLING, SAMPLE ACCEPTANCE POLICY AND SAMPLE RECEIPT 48
11.2 Sample Tracking 48
11.3 Sample Acceptance Policy 48
11.4 Sample Receipt Protocols 49
11.5 Storage Conditions 51
11.6 Sample Disposal 51

12.1 RECORDS 51
12.2 Record Keeping System and Design 52
12.3 Records Management and Storage 52
12.4 Laboratory Sample Tracking 53
12.4.1 Sample Handling 53
12.4.2 Laboratory Support Activities 53
12.4.3 Analytical Records 53
12.4.4 Administrative Records 54

13.0 LABORATORY REPORT FORMAT AND CONTENTS 54

14.0 SUBCONTRACTING ANALYTICAL SAMPLES 56

15.0 OUTSIDE SUPPORT SERVICES AND SUPPLIES 57

16.0 INQUIRIES AND COMPLAINTS 57

Formatted: Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.32"

Formatted: Indent: Left: 0.99", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.32"

Formatted: Indent: Left: 0.99", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.32"

Formatted: Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.32"

Formatted: Indent: Left: 0.99", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.32"

Formatted: Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.32"

Formatted: Indent: Left: 0.99", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.32"

Formatted: Indent: Hanging: 0.42", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.48" + Indent at: 1.91"

Formatted: Indent: Left: 1.48", Hanging: 0.43", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.48" + Indent at: 1.91"

Formatted: Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.31"

Formatted: Indent: Left: 1", Hanging: 0.49", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.31"

Formatted: Indent: Hanging: 0.41", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.49" + Indent at: 1.91"

Formatted: Indent: Left: 1", Hanging: 0.49", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.31"

Formatted: Indent: Hanging: 0.32", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"

Formatted … [18]

Formatted … [19]

Formatted … [20]

Formatted … [21]

Formatted … [22]

17.0 REVIEW OF WORK REQUESTS, CONTRACTS AND TENDERS....58

18.0 MANAGEMENT REVIEW, MANAGEMENT OF CHANGE AND CONTINUOUS IMPROVEMENT ..59
18.1 Management Review....59
18.2 Management of Change....60
18.3 Continuous Improvement....60

NELAC APPENDICES....62

APPENDIX A - REFERENCES....63

APPENDIX B - GLOSSARY....65

APPENDIX C - DEMONSTRATION OF CAPABILITY....73
C.1 PROCEDURE FOR DEMONSTRATION OF CAPABILITY....73
C.2 CERTIFICATION STATEMENT....75

APPENDIX D - ESSENTIAL QUALITY CONTROL REQUIREMENTS....76
D.1 CHEMICAL TESTING....76
D1.1 Positive and Negative Controls....77
D1.2 Analytical Variability / Reproducability....77
D1.3 Method Evaluation....77
D1.4 Analytical Measurement Uncertainty Estimation....77
D1.4.1 Using the LCS to Estimate Analytical Uncertainty....78
D1.4.2 Additional Compoments to Estimating Analytical Uncertainty....79
D1.5 Detection Limits....81
D1.6 Data Reduction....81
D1.7 Quality of Standards and Reagents....81
D1.8 Selectivity....82
D1.9 Constant and Consistent Test Conditions....82
D1.10 Method Validation - Modified Procedures, Non-Standard Methods, Additional Analytes....82
D1.10.1 Significant Modification / New Method / Additional Analyte Documentation....83

APPENDIX E - LIST OF ACCREDITED METHODS....85

APPENDIX F - LIST OF PHYSICAL LOCATIONS....87

APPENDIX G - SPECIAL PROGRAM REQUIREMENTS....88
G.1 United States Department of Defense / Energy Environmental Laboratory Accreditation Program 88

APPENDIX H - LIST OF MAJOR ANALYTICAL INSTRUMENTATION....89

END OF DOCUMENT....105

Formatted: Centered, Indent: Hanging: 0.49", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.19" + Indent at: 0.68"

Formatted: Centered, Indent: Left: 0.19", Hanging: 0.49", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.19" + Indent at: 0.68"

Formatted: Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.59"

Formatted: Indent: Left: 0.18", Hanging: 0.41", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.59"

Formatted: Indent: First line: 0.01", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: -0.24" + Indent at: 0.18"

PREFACE TO THE QUALITY SYSTEMS MANUAL

Purpose

The purpose of this document is to provide implementation guidance on the establishment and management of quality systems for Eurofins Calscience, Inc (ECI) and is based on the National Environmental Laboratory Accreditation Conference's (NELAC) Quality System requirements, the Department of Defense / Energy Environmental Laboratory Accreditation Program (DOD/DOE ELAP) and International Organization for Standardization / International Electrotechnical Commission (ISO/IEC) 17025:2005.

These three programs are built upon one another and are mutually reinforcing in their Quality Assurance programs and protocols.

Background

To be accredited and in compliance under the following three programs:

1. The National Environmental Laboratory Accreditation Program (NELAP). Accredited laboratories shall have a comprehensive quality system in place, the requirements for which are outlined in The NELAC Institute (TNI) 2009 Volume 1: Management and Technical Requirements for Laboratories Performing Environmental Analysis (EL-V1-2009). This manual was written with guidance primarily from Volume 1: Modules 2, 3, 4, 5, and 7.

   Additional information may be found at:

   - http://www.nelac-institute.org/

2. The Department of Defense Environmental Laboratory Accreditation Program (DOD/DOE ELAP) will provide a means for laboratories to demonstrate conformance to the DOD/DOE Quality Systems Manual for Environmental Laboratories (DOD/DOE QSM) as authorized by DOD Instruction 4715.15.

   The DOD/DOE QSM Revision 5.0 (July 2013) is based on the National Environmental Laboratory Accreditation Conference (NELAC) Quality Systems standard which provides guidelines for implementing the international standard, ISO/IEC 17025.

   Additional information may be found at:

   - http://www.denix.osd.mil/edqw/Accreditation/
   - http://www.denix.osd .mil/edqw/upload/QSM -Version-5-0-FINAL.pdf

3. ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories is for use by laboratories in developing their management system for quality, administrative and technical operations. Laboratory customers, regulatory authorities and accreditation bodies may also use it in confirming or recognizing the competence of laboratories.

   Additional information may be found at:

   - http://www .iso.org/iso/home .html

Formatted: Justified, Indent: Hanging: 0.24", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.37" + Indent at: 1.55"

Formatted: Outline numbered + Level: 4 + Numbering Style: Bullet + Aligned at: 1.8" + Indent at: 1.99"

Formatted: Justified, Indent: Left: 1.3", Hanging: 0.25", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.37" + Indent at: 1.55"

Formatted: Indent: Left: 1.81", Outline numbered + Level: 4 + Numbering Style: Bullet + Aligned at: 1.8" + Indent at: 1.99"

Formatted: Indent: Left: 1.81", Hanging: 0.18", Outline numbered + Level: 4 + Numbering Style: Bullet + Aligned at: 1.8" + Indent at: 1.99"

Formatted: Justified, Indent: Left: 1.31", Hanging: 0.25", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.37" + Indent at: 1.55"

Formatted: Indent: Left: 1.81", Outline numbered + Level: 4 + Numbering Style: Bullet + Aligned at: 1.8" + Indent at: 1.99"

Project Specific Requirements

Project-specific requirements or regulations may supersede requirements contained in this manual. The laboratory bears the responsibility for meeting all **State requirements.** Nothing in this document relieves the laboratory from complying with contract requirements, or with **Federal, State, and/or local regulations.**

Results and Benefits

- **Standardization of Processes** – Because this manual provides the laboratory with a comprehensive set of requirements that meet the needs of many clients, as well as the NELAP, the laboratory may use it to create a standardized quality system. Ultimately, this standardization saves laboratory resources by establishing one set of consistent requirements for all environmental work. Primarily, the laboratory bears the responsibility for meeting all State requirements as outlined in their respective certification programs.

- **Deterrence of Improper, Unethical, or Illegal Actions** – Improper, unethical, or illegal activities committed by only a few laboratories have implications throughout the industry, with negative impacts on all laboratories. This manual establishes a minimum threshold program for all laboratories to use to deter and detect improper, unethical, or illegal actions.

- **Foundations for the Future** – A standardized approach to quality systems, shared by laboratories and The NELAC Institute, paves the way for the standardization of other processes. For example, this manual might serve as a platform for a standardized strategy for Performance Based Measurement System (PBMS) implementation.

Document Format

This ECI Quality Systems Manual (QSM) is designed to implement the TNI 2009 (EL-V1-2009) standards along with the DOD/DOE QSM 5.0 and the ISO/IEC 17025:2005 standards.

The section numbering has been changed from that of these standards as the manual is meant to be a stand-alone document. Thus the numbering in this document is not consistent with the numbering in the above-mentioned standards; however, all required elements are covered, herein.

Formatted: Indent: Hanging: 0.16", Outline numbered + Level: 3 + Numbering Style: Bullet + Aligned at: 0.2" + Indent at: 0.37"

Formatted: Indent: Left: 0.21", Outline numbered + Level: 3 + Numbering Style: Bullet + Aligned at: 0.2" + Indent at: 0.37"

Formatted: Indent: Left: 0.21", Hanging: 0.16", Outline numbered + Level: 3 + Numbering Style: Bullet + Aligned at: 0.2" + Indent at: 0.37"

ACROYNM LIST

°C: Degrees Celsius
ANSI/ASQC: American National Standards Institute / American Society for Quality Control
ASTM: American Society for Testing and Materials
CAS: Chemical Abstract Service
CCV: Continuing calibration verification
CFR: Code of Federal Regulations
CLP: Contract Laboratory Program
COC: Chain of Custody
CV: Coefficient of Variation
DO: Dissolved Oxygen
DOC: Demonstration of Capability
DOD/DOE: Department of Defense / Energy
DQOs: Data Quality Objectives
EPA: Environmental Protection Agency
g/L: Grams per Liter
GC/MS: Gas Chromatography / Mass Spectrometry
ICP-MS: Inductively Coupled Plasma / Mass Spectrometer
ICV: Initial Calibration Verification
ID: Identifier
ISO/IEC: International Standards Organization / International Electrotechnical Commission
LCS: Laboratory Control Sample
LCSD: Laboratory Control Sample Duplicate
LOO: Limit of Detection
LOQ: Limit of Quantitation
LQMP: Laboratory Quality Management Plan
MDL: Method Detection Limit
ME: Marginal Exceedance
mg/kg: Milligrams per Kilogram
MS: Matrix Spike
MSD: Matrix Spike Duplicate
NELAC: National Environmental Laboratory Accreditation Conference
NELAP: National Environmental Laboratory Accreditation Program
NIST: National Institute of Standards and Technology
OSHA: Occupational Safety and Health Administration
PBMS: Performance Based Measurement System
PC: Personal Computer
PCBs: Polychlorinated Biphenyls
PT: Proficiency Testing
QA: Quality Assurance
QAD: Quality Assurance Division (EPA)
QAMS: Quality Assurance Management Section
QAPP: Quality Assurance Project Plan
QSM: Quality Systems Manual
QC: Quality Control
RL: Reporting Limit
RPO: Relative Percent Difference
RSD: Relative Standard Deviation
SD: Serial Dilutions
SOP: Standard Operating Procedure
TNI: The NELAC Institute
TSS: Total Suspended Solids
UV: Ultraviolet
VOC: Volatile Organic Compound

QUALITY SYSTEMS

Quality Systems include all quality assurance (QA) policies and quality control (QC) procedures that are delineated in a Quality Systems Manual (QSM) and followed to ensure and document the quality of the analytical data. Eurofins Calscience, Inc. (ECI), accredited under the National Environmental Laboratory Accreditation Program (NELAP), assures implementation of all QA policies and the applicable QC procedures specified in this Manual. The QA policies, which establish essential QC procedures, are applicable to all areas of ECI, regardless of size and complexity.

The intent of this document is to provide sufficient detail about quality management requirements so that all accrediting authorities evaluate laboratories consistently and uniformly.

The NELAC Institute (TNI) is committed to the use of Performance Based Measurement Systems (PBMS) in environmental testing and provides the foundation for PBMS implementation in these standards. While this standard may not currently satisfy all the anticipated needs of PBMS, NELAC will address future needs within the context of State statutory and regulatory requirements and the finalized EPA implementation plans for PBMS.

Chapter 5 is organized according to the structure of ISO/IEC 17025, 2005. Where deemed necessary specific areas within this Chapter may contain more information than specified by ISO/IEC 17025.

All items identified in this QSM shall be available for on-site inspection or data audit.

1.0 SCOPE

a) This QSM sets the general requirements that ECI must successfully demonstrate to be recognized as competent to perform specific environmental tests.

b) This QSM includes additional requirements and information for assessing competence or for determining compliance by the organization or accrediting authority that grants approval.

If more stringent standards or requirements are included in a mandated test method or by regulation, the laboratory demonstrates that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed.

c) ECI uses this QSM in the development and implementation of its quality systems. Accreditation authorities use this NELAC based standard to assess the competence of environmental laboratories.

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

2.0 REFERENCES

See Appendix A.

3.0 DEFINITIONS

The relevant definitions from ISO/IEC Guide 2, ANSI/ASQC E-4, 1994, the EPA "Glossary of Quality Assurance Terms and Acronyms," and the *International vocabulary of basic and general terms in metrology (VIM)* are applicable. The most relevant is quoted in Appendix A, Glossary, of Chapter 1 of NELAC, together with further definitions applicable for the purposes of this Standard.

4.1 ORGANIZATION AND MANAGEMENT

4.2 Legal Definition of Laboratory

ECI is legally definable as evidenced by its business license, and current California State Water Resources Control Board (SWRCB) Services Environmental Laboratory Accreditation Program (ELAP) certificate. It is organized and operates in such a way that its facilities meet the requirements of the Standard. See the graphical presentations of the Organization and QA responsibility in Figures 1 and 2, respectively.

4.3 Organization

Eurofins Calscience Inc.:

a) Has a managerial staff with the authority and resources necessary to discharge their duties;

b) Has processes to ensure that its personnel are free from any commercial, financial and other undue pressure that adversely affect the quality of their work;

c) Is organized in such a way that confidence in its independence of judgment and integrity is maintained at all times;

d) Specifies and documents the responsibility, authority, and interrelationship of all personnel who manage, perform or verify work affecting the quality of calibrations and tests;

Such documentation includes:

1) A clear description of the lines of responsibility in the laboratory, and is proportioned such that adequate supervision is ensured, and

2) Job descriptions for all positions.

e) Provides supervision by persons familiar with the calibration or test methods and procedures, the objective of the calibration or test, and the assessment of the results.

The ratio of supervisory to non-supervisory personnel ensures adequate supervision and adherence to laboratory procedures and accepted techniques.

f) Has a technical director who has overall responsibility for the technical operation of ECI.

The technical director certifies that personnel who perform the tests for which the laboratory is accredited have the appropriate educational and/or technical background. Such certification is documented.

The technical director meets the requirements specified in the Accreditation Process. (See NELAC Section 4.1.1.1.)

g) Has a quality assurance manager who has responsibility for the quality system and its implementation.

The quality assurance officer has direct access to the technical director and to the highest level of management at which decisions are made regarding laboratory policy or resources.

The quality assurance manager (and/or his/her designees):

1) Serves as the focal point for *QNQC* activities, and is responsible for the oversight and/or review of quality control data;

Formatted: Indent: Hanging: 0.51", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.49"

Formatted: Indent: Left: 0.98", Hanging: 0.51", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.49"

Formatted: Indent: Hanging: 0.51", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.49"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.24"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.24"

Formatted: Indent: Left: 0.98", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.24"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.24"

Formatted: Indent: Hanging: 0.24", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.48"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.48"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.24"

Formatted: Indent: Left: 0.98", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.24"

Formatted: Indent: Left: 0.99", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.24"

Formatted: Indent: Left: 1.25", Hanging: 0.24", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.48"

2) Has functions independent from laboratory operations for which she/he has quality assurance oversight;

3) Is able to evaluate data objectively and perform assessments without outside (e.g., managerial) influence;

4) Has documented training and/or experience in *QNQC* procedures and is knowledgeable in the quality system, as defined under NELAC;

5) Has a general knowledge of the analytical test methods for which data review is performed;

6) Arranges for and conducts internal audits as per ECI QSM section 5.3 annually; and

7) Notifies ECI management of deficiencies in the quality system and monitors corrective action.

h) Nominates, by way of the "Alternates List," deputies in case of absence of the Technical Director and/or the Quality Assurance Director;

i) ECI makes every effort to ensure the protection of its clients' information as confidential and proprietary.

ii) ECI is sensitive to the fact that much of the analytical work performed for clientele may be subject to litigation processes. ECI, therefore, holds all information in strict confidence with laboratory release only to the client.

iii) Information released to entities other than the client is performed only upon written request from the client.

iv) Due to the investigative nature of most site assessments, analytical information may become available to regulatory agencies or other evaluating entities during site assessment of the laboratory for the specific purpose of attaining laboratory certifications, accreditations, or evaluation of laboratory qualification for future work. During these occurrences, the laboratory will make every effort to maintain the confidence of client specific information.

j) For purposes of qualifying for and maintaining accreditation, participates in a proficiency test program as outlined in Chapter 2 of NELAC. Results of ECI's performance in rounds of proficiency testing are available by request or on the web site.

5.1 QUALITY SYSTEM - ESTABLISHMENT, AUDITS, ESSENTIAL QUALITY CONTROLS, AND DATA VERIFICATION

5.2 Establishment

ECI establishes and maintains quality systems based on the required elements contained in this Manual and appropriate to the type, range and volume of environmental testing activities it undertakes.

a) The elements of this quality system are documented in this quality manual.

b) The quality documentation is available for use by all laboratory personnel.

c) The laboratory defines and documents its policies and objectives for, and its commitment to accepted laboratory practices and quality of testing services.

d) The laboratory management ensures that these policies and objectives are documented in the quality manual and are communicated to, understood and implemented by all laboratory personnel concerned.

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.37" + Indent at: 0.62"

Formatted: Indent: Left: 0.37", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.37" + Indent at: 0.62"

Formatted: Indent: Left: 0.37", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.37" + Indent at: 0.62"

Formatted: Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.37" + Indent at: 0.62"

Formatted: Indent: Left: 0.37", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.37" + Indent at: 0.62"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.37" + Indent at: 0.62"

Formatted: Indent: Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 8 + Alignment: Left + Aligned at: 0.11" + Indent at: 0.37"

Formatted: Indent: Left: 0.12", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 8 + Alignment: Left + Aligned at: 0.11" + Indent at: 0.37"

Formatted: Justified, Indent: Hanging: 0.49", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 2 + Alignment: Left + Aligned at: 0.36" + Indent at: 0.86"

Formatted: Indent: Left: 0.37", Hanging: 0.49", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 2 + Alignment: Left + Aligned at: 0.36" + Indent at: 0.86"

Formatted: Indent: Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.62"

Formatted: Indent: Left: 0.12", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.62"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.13" + Indent at: 0.37"

Formatted: Indent: Left: 0.12", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.13" + Indent at: 0.37"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.13" + Indent at: 0.37"

Formatted … [23]

i. All staff members are given access to a controlled copy of the Quality Systems Manual (QSM) for review at the commencement of employment. However, the individual Standard Operating Procedures are the training documents that have precedence. The QSM is provided as a general overview.

ii. A controlled copy of the quality manual is also available in each department.

e) The quality manual is maintained current under the responsibility of the quality assurance department. This manual is reviewed on an annual basis or more frequently, and revised as necessary.

5.3 Quality Systems Manual (QSM) Elements

This Quality Systems Manual (QSM) and related quality documentation state ECI's policies and operational procedures established in order to meet the requirements of this Standard.

This manual lists on the title page: a document title; the laboratory's full name and address; the name, address, and telephone number of individuals responsible for the laboratory and the effective date of the version.

This quality manual and related quality documentation also contains:

a) A quality ***policy statement,*** including objectives and commitments, by top management;

i. Eurofins Calscience, Inc. (ECI) is committed to providing the highest quality environmental analytical services available. To ensure the production of scientifically sound, legally defensible data of known and proven quality, an extensive Quality Assurance program has been developed and implemented. This document, ECI's Quality Systems Manual for Environmental Analytical Services, presents an overview of the essential elements of our Quality Assurance program. ECI has modeled this systems manual after EPA guidelines as outlined in "Guidance for Quality Assurance Project Plans (EPA QA/G-5)", Office of Monitoring Systems and Quality Assurance, Office of Research and Development,
U.S. EPA, EPA/240-R-02/009 December 2002. ECI's QA Program is closely monitored at the Corporate, Divisional, and Group levels, and relies on clearly defined objectives, well-documented procedures, a comprehensive quality assurance/quality control system, and management support for its effectiveness.

ii. This QA Program Systems Manual is designed to control and monitor the quality of data generated at ECI. The essential elements described herein are geared toward generating data that is in compliance with federal regulatory requirements specified under the Clean Water Act, the Safe Drinking Water Act, the Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation, and Liability Act, and applicable amendments, and state and DOD/DOE/DoE equivalents. Although the quality control requirements of these various programs are not completely consistent, each of the programs base data quality judgments on the following three types of information, the operational elements of each being described elsewhere in this manual.

- Data which indicates the overall qualifications of the laboratory to perform environmental analyses;
- Data which measures the laboratory's daily performance using a specific method; and
- Data which measures the effect of a specific matrix on the performance of a method.

iii. It is important to note that the QA guidelines presented herein will always apply unless adherence to specific Quality Assurance Project Plans (QAPPs) or client and/or regulatory agency specific requirements are directed. In these cases, the elements contained within specified direction or documentation shall supersede that contained herein.

Formatted: Justified, Indent: Hanging: 0.19", Numbered + Level: 2 + Numbering Style: i, ii, iii, ... + Start at: 1 + Alignment: Left + Aligned at: 1.26" + Indent at: 1.36"

Formatted: Indent: Left: 1.14", Hanging: 0.13", Numbered + Level: 2 + Numbering Style: i, ii, iii, ... + Start at: 1 + Alignment: Left + Aligned at: 1.26" + Indent at: 1.36"

Formatted: Indent: Left: 0.99", Numbered + Level: 1 + Numbering Style: a, b, c, ... + Start at: 1 + Alignment: Left + Aligned at: 0.13" + Indent at: 0.37"

Formatted: Justified, Indent: Left: 0.99", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.62"

Formatted: Justified, Numbered + Level: 1 + Numbering Style: a, b, c, ... + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.23"

Formatted: Justified, Indent: Hanging: 0.18", Numbered + Level: 2 + Numbering Style: i, ii, iii, ... + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.44"

Formatted: Justified, Indent: Left: 1.23", Hanging: 0.21", Numbered + Level: 2 + Numbering Style: i, ii, iii, ... + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.44"

Formatted: Justified, Indent: Left: 1.2", Hanging: 0.25", Numbered + Level: 2 + Numbering Style: i, ii, iii, ... + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.44"

iv. This manual is a living document subject to periodic modifications to comply with regulatory changes and technological advancements. All previous versions of this document are obsolete. Users are urged to contact ECI to verify the current revision of this document.

b) The organization and management structure of the laboratory, its place in any parent organization and relevant organizational charts;

See Figure 1 Organizational Chart, and Figure 2 and 3 Responsibility Charts.

c) The relationship between management, technical operations, support services and the quality system;

d) Procedures to ensure that all records required under the NELAP are retained, as well as procedures for control and maintenance of documentation through a document control system which ensures that all standard operating procedures, manuals, or documents clearly indicate the time period during which the procedure or document was in force;

i. Ensuring a high quality work product in the environmental laboratory not only requires adherence to the quality issues discussed in the previous sections, but also requires the ability to effectively archive, restore, and protect the records that are generated.

ii. Procedures are in place to ensure that all records are retained. In addition, a documentation control system is employed to clearly indicate the time period during which a standard operating procedure, manual, or document was in force. These procedures are outlined in the laboratory standard operating procedure SOP-T002.

iii. All laboratory logbooks, instrument response printouts, completed analytical reports, chain-of-custodies, and laboratory support documentation are stored for a minimum of five years. Project specific data are stored in sequentially numbered project files and include copies of the applicable laboratory logbooks, instrument response printouts, completed analytical reports, chain-of-custodies, and any other pertinent supporting documentation.

iv. When complete, the project specific data are high speed optically scanned and transformed into digital CD media. Additional copies of these records are created at the time of scanning and are stored off-site for protection of the data. These records are stored for a minimum of five years.

v. Access to all systems is limited by use of log-in and password protection and is maintained by the system administrator.

vi. There are four forms of electronic data that are generated in the laboratory. Refer to Table 1 – Data Archiving Schedule below for a synopsis of general data archiving schedules.

vii. All electronic records are stored for a minimum of five years.

TABLE 1 - DATA ARCHIVING SCHEDULE

LIMS Database	
Backup frequency:	Daily
Backup media:	Hard Disk
Backup software:	MS SQL Server Backup
Backup versions kept:	Ten previous versions
Onsite copy:	Redundancy by using mirrored hard drive
Offsite copy:	One (Replicate to Lampson Facility)

Instrument Data

Formatted: Justified, Indent: Left: 0.37", Hanging: 0.26", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.44"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 2 + Alignment: Left + Aligned at: 0.26" + Indent at: 0.5"

Formatted: Indent: Left: 0.25", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 2 + Alignment: Left + Aligned at: 0.26" + Indent at: 0.5"

Formatted: Justified, Indent: Left: 0.25", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 2 + Alignment: Left + Aligned at: 0.26" + Indent at: 0.5"

Formatted: Justified, Indent: Hanging: 0.15", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.5" + Indent at: 0.66"

Formatted: Justified, Indent: Left: 0.49", Hanging: 0.18", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.5" + Indent at: 0.66"

Formatted: Justified, Indent: Left: 0.45", Hanging: 0.21", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.5" + Indent at: 0.66"

Formatted: Justified, Indent: Left: 0.45", Hanging: 0.22", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.5" + Indent at: 0.66"

Formatted: Justified, Indent: Left: 0.47", Hanging: 0.19", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.5" + Indent at: 0.66"

Formatted: Justified, Indent: Left: 0.44", Hanging: 0.22", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.5" + Indent at: 0.66"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.5" + Indent at: 0.66"

Backup frequency:	Daily
Backup media:	Hard Disk
Backup software:	NT Backup
Backup versions kept:	All versions
Offsite copy:	One (Replicate to Lampson Facility)

e) Job Descriptions, Roles and Responsibilities

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to their job function and the quality program as a whole.

The responsibility for quality lies with every employee at ECI. As such, all employees have access to the Quality Assurance Manual and are responsible for knowing the content of this manual and upholding the standards therein. Each employee is expected to conduct themselves in accordance with the procedures in this manual and the laboratory's SOPs.

The following descriptions define the primary roles and their relationship to the Quality Assurance Program. Members of the key staff include the following:

- Management (e.g., President, Vice-President, Business Unit Manager, Laboratory Director);
- Technical managers (e.g., Technical Director, Section Supervisors);
- Quality managers;
- Support systems and administrative managers (e.g., IT manager, Facilities manager, project managers); and
- Other staff

In these positions, members of the key staff are responsible for assuring compliance with the National Environmental Laboratory Accreditation Program (NELAP), California Environmental Laboratory Accreditation Program (ELAP), Department of Defense / Energy (DOD/DOE) ELAP, State and Federal Agencies, and ISO 17025:2005 Standard requirements. In these roles, key personnel may set or enforce quality policies, monitor compliance, initiate corrective actions, interface with laboratory, client, and regulatory personnel, and provide general program oversight.

Business Unit Manager:

ECI's Business Unit Manager represents ECI to the Eurofins US and Global Corporate entities.

c::> Ensures that ECI's financial and production performance meets assigned metrics.
c::> Determines need for capital and employee resources and allocates as appropriate.
c::> Serves as the legal representative for ECI.
c::> Responsible for yearly budget and overruns.
c::> Point person for major new initiatives

Laboratory Director:

ECI's Laboratory Director, through its Business Unit Manager, is the final authority on all issues dealing with data quality and has the authority to require that procedures be amended or discontinued, or analytical results voided or repeated. He or she also has the authority to suspend or terminate employees on the grounds of non-compliance with QA/QC procedures. In addition, the Laboratory Director:

Formatted: Justified, Indent: Left: 0.98", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 2 + Alignment: Left + Aligned at: 0.26" + Indent at: 0.5"

Formatted: Bulleted + Level: 1 + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Indent: Left: 1.24", Hanging: 0.25", Bulleted + Level: 1 + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Bulleted + Level: 1 + Aligned at: 1.24" + Indent at: 1.49"

- Ensures that ECI remains current with all regulations which affect operations and disseminate all such changes in regulatory requirements to the QA Director, Technical Director, QA Manager, and Group Leaders;
- Provides one or more Technical Directors for the appropriate fields of testing. The name(s) of the Technical Director are included **in** the national database. (The Laboratory Director may also act in the Technical Director capacity.) If the Technical Director is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director will designate another full time staff member meeting the qualifications of the Technical Director to temporarily perform this function. **If** the absence exceeds 35 consecutive calendar days, the primary accrediting authority will be notified in writing;
- Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented;
- Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work;
- Oversees the development and implementation of the QA Program which assures that all data generated will be scientifically sound, legally defensible, and of known quality;
- In conjunction with the QA Manager, conducts annual reviews of the QA Program;
- Oversees the implementation of new and revised QA procedures to improve data quality;
- Ensures that appropriate corrective actions are taken to address analyses Identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth **in** the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director;
- Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to;
- Oversees all laboratory accreditation efforts

Operations Director:

The Operations Director manages and directs the analytical production sections of the laboratory. He or she reports directly to the Laboratory Director and assists in determining the most efficient instrument utilization. More specifically, he/she:

- Evaluate the level of internal/external non-conformances for all departments;
- Continuously evaluate production capacity and improves capacity utilization;
- Continuously evaluate turnaround time and addresses any problems that may hinder meeting the required and committed turnaround time from the various departments;
- Develop and improve the training of all analysts **in** cooperation with the Laboratory Director, QA Director, QA Manager and Group Leaders, and in compliance with regulatory requirements;
- Ensure that scheduled instrument maintenance is completed;
- Are responsible for efficient utilization of supplies;
- Constantly monitor and modify the processing of samples through the departments; and
- Maintain sufficient personnel, equipment and supplies to achieve production goals.

Technical Director:

The Technical Director reports to the Business Unit Manager and is responsible for all laboratory, client, and project technical issues. More specifically, he/she:

- For major projects and/or clients, act as a technical resource for the client and the laboratory in matters of method selection or QC criteria.
- Company-wide, maintains all training-related documentation in a single secure location. Develops training guides and other training documentation as needed;

- Interface directly with Project Management staff in response to questions pre-release or from the client post-release. Determine causation and interface with QA staff to prevent recurrences;
- Interface directly with clients, or other client representatives in matters related to technical data quality requests.
- Attend client, Business Development, or industry meetings with or without management when a 'technical representative' is required or would be beneficial to ECI.
- Provide support to Business Development through the review of DOD/DOE-related SAPs, QAPPs, and work plans. Provide comment and alternative solutions if unable to meet specific requirements. Populate DOD/DOE UFP QAPP tables for client SAPs/QAPPs when needed;
- Support QA and Operations with SOP revisions, where needed;
- Perform full QA reviews and/or data validation where required;
- Provide technical solutions to QA with regard to laboratory procedures, data quality issues, possible solutions, and appropriate corrective actions;
- Provide technical opinions and support to Operations with regard to current procedures or new method development;
- Interface with QA staff as necessary to ensure continuous improvement in all areas of ECI's operations.
- Provide LIMS input; and
- As may be necessary, act as Program Director for DOD/DOE or other high profile projects.

Quality Assurance Director:

The Quality Assurance (QA) Director has full authority through the Business Unit Manager in all matters relating to quality assurance and quality control systems. The QA Director can make recommendations to the Business Unit Manager and/or Laboratory Director regarding the suspension analytical activities or the suspension or termination of employees on the grounds of non-compliance with QA/QC systems or procedures. An alternate QA Director is always assigned. In the absence of the primary designate, the alternate will act in the QA Director's capacity with the full authority of the position as allowed by ECI governing documents. In addition, the QA Director performs the following:

- Oversight and monitoring of and compliance with ECI's QA program;
- Ensuring continuous improvement in all aspects of ECI's QA program such as:
  - accreditations/certifications;
  - analytical method management;
  - internal and external audits;
  - documentation;
  - training;
  - proficiency evaluation studies;
- Ensuring ECI's QA program remains up-to-date consistent with current regulatory requirements and ECI's QA policies;
- Supervision and direction of all QA staff; and
- Serving as a technical resource for analytical chemistry or QA matters;
- Provide support and oversight to QA staff with regard to external audit responses. Provide input on, and define appropriate corrective actions for the laboratory. Document corrective action responses, and monitor the required audit response time frames, as needed.
- Oversees in-house training on quality assurance and control.

Formatted: Left, Indent: First line: 0", Bulleted + Level: 1 + Aligned at: 1.87" + Indent at: 2.11"

Formatted: Left, Indent: Left: 2.11", Hanging: 0.25", Bulleted + Level: 1 + Aligned at: 1.87" + Indent at: 2.11"

Quality Assurance Manager:

The Quality Assurance (QA) Manager has full authority through the Quality Assurance Director in matters dealing within the laboratory. The QA Manager can make recommendations to the Quality Assurance Director and/or Laboratory Director regarding the suspension or termination of employees on the grounds of

non-compliance with QA/QC procedures. An alternate QA Manager is always assigned. In the absence of the primary designate, the alternate will act in the QA Manager's capacity with the full authority of the position as allowed by ECI governing documents. In addition, the QA Manager performs the following:

- Maintains and updates the QAM on an annual basis;
- Implements ECI's QA Program;
- Monitors the QA Program within the laboratory to ensure complete compliance with its objectives, QC procedures, holding times, and compliance with client or project specific data quality objectives;
- Distributes performance evaluation (PE) samples on a routine basis to ensure the production of data that meets the objectives of its QA Program;
- Maintains all SOPs used at ECI;
- Maintains records and archives of all PE results, audit comments, and customer inquiries concerning the QA program;
- Performs statistical analyses of QC data and establish controls that accurately reflect the performance of the laboratory;
- Conducts periodic performance and system audits to ensure compliance with the elements of ECI's QA Program;
- Prescribes and monitors corrective action;
- Serves as in-house client representative on all project inquiries involving data quality issues;
- Coordinates data review process to ensure that thorough reviews are conducted on all project files;
- Develops revisions to existing SOPs;
- Reports the status of in-house QA/QC to the Laboratory Director;
- Maintains records and archives of all QA/QC data including but not limited to method detection limit (MDL) studies, accuracy and precision control charts, and completed log books; and
- Conducts and/or otherwise ensures that an adequate level of QA/QC training is conducted within the laboratory.

Quality Assurance Assistant:

The QA Assistant reports to the QA Manager and performs the following functions:

- Assists the QA Manager and lab staff with internal audits, corrective action review, test method assessments and overall implementation of the QA program;
- Generates and reviews, in conjunction with the QA Manager, Control Charts and Method Detection Limit (MDL) studies;
- Reviews and revises SOPs as needed;
- Distributes new SOPs to all applicable lab areas.
- Writes and promulgates QA Directives.

Director of Business Development:

The Director of Business Development reports to the Laboratory Director and serves as the interface between the laboratory's technical departments and the laboratory's clients. The staff consists of the Project Management team, Business Development team and satellite office Operations Manager. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Technical training and growth of the Project Management team;
- Business liaison for the Project Management team;
- Human resource management of the Project Management team;
- Responsible for the review and negotiation of client contracts and terms and conditions;

- Responsible for establishing standard fee schedules for the laboratory;
- Responsible for preparation of proposals and quotes for clients and client prospects;
- Accountable for response to client inquiries concerning sample status;
- Responsible for assistance to clients regarding the resolution of problems concerning Chains-of-Custody;
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory;
- Notifying the department managers of incoming projects and sample delivery schedules;
- Accountable to clients for communicating sample progress in daily status meeting with agreed-upon due dates;
- Responsible for discussing with client any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff;
- Responsible for staff familiarization with specific quotes, sample log-in review, and final report completeness; and
- Ensure that all non-conformance conditions are reported to the QA Manager, Operations Manager, and/or Laboratory Director via the Corrective Action process.

Technical Managers (at ECI known as Group Leaders):

The Group Leaders report directly to the Operations Director. They have the authority to accept or reject data based on pre-defined QC criteria. In addition, with the approval of the QA Manager, the Group Leaders may accept data that falls outside of normal QC limits if, in his or her professional judgment, there are technical justifications for the acceptance of such data. The circumstances must be well documented and any need for corrective action identified must be defined and initiated. The authority of the Group Leaders in QC related matters results directly from the QA Manager. The Group Leaders also

- Coordinating, writing, and reviewing test methods and SOPs, with regard to quality, integrity, regulatory requirements and efficient production techniques;
- Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process and providing technical and troubleshooting expertise on routine and unusual or complex problems;
- Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis; and
- Coordinates audit responses with supervisors and QA Manager.
- Actively support the implementation of ECI's QA Program;
- Ensure that their employees are in full compliance with ECI's QA Program;
- Maintain accurate SOPs (by reviewing and implementing updates) and enforce routine compliance with SOPs;
- Conduct technical training of new staff and when modifications are made to existing procedures;
- Maintain a work environment which emphasizes the importance of data quality;
- Ensure all logbooks are current, reviewed and properly labeled or archived;
- Ensure that all non-conformance conditions are reported to the QA Manager, Operations Manager, and/or Laboratory Director via Corrective Action reports;
- Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Director, Operations Manager, and/or QA Manager. Each is responsible for 100% of the data review and documentation, nonconformance issues, and the timely and accurate completion of performance evaluation samples and MDLs, for his/her department;.

- Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and using appropriate documentation techniques;.
- Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He or she is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments;
- Provide written responses to external and internal audit issues; and
- Provide support to all levels of ECI Management.

Technical Managers (Sample Control Group Leader):

The Sample Control Group Leader reports to the Operations Manager. The responsibilities are outlined below:

- Direct the receipt, handling, labeling and proper storage of samples in compliance with laboratory procedures and policies;
- Oversee the training of Sample Control Technicians regarding the above items;
- Direct the logging of incoming samples into the LIMS and ensure the verification of data entry from login;
- Oversee all sample courier operations;
- Acts as a liaison between Project Managers and Analytical departments in respect to handling rush orders and resolving inconsistencies and problems with chain-of-custody forms, and routing of subcontracted analyses; and
- Oversees the handling of samples in accordance with the Waste Disposal SOP, the Hazardous Waste Contingency Plan in the Chemical Hygiene/Safety Manual, and the U. S. Department of Agriculture requirements.

Laboratory Analysts

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the group leader or supervisor. The responsibilities of the analysts are listed below:

- Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, the Data Integrity Policy, and project-specific QA plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on work sheets, bench sheets, preparation logbook, and/or a Non-Conformance report;
- Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to the Group Leader and/or the QA Manager;
- Perform 100% review of the data generated prior to entering and submitting for secondary level review; and
- Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

Laboratory Technicians:

- Prepare samples for analysis by weighing, extracting or digesting, filtering, or concentrating samples; and

- Prepare method specific QC Samples with each preparation batch. All personnel must adhere to all QC procedures specified in the analytical method and in accordance to procedures or policies and are responsible for the full documentation of these procedures.

Project Managers:

The Project Manager normally reports to the Senior Project Manager and/or Business Development Director. Typical responsibilities include:

- Serving as the laboratories' primary point of contact for assigned clients;
- Working with laboratory chemists to resolve questions on data;
- Scheduling of courier deliveries and pick-ups;
- Tracking the progress of all laboratory production efforts;
- Advising clients of any scheduling conflicts, possible delays, or other problems which may arise;
- Resolving any questions or issues that clients may have with regard to our services, especially our reports;
- Preparation of bottle kits for use by clients in their sampling efforts (as necessary);
- Reviewing of reports/EDDs (Electronic Data Deliverables) as necessary prior to release;
- Invoice preparation and review prior to release to client;
- Serving as back-up contact person for other Project Managers in the event of his/her absence;
- Coordination of all subcontracting efforts for projects assigned;
- Preparation and implementation of program QAPPs (Quality Assurance Project Plans), if needed;
- Preparation of project Case Narratives, as needed; and
- Assembly of full data packages in accordance with company or client protocol, as needed.

Project Management Assistant:

The Project Management Assistant normally receives direction from the Project Manager(s) for which he/she is assigned. Typical responsibilities include:

- Working with laboratory chemists to resolve questions on data;
- Scheduling of courier deliveries and pick-ups;
- Tracking the progress of all laboratory production efforts;
- Advising clients of any scheduling conflicts, possible delays, or other problems which may arise;
- Resolving any questions or issues that clients may have with regard to our services, especially our reports;
- Preparation of bottle kits for use by clients in their sampling efforts;
- Reviewing of reports/EDDs (Electronic Data Deliverables) prior to release;
- Invoice preparation and review prior to release to client;
- Serving as back-up contact person for the project managers in the event of his/her absence;
- Coordination of all subcontracting efforts for projects assigned; and
- Preparation and implementation of program QAPPs (Quality Assurance Project Plans), if needed.
- As part of the administrative staff, this person may also be required to answer phones, do occasional filing, mailing, etc.

Health, Safety, and Respiration Protection Manager:

The Health and Safety Manager reports to the Laboratory Director and ensures that systems are maintained for the safe operation of the laboratory. The EHS Manager is responsible for:

- Conducting ongoing, necessary safety training and conducting new employee safety orientations;
- Assisting in developing and maintaining the Chemical Hygiene/Safety Manual;
- Oversees the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed; and
- Completes accident reports, follows up on root causes and defines corrective actions.

Hazardous Waste Coordinator:

The Hazardous Waste Coordinator reports directly to the Environmental Health & Safety Manager. The duties of the HWC consist of:

- Staying current with the hazardous waste regulations and continuing training on hazardous waste issues;
- Contacting the hazardous waste subcontractors for review of procedures and opportunities for minimization of waste;
- Supervise the recording of the transfer of samples from refrigerated conditions to ambient conditions [in the sample disposal log sheets (SOLS)];
- Check the records in SDLS against the logbook (LIMS) records;
- Coordinate the collection of waste throughout the laboratory that will be disposed of through "Lab Packs";
- Coordinate and supervise Hazardous Waste Technician(s);
- Dispose of solid waste to an assigned Tote;
- Supervise the recording and disposal of acid and soil with methylene chloride extracts into appropriate drums;.
- Prepare and discharge treated wastewater to the sewer system;
- Maintain Uniform Hazardous Waste Manifest files;
- Prepare weekly sample disposal schedules;
- Coordinate and schedule waste pick-up;
- Check **all** waste containers for appropriate labels; and
- Maintain safe housekeeping and practices.

Education and Experience

ECI makes every effort to hire analytical staff that posses a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions are made based upon experience and an individual's ability to learn as there are many **in** the industry that are more than competent, experts perhaps, who have not earned a college degree.

Selection of qualified individuals for employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Experience and specialized training may be accepted in lieu of a college degree (basic lab skills such as using a balance, aseptic or quantitation techniques, etc. are also considered).

Included in Section 5.2 (e) of this Quality Assurance Manual are the basic job titles and personnel responsibilities for anyone who manages, performs or verifies work affecting the quality of the laboratory's environmental sample testing. Minimum education and training requirements are summarized in the following table:

When an analyst does not meet these minimum requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Group Leader, and are considered an analyst in training. The person supervising an analyst **in** training is directly accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

Job Type	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.}, Titrimetric and Gravimetric Analyses,	H.S. Diploma or GED	On the job training
GFAA CVAA, FLAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC	A college degree in an applied science or 2 years of college with at least 1 year of college chemistry, or	2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pest, PCB, Herb, HPLC, etc.}, GCMS	A college degree in an applied science or 2 years of college chemistry, or	5 years of prior analy!ical experience is required
Spectra Interpretation	A college degree in an applied science or 2 years of college Chemistry, and	2 years relevant experience, or 5 years of prior analy!ical experience is required
Group Leaders - Advanced Instrumentation	Bachelors Degree in an applied science with 16 semester hours in chemistry. An advanced (MS, PhD.} degree may substitute for one year of experience, and	2 years experience in the analy!ical technique for environmental analysis of representative analyj;es for which they will oversee
Group Leaders - Wet Chemist[V (Basic Skills}	Associates degree in an applied science or 2 years of college with 16 semester hours in Chemistry, and	2 years relevant experience

f) Identification of the laboratory's approved signatories; at a minimum, the title page of the quality manual has the signed and dated concurrence (with appropriate titles) of all responsible parties including the QA Manager, Operations, QA, Technical, Laboratory and Operations Directors.

g) The laboratory's procedures for achieving traceability of measurements;

h) A list of all test methods under which the laboratory performs its accredited testing may be found in the Index of Standard Operating Procedures, a separate document.

i) Mechanisms for ensuring that the laboratory reviews all new work to ensure that it has the appropriate facilities and resources before commencing such work;

j) Reference to the calibration and/or verification test procedures used;

Formatted: Justified, Indent: Left: 0.98", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 2 + Alignment: Left + Aligned at: 0.26" + Indent at: 0.5"

Formatted: Indent: Left: 0.99", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 2 + Alignment: Left + Aligned at: 0.26" + Indent at: 0.5"

Formatted: Justified, Indent: Left: 0.99", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 2 + Alignment: Left + Aligned at: 0.26" + Indent at: 0.5"

Formatted: Justified, Indent: Left: 0.99", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 2 + Alignment: Left + Aligned at: 0.26" + Indent at: 0.5"

Formatted: Indent: Left: 0.98", Hanging: 0.27", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 2 + Alignment: Left + Aligned at: 0.26" + Indent at: 0.5"

Calibration procedures and verification of acceptability for each set of required calibrations are defined in Section 13 (Calibration) and Section 12 (Quality Control) of each standard operating procedure.

k) Procedures for handling samples received:

Formatted: Indent: Left: 0.13", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 2 + Alignment: Left + Aligned at: 0.26" + Indent at: 0.5"

The generation of quality analytical data begins with the collection of the sample and, therefore, the integrity of the sample collection process is of importance to ECI. Samples must be collected in such a way that foreign material is not introduced into the samples and that analytes of interest do not escape from the samples or degrade prior to their analysis. To ensure sample integrity and representativeness, the following items must be considered:

- Samples must be collected in appropriate containers. In general, glass containers are used for organic analytes and polyethylene for inorganic/metal analytes;
- Only new sample containers which are certified and documented clean in accordance with U.S. EPA OSWER Directive No. 9240.0-0.05 specifications shall be provided by ECI for sample collection;
- Certain extremely hazardous samples or samples that have the potential to become extremely hazardous will not be accepted. These include (but are not limited to)

1. Radioactive samples that significantly exceed background levels
2. Biohazardous samples (medical wastes, body fluids, etc.)
3. Explosive samples in pure form (Semtex, Flash or gunpowder, ammunition, flares, etc.)
4. Neurological or other toxic agents (Sarin, Anthrax, Ricin, etc.)

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.63" + Indent at: 0.88"

Formatted: Indent: Left: 0.62", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.63" + Indent at: 0.88"

ECI's chain-of-custody document is used to forward samples from the client to the laboratory. As the basic elements of most all chain-of-custody (COC) documents are similar, clientele may choose to use their own chain-of-custody document to forward samples to ECI.

Any discrepancies in the COC must be documented on the Sample Receipt Form and resolved prior to analysis of samples. Further guidance may be found in SOP T100 "Sample Receipt and Log-In Procedures".

Upon receipt by ECI, samples proceed through an orderly processing sequence designed to ensure continuous integrity of both the sample and its documentation from sample receipt through its analysis and beyond.

All coolers that are received by the Sample Control Group undergo a preliminary examination in accordance of the Sample Receipt Form. Specifically, each sample is carefully examined for label identification, proper container (type and volume), chemical preservation when applicable, container condition, and chain-of-custody documentation consistency with sample labels. Discrepancies are noted on both the Sample Receipt Form and the Sample Anomaly Form and, if possible, discussed with the client prior to his or her departure. If this is not possible, the discrepancies are communicated to the client for resolution prior to the completion of the log-in process. The temperature of the cooler is measured and, with other observations, is recorded.

During the log-in process each sample is assigned a unique laboratory identification number through a computerized Laboratory Information Management System (LIMS), which stores all essential project information. ECI maintains multiple security levels of access into LIMS to prevent unauthorized tampering/release of sample and project information.

Once all analyses for a sample have been completed and the sample container is returned to Sample Control, it shall remain in refrigerated storage for a period not less than 14 days following sample receipt unless the client requests return/forwarding of the sample. Following the 14-day refrigerated storage period, the samples are placed into ambient storage for another period not less than 14 days after which the samples are bulked into drums for later disposal.

Extended storage may be requested at prevailing per sample rates.

l) Reference to the major equipment and reference measurement standards used as well as the facilities and services used by the laboratory in conducting tests;

A list of major equipment is kept up-to-date on the List of Major Assets, reference Appendix G. This, as well as a list of reference measurement standards and their certificates of calibration, is maintained by the QA Manager or the respective departments. In general, all calibrations and references should be traceable to NIST

m) Reference to procedures for calibration, verification and maintenance of equipment; Laboratory SOPs (T043 and T066) are available to staff for calibration, verification and maintenance of equipment. In general,

n) Reference to verification practices which may include inter-laboratory comparisons, proficiency testing programs, use of reference materials and internal quality control schemes;

Instrument calibration is required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity such that required reporting limits can be met. Each instrument is calibrated with standard solutions appropriate to the type of instrument and the linear range established for the analytical method. The manufacturer's guidelines, the analytical method, and/or the requirements of special contracts determine the frequency of calibration and the concentration of calibration standards, whichever is most applicable. The following are very general guidelines and are not meant to be all-inclusive. Detailed calibration procedures are specified in the SOP for each method performed.

Gas Chromatography/Mass Spectroscopy (GC/MS): Each day prior to analysis of samples, all GC/MS instruments are tuned with 4-bromofluorobenzene (BFB) for VOCs and decafluorotriphenylphosphine (DFTPP) for SVOCs in accordance with the tuning criteria specified in the applicable methods. Samples are not analyzed until the method-specific tuning requirements have been met.

After the tuning criteria are met, the instrument is then calibrated for all target analytes and an initial multipoint calibration curve established. The calibration curve is then validated by the analysis of a second source standard, referred to as the initial calibration verification (ICV). Alternatively, the previous calibration curve may be used if validated by a continuing calibration verification (CCV) standard. All target analytes are represented in the calibration and certain key target analytes referred to as system performance calibration compounds (SPCCs) and calibration check compounds (CCCs) are used for curve acceptance determination. For the initial calibration to be deemed acceptable, the SPCCs and CCCs must meet established acceptance criteria and must be re-evaluated and meet the acceptance criteria, at a minimum, every twelve (12) hours thereafter.

Non-GC/MS Chromatography: The field of chromatography involves a variety of instrumentation and detectors. While calibration standards and control criteria vary depending upon the type of system and analytical methodology required for a specific analysis, the general principles of calibration apply uniformly. Each chromatographic system is calibrated prior to sample analysis. An initial multipoint calibration curve is generated using all target analytes. All target analytes must meet the acceptance criteria for the calibration to be deemed acceptable. The calibration curve is then validated by the analysis of a second source standard, referred to as the initial calibration verification (ICV). The continued validity of the initial multipoint calibration is verified every 12 hours using continuing calibration verification (CCV) standard containing all target analytes. If the CCV fails to meet the acceptance criteria, the system is re-calibrated and all samples analyzed since the last acceptable CCV must be re-analyzed.

Inductively Coupled Plasma Emission Spectroscopy: Initial calibration consists of a calibration blank (CB) plus one calibration standard. The calibration is verified by the re-analysis of the standard and initial calibration verification (ICV) standard. If the standard and the ICV fail to meet the acceptance criteria, the initial calibration is considered invalid and is re-performed.

Formatted: Justified, Indent: Hanging: 0.24", Numbered + Level: 2 + Numbering Style: I, II, III, ... + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, ... + Start at: 13 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, ... + Start at: 13 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Continuing calibration verification (CCV) consists of a mid-concentration standard plus a calibration blank (CB) analyzed every 10 samples and at the end of the sequence. If the CCV and/or CB fail to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV and/or CB must be re-analyzed.

ICP/MS Spectroscopy: Each day prior to the analysis of samples, all ICP/MS instruments undergo mass calibration and resolution checks prior to initial calibration. Initial calibration consists of a calibration blank (CB) and at least one calibration standard. The calibration is verified by the re-analysis of the standard and initial calibration verification (ICV) standards. If the standard and the ICV fail to meet the acceptance criteria, the initial calibration is considered invalid and is re-performed.

Continuing calibration verification (CCV) consists of a mid-concentration standard plus a calibration blank (CB) analyzed every 10 samples and at the end of the sequence. If the CCV and/or CB fail to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV and/or CB must be re-analyzed.

Cold Vapor Atomic Absorption Spectroscopy: Initial calibration consists of a calibration blank plus a series of at least 5 standards. The calibration curve is then validated by the analysis of a second source standard, referred to as the initial calibration verification (ICV). Continuing calibration verification (CCV) consists of midpoint calibration standard plus a continuing calibration blank (CCB) analyzed every 10 samples and at the end of the sequence. If the CCV and/or CCB fail to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV and/or CCB must be re-analyzed. If the calibration blanks contain target analyte concentrations exceeding the acceptance limits, the cause must be determined and corrected.

Flame and Graphite Furnace Atomic Absorption Spectroscopy: Initial calibration consists of a calibration blank plus a low, medium, and high calibration standard. Continuing calibration verification (CCV) consists of midpoint calibration standard plus a continuing calibration blank (CCB) analyzed every 10 samples and at the end of the sequence. If the CCV and/or CCB fail to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV and/or CCB must be re-analyzed. If the calibration blanks contain target analyte concentrations exceeding the acceptance limits, the cause must be determined and corrected.

General Inorganic Analyses: General inorganic (non-metal) analyses involve a variety of instrumental and wet chemistry techniques. While calibration procedures vary depending on the type of instrumentation and methodology, the general principles of calibration apply universally. Each system or method is initially calibrated using standards prior to analyses being conducted with continual verification that the calibration remains acceptable throughout analytical processing. If continual calibration verification fails to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV must be re-analyzed.

o) Procedures to be followed for feedback and corrective action whenever testing discrepancies are detected, or departures from documented policies and procedures occur;

Formatted: Indent: Left: 0.18", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

These procedures may be found in SOP-T015 (Correction/Prevention of Errors in Test Records) and SOP-T022 (Corrective/Preventive Actions).

p) The laboratory management arrangements for permitting exceptions and departures from documented policies and procedures or from standard specifications;

Formatted: Indent: Left: 0.18", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

ECl's SOPs are in substantial conformity with their corresponding published method references. Departure from approved SOPs shall be approved if necessary or appropriate due to the nature or composition of the sample or otherwise based on the reasonable judgment of ECl's Laboratory Director, Technical Director, or QA Manager.

Departures shall be made on a case-by-case basis consistent with recognized standards of the industry. In no case shall departures be approved without written communication between EC land the affected client.

g) Procedures for dealing with complaints;

Formatted: Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Procedures for dealing with complaints may be found in SOP-T018, Handling of Inquiries and Complaints.

r) Procedures for protecting confidentiality (including national security concerns) and proprietary rights;

Formatted: Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

ECI is sensitive to the fact that much of the analytical work performed for clientele may be subject to litigatory processes. ECI, therefore, holds all information in strict confidence with laboratory release only to the client or designee. Information released to entities other than the client is performed only upon written, facsimile or e-mail request from the client.

Due to the investigative nature of most site assessments, analytical information may become available to regulatory agencies or other evaluating entities during site assessment of the laboratory for the specific purpose of attaining laboratory certifications, accreditations, or evaluation of laboratory qualification for future work. During these occurrences, the laboratory will make its best effort to maintain the confidence of client specific information.

s) Procedures for audits;

Formatted: Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

ECI participates in a wide variety of system and performance audits conducted by numerous federal and state agencies, as well as through its major clientele. These audits are conducted to verify that analytical data produced conforms to industry standards on a routine basis.

A System Audit is a qualitative evaluation of the measurement systems utilized at ECI, specifically, that ECI has, in place, the necessary facilities, staff, procedures, equipment, and instrumentation to generate acceptable data. This type of audit typically involves an on-site inspection of the laboratory facility, operations, and interview of personnel by the auditing agency.

A Performance Audit verifies the ability of ECI to correctly identify and quantitate compounds in blind check samples. This type of audit normally is conducted by the auditing agency through laboratory participation in round robin Performance Evaluation (PE) programs. Examples of current PE program involvement include those offered by commercial suppliers like ERA (WS/WP/SOIL and DMR-QA), or other inter-laboratory studies not required for certification but done to ensure laboratory performance, as well as programs administered by major industry.

Outliers in required PE samples will be investigated and corrective actions documented using the Corrective/Preventive Action Record.

Should the result of any audit detect a significant error, which has been identified to adversely affect released data, the situation shall be thoroughly investigated. Corrective measures shall be enacted to include system re-evaluation, the determined affect on released data and client notification, as necessary. These measures shall be documented using the Corrective/Preventive Action Record.

t) Processes/procedures for establishing that personnel are adequately experienced in the duties they are expected to carry out and are receiving any needed training;

Formatted: Indent: Left: 0.99", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Quality control begins prior to sample(s) receipt at the laboratory. The selection of well qualified personnel, based upon education and/or experience is the first step in successful laboratory management. A thorough screening of job applicants and selection of the best candidate to fulfill a well-defined need is as important an aspect of a successful QA/QC program as a careful review of analytical data.

Employee training and approval procedures used at ECI are specified in SOP-T010, "Employee Training", and includes but is not limited to the following:

- A thorough understanding of the applicable regulatory method and ECI SOP;
- A review of ECI's QA Program Manual and thorough understanding of the specifics contained therein that are directly related to the analysis to be performed;
- Instruction by the applicable Group Leader on all aspects of the analytical procedure;
- Performance of analyses under supervision of experienced laboratory personnel, which shall include analysis of blind QC check samples, when deemed appropriate;
- Participation in in-house seminars on analytical methodologies and procedures;
- Participation in job related seminars outside of the laboratory; and
- Participation in conventions and meetings, i.e., ACS, etc.

u) Ethics policy statement developed by the laboratory and processes/procedures for educating and training personnel in their ethical and legal responsibilities including the potential punishments and penalties for improper, unethical, or illegal actions;

Formatted: Justified, Indent: Left: 0.16", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

A vital part of ECI's analytical laboratory services is their Laboratory Ethics Training Program. An effective program starts with an Ethics Policy Statement that is supported by all staff, and is reinforced with initial and ongoing ethics training.

"It shall be the policy of ECI to conduct all business with integrity and in an ethical manner. It is a basic and expected responsibility of each staff member and manager to hold to the highest ethical standard of professional conduct in the performance of all duties."

A proactive ethics training program is the most effective means of deterring and detecting improper, unethical, or illegal actions in the laboratory. There are six facets to the program: (1) clearly define improper, unethical, and illegal actions; (2) outline elements of prevention and detection programs for improper, unethical, or illegal actions; and (3) identify examples of inappropriate (i.e., potentially fraudulent) laboratory practices; (4) Annual Ethics and Data Integrity Training to be documented and maintained in the personnel file of each employee., (5) Documented training on new revisions of the Quality Systems Manual (QSM) and for new employees as needed. (6) Signed Ethics and Data Integrity Agreement (to be completed for new employees and annually thereafter)

Definition of Improper, Unethical, and Illegal Actions

Improper actions are defined as deviations from contract-specified or method-specified analytical practices and may be intentional or unintentional.

Unethical or illegal actions are defined as the deliberate falsification of analytical or quality assurance results, where failed method or contractual requirements are made to appear acceptable.

Prevention of laboratory improper, unethical, or illegal actions begins with a zero-tolerance philosophy established by management. Improper, unethical, or illegal actions are detected through the implementation of oversight protocols.

Prevention and Detection Program for Improper, Unethical, or Illegal Actions

ECI management has implemented a variety of proactive measures to promote prevention and detection of improper, unethical, or illegal activities. The following components constitute the basic program:

- Data Integrity Standard Operating Procedure (SOP) T065
- Data Integrity Documentation Procedures
- An Ethics and Data Integrity Agreement that is read and signed by all personnel;
- Initial and annual ethics training;

.l

c::> Internal audits;
c::> Inclusion of anti-fraud language in subcontracts;
- Analyst notation and sign-off on manual integration changes to data;
- Active use of electronic audit functions when they are available in the instrument software; and
- A "no-fault" policy that encourages laboratory personnel to come forward and report fraudulent activities. Alternately, employees may report ethics violations to a third party agent contracted by Eurofins USA c/o reports@lighthouse-services.com/eurofinsus

A proactive, "beyond the basics" approach to the prevention of improper, unethical, or illegal actions are a necessary part of laboratory management. As such, in addition to the requirements above, ECI has a designated ombudsman (data integrity officer) to whom laboratory personnel can report improper, unethical, or illegal practices, or provide routine communication of training, lectures, and changes in policy intended to reduce improper, unethical, or illegal actions.

Examples of Improper. Unethical, or Illegal Practices

Documentation that clearly shows how all analytical values were obtained are maintained by ECI and supplied to the data user as needed. To avoid miscommunication, ECI clearly documents all errors, mistakes, and basis for manual integrations within the project file and case narrative as applicable. Notification is also made to the appropriate supervisor so that appropriate corrective actions can be initiated. Gross deviations from specified procedures are investigated for potential improper, unethical, or illegal actions, and findings of fraud are fully investigated by senior management. Examples of improper, unethical, or illegal practices are identified below:

c::> Improper use of manual integrations to meet calibration or method QC criteria (for example, peak shaving or peak enhancement are considered improper, unethical, or illegal actions if performed solely to meet QC requirements);
c::> Intentional misrepresentation of the date or time of analysis (for example, intentionally resetting a computer system's or instrument's date and/or time to make it appear that a time/date requirement was met);
c::> Falsification of results to meet method requirements;
c::> Reporting of results without analyses to support (i.e., dry-labbing);
c::> Selective exclusion of data to meet QC criteria (for example, initial calibration points dropped without technical or statistical justification);
c::> Misrepresentation of laboratory performance by presenting calibration data or QC limits within data reports that are not linked to the data set reported, or QC control limits presented within QAPP that are not indicative of historical laboratory performance or used for batch control;
c::> Notation of matrix inference as basis for exceeding acceptance limits (typically without implementing corrective actions) in interference-free matrices (for example, method blanks or laboratory control samples);
c::> Unwarranted manipulation of computer software (for example, improper background subtraction to meet ion abundance criteria for GC/MS tuning, chromatographic baseline manipulations);
c::> Improper alteration of analytical conditions (for example, modifying EM voltage, changing GC temperature program to shorter analytical run time) from standard analysis to sample analysis;
c::> Misrepresentation of QC samples (for example, adding surrogates after sample extraction, omitting sample preparation steps for QC samples, over- or under-spiking); and
c::> Reporting of results from the analysis of one sample for those of another.

v) Reference to procedures for reporting analytical results;

Formatted: Indent: Left: 0.99", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Standard operating procedures pertaining to the reporting of results are available to all laboratory personnel. They are: SOP-T009, Significant Figures, Rounding, and Reporting of Results; SOP-T025, Reporting of Tentatively Identified Compounds (TICs); and T-026, Reporting of Data Qualifiers.

All analytical data generated within ECI is thoroughly checked for accuracy and completeness. The data validation process consists of data generation, reduction, and four levels of review as described below.

The analyst generating the analytical data has the primary responsibility for its correctness and completeness. All data is generated and reduced following protocols specified in the appropriate SOPs. Each analyst reviews the quality of his or her work based upon an established set of guidelines specified in the SOPs or as specified by project requirements. The analyst reviews the data package to ensure that:

c> Holding times have not been exceeded;
c> Sample preparation information is correct and complete;
c> Analysis information is correct and complete;
c> The appropriate procedures were employed;
c> Analytical results are correct and complete;
c> All associated QC is within established control limits and, if not, out-of-control forms are completed thoroughly explaining the cause and corrective action taken;
c> Any special sample preparation and analytical requirements have been met; and
c> Documentation is complete, i.e., all anomalies in the preparation and analysis have been documented; out-of-control forms, if required, are complete, etc.

The data reduction and validation steps are documented, signed, and dated by the analyst on the QC Review coversheet accompanying each data package. This initial review step, performed by the analyst, is designated as primary review. The analyst then forwards the data package to his or her Group Leader, or designated data reviewer, who performs a secondary review. Secondary reviews consist of an independent check equivalent to that of the primary review and are designed to ensure that:

c> Calibration data is scientifically sound, appropriate to the method, and completely documented;
c> QC data is within established guidelines or reported with appropriate clarification/qualification;
c> Qualitative identification of sample components is correct;
c> Quantitative results are correct;
c> Documentation is complete and any anomalies properly addressed and documented;
c> The data is ready for incorporation into the final report package; and
c> The data package is complete and ready for archiving.

A significant component of the secondary review is the documentation of any errors that have been identified and corrected during the review process. ECI believes that the data package that is submitted for a secondary review should be free from errors. Errors that are discovered are documented and formally transmitted to the appropriate Group Leader. The cause of the errors is then addressed by additional training or clarification of procedures (SOP revisions) to ensure that similar errors do not recur and high quality data will be generated.

Signature of Data Reviewer and the date of review document the completion of secondary reviews on the QC Review coversheet. These constitute approval for data release and generation of analytical report.

During both of the QC review processes, 100% of the raw data associated with the entire project is available to the reviewer. Data packages are checked back to the raw data as deemed necessary by the reviewer.

Following draft report generation, the report is reviewed by the Project Manager to ensure that the data set and quality control data is complete and meets the specific requirements of the project. When available, the data is also evaluated against historical site information. Once all requested analytical work has been verified as complete, a final report is generated and signed by the Project Manager.

Following approval for release by the Project Manager, the Quality Assurance Manager or other qualified personnel may review 10% of the project files back to the raw data as an additional check, if a situation so warrants.

A variety of reporting formats, from Portable Document File (PDF), normal typed reports to computerized data tables to complex reports discussing regulatory issues are available. In general, ECIreports contain the following information.

Analytical Data

Analytical data is reported by sample identification (both client and laboratory) and test. Pertinent information including date(s) sampled, received, prepared, and analyzed; any required data qualifiers are included on each results page. The reporting limit for each method analyte is also listed. Additional data may include Method Detection Limits (MDLs).

QC Data

A QC Summary is provided with each final report. Unless otherwise specified in a QAPP or requested by the client, QC Summaries include results for method blanks, matrix spikes, matrix spike duplicates, and surrogate spikes. Laboratory control sample and method blank surrogates are routinely included if matrix interference results in a QC outlier. The effective control limits for the reported QC values are also provided on the QC Summary as well as explanations for any QC outliers. Case Narratives may be included as appropriate.

As required for the project, data reports from "results only" through "full CLP-like" will be generated and provided. Included in this range are reports for the major DOD/DOE programs including NFESC, AFC EE, and USAGE.

Methodology

References for the preparative and analytical methodology employed is included on all preliminary or final analytical reports.

Signatory

Final reports are ready for release to the client following review and approval by the Project Manager, as evidenced by his/her signature on the final report cover page. An approved signatories listing shall be maintained by the QA office.

Preliminary Data

Upon client request, preliminary data shall be released prior to completion of a full QC review. Preliminary data is subject to change pending QC review and, therefore, shall be clearly marked as "Preliminary". This qualification is provided as notification to the client that the data review process has not been completed yet and that the data is subject to possible modification resulting therefrom.

Revised Data

Analytical reports that have been revised for any reason from the original sent report shall be noted as being revised with a report note, case narrative or indication as to the revision.

Formatting

At a minimum, an analytical report shall consist of the Report Cover Page, Analytical Results, QA/QC Data (Default), Footnotes/Comments Page, Sample Receipt Form and COG. Paginated reports shall be employed for all reports unless used for non-NELAP analysis.

w) A Table of Contents and applicable lists of references and glossaries, and appendices.

Formatted: Indent: Left: 0.12", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

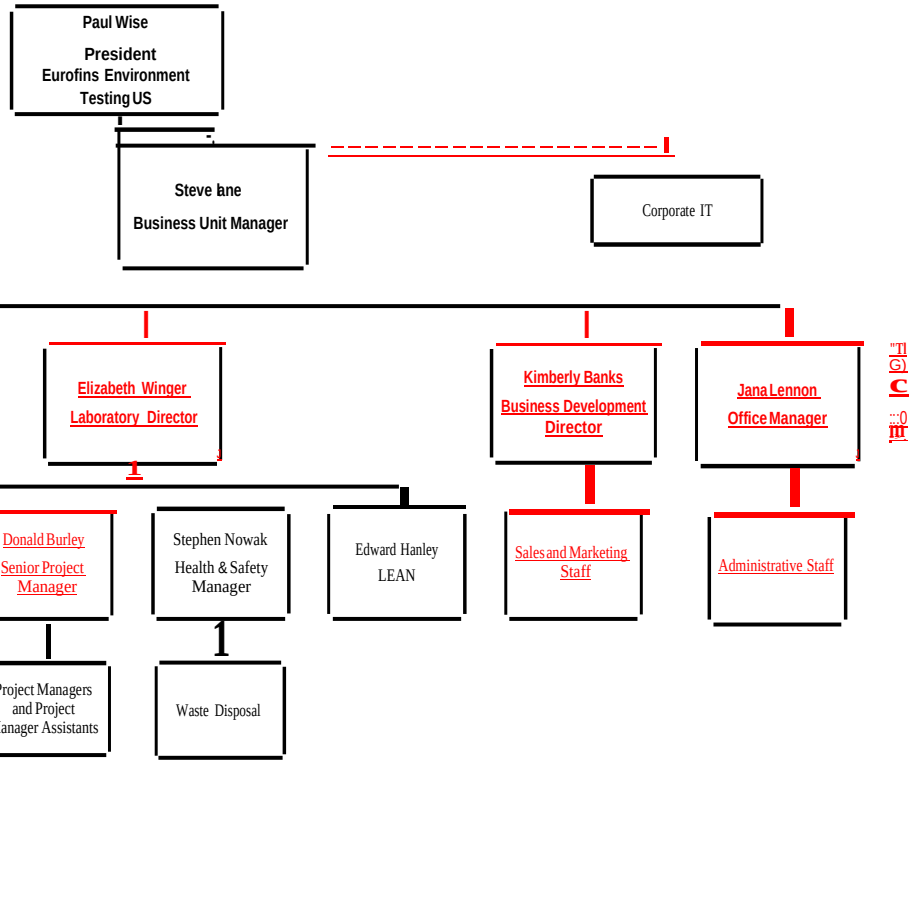
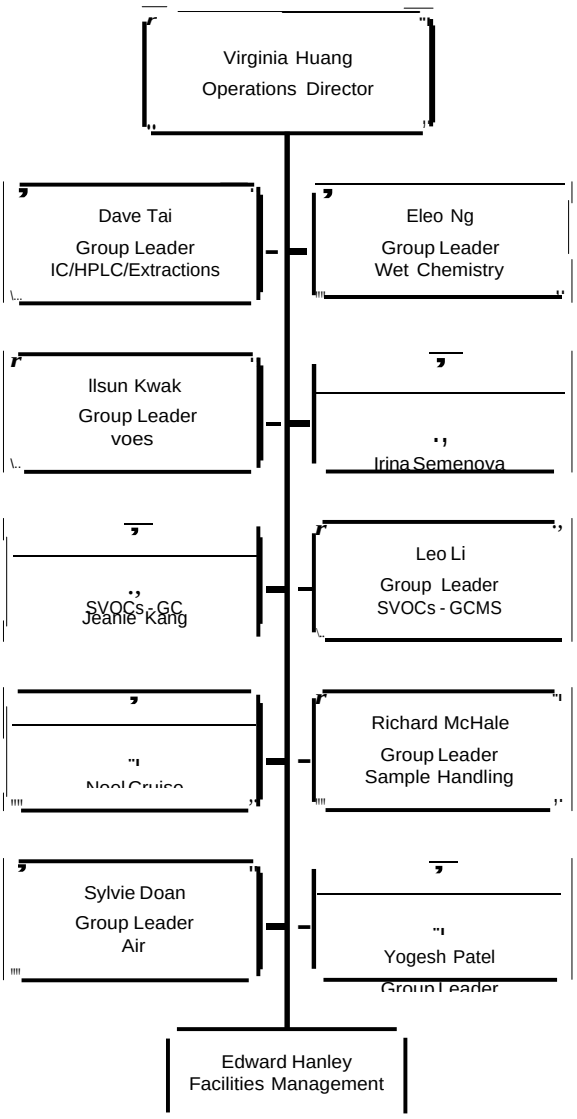

Paul Wise
President
Eurofins Environment Testing US
Steve Lane
Business Unit Manager
Corporate IT
Linda Scharpenberg
QA Director
Technical Director
Elizabeth Winger
Laboratory Director
Kimberly Banks
Business Development Director
Jana Lennon
Office Manager
Lawrence Lem
QA Manager
Virginia Huang
Operations Director
Donald Burley
Senior Project Manager
Stephen Nowak
Health & Safety Manager
Edward Hanley
LEAN
Sales and Marketing Staff
Administrative Staff
Administrative Staff - QA Data Packaging
Group Leaders Operations, and Facilities Management
Project Managers and Project Manager Assistants
Waste Disposal
Chemists, Technicians, and Sample Receiving Personnel

FIGURE 2:


Virginia Huang
Operations Director
Dave Tai
Group Leader
IC/HPLC/Extractions
Eleo Ng
Group Leader
Wet Chemistry
Ilsun Kwak
Group Leader
voes
Irina Semenova
Jeanie Kang
SVOCs - GC
Leo Li
Group Leader
SVOCs - GCMS
Richard McHale
Group Leader
Sample Handling
Sylvie Doan
Group Leader
Air
Yogesh Patel
Edward Hanley
Facilities Management

5.4 Audits

5.3.1 Internal Audits

The laboratory arranges comprehensive annual internal audits to verify that its operations continue to comply with the requirements of the laboratory's said quality system. The Quality Assurance Manager or the Quality Assurance Assistant plans and organizes audits as required by a predetermined schedule and requested by management. The internal audits are buttressed by regular and scheduled Test Method Assessments (TMA).

The Quality Assurance Assistant or other qualified personnel, independent of the activity to be audited, will carry out such audits following the procedures noted in SOP T028, Internal Audit Procedures.

Personnel do not audit their own activities except when it can be demonstrated that an effective audit will be carried out.

Where the audit findings cast doubt on the correctness or validity of the laboratory's calibrations or test results, the laboratory takes immediate corrective action and immediately notifies, in writing, any client whose work was involved.

i. List of available qualified personnel for internal audits include:

- QA Director
- QA Manager
- QA Assistant
- Department Manager
- Assistant Department Manager
- Group Leader (For departments other than their own)
- Program Manager
- Health and Safety Manager (For non-analytical departments)
- Any Senior Chemist (With documented training in proper internal auditing procedures from a qualified source).

ii. The minimum qualifications for an internal auditor shall be:

- Education: A Bachelors (BS) Degree in an applied science with 16 semester hours in chemistry.
- Experience: Two years' experience in an instrumental analytical technique for environmental analysis of representative environmental samples. Training to the most current revision of ECISOP T028 (Internal Audits). The training to be overseen by an individual that is ISO 17025 / 9001 trained in internal auditing procedures, or equivalent.
- An advanced (MS, PhD.) degree may be substituted for one year of experience.

Any outside audit findings will also be included in the Internal Audits.

5.3.2 Management Review

ECI management conducts an annual review of its quality system and its testing and calibration activities to ensure its continuing suitability and effectiveness and to introduce any necessary changes or improvements in the quality system and laboratory operations.

Formatted: Justified, Indent: Left: 0.98", Hanging: 0.49", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.62"

Formatted: Outline numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.48"

Formatted: Outline numbered + Level: 4 + Numbering Style: Bullet + Aligned at: 1.48" + Indent at: 1.73"

Formatted: Indent: Left: 1.48", Hanging: 0.26", Outline numbered + Level: 4 + Numbering Style: Bullet + Aligned at: 1.48" + Indent at: 1.73"

Formatted: Outline numbered + Level: 4 + Numbering Style: Bullet + Aligned at: 1.48" + Indent at: 1.73"

Formatted: Indent: Left: 1.48", Hanging: 0.26", Outline numbered + Level: 4 + Numbering Style: Bullet + Aligned at: 1.48" + Indent at: 1.73"

Formatted: Outline numbered + Level: 4 + Numbering Style: Bullet + Aligned at: 1.48" + Indent at: 1.73"

Formatted: Indent: Left: 1.21", Hanging: 0.26", Outline numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.48"

Formatted: Outline numbered + Level: 4 + Numbering Style: Bullet + Aligned at: 1.48" + Indent at: 1.73"

Formatted: Outline numbered + Level: 4 + Numbering Style: Bullet + Aligned at: 1.48" + Indent at: 1.73"

Formatted: Indent: Left: 0.98", First line: 0.5", Outline numbered + Level: 4 + Numbering Style: Bullet + Aligned at: 1.48" + Indent at: 1.73"

Formatted: Justified, Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

This review takes account of reports from managerial and supervisory personnel, the outcome of recent internal audits, assessments by external bodies, the results of inter-laboratory comparisons or proficiency tests, any changes in the volume and type of work undertaken, feedback from clients, senior lab personnel, corrective actions, and other relevant factors.

The laboratory shall have a procedure for review by management, and maintain records of review findings and actions. For more detailed descriptions Reference section 18.1 of this QSM and SOP T030.

5.3.3 Audit Review

All audit and review findings and any corrective actions that arise from them are documented. The laboratory management ensures that these actions are discharged within the agreed time frame as indicated in the quality manual and/or SOPs.

5.3.4 Performance Audits

In addition to periodic audits, the laboratory ensures the quality of results provided to clients by implementing checks to monitor the quality of the laboratory's analytical activities. Examples of such checks are:

a) Internal quality control procedures using statistical techniques (see Section 5.4 below);

b) Participation in proficiency testing or other inter-laboratory comparisons;

c) Use of certified reference materials and/or in-house quality control using secondary reference materials as specified in ECIQSM Section 5.4;

d) Replicate testing using the same or different test methods;

g) Re-testing of retained samples;

h) Correlation of results for different but related analysis of a sample (for example, total phosphorus should be greater than or equal to orthophosphate).

5.3.5 Corrective / Preventive Actions

a) In addition to providing acceptance criteria and specific protocols for corrective/preventive actions in SOP-T022, the laboratory implements general procedures to be followed to determine when departures from documented policies, procedures and quality control have occurred. These procedures include but are not limited to the following:

1) Identify the individual(s) responsible for assessing each QC data type;

2) Identify the individual(s) responsible for initiating and/or recommending corrective/preventive actions;

3) Define how the analyst shall treat a data set if the associated QC measurements are unacceptable;

4) Specify how out-of-control situations and subsequent corrective actions are to be documented; and

5) Specify procedures for management (including the QA officer) to review corrective/preventive action reports.

Formatted: Justified, Indent: Left: 0.12", Hanging: 0.5", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Justified, Indent: Left: 0.12", Hanging: 0.51", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.1" + Indent at: 0.36"

Formatted: Justified, Indent: Left: 0.12", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.1" + Indent at: 0.36"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.1" + Indent at: 0.36"

Formatted: Justified, Indent: Left: 0.11", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.1" + Indent at: 0.36"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 7 + Alignment: Left + Aligned at: 0.11" + Indent at: 0.37"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 7 + Alignment: Left + Aligned at: 0.11" + Indent at: 0.37"

Formatted … [24]

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.1" + Indent at: 0.36"

Formatted: Indent: Hanging: 0.24", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.36" + Indent at: 0.61"

Formatted: Indent: Left: 0.37", Hanging: 0.26", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.36" + Indent at: 0.61"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.36" + Indent at: 0.61"

Formatted: Indent: Hanging: 0.26", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.36" + Indent at: 0.61"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.36" + Indent at: 0.61"

b) To the extent possible, sample results are reported only if all quality control measures are acceptable. If a quality control measure is found to be out of control, and the data are to be reported, all samples associated with the failed quality control measure are reported with the appropriate data qualifier(s).

5.4 Essential Quality Control Procedures

These general quality control principles apply, where applicable, to all testing at ECI. The manner in which each is implemented is dependent on the types of tests performed by the laboratory and is further described in Appendix D and in SOP-T020, Internal Quality Control Checks. The standards for any given test type assures that the applicable principles are addressed:

a) All laboratories have detailed written protocols in place to monitor the following quality controls:

1) Positive and negative controls (blanks, spikes, reference toxicants, etc.) to monitor tests;

2) Tests to define the variability and/or repeatability of the laboratory results such as replicates;

3) Measures to assure the accuracy of the test method including calibration and/or continuing calibrations, use of certified reference materials, proficiency test samples, or other measures;

4) Measures to evaluate test method capability, such as detection limits and quantitation limits or range of applicability such as linearity;

5) Selection of appropriate formulae to reduce raw data to final results such as regression analysis, comparison to internal/external standard calculations, and statistical analyses;

6) Selection and use of reagents and standards of appropriate quality;

7) Measures to assure the selectivity of the test for its intended purpose; and

8) Measures to assure constant and consistent test conditions (both instrumental and environmental) where required by the test method, such as temperature, humidity, light or specific instrument conditions.

b) All quality control measures are assessed and evaluated on an on-going basis, and quality control acceptance criteria are used to determine the usability of the data. (See Appendix D.)

c) The laboratory has procedures for the development of acceptance/rejection criteria where no method or regulatory criteria exist. (See ECI QSM Section 11.2, Sample Acceptance Policy.)

d) The quality control protocols specified in the method manual (ECI QSM Section 10.1.2) is followed. ECI ensures that the essential standards outlined in NELAC 5, Appendix D, or mandated methods or regulations (whichever are more stringent) are incorporated into the method manuals. When it is not apparent which is more stringent the QC in the mandated method or regulations is to be followed.

The essential quality control measures for testing are found in Appendix D.

6.1 PERSONNEL

6.2 General Requirements for Laboratory Staff

ECI's testing departments have a sufficient level of personnel with the necessary education, training, technical knowledge and experience to perform the assigned functions.

Formatted: Justified, Indent: Left: 1", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.1" + Indent at: 0.36"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.24"

Formatted: Indent: Hanging: 0.24", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Indent: Left: 1.24", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Indent: Hanging: 0.26", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Indent: Left: 1.24", Hanging: 0.26", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Indent: Left: 1.24", Hanging: 0.26", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Justified, Indent: Left: 1.24", Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.24"

Formatted: Justified, Indent: Left: 1", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.24"

Formatted … [25]

Formatted: Indent: Hanging: 0.51", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.51"

Formatted: Indent: Left: 1", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.51"

All personnel are responsible for complying with all quality assurance/quality control requirements that pertain to their organizational/technical function. Each technical staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular function and a general knowledge of laboratory operations, test methods, quality assurance/quality control procedures and records management.

6.3 Laboratory Management Responsibilities

In addition to ECI QSM Section 4.2.d, the laboratory management:

a) Defines the minimum level of qualification, experience and skills necessary for all positions in the laboratory. In addition to education and/or experience, basic laboratory skills such as using a balance and quantitative techniques, are considered.

b) Ensures that all technical laboratory staff members demonstrate capability in the activities for which they are responsible. Such demonstration is documented (See Appendix C). Note: In departments with specialized "work cells" (a well-defined group of analysts that together perform the method analysis), the group as a unit meets the above criteria and this demonstration is fully documented.

c) Ensures that the training of each member of the technical staff is kept up-to-date (on-going) by the following:

1) Keeping evidence on file that demonstrates that each employee has read, understood, and is using the latest version of the laboratory's in-house quality documentation that relates to his/her job responsibilities.

2) Documenting training courses or workshops on specific equipment, analytical techniques, or laboratory procedures.

3) Documenting employee attendance at training courses on ethical and legal responsibilities including the potential punishments and penalties for improper, unethical or illegal actions. Keeping on file evidence that demonstrates that each employee has read, acknowledges, and understands their personal ethical and legal responsibilities including the potential punishments and penalties for improper, unethical or illegal actions.

4) Maintains up-to-date analyst training records that contain a certification that technical personnel have read, understood and agreed to perform the most recent version of the test method (the approved method or SOP as defined by the laboratory document control system, ECI QSM Section 5.2.d) and documentation of continued proficiency by at least one of the following once per year:

i. Acceptable performance of a blind sample (single blind to the analyst);

ii. Another demonstration of capability;

iii. Successful analysis of a blind performance sample on a similar test method using the same technology (e.g., GC/MS volatiles by purge and trap for Methods 524.2, 624, or 5035/8260) would only require documentation for one of the test methods;

iv. At least four consecutive laboratory control samples with acceptable levels of precision and accuracy;

v. If subsections i-iv cannot be performed, analysis of authentic samples with results statistically indistinguishable from those obtained by another trained analyst.

Formatted: Justified, Indent: Left: 0.15", Hanging: 0.51", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.51"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.4"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.4"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.4"

Formatted: Justified, Indent: Hanging: 0.24", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.4" + Indent at: 0.65"

Formatted: Justified, Indent: Left: 0.4", Hanging: 0.26", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.4" + Indent at: 0.65"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.4" + Indent at: 0.65"

Formatted: Justified, Indent: Left: 0.39", Hanging: 0.26", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.4" + Indent at: 0.65"

Formatted: Numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.65" + Indent at: 0.89"

Formatted: Numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.65" + Indent at: 0.89"

Formatted: Justified, Indent: Hanging: 0.24", Numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.65" + Indent at: 0.89"

Formatted: Justified, Indent: Left: 0.65", Hanging: 0.25", Numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.65" + Indent at: 0.89"

Formatted: Justified, Indent: Left: 0.65", Hanging: 0.25", Numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.65" + Indent at: 0.89"

d) Documents all analytical and operational activities of the laboratory;

e) Supervises all personnel employed by the laboratory;

f) Ensures that all sample acceptance criteria (ECI QSM Section 11.0) are verified and that samples are logged into the sample tracking system and properly labeled and stored.

g) Documents the quality of all data reported by the laboratory.

h) Develops a proactive program for the prevention and detection of improper, unethical, or illegal actions. Components of this program could include: internal proficiency testing (single and double blind); post-analysis electronic and magnetic tape audits; effective reward program to improve employee vigilance and co-monitoring; and separate SOPs identifying appropriate and inappropriate laboratory and instrument manipulation practices.

6.2.1 Ownership Transfer / Out of Business

a) In the event that the laboratory transfers ownership or goes out of business, ECI will ensure that the records are maintained or transferred according to client instruction.

b) Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives will be clearly established. In cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records will be followed.

c) In the event that the laboratory goes out of business, all records will revert to the control of the client or regulatory agency, as applicable. As much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

6.3 Personnel Records

Records on the relevant qualifications, training, skills and experience of the technical personnel are maintained by the laboratory (see EC IQSM Section 6.2.c), including records on demonstrated proficiency for each laboratory test method, such as the criteria outlined in ECI QSM Section 10.5 for chemical testing.

7.1 PHYSICAL FACILITIES - ACCOMMODATION AND ENVIRONMENT

7.2 Environment

a) Laboratory accommodations, test areas, energy sources, lighting, heating and ventilation are such that they facilitate proper performance of tests.

b) The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of the measurements. Particular care shall be taken when such activities are undertaken at sites other than the permanent laboratory premises.

c) The laboratory shall provide for the effective monitoring, control and recording of environmental conditions as appropriate. Such environmental conditions may include biological sterility, dust, electromagnetic interference, humidity, main voltage, temperature, and sound and vibration levels.

d) In instances where monitoring or control of any of the above-mentioned items is specified in a test method or by regulation, the laboratory meets and documents adherence to the laboratory facility requirements.

Formatted: Indent: Left: 0.99", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.4"

Formatted: Indent: Left: 0.99", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.4"

Formatted: Justified, Indent: Left: 0.98", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.4"

Formatted: Indent: Left: 0.99", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.4"

Formatted: Justified, Indent: Left: 0.99", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.4"

Formatted: Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.48"

Formatted: Justified, Outline numbered + Level: 4 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.23" + Indent at: 1.48"

Formatted: Justified, Indent: Left: 1.24", Hanging: 0.24", Outline numbered + Level: 4 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.23" + Indent at: 1.48"

Formatted: Justified, Indent: Left: 1.23", Hanging: 0.25", Outline numbered + Level: 4 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.23" + Indent at: 1.48"

Formatted: Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Justified, Indent: Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.23"

Formatted: Justified, Indent: Left: 0.99", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.23"

Formatted: Justified, Indent: Left: 0.99", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.23"

Formatted … [26]

7.2 Work Areas

a) There is effective separation between neighboring areas when the activities therein are incompatible including volatile organic chemicals handling areas.

b) Access to and use of all areas affecting the quality of these activities are defined and controlled.

c) Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality.

d) Workspaces are available to ensure an unencumbered work area. Work areas include:

1) Access and entryways to the laboratory;

2) Sample receipt areas;

3) Sample storage areas;

4) Chemical and waste storage areas; and

5) Data handling and storage areas.

8.0 EQUIPMENT AND REFERENCE MATERIALS

a) ECI is furnished with all items of equipment (including reference materials) required for the correct performance of tests for which accreditation is maintained. Note that ECI does not use equipment outside its permanent control.

b) All equipment is properly maintained, inspected, and cleaned. Maintenance procedures are documented.

c) Any equipment item that has been subjected to overloading or mishandling, or that gives suspect results, or has been shown by verification or otherwise to be defective, is taken out of service, clearly identified and wherever possible stored at a specified place until it has been repaired and shown by calibration, verification or test to perform satisfactorily. The laboratory shall examine the effect of this defect on previous calibrations or tests.

d) When appropriate, each item of equipment, including reference materials, is labeled, marked, or otherwise identified to indicate its calibration status.

e) Records are maintained of each major item of equipment and all reference materials significant to the tests performed. These records include documentation on all routine and non-routine maintenance activities in assigned log books and reference material verifications.

The records include:

1) The name of the item of equipment;

2) The manufacturer's name, type identification, and serial number or other unique identification;

3) Date received and date placed in service (if available);

4) Current location, where appropriate;

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Indent: Left: 0.18", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Justified, Indent: Left: 0.18", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Indent: Left: 0.18", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.67"

Formatted: Indent: Left: 0.43", Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.67"

Formatted: Indent: Left: 0.43", Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.67"

Formatted: Indent: Left: 0.43", Hanging: 0.26", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.67"

Formatted: Indent: Left: 0.43", Hanging: 0.26", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.67"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.17" + Indent at: 0.43"

Formatted: Indent: Left: 0.18", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.17" + Indent at: 0.43"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.17" + Indent at: 0.43"

Formatted: Justified, Indent: Left: 0.18", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.17" + Indent at: 0.43"

Formatted … [27]

Formatted … [28]

Formatted … [29]

Formatted … [30]

Formatted … [31]

5) If available, condition when received (e.g., new, used, reconditioned);

6) Copy of the manufacturer's instructions, where available;

7) Dates and results of calibrations and/or verifications and date of the next calibration and/or verification;

8) Details of maintenance carried out to date and planned for the future; and

9) History of any damage, malfunction, modification or repair.

9.1 MEASUREMENT TRACEABILITY AND CALIBRATION

9.2 General Requirements

All measuring operations and testing equipment having an effect on the accuracy or validity of tests are calibrated and/or verified before being put into service and on a continuing basis. The laboratory has an established program for the calibration and verification of its measuring and test equipment. This includes balances, thermometers and control standards.

9.3 Traceability of Calibration

a) The overall program of calibration and/or verification and validation of equipment is designed and operated so as to ensure that measurements made by the laboratory are traceable to national standards of measurement.

b) Calibration certificates indicate the traceability to national standards of measurement and provide the measurement results and associated uncertainty of measurement and/or a statement of compliance with an identified metrological specification. The laboratory maintains records of all such certification in the QA office.

c) Where traceability to national standards of measurement is not applicable, the laboratory provides satisfactory evidence of correlation of results, for example, by participation in a suitable program of inter-laboratory comparisons, proficiency testing, or independent analysis.

9.3 Reference Standards

a) Reference standards of measurement held by the laboratory (such as Class S or equivalent weights, or traceable thermometers) are used for calibration only and for no other purpose, unless it can be demonstrated that their performance as reference standards has not been invalidated. A body that can provide traceability calibrates reference standards of measurement. Where possible, this traceability is to a national standard of measurement.

b) There is a program of calibration and verification for reference standards.

i. Two weeks prior to their date of calibration expiration, individual thermometers are removed from service and replaced by newly calibrated units from the supplier.

ii. ECI keeps two sets of Class S weights on hand for use in the laboratory. One set is used for daily calibration checks, and the second set is kept for back up use should the first set be damaged, lost or otherwise compromised. The second set of weights is also place in service when the daily use set is shipped off site for recalibration.

Formatted: Indent: Left: 1.22", Hanging: 0.26", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.67"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 6 + Alignment: Left + Aligned at: 1.22" + Indent at: 1.47"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 6 + Alignment: Left + Aligned at: 1.22" + Indent at: 1.47"

Formatted: Indent: Left: 1.22", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 6 + Alignment: Left + Aligned at: 1.22" + Indent at: 1.47"

Formatted: Indent: Left: 1.23", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 6 + Alignment: Left + Aligned at: 1.22" + Indent at: 1.47"

Formatted: Justified, Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.48"

Formatted: Justified, Indent: Left: 0.98", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.48"

Formatted: Justified, Indent: Left: 0.98", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.48"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.22"

Formatted: Justified, Indent: Left: 0.98", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.22"

Formatted: Justified, Indent: Left: 0.98", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.22"

Formatted: Justified, Indent: Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.97" + Indent at: 1.22"

Formatted: Justified, Indent: Left: 0.98", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.97" + Indent at: 1.22"

Formatted: Justified, Indent: Hanging: 0.32", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 1.42" + Indent at: 1.74"

Formatted … [32]

iii. Analytical balances are serviced and calibrated on a routine, annual schedule.

c) Where relevant, reference standards and measuring and testing equipment are subjected to in-service checks between calibrations and verifications. Reference materials are traceable. Where possible, traceability is to national or international standards of measurement, or to national or international standard reference materials.

d) NIST-Traceable Weights and Thermometers

i. Reference standards of measurement shall be used for the purposes of calibration only. NIST traceable thermometers and NIST-traceable weights shall not be used for routine testing. If NIST traceable reference sources are used for routine testing they shall not be used for calibration purposes unless it can be shown that their performance as reference standards would not be invalidated.

ii. For NIST-traceable weights and thermometers, ECI requires that all calibrations be conducted by a calibration laboratory accredited by ACLASS, A2LA or other recognized accrediting body.

a. The calibration laboratory must hold ISO 17025 or ISO 9001 accreditation for the services rendered. Prior to use, QA verifies that the selected vendor holds the appropriate scope of accreditation for the services required.

b. The calibration certificate or report supplied by the calibration laboratory must contain a traceability statement, the conditions under which the calibrations were made, a compliance statement with an identified metrological specification and the pertinent clauses when applicable, and a clearly identified record of the quantities and functional test results before and after re-calibration.

c. The certificate and scope of accreditation is kept on file at the laboratory and is reviewed yearly.

iii. If significant amendments are made to a calibration certificate, it must have its own unique report identifier and must reference the one it is replacing. The piece of equipment must be identified in the amended report using its unique serial number or other laboratory defined identifier. The amended report is maintained with the original calibration report.

iv. Laboratory balances are recalibrated annually by an external, certified vendor that is certified to ISO 17025 / ISO 9001 standards for calibration. Prior to use, QA verifies that the selected vendor holds the appropriate scope of accreditation for the services required. This service is documented on each balance with a signed and dated certification sticker.

v. NIST mercury thermometers are sent out for recalibration every five years, or are replaced. All working mercury thermometers are calibrated annually against a NIST-traceable reference thermometer. All digital temperature measuring devices (min/max thermometers, IR guns) are calibrated quarterly. Equipment that does not meet acceptance criteria is removed from service and repaired or replaced. Calibration reports are maintained by the QA Manager

vi. Balance calibrations and temperature readings of ovens, refrigerators, and incubators are checked on each day of use. Min/Max thermometers are used for refrigerators and freezers to continually monitor temperature performance.

e) Traceable Reference Standards and Materials

Formatted: Justified, Indent: Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 3 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.42"

Formatted: Indent: Left: 0.18", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 3 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.42"

Formatted: Justified, Indent: Hanging: 0.31", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.6" + Indent at: 0.92"

Formatted: Justified, Indent: Left: 0.58", Hanging: 0.35", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.6" + Indent at: 0.92"

Formatted: Justified, Numbered + Level: 3 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.17" + Indent at: 1.42"

Formatted: Justified, Indent: Left: 1.18", Hanging: 0.24", Numbered + Level: 3 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.17" + Indent at: 1.42"

Formatted: Justified, Indent: Left: 1.17", Hanging: 0.25", Numbered + Level: 3 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.17" + Indent at: 1.42"

Formatted: Justified, Indent: Hanging: 0.38", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.6" + Indent at: 0.92"

Formatted: Justified, Indent: Left: 0.54", Hanging: 0.39", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.6" + Indent at: 0.92"

Formatted: Justified, Indent: Hanging: 0.36", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.6" + Indent at: 0.92"

Formatted: Justified, Indent: Left: 0.54", Hanging: 0.39", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.6" + Indent at: 0.92"

Formatted: Indent: Left: 0.18", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 3 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.42"

i. Reference standards and materials are traceable to certified reference materials, where available. Commercially prepared standard materials are purchased from vendors accredited by A2LA, NVLAP (National Voluntary Lab Accreditation Program) or other recognized vendor, and come with a Certificate of Analysis that documents the purity of the standard and expiration date, if assigned. If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis against a known reference.

ii. Analytical reagents must be at a minimum the purity required by or stated in the test method. Commercial materials that are purchased for the preparation of calibration, verification or spiking solutions, are usually accompanied by an assay certificate or the purity is noted on the label. If the purity is ::96%, the weight provided by the vendor may be used without correction. If the purity is <96%, a correction will be made to solution concentrations prepared from that material.

iii. The receipt of all reference standards and materials, including received date and expiration date, is documented by the laboratory at the time of receipt, in chemical receiving logbooks. All documentation received with the reference standard or material (Certificate of Analysis or Purity Certificates) is retained by the laboratory. To prevent contamination and/or deterioration in quality, all standards and materials are handled and stored according to the method or manufacturer's requirements.

iv. Preparation of standard or reference materials are documented in Standard Preparation Logbooks maintained in each department. These records show the traceability to the purchased standards or materials, and include the method of preparation, date of preparation, expiration date, and preparer's initials, at a minimum. Reference standards are assigned a unique identifier and are then labeled with the identifier and expiration date. Refer to ECISOP, T003, Standards and Reagents Login, Preparation, Storage and Disposal, for additional information.

v. All standards, reference, primary and working, whether purchased from a commercial vendor or prepared by the laboratory, must be checked regularly to ensure that the variability of the standard from the 'true' value does not exceed method requirements. Calibration standards are checked by comparison with a standard from a second source, usually another manufacturer and vendor. In cases where a second manufacturer is not available, a different lot, with vendor certification, may be used as a second source.

vi. Quality control (QC) criteria for primary and second source standards are defined in laboratory SOPs. The Reagent and Chemicals SOP, T107, gives a general overview of the requirements with the determinative SOPs for each process further defining the QC acceptance criteria. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS/LCSD (where there is no sample preparation) is used as the second source verification of a primary calibration source.

9.4 Calibration

Calibration requirements are divided into two parts: (1) requirements for analytical support equipment, and (2) requirements for instrument calibration. In addition, the requirements for instrument calibration are divided into initial calibration and second source or initial calibration verification, and continuing calibration verification.

9.4.1 Support Equipment

These standards apply to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, thermometers, and volumetric dispensing devices (such as Eppendorf®, or automatic dilutor/dispensing devices) if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume.

Formatted: Justified, Indent: Left: 1.42", Hanging: 0.31", Numbered + Level: 2 + Numbering Style: i, ii, iii, ... + Start at: 1 + Alignment: Left + Aligned at: 0.6" + Indent at: 0.92"

Formatted: Justified, Indent: Left: 1.38", Hanging: 0.35", Numbered + Level: 2 + Numbering Style: i, ii, iii, ... + Start at: 1 + Alignment: Left + Aligned at: 0.6" + Indent at: 0.92"

Formatted: Justified, Indent: Left: 1.35", Hanging: 0.38", Numbered + Level: 2 + Numbering Style: i, ii, iii, ... + Start at: 1 + Alignment: Left + Aligned at: 0.6" + Indent at: 0.92"

Formatted: Justified, Indent: Left: 1.35", Hanging: 0.39", Numbered + Level: 2 + Numbering Style: i, ii, iii, ... + Start at: 1 + Alignment: Left + Aligned at: 0.6" + Indent at: 0.92"

Formatted: Justified, Indent: Left: 1.37", Hanging: 0.36", Numbered + Level: 2 + Numbering Style: i, ii, iii, ... + Start at: 1 + Alignment: Left + Aligned at: 0.6" + Indent at: 0.92"

Formatted: Justified, Indent: Left: 1.34", Hanging: 0.39", Numbered + Level: 2 + Numbering Style: i, ii, iii, ... + Start at: 1 + Alignment: Left + Aligned at: 0.6" + Indent at: 0.92"

Formatted: Justified, Indent: Hanging: 0.5", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

a) All support equipment is maintained in proper working order. The records of all repair and maintenance activities, including service calls is kept.

b) All support equipment is calibrated or verified at least annually, using NIST traceable references when available, over the entire range of use. The results of such calibration are within the specifications required of the application for which this equipment is used or:

1) The item is removed from service until repaired; or

2) The laboratory maintains records of established correction factors to correct all measurements.

c) Raw data records are retained to document equipment performance.

d) Prior to use on each working day, balances, ovens, refrigerators, freezers, and water baths are checked in the expected use range, with NIST traceable calibrated references. The acceptability for use or continued use is according to the needs of the analysis or application for which the equipment is being used.

e) Mechanical volumetric dispensing devices including burettes (except Class A glassware) are checked for accuracy on at least a quarterly use basis. Glass microliter syringes are to be considered Class A glassware, and come with a certificate from the manufacturer attesting to established accuracy or the accuracy is initially demonstrated and documented by the laboratory.

9.4.2 Instrument Calibration

This manual specifies the essential elements that define the procedures and documentation for initial instrument calibration and continuing instrument calibration verification to ensure that the data are of known quality and be appropriate for a given regulation or decision. This manual does not specify detailed procedural steps ("how to") for calibration, but establishes the essential elements for selection of the appropriate technique(s). This approach allows flexibility and permits the employment of a wide variety of analytical procedures and statistical approaches currently applicable for calibration. If more stringent standards or requirements are included in a mandated test method or by regulation, the laboratory demonstrates that such requirements are met. If it is not apparent which standard is more stringent, then the requirements of the regulation or mandated test method are to be followed.

Note: In the following sections, initial instrument calibration is directly used for quantitation and continuing instrument calibration verification is used to confirm the continued validity of the initial calibration, unless otherwise stipulated by the analytical method.

9.4.2.1 Initial Instrument Calibrations

The following items are essential elements of initial instrument calibration:

a) The details of the initial instrument calibration procedures including calculations, integrations, acceptance criteria and associated statistics are included or referenced in the test method SOP. When initial instrument calibration procedures are referenced in the test method, the referenced material is retained by the laboratory and is available for review.

b) Sufficient raw data records are retained to permit reconstruction of the initial instrument calibration, e.g., calibration date, test method, instrument, analysis date, each analyte name, analyst's initials or signature; concentration and response, calibration curve or response factor; or unique equation or coefficient used to reduce instrument responses to concentration.

c) Sample results are quantitated from the initial instrument calibration and may not be quantitated from any continuing instrument calibration verification unless specifically stated in a mandated test method.

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Justified, Indent: Left: 0.18", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.44" + Indent at: 0.74"

Formatted: Indent: Hanging: 0.32", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.44" + Indent at: 0.74"

Formatted: Justified, Indent: Left: 0.18", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Justified, Indent: Left: 0.17", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Justified, Indent: Left: 0.18", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Justified, Indent: Left: 0.18", Hanging: 0.51", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Justified, Indent: Left: 0.18", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

d) All initial instrument calibrations are verified with a standard obtained from a second manufacturer or lot. Traceability shall be to a national standard, when available.

e) Criteria for the acceptance of an initial instrument calibration is established, e.g., correlation coefficient or relative percent difference. The criteria used are appropriate to the calibration technique employed.

f) Results of samples not bracketed by initial calibration standards (within calibration range) are reported as having less certainty, e.g., defined qualifiers or flags or explained in the case narrative. As determined by the method, the lowest calibration standard is at or above the method detection limit and at or below the reporting limit.

g) If the initial instrument calibration results are outside established acceptance criteria, corrective actions are performed. Data associated with an unacceptable initial instrument calibration is not reported.

h) Calibration standards include concentrations at or below the regulatory limit/decision level, if the laboratory knows these limits/levels, unless these concentrations are below the laboratory's demonstrated detection limits (See ECI QSM Section Appendix D.1.5 Detection Limits).

i) If a reference or mandated method does not specify the number of calibration standards, the minimum number is two, not including blanks or a zero standard. The laboratory's standard operating procedure defines the number of points for establishing the initial instrument calibration.

9.4.2.2 Continuing Instrument Calibration Verification

When an initial instrument calibration is not performed on the day of analysis, the validity of the initial calibration is verified prior to sample analyses by analyzing a continuing calibration verification standard with each analytical batch. The following items are essential elements of continuing calibration verification:

a) The details of the continuing calibration procedure, calculations and associated statistics must be included or referenced in the test method SOP.

b) A continuing calibration verification standard must be analyzed at the beginning and end of each analytical batch, and where required by method or project, at a specific frequency, every 1O or 20 samples or 12 hours, within the batch. The concentrations of the calibration verification shall be varied within the established calibration range. If an internal standard is used, only one continuing calibration verification standard must be analyzed, prior to sample or QC analysis, per analytical batch.

c) Sufficient raw data records must be retained to permit reconstruction of the continuing calibration verification, e.g., test method, instrument, analysis date, each analyte name, concentration and response, calibration curve or response factor, or unique equations or coefficients used to convert instrument responses into concentrations. Continuing calibration verification records must explicitly connect the continuing calibration verification data to the initial calibration.

d) Criteria for the acceptance of a continuing calibration verification must be established, e.g., relative percent difference.

e) If the continuing calibration verification results obtained are outside established acceptance criteria, corrective actions must be performed. If routine corrective action procedures fail to produce a second (consecutive and immediate) calibration verification within acceptance criteria, then the laboratory shall demonstrate performance after corrective action with two consecutive successful calibration verifications, or a new instrument calibration must be performed. If the laboratory has not demonstrated acceptable performance, sample analyses shall not occur until a new initial calibration curve is established and verified.

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 4 + Alignment: Left + Aligned at: 1" + Indent at: 1.24"

Formatted: Justified, Indent: Left: 1", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 4 + Alignment: Left + Aligned at: 1" + Indent at: 1.24"

Formatted: Justified, Indent: Left: 0.99", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 4 + Alignment: Left + Aligned at: 1" + Indent at: 1.24"

Formatted: Justified, Indent: Left: 0.99", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 4 + Alignment: Left + Aligned at: 1" + Indent at: 1.24"

Formatted: Justified, Indent: Left: 1", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 4 + Alignment: Left + Aligned at: 1" + Indent at: 1.24"

Formatted: Justified, Indent: Left: 1", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 4 + Alignment: Left + Aligned at: 1" + Indent at: 1.24"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.25"

Formatted: Justified, Indent: Left: 1", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.25"

Formatted: Justified, Indent: Left: 1", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.25"

Formatted: Justified, Indent: Left: 1", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.25"

Formatted: Justified, Indent: Left: 1", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.25"

As an exception, sample data associated with an unacceptable continuing calibration verification may be reported as qualified data under the following special conditions:

i. When the acceptance criteria for the continuing calibration verification are exceeded high, i.e., high bias and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise the samples affected by the unacceptable calibration verification are reanalyzed after a new calibration curve has been established, evaluated and accepted.

ii. When the acceptance criteria for the continuing calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable verification are reanalyzed after a new calibration curve has been established, evaluated and accepted.

10.1 TEST METHODS AND STANDARD OPERATING PROCEDURES

10.2 Methods Documentation

a) The laboratory has documented instructions on the use and operation of all relevant equipment, on the handling and preparation of samples and for calibration and/or testing, where the absence of such instructions could jeopardize the calibrations or tests.

b) All instructions, standards, manuals, and reference data relevant to the work of the laboratory are maintained up-to-date and be readily available to the staff.

10.1.1 Standard Operating Procedures (SOPs) Administrative

ECI maintains standard operating procedures that accurately reflect all phases of current laboratory activities such as instrument operation, assessing data integrity, corrective actions, handling customer complaints, reporting of test results, etc.

a) These documents, for example, may be equipment manuals provided by the manufacturer or internally written documents.

b) The test methods may be copies of published methods as long as any changes or selected options in the methods are documented and included in the SOP (See 10.1.2.)

c) Copies of all SOPs are accessible to all personnel.

d) The SOPs are organized.

e) Each SOP clearly indicates the effective date of the document, the revision number and the signatures of the approving authorities.

10.1.2 Standard Operating Procedures (SOPs) Analytical

a) The laboratory has and maintains SOPs for each accredited analyte or test method.

b) This SOP may consist of copies of published or referenced test methods or standard operating procedures that have been written by the laboratory. In cases where modifications to the published method have been made by the laboratory or where the referenced test method is ambiguous or provides insufficient detail, these changes or clarifications are clearly described. Each test method includes or references where applicable:

Formatted: Justified, Indent: Hanging: 0.33", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.42" + Indent at: 0.75"

Formatted: Justified, Indent: Left: 0.41", Hanging: 0.33", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.42" + Indent at: 0.75"

Formatted: Indent: Hanging: 0.49", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.66"

Formatted: Indent: Left: 0.17", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.66"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.17" + Indent at: 0.41"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.17" + Indent at: 0.41"

Formatted: Indent: Hanging: 0.5", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.66"

Formatted: Indent: Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.4"

Formatted: Indent: Left: 0.17", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.4"

Formatted: Indent: Left: 0.16", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.4"

Formatted: Indent: Left: 0.16", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.4"

Formatted: Indent: Left: 0.16", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.4"

Formatted: Indent: Left: 0.17", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.66"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.41"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.41"

1) Identification of the test method;
2) Applicable matrix or matrices;
3) Detection limit;
4) Scope and application, including components to be analyzed;
5) Summary of the test method;
6) Definitions;
7) Interferences;
8) Safety;
9) Equipment and supplies;
10) Reagents and standards;
11) Sample collection, preservation, shipment, and storage;
12) Quality control;
13) Calibration and standardization;
14) Procedure;
15) Calculations;
16) Method performance;
17) Pollution prevention;
18) Data assessment and acceptance criteria for quality control measures;
19) Corrective actions for out-of-control data;
20) Contingencies for handling out-of-control or unacceptable data;
21) Waste management;
22) References; and
23) Any tables, diagrams, flowcharts, and validation data.
24) Modifications
25) Revision History

Laboratory procedures other than preparative or analytical procedure may use a shortened format as outlined in SOP T001.

10.2 Exceptionally Permitting Departures from Documented Policies / Procedures

a) If it is necessary to depart from a documented procedure or policy due to circumstances outside of ECI's control or due to conditions encountered while preparing or analyzing a sample, the following will be documented.

1) The nature of the exception
2) How the data or procedure may be impacted
3) Any Corrective Action that may be needed.
4) Any approval from a client that may be required.
5) Approval by management to report or proceed with the exception.
6) A Case Narrative with the Final Report explaining the exception.

10.3 Test Methods

The laboratory uses appropriate test methods and procedures for all tests and related activities within its responsibility (including, as applicable, sample collection, sample handling, transport and storage, sample preparation and sample analysis). The method and procedures shall be consistent with the accuracy required, and with any standard specifications relevant to the calibrations or tests concerned.

a) When the use of specific test methods for a sample analysis is mandated or requested, only those methods are used.

b) Where test methods are employed that are not required, as in the Performance Based Measurement System approach, the methods are fully documented and validated (see ECIQSM Section 10.1.2 and Appendix C), and are available to the client and other recipients of the relevant reports.

Formatted: Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.5"

Formatted: Indent: Left: 1.24", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.5"

Formatted: Indent: Left: 1.24", Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.5"

Formatted: Indent: Left: 1.24", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.5"

Formatted: Indent: Left: 1.24", Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.5"

Formatted: Indent: Left: 1.24", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.5"

Formatted: Indent: Left: 1.24", Hanging: 0.26", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.5"

Formatted: Indent: Left: 1.23", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.5"

Formatted: Indent: Left: 1.23", Hanging: 0.26", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.5"

Formatted: Indent: Left: 1.23", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.5"

Formatted: Indent: Left: 1.23", Hanging: 0.26", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.5"

Formatted: Justified, Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Justified, Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.24"

Formatted: Indent: Hanging: 0.24", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.49"

Formatted … [33]

Formatted … [34]

Formatted … [35]

Formatted … [36]

10.4 Test Method Assessment

The laboratory will periodically conduct a Test Method Assessment (TMA) on the analytical methods in use. These TMAs will be conducted under the guidance of SOP T029. The purpose is to evaluate the compliance between bench performances of the method versus the current ECI Standard Operating Procedure versus the promulgated or published method. Discrepancies will need to be addressed and resolved. Note that some methods are totally prescriptive while others may contain prescriptive aspects, and still others are performance based. In many cases, modifications to the published method may be required due to circumstances outside the laboratories' control.

10.5 Demonstration of Capability

a) Prior to acceptance and institution of any test method, satisfactory demonstration of method capability is required. (See ECI QSM Section Appendix C and 6.2.b.) This demonstration does not test the performance of the method in real world samples, but in the applicable and available clean matrix (sample of a matrix is which no target analytes or interferences are present at concentrations that impact the results of a specific test method), e.g., water, solids and air. In addition, for analytes that do not lend themselves to spiking, the demonstration of capability may be performed using quality control samples.

b) Continuing demonstration of method performance, as per the quality control requirements in Appendix D (such as laboratory control samples) is required.

c) In all cases, the appropriate forms, such as the Certification Statement (Appendix C), is completed and retained by the laboratory to be made available upon request. The laboratory retains all associated supporting data necessary to reproduce the analytical results summarized in the Certification Statement. (See Appendix C for an example of a Certification Statement.)

d) Demonstration of capability is completed each time there is a significant change in instrument type, personnel, or test method.

e) In departments with specialized "work cell(s)" (a group consisting of analysts with specifically defined tasks that together perform the test method), the group as a unit must meet the above criteria and this demonstration of capability is fully documented.

f) When a work cell is employed, and the members of the cell change, the new employee(s) must work with an experienced analyst in that area of the work cell where they are employed. This new work cell must demonstrate acceptable performance through acceptable continuing performance checks (appropriate sections of Appendix D, such as laboratory control samples). Such performance is documented and the four preparation batches following the change in personnel must not result in the failure of any batch acceptance criteria, e.g., method blank and laboratory control sample, or the demonstration of capability must be repeated. In addition, if the entire work cell is changed or replaced, the new work cell must perform the demonstration of capability (Appendix C).

g) Performance of the work cell is linked to the training records of the individual members of the work cell (See ECI QSM Section 6.2).

10.6 Sample Aliquots

Where sampling (as in obtaining sample aliquots from a submitted sample) is carried out as part of the test method, the laboratory shall use documented procedures and appropriate techniques to obtain representative subsamples. Reference SOP M230, Homogenization and Compositing of Solid, Soil and Sediment Samples for further guidance.

Formatted: Justified, Indent: Left: 0.18", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Justified, Indent: Left: 0.18", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.42"

Formatted: Justified, Indent: Left: 0.18", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.42"

Formatted: Justified, Indent: Left: 0.17", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.42"

Formatted: Justified, Indent: Left: 0.17", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.42"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.42"

Formatted: Justified, Indent: Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.42"

Formatted: Justified, Indent: Left: 0.17", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.42"

Formatted: Justified, Indent: Left: 0.17", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

10.7 Data Verification

Calculations and data transfers are subject to appropriate checks.

a) The laboratory has Standard Operating Procedures that ensure that the reported data are free from transcription and calculation errors.

b) The laboratory has Standard Operating Procedures that ensure that all quality control measures are reviewed, and evaluated before data are reported. Refer to SOPs T020, internal Quality Control Checks and T062, Project Management and Analytical Report Review

c) The laboratory has Standard Operating Procedures that address manual calculations including manual integrations. Refer to SOPs T065, Data Integrity and T023, Peak Integration Procedures.

10.8 Documentation and Labeling of Standards and Reagents

Documented procedures exist for the purchase, receipt and storage of consumable materials used for the technical operations of the laboratory.

a) The laboratory retains records for all standards, reagents and media including the manufacturer/vendor, the manufacturer's Certificate of Analysis or purity (if supplied), the date of receipt, recommended storage conditions, and an expiration date after which the material is not used, unless the laboratory verifies its suitability for testing use.

b) Original containers (such as those provided by the manufacturer or vendor) are labeled with an expiration date.

c) Records are maintained on reagent and standard preparation. These records indicate traceability to purchased stocks or neat compounds, reference to the method of preparation, date of preparation, expiration date and preparer's initials.

d) All containers of prepared reagents and standards bear a unique identifier and expiration date and are linked to the documentation requirements in ECIQSM Section 10.8.c above.

10.9 Computers and Electronic Data Related Requirements

Where computers, automated equipment, or microprocessors are used for the capture, processing, manipulation, recording, reporting, storage or retrieval of test data, ECI ensures that:

a) All requirements of the NELAC Standard (i.e., Chapter 5 of NELAC) are met;

b) Computer software is tested and documented to be adequate for use, e.g., internal audits, personnel training, focus point of QA and QC;

c) Procedures are established and implemented for protecting the integrity of data. Such procedures include, but are not limited to, integrity of data entry or capture, data storage, data transmission and data processing;

d) Computer and automated equipment are maintained to ensure proper functioning and provided with the environmental and operating conditions necessary to maintain the integrity of calibration and test data; and,

e) It establishes and implements appropriate procedures for the maintenance of security of data including the prevention of unauthorized access to, and the unauthorized amendment of, computer records.

Formatted: Indent: Left: 0.98", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Justified, Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.23"

Formatted: Justified, Indent: Left: 0.98", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.23"

Formatted: Justified, Indent: Left: 0.98", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.23"

Formatted: Indent: Left: 0.98", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Justified, Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.97" + Indent at: 1.23"

Formatted: Justified, Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.97" + Indent at: 1.23"

Formatted: Justified, Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.97" + Indent at: 1.23"

Formatted: Justified, Indent: Left: 0.98", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.97" + Indent at: 1.23"

Formatted: Indent: Left: 0.98", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.23"

Formatted: Justified, Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.23"

Formatted: Justified, Indent: Left: 0.98", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.23"

Formatted … [37]

Formatted: Justified, Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.23"

11.1 SAMPLE HANDLING, SAMPLE ACCEPTANCE POLICY AND SAMPLE RECEIPT

While ECI does not have control of field sampling activities, the following are essential to ensure the validity of the laboratory's data.

11.2 Sample Tracking

a) The laboratory has a documented system for uniquely identifying the items to be tested, to ensure that there can be no confusion regarding the identity of such items at any time. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates. The laboratory assigns a unique identification (ID) code to each sample container received in the laboratory. (The use of container shape, size, or other physical characteristic, such as amber glass, or purple top, is not an acceptable means of identifying the sample.)

b) This laboratory code is maintained as an unequivocal link with the unique field ID code assigned each container.

c) The laboratory ID code is placed on the sample container as a durable label.

d) The laboratory ID code is entered into the laboratory records (see ECIQSM Section 11.3.d) and is the link that associates the sample with related laboratory activities such as sample preparation or calibration.

e) In cases where the sample collector and analyst is the same individual or the laboratory pre-assigns numbers to sample containers, the laboratory ID code may be the same as the field ID code.

11.3 Sample Acceptance Policy

The laboratory has a written sample acceptance policy that clearly outlines the circumstances under which samples are accepted or rejected. Data from any samples that do not meet the following criteria are flagged in an unambiguous manner, and the nature of the variation is clearly defined. The sample acceptance policy is available to sample collection personnel and includes, but is not limited to, the following areas of concern:

a) Proper, full, and complete documentation, that includes sample identification, the location, date and time of collection, collector's name, preservation type, sample type and any special remarks concerning the sample;

b) Proper sample labeling that includes a unique identification and a labeling system for the samples with requirements concerning the durability of the labels (water resistant) and the use of indelible ink;

c) Use of appropriate sample containers;

d) Adherence to specified holding times;

e) Adequate sample volume. Sufficient sample volume must be available to perform the necessary tests; and,

f) Procedures to be used when samples show signs of damage, contamination or inadequate preservation.

g) Samples are NOT accepted if classified as extremely hazardous, reference section 5.2 k for examples.

11.4 Sample Acceptance Policy (Posted)

This sample acceptance policy outlines the circumstances in which received samples are accepted or rejected by Eurofins Calscience, Inc. (ECI). If any of the below criteria are not met, it may delay ECI's processing of samples, possibly compromising "short" holding time analyses. Where received

Formatted: Indent: Hanging: 0.49", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.14" + Indent at: 0.63"

Formatted: Indent: Left: 0.14", Hanging: 0.49", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.14" + Indent at: 0.63"

Formatted: Justified, Indent: Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.13" + Indent at: 0.37"

Formatted: Indent: Left: 0.13", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.13" + Indent at: 0.37"

Formatted: Indent: Left: 0.13", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.13" + Indent at: 0.37"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.13" + Indent at: 0.37"

Formatted: Indent: Left: 0.13", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.13" + Indent at: 0.37"

Formatted: Indent: Left: 0.13", Hanging: 0.49", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.14" + Indent at: 0.63"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.37"

Formatted: Indent: Left: 0.13", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.37"

Formatted: Indent: Left: 0.13", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.37"

Formatted: Indent: Left: 0.12", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.37"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.37"

Formatted: Indent: Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.37"

Formatted … [38]

Formatted … [39]

samples do not meet these criteria, ECI will contact the client. If immediate client contact cannot be made, and hold times are not an issue, samples will be appropriately stored until the situation is clarified with the client. If a delay in sample processing will result in missed holding times, and ECI deems there is sufficient information provided on the Chain-of-Custody (COC), the lab will proceed with sample log-in and processing; however, ECI will not assume any liability for samples processed under these circumstances.

Data from samples that do not meet the sample acceptance criteria are flagged and/or addressed in a case narrative, with the nature of the deviation clearly defined. Samples must have written authorization to proceed if not in compliance with this guidance.

1. Complete COC with the following information:

   Unique sample identification, date and time of collection, sample matrix, analysis requested, sampler's name, preservation type (if applicable), client name and address, any additional comments, signature of relinquishing party and date and time that samples were relinquished.

2. Sample temperature upon receipt of >0°C to 6°C, as applicable to the method.

   In the event that samples are collected on the same day that they are received by the laboratory, they are deemed acceptable if they are received on ice and the cooling process has begun.

3. Sample containers and preservatives must be appropriate for the test and method being requested on the COC.

4. Sample labels must include a unique identification written with indelible ink on water resistant labels that correspond with the COC.

5. Adequate sample volume must be provided for the analyses requested on the COC, and containers for volatile analyses must be free of headspace. This includes Tedlar bags and Summa canisters.

6. Sufficient holding time available to perform the analyses requested:

   Samples shall be received at the laboratory within 72 hours of sampling, or with at least 1/2 of the holding time left for the analysis, whichever is less. ECI always makes a best effort to ensure that holding times are not exceeded under these circumstances. In the event that a preparation or analysis is performed outside of the associated holding time, the data will be qualified in the report.

7. Coolers and samples must be received in good condition, with no obvious signs of damage or tampering.

8. Received with a copy of ECI's Foreign Soil Permit, if applicable.

9. Please note, mixed waste, or samples classified as extremely hazardous are **NOT** accepted.

If you require additional information or clarification, please do not hesitate to contact ECI, or your Project Manager at (714) 895-5494.

11.5 Sample Receipt Protocols

a) Upon receipt, the condition of the sample, including any abnormalities or departures from standard condition as prescribed in the relevant test method, is recorded. All items specified in ECIQSM Section 11.2 above are checked.

   1) All samples that require cold temperature preservation are considered acceptable if the arrival temperature is within 2°c of the required temperature or the method-specified range. For samples with a specified temperature of 4°C, samples with a temperature ranging from just above the freezing temperature of water to 6°C shall be acceptable. Samples that are hand delivered to the laboratory

Formatted: Justified, Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.5" + Indent at: 1.74"

Formatted: Justified, Indent: Hanging: 0.26", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.5" + Indent at: 1.74"

Formatted: Indent: Hanging: 0.25", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.5" + Indent at: 1.74"

Formatted: Indent: Hanging: 0.26", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.5" + Indent at: 1.74"

Formatted: Justified, Indent: Left: 1.49", Hanging: 0.25", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.5" + Indent at: 1.74"

Formatted: Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.5" + Indent at: 1.74"

Formatted: Justified, Indent: Left: 1.5", Hanging: 0.26", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.5" + Indent at: 1.74"

Formatted: Indent: Left: 1", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.14" + Indent at: 0.63"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.25"

Formatted: Justified, Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.26" + Indent at: 1.49"

immediately after collection may not meet these criteria. In these cases, the samples shall be considered acceptable if there is evidence that the chilling process has begun, such as arrival on ice.

2) The laboratory shall implement procedures for checking chemical preservation using readily available techniques, such as pH or free chlorine, prior to or during sample preparation or analysis.

With the exception of residual chlorine measurements in aquatic toxicity samples, certain measurements, such a pH, are performed and recorded just prior to analysis.

Field filtration for dissolved metals, Perchlorate and others may also be required. If there is no documentation of field filtration on the Chain of Custody when required, the Project Manager is notified and the client asked. If samples are not field filtered, they are sent to the lab for filtration within 24 or 48 hours depending on the analysis.

b) The results of all checks are recorded on Sample Receipt and, as needed, Sample Anomaly forms.

c) When there is any doubt as to the item's suitability for testing, when the sample does not conform to the description provided, and when the test required is not fully specified, the laboratory makes every attempt to consult the client for further instruction before proceeding. The laboratory establishes whether the sample has received all necessary preparation, or whether sample preparation has yet to be performed. If the sample does not meet the sample receipt acceptance criteria listed in this standard, the laboratory:

1) Retains correspondence and/or records of conversations concerning the final disposition of rejected samples; or

2) Fully documents any decision to commence with the analysis of samples not meeting acceptance criteria.

i. The condition of these samples is, at a minimum, noted on the chain of custody record or transmittal form, and laboratory receipt documents.

ii. The analysis data is/are appropriately "qualified" on the final report.

d) The laboratory utilizes a permanent chronological record such as a logbook or electronic database to document receipt of all sample containers.

1) This sample receipt log records the following:

i. Client/Project Name;

ii. Date and time of laboratory receipt;

iii. Unique laboratory ID code (see ECIQSM Section 11.1); and

iv. Signature or initials of the person making the entries.

2) During the login process, the following information is linked to the log record or included as a part of the log. If such information is recorded/documented elsewhere, that document becomes part of the laboratory's permanent records, easily retrievable upon request, and readily available to individuals who will process the sample. Note: The placement of the laboratory ID number on the sample container is not considered a permanent record.

i. The field ID code that identifies each container is linked to the laboratory ID code in the sample receipt log.

Formatted: Justified, Indent: Left: 0.43", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.26" + Indent at: 1.49"

Formatted: Indent: Left: 0.18", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.25"

Formatted: Justified, Indent: Left: 0.18", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.25"

Formatted: Justified, Indent: Hanging: 0.24", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.68"

Formatted: Justified, Indent: Left: 0.42", Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.68"

Formatted: Indent: Hanging: 0.24", Numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.67" + Indent at: 0.92"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.67" + Indent at: 0.92"

Formatted: Justified, Indent: Left: 0.17", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.25"

Formatted: Indent: Left: 0.43", Hanging: 0.24", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.68"

Formatted: Indent: Left: 0.68", Hanging: 0.25", Numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.67" + Indent at: 0.92"

Formatted: Indent: Left: 0.67", Hanging: 0.25", Numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.67" + Indent at: 0.92"

Formatted: Indent: Left: 0.67", Hanging: 0.25", Numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.67" + Indent at: 0.92"

Formatted: Indent: Left: 0.67", Hanging: 0.25", Numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.67" + Indent at: 0.92"

Formatted … [40]

Formatted: Indent: Left: 0.67", Hanging: 0.25", Numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.67" + Indent at: 0.92"

ii. The date and time of sample collection is linked to the sample container and to the date and time of receipt in the laboratory.

iii. The requested analyses (including applicable approved test method numbers) are linked to the laboratory ID code.

iv. Any comments resulting from inspection for sample rejection are linked to the laboratory ID code.

e) All documentation (i.e., memos or transmittal forms) that are conveyed to the laboratory by the sample submitter is retained.

f) A complete chain of custody record form is maintained.

11.6 Storage Conditions

The laboratory has documented procedures and appropriate facilities to avoid deterioration, contamination, and damage to the sample during storage, handling, preparation, and testing; any relevant instructions provided with the item are followed. Where items must be stored or conditioned under specific environmental conditions, these conditions are maintained, monitored, and recorded.

a) Samples are stored according to the conditions specified by preservation protocols:

1) Samples that require thermal preservation are stored under refrigeration at +/-2° of the specified preservation temperature unless method-specified criteria exist. For samples with a specified storage temperature of 4°C, storage at a temperature above the freezing point of water to 6°C is acceptable.

2) Samples are stored away from all standards, reagents, food, and other potentially contaminating sources. Samples are stored in such a manner to prevent cross contamination.

b) Sample fractions, extracts, leachates, and other sample preparation products are stored according to ECIQSM Section 11.4.a above or according to specifications in the test method.

c) When a sample or portion of a sample needs to be held secure (for example, for reasons of record, safety or value, or to enable check calibrations or tests to be performed later), the laboratory has storage and security arrangements that protect the condition and integrity of the secured items or portions concerned.

11.7 Sample Disposal

The laboratory has standard operating procedures for the disposal of samples, digestates, leachates and extracts or other sample preparation products. Refer to SOP T005, Disposal of Laboratory Samples and Wastes.

12.0 RECORDS

The laboratory maintains a record system to suit its particular circumstances and comply with any applicable regulations. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the test report for a minimum of five years.

There are two levels of sample handling: 1) sample tracking and 2) legal chain of custody protocols that are used for evidentiary or legal purposes. All essential requirements for sample tracking (e.g., chain of custody form) are outlined in ECIQSM Sections 12.1, 12.2 and 12.3. ECI details the Legal/Evidentiary and Internal Chain of Custody procedures in SOP T100, Sample Receipt and Log-In Procedures.

Formatted: Indent: Left: 1.49", Hanging: 0.25", Numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.67" + Indent at: 0.92"

Formatted: Indent: Left: 1.48", Hanging: 0.25", Numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.67" + Indent at: 0.92"

Formatted: Indent: Left: 1.48", Hanging: 0.24", Numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.67" + Indent at: 0.92"

Formatted: Indent: Left: 0.98", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.25"

Formatted: Justified, Indent: Left: 0.98", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.25"

Formatted: Justified, Indent: Left: 0.99", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.14" + Indent at: 0.63"

Formatted: Justified, Indent: Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Justified, Indent: Hanging: 0.24", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.23" + Indent at: 1.48"

Formatted: Justified, Indent: Left: 1.23", Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.23" + Indent at: 1.48"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Justified, Indent: Left: 0.98", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Justified, Indent: Left: 0.99", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.14" + Indent at: 0.63"

12.1 Record Keeping System and Design

The ECI record keeping system allows historical reconstruction of all laboratory activities that produced the analytical data. The history of the sample is readily understood through the documentation. This includes inter-laboratory transfers of samples and/or extracts.

a) The records include the identity of personnel involved in sampling, sample receipt, preparation, and calibration or testing.

b) All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification, are documented.

c) The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes, e.g., set format for naming electronic files.

d) All changes to records are signed or initialed by responsible staff. The reason for the signature or initials is clearly indicated in the records such as "sampled by," "prepared by," or "reviewed by."

e) All generated data, except those that are generated by automated data collection systems, are recorded directly, promptly, and legibly in permanent ink.

f) Entries in records are not be obliterated by methods such as erasures, overwritten files or markings. All corrections to record-keeping errors are made by one line marked through the error. The individual making the correction signs (or initials) and dates the correction. These criteria also apply to electronically maintained records.

g) Refer to 10.9 for Computer and Electronic Data.

12.2 Records Management and Storage

a) All records (including those pertaining to calibration and test equipment), certificates and reports are safely stored, and held secure and in confidence to the client. NELAP-related records are available to the accrediting authority.

b) All records, including those specified in ECIQSM Section 12.3, are retained for a minimum of five years from generation of the last entry in the records. The laboratory maintains all information necessary for the historical reconstruction of data. Records stored only on electronic media are supported by the hardware and software necessary for their retrieval.

c) Records that are stored or generated by computers or personal computers have hard copy or write-protected backup copies.

d) The laboratory has an established record management system for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation storage and reporting.

e) Access to archived information is documented with an access log. These records are protected against fire, theft, loss, environmental deterioration, vermin, and in the case of electronic records, electronic or magnetic sources.

f) The laboratory has a plan to ensure that the records are maintained or transferred according to the clients' instructions (see 4.1.8.e of NELAC) in the event of Laboratory Transfer of Ownership, Going out of Business or Bankruptcy. In all cases, appropriate regulatory and state legal requirements concerning laboratory records will be followed. For detailed policies and procedures for handling of client records and data in these situations, reference QSM Section 6.2.1 and SOP T-002, Document Control.

Formatted: Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.14" + Indent at: 0.64"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.14" + Indent at: 0.38"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.14" + Indent at: 0.38"

Formatted: Justified, Indent: Left: 0.13", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.14" + Indent at: 0.38"

Formatted: Justified, Indent: Left: 0.13", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.14" + Indent at: 0.38"

Formatted: Justified, Indent: Left: 0.13", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.14" + Indent at: 0.38"

Formatted: Justified, Indent: Left: 0.13", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.14" + Indent at: 0.38"

Formatted: Indent: Left: 0.13", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.14" + Indent at: 0.38"

Formatted: Indent: Left: 0.13", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.14" + Indent at: 0.64"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.13" + Indent at: 0.37"

Formatted: Justified, Indent: Left: 0.13", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.13" + Indent at: 0.37"

Formatted: Justified, Indent: Left: 0.13", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.13" + Indent at: 0.37"

Formatted: Justified, Indent: Left: 0.12", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.13" + Indent at: 0.37"

Formatted: Justified, Indent: Left: 0.12", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.13" + Indent at: 0.37"

12.3 Laboratory Sample Tracking

12.3.1 Sample Handling

A record of all procedures to which a sample is subjected while in ECI's possession is maintained. These include but are not limited to all records pertaining to:

a) Sample preservation, including appropriateness of sample container and compliance with holding time requirement;

b) Sample identification, receipt, acceptance or rejection, and log-in;

c) Sample storage and tracking, including shipping receipts, sample transmittal forms (chain of custody form); and

d) Documentation procedures for the receipt and retention of test items, including all provisions necessary to protect the integrity of samples.

12.3.2 Laboratory Support Activities

In addition to documenting all the above-mentioned activities, the following is retained:

a) All original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts work sheets and data output records (chromatograms, strip charts, and other instrument response readout records);

b) A written description or reference to the specific test method used, which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value;

c) Copies of final reports;

d) Archived standard operating procedures;

e) Correspondence relating to laboratory activities for a specific project;

f) All corrective/preventive action reports, audits and audit responses;

g) Proficiency test results and raw data; and,

h) Results of data review, verification, and cross-checking procedures.

12.3.3 Analytical Records

The essential information associated with analyses, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:

a) Laboratory sample ID code;

b) Date of analysis and time of analysis if the method-specified holding time is 72 hours or less, or when time critical steps are included in the analysis, e.g., extractions, and incubations;

c) Instrument identification and instrument operating conditions/parameters (or reference to such data);

d) Analysis type;

Formatted: Indent: Left: 0.99", Hanging: 0.51", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.14" + Indent at: 0.64"

Formatted: Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Indent: Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Indent: Left: 0.99", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Indent: Left: 0.99", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Indent: Left: 0.99", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Indent: Left: 0.99", Hanging: 0.5", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Indent: Left: 0.99", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Indent: Left: 0.99", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted … [41]

Formatted … [42]

Formatted … [43]

Formatted … [44]

Formatted … [45]

Formatted … [46]

Formatted … [47]

Formatted … [48]

e) All manual calculations e.g., manual integrations;

f) Analyst's or operator's initials/signature or chemist ID number;

g) Sample preparation including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;

h) Sample analysis;

i) Standard and reagent origin, receipt, preparation, and use;

j) Calibration criteria, frequency and acceptance criteria;

k) Data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;

l) Quality control protocols and assessment;

m) Electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and,

n) Method performance criteria including expected quality control requirements.

12.3.4 Administrative Records

The following are maintained:

a) Personnel qualifications, experience and training records;

b) Ethics Statements;

c) Records of demonstration of capability for each analyst; and

d) A log of names, initials and signatures for all individuals who are responsible for signing or initialing any laboratory record.

13.0 LABORATORY REPORT FORMAT AND CONTENTS

The results of each test, or series of tests carried out by the laboratory must be reported accurately, clearly, unambiguously and objectively. The results normally reported in a test report and include all the information necessary for the interpretation of the test results and all information required by the method used. Some regulatory reporting requirements or formats, such as monthly operating reports may not require all items listed below, however, ECI will provide all the required information to their client for use in preparing such regulatory reports.

a) Except as discussed in 13.b, each report to an outside client includes at least the following information (those prefaced with "where relevant" are not mandatory):

1) A title, e.g., "Analytical Report," or "Test Certificate," "Certificate of Results" or "Laboratory Results";

2) Name and address of laboratory, and location where the test was carried out if different from the address of the laboratory and phone number with name of contact person for questions;

Formatted: Indent: Left: 0.19", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.24"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 6 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Indent: Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 6 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Indent: Left: 0.19", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 6 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Indent: Left: 0.19", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 6 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Indent: Left: 0.17", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 6 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Indent: Left: 0.19", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 6 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 2 + Numbering Style: I, II, III, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Indent: Left: 0.19", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Indent: Left: 0.19", Hanging: 0.48", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Indent: Left: 0.19", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Indent: Left: 0.18", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted … [49]

Formatted … [50]

Formatted … [51]

Formatted … [52]

3) Unique identification of the certificate or report (such as serial number) and of each page, and the total number of pages;

This requirement may be presented in several ways:

i. The total number of pages may be listed on the first page of the report as long as the subsequent pages are identified by the unique report identification and consecutive numbers, or

ii. Each page is identified with the unique report identification, the pages are identified as a number of the total report pages (example: 3 of 10, or 1 of 20).

Other methods of identifying the pages in the report may be acceptable as long as it is clear to the reader that discrete pages are associated with a specific report, and that the report contains a specified number of pages.

4) Name and address of client, where appropriate and project name if applicable;

5) Description and unambiguous identification of the tested sample including the client identification code;

6) Identification of test results derived from any sample that did not meet NELAC sample acceptance requirements such as improper container, holding time, or temperature;

7) Date of receipt of sample, date and time of sample collection, date(s) of performance test, and time of sample preparation and/or analysis if the required holding time for either activity is less than or equal to 72 hours;

8) Identification of the test method used, or unambiguous description of any nonstandard method used;

9) If the laboratory collected the sample, reference to sampling procedure;

10) Any deviations from (such as failed quality control), additions to or exclusions from the test method (such as environmental conditions), and any nonstandard conditions that may have affected the quality of results, and including the use and definitions of data qualifiers.

11) Measurements, examinations and derived results, supported by tables, graphs, sketches, and photographs as appropriate, and any failures identified; identify whether data are calculated on a dry weight or wet weight basis; identify the reporting units such as µg/l or mg/kg;

12) When required, a statement of the estimated uncertainty of the test results;

13) A signature and title, or an equivalent electronic identification of the person(s) accepting responsibility for the content of the certificate or report (however produced), and date of issue;

14) At the ECl's discretion, a statement to the effect that the results relate only to the items tested or to the sample as received by the laboratory;

15) At the ECl's discretion, a statement that the certificate or report shall not be reproduced except in full, without the written approval of the laboratory;

16) Clear identification of all test data provided by outside sources, such as subcontracted laboratories, clients, etc.; and

17) Clear identification of numerical results with values outside of quantitation limits.

Formatted: Justified, Indent: Hanging: 0.24", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 3 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 1.5" + Indent at: 1.74"

Formatted: Indent: Left: 1.49", Hanging: 0.25", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 1.5" + Indent at: 1.74"

Formatted: Indent: Left: 1.24", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 3 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Justified, Indent: Left: 1.24", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 3 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Justified, Indent: Left: 1.24", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 3 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Justified, Indent: Left: 1.24", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 3 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Indent: Left: 1.24", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 3 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Indent: Left: 1.24", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 3 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Justified, Indent: Left: 1.25", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 3 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Justified, Indent: Hanging: 0.24", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 3 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Indent: Hanging: 0.24", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 3 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Justified, Indent: Hanging: 0.23", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 3 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted: Justified, Indent: Hanging: 0.23", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 3 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Formatted … [53]

Formatted … [54]

Formatted … [55]

b) Where the certificate or report contains results of tests performed by subcontractors, these results are clearly identified by subcontractor name or applicable accreditation number and the entirety of the subcontract report is included with the final ECI report.

c) After issuance of the report, the laboratory report remains unchanged. Material amendments to a calibration certificate, test report or test certificate after issue may be made only in the form of a further document, or data transfer, including the statement "Supplement to Test Report or Test Certificate, serial number . . . [or as otherwise identified]", or equivalent form of wording. Such amendments meet all the relevant requirements of the NELAC Standard.

d) ECI notifies clients promptly, in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any calibration certificate, test report or test certificate or amendment to a report or certificate.

e) The laboratory will, where clients require transmission of test results by telephone, telex, facsimile or other electronic or electromagnetic means, follow documented procedures that ensure that the requirements of this Standard are met and that confidentiality is preserved.

f) ECI will certify that all its NELAC-certified test results reported meet all requirements of NELAC or provide reasons and/or justification if they do not.

14.0 SUBCONTRACTING ANALYTICAL SAMPLES

When ECI subcontracts work whether because of unforeseen circumstances (e.g. workload, need for further expertise or temporary incapacity) or on a continuing basis (e.g. through client direction, contractual arrangement or permanent subcontracting), this work shall be placed with a laboratory accredited under NELAP, or other appropriate certification, for the tests to be performed or with a laboratory that meets applicable statutory and requirements for performing the tests and submitting the results of tests performed. All subcontracted work shall be referenced and so noted in the final ECI analytical report.

Subcontract laboratories will provide or make available, current copies of the following documents prior to ECI submitting samples. This information will be updated annually or on an as needed basis.

a) Laboratory accreditations / certifications

b) Upon request, any Proficiency Testing (PT) or Performance Evaluation (PE) results relevant to the subcontracted samples.

c) Insurance Certificates

d) Quality Assurance Manual

e) Subcontract laboratories will also submit statements affirming that ECI will be notified if any of the following occur.

- There is a change or loss in accreditation for the applicable analysis.
- Most recent PT or PE study results for the applicable analysis are unacceptable *AND* are not able to be addressed via Corrective Action.
- There is a need to subcontract ECI project samples. Prior ECI approval is required in writing for subcontracting samples.

Formatted: Justified, Indent: Left: 0.17", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Justified, Indent: Left: 0.17", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Justified, Indent: Left: 0.17", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Justified, Indent: Left: 0.16", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Justified, Indent: Left: 0.16", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.41"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.41"

Formatted: Indent: Left: 0.16", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.41"

Formatted: Indent: Left: 0.16", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.41"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.41"

Formatted: Indent: Hanging: 0.25", Bulleted + Level: 2 + Aligned at: 0.42" + Indent at: 0.66"

Formatted: Indent: Hanging: 0.25", Bulleted + Level: 2 + Aligned at: 0.42" + Indent at: 0.66"

Formatted: Indent: Hanging: 0.25", Bulleted + Level: 2 + Aligned at: 0.42" + Indent at: 0.66"

f) The client project requirements will be used to evaluate the subcontract laboratories and to determine their acceptability. Approval by either: the QA Manager, Laboratory Director or Client Services Director (or designee) is required.

g) A master list of approved laboratories will be created and distributed to Sample Control and all Project Managers. All subcontracting must utilize a laboratory from this list.

The procedure for subcontracting samples will follow these guidelines:

a) ECI will advise its client via written, facsimile or e-mail notification of its intention to subcontract any portion of the testing to another party in cases when unforeseen circumstances occur. ECI shall gain approval by the client in writing, facsimile or via e-mail response.

b) ECI may subcontract samples on a continuing basis without written, facsimile or e-mail notification under the following (but not limited to) cases:

- Standing Client direction or instruction
- Contractual specification or requirement
- Project historical precedent

c) A separate Chain of Custody will be created specifically for the subcontracted sample(s). This (or a copy) will be included with the full and complete subcontract report in the final ECI analytical report.

d) ECI shall retain records demonstrating that the above requirements have been met.

e) If the samples to be subcontracted are submitted to ECI under special regulatory, agency or governmental accreditation, Example: Department of Defense / Energy, that have more comprehensive or differing quality criteria, Example: DOD/DOE QSM for Environmental Laboratories Version 5.0 July 2013, then the subcontract laboratory MUST have certification for the subcontracted analysis from the same entity and MUST have undergone similar assessment as the primary laboratory for the subcontracted component. Written authorization from the client or authorizing body must be obtained prior to usage of each subcontract laboratory.

15.0 OUTSIDE SUPPORT SERVICES AND SUPPLIES

ECI does not procure outside services and supplies, other than those referred to in this Manual.

Service providers and vendors are evaluated in accordance with ISO/IEC 17025:2005 or ISO 9001 guidelines prior to use by ECI, reference SOP T019 and T107 for additional information.

16.0 INQUIRIES AND COMPLAINTS

ECISOP-T018 addresses the policies and procedures for the resolution of inquiries and complaints received from clients or other parties about the laboratory's activities. Where an inquiry or complaint, or any other circumstance, raises doubt concerning the laboratory's compliance with the laboratory's policies or procedures, or with the requirements of this manual or otherwise concerning the quality of the laboratory's calibrations or tests, the laboratory shall ensure that those areas of activity and responsibility involved are promptly audited in accordance with NELAC Section 5.3.1. Records of the complaint and subsequent actions are maintained and are available for audits.

Formatted: Justified, Indent: Left: 0.97", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.41"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.97" + Indent at: 1.23"

Formatted: Justified, Indent: Left: 0.98", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.97" + Indent at: 1.23"

Formatted: Indent: Hanging: 0.25", Bulleted + Level: 2 + Aligned at: 1.23" + Indent at: 1.49"

Formatted: Indent: Left: 1.23", Hanging: 0.26", Bulleted + Level: 2 + Aligned at: 1.23" + Indent at: 1.49"

Formatted: Indent: Left: 1.23", Hanging: 0.26", Bulleted + Level: 2 + Aligned at: 1.23" + Indent at: 1.49"

Formatted: Justified, Indent: Left: 0.98", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.97" + Indent at: 1.23"

Formatted: Indent: Left: 0.98", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.97" + Indent at: 1.23"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.97" + Indent at: 1.23"

17.0 REVIEW OF WORK REQUESTS, CONTRACTS AND TENDERS

ECI has established procedures for the review of work requests contracts and tenders. Projects, proposals and contracts are reviewed for adequately defined requirements and the ability of ECI to meet those requirements. A thorough review of all technical and quality control requirements contained in these requests is performed to ensure a project's success. The appropriateness of requested methods, and the lab's capability to perform them must be established. A review of the laboratory's capability to analyze non-routine analytes is also part of this review process. Additionally, alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, detection and reporting levels, and quality control limits. During the review process, the laboratory determines whether it has the necessary physical, personnel and information resources to meet the project requirements, and if the personnel have the expertise needed to perform the required testing. Each proposal is also checked for its impact on the overall capacity of the laboratory. The proposed turnaround time will be checked for feasibility. Electronic or hard copy deliverable requirements are evaluated against the laboratory's ability to produce such documentation.

This review process ensures that the laboratory's test methods are suitable to achieve regulatory and/or client requirements and that the laboratory holds the appropriate certifications to perform the work. In the event that the use of a subcontract laboratory is needed, also confirming that they meet all project requirements and maintain the appropriate certifications for the proposed subcontract analyses. If the laboratory cannot provide all services and therefore intends to use the services of a subcontract laboratory, this will be documented and discussed with the client prior to project or contract approval.

Following the review process, the laboratory informs the client of the results of the review and notes any potential conflict, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and the capability of the laboratory to meet those requirements is resolved in writing before acceptance of the project or contract. It is necessary that the project requirements or contract be acceptable to both the client and the laboratory prior to the start of the work. The review process is repeated when there are amendments to the original contract by the client.

All contracts, Quality Assurance Project Plans (QAPPs), Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

Review Personnel

Depending upon the scope of a project or contract, one or more key persons may review and accept work on behalf of the laboratory. For routine projects, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has the necessary certifications, that it can meet the clients' data quality, reporting and turn-around time requirements.

For new, complex or large projects, the proposed project proposal or contract is given to the Business Development Director for an initial review that encompasses all facets of the operation. The scope of work is then distributed to the following personnel, as needed based on scope of contract, to evaluate all of the project related requirements:

- Laboratory Director
- Operations Director
- Technical Director
- Quality Assurance Director
- Quality Assurance Manager
- Group Leaders

Project Manager(s)

Appropriate records are maintained for every contract or work request. Copies of the agreed-upon contract will be distributed to key personnel as needed and the signed copies maintained by the Business Development Director and/or Laboratory Director.

Project Kick-off and Status Meetings

For routine project work, project managers ensure that specific technical and QC requirements are effectively evaluated and communicated to laboratory personnel through the use of the LIMS system: special requirements section of the chemist's worksheet.

Prior to work on a new or complex project, project managers or key personnel will hold meetings with operations personnel to discuss schedules and any unique aspects of the project. Items discussed include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, and any other special requirements.

Project requirements are given to the laboratory staff during project kick-off meetings or the daily status meetings. Information disseminated during these meetings provides direction to the laboratory staff in order to maximize production, maintain high quality and ensure client satisfaction.

During the project, changes to the scope of work may occur due to client, sampling or regulatory reasons. If these changes impact the laboratory's role in the project (use of a non-standard method or modification of a method to comply with revised requirements) then the changes need to be discussed with and agreed upon with the client prior to continuing with the work. These changes must be documented prior to implementation and communicated to the laboratory staff during a status or project specific meeting. Documentation of the modification is made in the analytical report narrative.

And at all times, records of all pertinent discussions with a client relating to the project or contract are documented and maintained as a part of the project record.

18.1 MANAGEMENT REVIEW, MANAGEMENT OF CHANGE AND CONTINUOUS IMPROVEMENT

18.2 Management Review

A comprehensive Management Review of the entire ECI Quality System will be conducted by the Laboratory Director on an annual basis, no later than the end of the first quarter for the previous year's review. The SOP T-030 may be consulted for detailed guidance. All major stakeholders will be given an opportunity to provide comment or input for the review. These will include:

- Laboratory Director
- Client Services Director
- Operations Director
- Technical Director
- Senior Project Manager
- Other Operational / Project Management personnel as appropriate.
- Clients

The purpose and goal of the Management Review will identify weaknesses, areas requiring more resources or oversight, opportunities for continuous improvement and follow up on previous recommendations.

Formatted: Justified, Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Justified, Indent: Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

The final completed review is part of the NELAP laboratory documentation requirements and may be submitted to ECI authorized auditing agencies or clients upon request.

18.3 Management of Change

Whenever a change is made in a controlled environment (not just production) the laboratory is put at risk. However, one needs to constantly make changes to keep pace with business / regulatory requirements. The challenge to the laboratory is to minimize the risk and impact of that change.

An organization must have an operating process in place for which an evaluation has been conducted, and that allows proper lead times and approvals to ensure that the laboratory is unaffected when changes are made. But to successfully implement a change, one also needs to have a comprehensive understanding of the infrastructure that supports the services to determine the overall impact. The Management of Change process will facilitate, as referenced in SOP T030, this evaluation.

The Management of Change process will track and implement the following types of changes:

a) Permanent Change: – A change that is considered long term and durable. Any change which is not categorized as a Temporary Change.

b) Temporary Change: – A change which has a defined lifetime and which will be removed before a defined date (usually no more than six months). All temporary changes must have a specified removal date that is documented on the approved MOC form.

c) Emergency Change: – An emergency change path that allows the change to be implemented and commissioned immediately in order to address an immediate safety, operational, health, environmental, or product quality situations.

The functional categories that will be managed include:

a) Laboratory Facility Acquisition
b) Laboratory Instrument Acquisition
c) Analytical Method Development and Validation
d) Laboratory Operations Process Change
e) Department Relocation
f) Activation of Analytical Method
g) Information Technology (Major Initiatives)
h) New Accreditation or Certification

18.4 Continuous Improvement

In order for ECI to be proactive and a leader in the industry, the entire ECI Quality system is designed to ensure the production of scientifically sound, legally defensible data of known and proven quality. The addition of the Management Review and Management of Change processes enhances ECI's ability to foster continuous improvement.

Continuous improvement is an ongoing effort to improve data integrity, services or processes. These efforts can seek "incremental" improvement over time or "breakthrough" improvement all at once. All staff at ECI participates in continuous improvement, from the Laboratory Director down to the beginning technician, as well as external stakeholders when applicable.

The following procedures / inputs have direct involvement in the continuous improvement process:

Formatted: Justified, Indent: Left: 0.13", Hanging: 0.49", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Indent: Hanging: 0.25", Outline numbered + Level: 3 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.22" + Indent at: 0.47"

Formatted: Justified, Indent: Hanging: 0.25", Outline numbered + Level: 3 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.22" + Indent at: 0.47"

Formatted: Justified, Indent: Left: 0.22", Hanging: 0.25", Outline numbered + Level: 3 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.22" + Indent at: 0.47"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.2" + Indent at: 0.45"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.2" + Indent at: 0.45"

Formatted: Indent: Left: 0.2", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.2" + Indent at: 0.45"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.2" + Indent at: 0.45"

Formatted: Indent: Left: 0.19", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.2" + Indent at: 0.45"

Formatted: Indent: Left: 0.2", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.2" + Indent at: 0.45"

Formatted: Justified, Indent: Left: 0.12", Hanging: 0.49", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

a) External Audits (Regulatory and Client Based)
b) Internal Audits
c) Corrective / Preventive Actions
d) Statistical Quality Control (SQC) Monitoring
e) Proficiency Testing Performance
f) Client Feedback - Complaints and Commendations
g) Management Review
h) Management of Change

The Management of Change process will guide and document the major improvements. The Corrective / Preventive Action procedure will enable and record the more incremental changes.

The principal elements are commitment to quality, focused effort, involvement of all employees, willingness to change, and communication.

Formatted: Indent: Left: 1.06", Hanging: 0.26", Outline numbered + Level: 3 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.22" + Indent at: 0.47"

Formatted: Indent: Left: 1.06", Outline numbered + Level: 3 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.22" + Indent at: 0.47"

Formatted: Indent: Left: 1.06", Hanging: 0.25", Outline numbered + Level: 3 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.22" + Indent at: 0.47"

Formatted: Indent: Left: 1.07", Outline numbered + Level: 3 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.22" + Indent at: 0.47"

NELAC APPENDICES

APPENDIX A - REFERENCES

NELAC Standards, Chapters 1-6. Adopted September 8, 2009, Effective July 01, 2010

40 CFR Part 136, Appendix A, paragraphs 8.1.1 and 8.2.

American Association for Laboratory Accreditation April 1996. General Requirements for Accreditation.

"American National Standards Specification and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs (ANSI/ASQC E-4)," 1994.

ASTM E1598-94 Conducting Early Seedling Growth Tests, American Society for Testing and Materials, West Conshocken, PA 1999.

ASTM E11676-97 Conducting a Laboratory Soil Toxicity Test with Lumbricid Earthworm *Eisenia foetida,* American Society for Testing and Materials, West Conshocken, PA 1999.

Catalog of Bacteria, American Type Culture Collection, Rockville, MD.

EPA 2185 - Good Automated Laboratory Practices, 1995 available at www.epa.gov/docs/etsdwe1/irm_galp/

EPA/600/3-89/013 Ecological Assessment of Hazardous Waste Sites, Office of Research and Development, Washington, DC, 1991.

EPA/503/8-91/001 Evaluation of Dredged Material Proposed for Ocean Disposal – Testing Manual. Office of Water, Washington, DC, 1991.

EPA/600/4-90/031 Manual for Evaluation of Laboratories Performing Aquatic Toxicity Tests, Office of Research and Development, Washington, DC, 1991.

EPA/600/3-88/029 Protocol for Short-term Toxicity Screening of Hazardous Wastes, Office of Research and Development, Washington, DC, 1991.

EPA/600/4-90/027F Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, 4th Ed., Office of Research and Development, Washington, DC, 1993.

EPA/823/8-98/004 Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Inland Testing Manual. Office of Water, Washington, DC, 1994.

EPA/600/R-94/025 Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods, Office of Research and Development, Washington, DC, 1994.

EPA/600/R-94/024 Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Office of Research and Development, Washington, DC, 1994.

EPA/600/4-91/002 Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, 3rd Ed., Office of Research and Development, Washington, DC, 1994.

EPA/600/4-91/003 Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Marine and Estuarine Organisms, 2nd Ed., Office of Research and Development, Washington, DC, 1994.

"Glossary of Quality Assurance Terms and Acronyms," Quality Assurance Division, Office of Research and Development, USEPA.

"Guidance on the Evaluation of Safe Drinking Water Act Compliance Monitoring Results from Performance Based Methods," September 30, 1994, Second draft.

ISO/IEC 17025: 2005. General requirements for the competence of calibration and testing laboratories.

"Laboratory Biosafety Manual," World Health Organization, Geneva, 1983.

Manual for the Certification of Laboratories Analyzing Drinking Water, Revision 4, EPA 815-B-97-001.

Performance Based Measurement System, EPA EMMC Method Panel, PBMS Workgroup, 1996.

APPENDIX B - GLOSSARY

The following definitions are used in the text of Quality Systems. In writing this document, the following hierarchy of definition references was used: ISO 8402, ANSI/ASQC E-4, EPA's Quality Assurance Division Glossary of Terms, and finally definitions developed by NELAC. The source of each definition, unless otherwise identified, is the Quality Systems Committee.

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (NELAC)

Accrediting Authority: The Territorial, State, or Federal agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation. (NELAC) [1.5.2.3]

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analysis Duplicate: The second measurement of the target analyte(s) performed on a single sample or sample preparation.

Analyst: The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (NELAC)

Analytical Reagent (AR) Grade: Designation for the high purity of certain chemical reagents and solvents given by the American Chemical Society. (Quality Systems)

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of NELAC). (NELAC)

Audit: A systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity. (EPA-QAD)

Batch: Environmental samples, which are prepared and/or analyzed together with the same process and personnel using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same NELAC-defined matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples. (NELAC Quality Systems Committee)

Blank: A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Blind Sample: A sub-sample for analysis with a composition known to the submitter. The analyst/ laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process. (NELAC)

Calibration: To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements. (NELAC)

Calibration Curve: The graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (NELAC)

Calibration Method: A defined technical procedure for performing a calibration. (NELAC)

Calibration Standard: A substance or reference material used to calibrate an instrument. (QAMS)

Certified Reference Material (CRM): A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30 - 2.2)

Chain of Custody Form: A record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; collector; time of collection; preservation; and requested analyses. (NELAC)

Compromised Samples: Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions compromised samples are not analyzed. If emergency situations require analysis, the results must be appropriately qualified. (NELAC)

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

- Second column confirmation;
- Alternate wavelength;
- Derivatization;
- Mass spectral interpretation;
- Alternative detectors; or
- Additional cleanup procedures. (NELAC)

Conformance: An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ ASQC E4-1994)

Corrective Action: The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality (i.e., that they meet specified acceptance criteria). (NELAC)

Data Reduction: The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (EPA-QAD)

Deficiency: An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC)

Demonstration of Capability: A procedure to establish the ability of the analyst to generate acceptable accuracy. (NELAC)

Formatted: Bulleted + Level: 2 + Aligned at: 0.42" + Indent at: 0.67"

Formatted: Indent: Left: 0.42", Hanging: 0.24", Bulleted + Level: 2 + Aligned at: 0.42" + Indent at: 0.67"

Formatted: Bulleted + Level: 2 + Aligned at: 0.42" + Indent at: 0.67"

Formatted: Indent: Left: 0.42", Bulleted + Level: 2 + Aligned at: 0.42" + Indent at: 0.67"

Formatted: Indent: Left: 0.42", Hanging: 0.24", Bulleted + Level: 2 + Aligned at: 0.42" + Indent at: 0.67"

Desorption Efficiency: The mass of target analyte recovered from sampling media, usually a sorbent tube, divided by the mass of target analyte spiked on to the sampling media expressed as a percentage. Sample target analyte masses are usually adjusted for the desorption efficiency. (NELAC)

Detection Limit: The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit. (NELAC)

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

Duplicate Analyses: The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA- QAD)

Holding Times (Maximum Allowable Holding Times): The maximum times that samples may be held prior to analysis and still be considered valid or not compromised. (40 CFR Part 136)

Inspection: An activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic. (ANSI/ ASQC E4-1994)

Internal Standard: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method. (NELAC)

Instrument Blank: A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Laboratory: A body that calibrates and/or tests. (ISO 25)

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system. (NELAC)

Laboratory Duplicate: Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently. (NELAC)

Limit of Detection (LOO): Limit of Detection (LOO): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOO, the false negative rate (Type II error) is 1%. (NELAC)

Limit of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. (NELAC)

Manager (however named): The individual designated as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual. (NELAC)

Matrix: The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

- Aqueous: Any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.
- Drinking Water: Any aqueous sample that has been designated a potable or potential potable water source.
- Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.
- Non-aqueous Liquid: Any organic liquid with <15% settleable solids.
- Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.
- Solids: Includes soils, sediments, sludges and other matrices with >15% settleable solids.
- Chemical Waste: A product or by-product of an industrial process that results in a matrix not previously defined.
- Air: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter or other device. (NELAC)

Matrix Spike {spiked sample or fortified sample): A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency. (QAMS)

Matrix Spike Duplicate {spiked sample or fortified sample duplicate): A second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte. (QAMS)

May: Denotes permitted action, but not required action. (NELAC)

Media: Material that supports the growth of a microbiological culture.

Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. (NELAC)

Method Detection Limit: The minimum concentration of a substance (an analyte) 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. (40 CFR Part 136 Appendix B)

Must: Denotes a requirement that must be met. (Random House College Dictionary)

National Accreditation Database: The publicly accessible database listing the accreditation status of all laboratories participating in NELAP. (NELAC)

National Environmental Laboratory Accreditation Conference {NELAC): A voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP. (NELAC)

National Environmental Laboratory Accreditation Program {NELAP): The overall National Environmental Laboratory Accreditation Program of which NELAC is a part. (NELAC)

Negative Control: Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (NELAC)

Formatted: Left, Indent: Hanging: 0.24", Bulleted + Level: 1 + Aligned at: 0.19" + Indent at: 0.43"

Formatted: Left, Indent: Left: 0.18", Hanging: 0.25", Bulleted + Level: 1 + Aligned at: 0.19" + Indent at: 0.43"

Formatted: Left, Indent: Hanging: 0.25", Bulleted + Level: 1 + Aligned at: 0.19" + Indent at: 0.43"

Formatted: Indent: Left: 0.18", Hanging: 0.25", Bulleted + Level: 1 + Aligned at: 0.19" + Indent at: 0.43"

Formatted: Left, Indent: Hanging: 0.25", Bulleted + Level: 1 + Aligned at: 0.19" + Indent at: 0.43"

Formatted: Indent: Hanging: 0.25", Bulleted + Level: 1 + Aligned at: 0.19" + Indent at: 0.43"

Formatted: Left, Indent: Left: 0.19", Hanging: 0.24", Bulleted + Level: 1 + Aligned at: 0.19" + Indent at: 0.43"

Objective Evidence: Any documented statement of fact, other information, or record, either quantitative or qualitative, pertaining to the quality of an item or activity, based on observations, measures, or tests that can be verified. (ASQC)

Performance Audit: The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (NELAC)

Performance Based Measurement System (PBMS): A set of processes wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner. (NELAC)

Positive Control: Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects. (NELAC)

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (NELAC)

Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample. (NELAC)

Proficiency Testing: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (NELAC) [2.1]

Proficiency Testing Program: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (NELAC)

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (QAMS)

Protocol: A detailed written procedure for field and/or laboratory operation (e.g., sampling, and analysis) which must be strictly followed. (EPA- QAD)

Pure Reagent Water: Shall be water (defined by national or international standard) in which no target analytes or interferences are detected as required by the analytical method. (NELAC)

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

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

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

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

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (NELAC)

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC. (ANSI/ ASQC E-41994)

Quantitation Limits: Levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported at a specific degree of confidence. (NELAC)

Range: The difference between the minimum and the maximum of a set of values. (EPA-QAD)

Raw Data: Any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, data and verified accurate by signature), the exact copy or exact transcript may be submitted. (EPA-QAD)

Reagent Blank (method reagent blank): A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (QAMS)

Record Retention: The systematic collection, indexing and storing of documented information under secure conditions. (EPA-QAD)

Reference Material: A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30- 2.1)

Reference Method: A method of known and documented accuracy and precision issued by an organization recognized as competent to do so. (NELAC)

Reference Standard: A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM-6.08)

Reference Toxicant: The toxicant used in performing toxicity tests to indicate the sensitivity of a test organism and to demonstrate the laboratory's ability to perform the test correctly and obtain consistent results (see Chapter 5, Appendix D, Section 2.1.f). (NELAC)

Replicate Analyses: The measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)

Requirement: Denotes a mandatory specification; often designated by the term "shall". (NELAC)

Sampling Media: Material used to collect and concentrate the target analytes(s) during air sampling such as solid sorbents, filters, or impinger solutions.

Selectivity: (Analytical chemistry) The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. (EPA-QAD)

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

Shall: Denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled. (ANSI)

Should: Denotes a guideline or recommendation whenever noncompliance with the specification is permissible. (ANSI)

Spike: A known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes. (NELAC)

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies. (ASQC)

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

Standardized Reference Material (SRM): A certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method. (EPA-QAD)

Supervisor (however named): The individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses. (NELAC)

Surrogate: A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes. (QAMS)

Systems Audit (also Technical Systems Audit): A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Director: Individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory. (NELAC)

Test: A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate. (ISO/IEC Guide 2-12.1, amended)

Test Method: An adoption of a scientific technique for a specific measurement problem, as documented in a laboratory SOP. (NELAC)

Testing Laboratory: Laboratory that performs tests. (ISO/ IEC Guide 2 - 12.4)

Test Sensitivity/Power: The minimum significant difference (MSD) between the control and test concentration that is statistically significant. It is dependent on the number of replicates per concentration, the selected significance level, and the type of statistical analysis (see Chapter 5, Appendix D, Section 2.4.a). (NELAC)

Tolerance Chart: A chart in which the plotted quality control data is assessed via a tolerance level (e.g. +/- 10% of a mean) based on the precision level judged acceptable to meet overall quality/data use requirements instead of a statistical acceptance criteria (e.g. +/- 3 sigma) (applies to radiobioassay laboratories). (ANSI)

Traceability: The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM - 6.12)

Validation: The process of substantiating specified performance criteria. (EPA- QAD)

Verification: Confirmation by examination and provision of evidence that specified requirements have been met. (NELAC)

NOTE: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment.

The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.

Work Cell: A well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented. (NELAC)

Sources:

American Society for Quality Control (ASQC), Definitions of Environmental Quality Assurance Terms, 1996

American National Standards Institute (ANSI), Style Manual for Preparation of Proposed American National Standards, Eighth Edition, March 1991

ANSI/ASQC E4, 1994

ANSI N42.23- 1995, Measurement and Associated Instrument Quality Assurance for Radiobioassay Laboratories

International Standards Organization (ISO) Guides 2, 30, 8402

International Vocabulary of Basic and General Terms in Metrology (VIM): 1984. Issued by BIPM, IEC, ISO and OIML

National Institute of Standards and Technology (NIST)

National Environmental Laboratory Accreditation Conference (NELAC), July 1998 Standards

Random House College Dictionary

U.S. EPA Quality Assurance Management Section (QAMS), Glossary of Terms of Quality Assurance Terms, 8/31/92 and 12/6/95

U.S. EPA Quality Assurance Division (QAD)

40 CFR, Part 136

Webster's New World Dictionary of the American Language

Formatted: Indent: First line: 0.01", Outline numbered + Level: 2 + Numbering Style: A, B, C, … + Start at: 19 + Alignment: Left + Aligned at: -0.19" + Indent at: 0.11"

APPENDIX C - DEMONSTRATION OF CAPABILITY

C.1 PROCEDURE FOR DEMONSTRATION OF CAPABILITY

A demonstration of capability (DOC) must be made prior to using any test method, and at any time there is a change in instrument type, personnel or test method. (See NELAC 10.2.1.)

Note: Where tests are performed by specialized "work cells" (a well-defined group of analysts that together perform the method analysis), the work cell as a unit meets the above criteria and this demonstration is fully documented.

In general, this demonstration does not test the performance of the method in real world samples, but in the applicable and available clean matrix (a sample of a matrix in which no target analytes or interferences are present at concentrations that impact the results of a specific test method), e.g., water, solids and air. However, before any results are reported using this method, actual sample spike results may be used to meet this standard, i.e., at least four consecutive matrix spikes within the last twelve months. In addition, for analytes that do not lend themselves to spiking, e.g., TSS, the demonstration of capability may be performed using quality control samples.

All demonstrations shall be documented through the use of the form in this appendix.

The following steps, which are adapted from the EPA test methods published in 40 CFR Part 136, Appendix A, are performed if required by mandatory test method or regulation. Note: For analytes for which spiking is not an option and for which quality control samples are not readily available, the 40 CFR approach is one way to perform this demonstration. The laboratory documents that other approaches to DOC are adequate, and this is documented in the laboratory's Quality Manual.

a) A quality control sample is obtained from an outside source. If not available, the QC sample may be prepared by the laboratory using stock standards that are prepared independently from those used in instrument calibration.

b) The analyte(s) is diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified, or if unspecified, to a concentration approximately 10 times the method-stated or laboratory-calculated method detection limit.

c) At least four aliquots are prepared and analyzed according to the test method either concurrently or over a period of days.

d) Using all of the results, the mean recovery ($\bar{X}$) is calculated in the appropriate reporting units (such as µg/L) and the standard deviations of the population sample (n-1) (in the same units) for each parameter of interest. When it is not possible to determine mean and standard deviations, such as for presence/absence and logarithmic values, the laboratory will assess performance against established and documented criteria.

e) Compare the information from (d) above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory-generated acceptance criteria (if there are no established mandatory criteria). If all parameters meet the acceptance criteria, the analysis of actual samples may begin. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

f) When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to 1) or 2) below.

Formatted: Justified, Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Justified, Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.23"

Formatted: Justified, Indent: Left: 0.99", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.23"

Formatted: Justified, Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.23"

Formatted: Justified, Indent: Left: 0.98", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.23"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.23"

Formatted: Justified, Indent: Left: 0.98", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.23"

1) Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with c) above.

2) Beginning with c) above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with c).

C.2 CERTIFICATION STATEMENT

The following certification statement shall be used to document the completion of each demonstration of capability. A copy of the certification statement shall be retained in the personnel records of each affected employee (see ECIQSM Section 6.3 and 12.3.4.b.).

Formatted: Justified, Indent: Hanging: 0.25", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.44" + Indent at: 0.68"

Formatted: Justified, Indent: Left: 0.43", Hanging: 0.25", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.44" + Indent at: 0.68"

Formatted: Indent: Left: 0.18", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Demonstration of Capability
Certification Statement

Date: Page__of__
Laboratory Name:
Laboratory Address:
Analyst(s) Name(s):

Matrix:
Examples: laboratory pure water, soil, air, solid, biological tissue)

Method number, SOP#, Rev #, and Analyte, or Class of Analytes or Measured Parameters:
(examples: barium by 200.7, trace metals by 6010, benzene by 8021, etc.)

We, the undersigned, CERTIFY that:

1. The analysts identified above, using the cited test method(s), which is in use at this facility for the analyses of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

2. The test method(s) was performed by the analyst(s) identified on this certification.

3. A copy of the test method(s) and the laboratory-specific SOPs are available for all personnel on-site.

4. The data associated with the demonstration capability are true, accurate, complete and self-explanatory (1).

5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized assessors.

Technical Director's Name and Title	Signature	Date
Quality Assurance Officer's Name	Signature	Date

This certification form must be completed each time a demonstration of capability study is completed.

(1) True: Consistent with supporting data.
Accurate: Based on good laboratory practices consistent with sound scientific principles/practices.
Complete: Includes the results of all supporting performance testing.
Self-explanatory: Data properly labeled and stored so that the results are clear and require no additional explanation.

(Note: Form may be modified so Jong as the essential items are included in the revised form)

Formatted: Justified, Indent: First line: 0.01", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.83" + Indent at: 0.97"

Formatted: Justified, Indent: Left: 0.97", Hanging: 0.16", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.83" + Indent at: 0.97"

Formatted: Justified, Indent: Left: 0.97", Hanging: 0.15", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.83" + Indent at: 0.97"

Formatted: Justified, Indent: Left: 0.97", Hanging: 0.16", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.83" + Indent at: 0.97"

Formatted: Justified, Indent: Left: 0.97", Hanging: 0.15", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.83" + Indent at: 0.97"

APPENDIX D - ESSENTIAL QUALITY CONTROL REQUIREMENTS

Th.e quality control protocols specified by the laboratory's method manual (10.1.2) shall be followed. The laboratory shall ensure that the essential standards outlined in Appendix D are incorporated into their method manuals.

All quality control measures shall be assessed and evaluated on an ongoing basis and quality control acceptance criteria shall be used to determine the validity of the data. The laboratory shall have procedures for the development of acceptance/rejection criteria where no method or regulatory criteria exists.

The requirements from the body of Chapter 5, e.g., Section 5.4, apply to all types of testing. The specific manner in which they are implemented is detailed in each of the sections of this Appendix, i.e., chemical testing.

The Standard Operating Procedure (SOP) T020 "Internal Quality Control Checks" and the specific analytical method SOPs have a more detailed outline of the quality control procedures.

D.1 CHEMICAL TESTING

D.1.1 Positive and Negative Controls

a) Negative Controls

1) Method Blanks - Shall be performed at a frequency of one per preparation batch of samples per matrix type. The results of this analysis shall be one of the QC measures to be used to assess the batch. The source of contamination must be investigated and measures taken to correct, minimize or eliminate the problem if

i) the blank contamination exceeds a concentration greater than 1/10 of the measured concentration of any sample in the associated sample batch or

ii) the blank contamination exceeds the concentration present in the samples and is greater than 1/10 of the specified regulatory limit.

Any sample associated with the contaminated blank shall be reprocessed for analysis or the results reported with appropriate data qualifying codes.

b) Positive Controls

1) Laboratory Control Sample (LCS) - (QC Check Samples) Shall be analyzed at a minimum of 1 per preparation batch of 20 or less samples per matrix type, except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to assess the batch. NOTE: The matrix spike (see 2 below) may be used in place of this control as long as the acceptance criteria are as stringent as for the LCS.

a. The NELAC requirements (2009 Standard, Section 1.7.4.2 b) allow the usage of LCS Marginal Exceedance control limits for those analyses with multiple reporting analytes.

b. The NELAC standards state that if a large number of analytes are in the LCS, it becomes statistically likely that a few will be outside control limits. This may not indicate that the system is out of control; therefore, corrective action may not be necessary. Upper and lower marginal exceedance (ME) limits can be established to determine when corrective action is necessary. ME is defined as being beyond the LCS control limit but within the ME limits. ME limits are between 3 and 4 standard deviations around the mean.

Formatted: Justified, Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.68"

Formatted: Justified, Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.68"

Formatted: Justified, Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Justified, Indent: Hanging: 0.24", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.67"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.68" + Indent at: 0.92"

Formatted: Indent: Left: 0.68", Hanging: 0.26", Numbered + Level: 3 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 0.68" + Indent at: 0.92"

Formatted: Justified, Indent: Left: 0.18", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Justified, Indent: Left: 0.43", Hanging: 0.24", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.67"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.18" + Indent at: 1.43"

Formatted: Justified, Indent: Left: 1.18", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.18" + Indent at: 1.43"

c. The number of allowable marginal exceedance is based on the number of analytes in the LCS. If there is any analyte that exceed the LCS control limits, it does not necessary mean the LCS fails. The NELAC standard states if the number of analytes fails LCS control limits but is within the ME limits, it is acceptable.

2) Matrix Spikes (MS) - Shall be performed at a frequency of one out of every 20 samples per matrix type prepared over time, except for analytes for which spiking solutions are not available such as, total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in a matrix spike may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the spike.

3) Surrogates - Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with the sample composition and shall be reported to the client whose sample produced the poor recovery.

4) If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene, and PCBs in Method 608), the test method has an extremely long list of components or components that are incompatible, a representative number (minimum of 10%) of the listed components may be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit-specified analytes, and other client-requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

D.1.2 Analytical Variability/Reproducibility

Matrix Spike Duplicates (MSDs) or Laboratory Duplicates - Shall be analyzed at a minimum of 1 in 20 samples per matrix type per sample extraction or preparation method. The laboratory shall document its procedure to select the use of appropriate type of duplicate. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in the duplicates may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the duplicate.

D.1.3 Method Evaluation

In order to ensure the accuracy of the reported result, the following procedures shall be in place:

a) Demonstration of Analytical Capability - (Section 10.5) shall be performed initially (prior to the analysis of any samples) and with a significant change in instrument type, personnel, matrix or test method.

b) Calibration - Calibration protocols specified in Section 9.4 shall be followed.

c) Proficiency Test Samples - The results of such analyses (4.2.j or 5.3.4) shall be used by the laboratory to evaluate the ability of the laboratory to produce accurate data.

D.1.4 Analytical Measurement Uncertainty Estimation

Uncertainty is "a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand" (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1).

Formatted: Justified, Indent: Left: 1.99", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.18" + Indent at: 1.43"

Formatted: Justified, Indent: Left: 1.23", Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.67"

Formatted: Justified, Indent: Left: 1.24", Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.67"

Formatted: Justified, Indent: Left: 1.23", Hanging: 0.26", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.67"

Formatted: Justified, Indent: Left: 1", Hanging: 0.49", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.68"

Formatted: Justified, Indent: Left: 1", Hanging: 0.5", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.68"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Justified, Indent: Left: 1", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Indent: Left: 1", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Justified, Indent: Left: 1", Hanging: 0.49", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.68"

Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. For environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error.

Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to have a Gaussian distribution, and be reducible by increasing the total number of measurements.

Knowledge of the uncertainty of a measurement provides additional confidence in the validity of a result as its value accounts for all the factors which could possibly affect the result. Certain test methods will specify limits to the values of sources of uncertainty of measurement (EPA 500 series methods, etc.) and will specify the form of presentation of calculated results.

When the method makes these stipulations, there is no need to provide a mechanism for calculating the uncertainty. Where this information is not provided within a method or other regulatory device, the uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte because LCS recoveries incorporate all of the laboratory-related variables associated with a given test over time. It is recognized that other approaches exist; however, ECI's standard for estimating analytical data uncertainty uses this approach.

D.1.4.1 Using the Laboratory Control Sample (LCS) to Estimating Analytical Uncertainty

a) The estimated measurement uncertainty can be expressed as a range (±) around the reported analytical results at a specified confidence level. For methods that use statistically-derived LCS control limits based on historical LCS recovery data to assess the performance of the measurement system, these limits are considered an estimate of the minimum laboratory contribution to measurement uncertainty at a 99% confidence interval, The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

- Uncertainty values may be reported for specific projects upon request. In absence of alternate client-specified approaches or confidence levels,

  ECI will use the following procedure:

  To calculate the uncertainty value of a reported analytical result, the lower uncertainty range value is calculated by subtracting the product of the result and the lower LCS percent recovery from the result; and the upper uncertainty value result is calculated by adding the product of the result and the upper LCS percent recovery.

  These calculated values represent approximately a 99% confidence level. In other words, approximated 99% of the measured values for the analyte will fall within this calculated range.

- Example: If the reported result is 1.0 mg/l, and the LCS percent recovery range is 75 to 125%. The uncertainty range would be 0.75 to 1.25 mg/l, which could also be written as 1.0 +/- 0.25 mg/l.

- The Laboratory Quality and Accreditation Office has made available to the public both a spreadsheet that calculates analytical measurement uncertainty and an SOP describing how to use it. This SOP applies to test methods that are within the scope of ISO/IEC 17025-1999 Standard: General Requirements for the Competence of Testing and Calibration Laboratories and it is based on the general rules outlined in Guide to the Expression of Uncertainty in Measurement (GUM).

Formatted: Justified, Indent: Hanging: 0.48", Outline numbered + Level: 4 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.66"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.17" + Indent at: 0.42"

Formatted: Indent: Hanging: 0.16", Bulleted + Level: 2 + Aligned at: 0.41" + Indent at: 0.58"

Formatted: Indent: Left: 0.42", Hanging: 0.16", Bulleted + Level: 2 + Aligned at: 0.41" + Indent at: 0.58"

Formatted: Indent: Left: 0.42", Hanging: 0.16", Bulleted + Level: 2 + Aligned at: 0.41" + Indent at: 0.58"

The spreadsheet provides a QC-based nested approach for estimating measurement uncertainty using laboratory generated calibration and QC spike results. This spreadsheet has been authorized to be used on DOD/DOE projects, if requested.

D.1.4.2 Additional Components to Estimating Analytical Uncertainty

When estimating analytical measurement uncertainty, all significant components of uncertainty must be identified and quantified. Components that affect analytical measurement uncertainty include sampling, handling, transport, storage, preparation and testing. A typical environmental laboratory will have the greatest contribution to uncertainty in the storage, preparation and testing portion of the analytical train, hence the estimation can be limited to those three areas, assuming all other factors are within recommended guidelines for sample size, container type, preservation (chemical, temperature, temporal) and handling/transport. If the latter are *NOT* within guidelines then these additional estimations of variability must be accounted for, and may supersede the laboratory contribution to uncertainty.

Definitive references and procedural manuals for calculating Analytical Measurement Uncertainty are listed below. Note that there are different theories on the "best" way to estimate uncertainty, it is up to the end user to determine that which best meets their project needs.

a) "Environmental Analytical Measurement Uncertainty Estimation – Nested Hierarchical Approach", William Ingersoll, Defense Technical Information Center # ADA396946, 2001

b) "Quantifying Uncertainty in Analytical Measurement", EuraChem / CITAC Guide CG 4, Second Edition, QUAM 2000.1

c) "Quantifying Measurement Uncertainty in Analytical Chemistry – A Simplified Practical Approach", Thomas W. Vetter, National Institute of Standards and Technology

d) ISO Guide to the Expression of Uncertainty in Measurement (GUM), 1993

e) "Estimation of Analytical Measurement Uncertainty - Laboratory Quality and Accreditation Office Uncertainty Calculator Standard Operating Procedure. Downloaded from http://www.denix.osd.mil/edqw/upload/UNCERTAINTY-SOP.**PDF**, 2013

f) QC-based Nested Approach for Estimating Measurement Uncertainty Spreadsheet, Microsoft Excel Spreadsheet, Ingersoll, William Stephen, 2002

The process in general involves the following steps:

1. Specify the Measurand – Write down a clear statement of what is being measured, including the relationship between the measurand and the input quantities, i.e., measured quantities, constants, calibration standard values, etc.

2. Identify uncertainty sources – This will include sources that contribute to the uncertainty on the parameters in the relationships identified in step 1, but may include other sources and must include sources arising from chemical assumptions.

3. Quantify uncertainty components – Measure or estimate the size of the uncertainty component associated with each potential source of uncertainty identified. It is often possible to estimate or determine a single contribution to uncertainty from the aggregate of multiple sources.

Formatted: Indent: Left: 0.99", Hanging: 0.48", Outline numbered + Level: 4 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.66"

Formatted: Indent: Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.25"

Formatted: Indent: Left: 0.99", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.25"

Formatted: Indent: Left: 0.99", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.25"

Formatted: Indent: Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.25"

Formatted: Indent: Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.25"

Formatted: Indent: Left: 0.99", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.25"

Formatted: Justified, Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.51" + Indent at: 1.75"

Formatted: Justified, Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.51" + Indent at: 1.75"

Formatted: Justified, Indent: Hanging: 0.24", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.51" + Indent at: 1.75"

4. Calculate combined uncertainty – The information obtained in step 3 will consist of a number of quantified contributions to overall uncertainty, whether associated with individual sources or with the combined effects of several sources.

The process outlined above relates to the measurement of uncertainty for the preparative / analytical laboratory procedure. However, there are uncertainty contributions from other factors outside the preparative / analytical procedure. These can be controlled to a great extent by specifying uniform and standardized training or conditions.

Examples:

Human Factors

a) All personnel at ECI undergo documented training in the method and / or instrument used. Minimum levels of education or experience are required.

b) Initial and continuing Demonstrations of Capability (DOC) must be performed and documented prior to and in continuance of analytical work related to their areas of responsibilities.

c) Blind Proficiency Testing samples are analyzed twice a year to gauge each department, matrix and method.

d) Data Integrity and Ethics Training are provided to new employees and on an annual basis to all employees.

Accommodation and Environmental Conditions

a) ECI has standardized operating procedures for transport, storage and tracking of samples, extracts and digests throughout the laboratory. All incoming orders are logged into a Laboratory Information System that assigns a specific identifier code to each work order, sample container and analytical result.

b) The sample control areas are secured with restricted access using card key portals. Internal chain of custody is available if the project requires.

c) The laboratory has over 35,000 sq ft of laboratory space with temperature controlled and air positive or negative environmental controls.

d) Regular safety inspections are performed to identify potentially hazardous conditions and to ensure general cleanliness.

Environmental Test Methods and Method Validation

a) All methods in use have Standard Operating Procedures (SOPs) based upon published methods from the EPA, ASTM, Standard Methods or other established body. These are controlled documents assigned to each department. An annual review is performed.

b) Each method has internal and external quality control criteria for preparative efficiency, instrument performance, calibration, continuing method performance and possible matrix effects as appropriate.

c) Ongoing Proficiency Testing program.

Equipment and Instrumentation

a) Each instrument in use has performance parameters that must be evaluated to specific standards based on the established method prior to any analytical use.

Formatted: Justified, Indent: Left: 0.67", Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.51" + Indent at: 1.75"

Formatted: Justified, Indent: Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.17" + Indent at: 0.42"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.17" + Indent at: 0.42"

Formatted: Justified, Indent: Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.17" + Indent at: 0.42"

Formatted: Justified, Indent: Left: 0.16", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.17" + Indent at: 0.42"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.41"

Formatted: Justified, Indent: Left: 0.16", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.41"

Formatted: Justified, Indent: Left: 0.16", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.41"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.41"

Formatted: Justified, Indent: Left: 0.16", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.41"

Formatted: Indent: Left: 0.16", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.16" + Indent at: 0.41"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.41"

b) Routine and preventative maintenance is performed to maintain optimum operational performance.

c) Complex instrument systems are covered under manufacturer service contracts as appropriate.

Measurement Traceability

a) Every reagent used must meet the indicated purity and fitness for usage as referenced in the method SOPs.

b) All calibration standards are certified by the manufacturer to meet or exceed purity levels as recorded in the accompanying Certificate of Traceability to NIST or other standards verification.

c) Each reagent, standard or working standard is recorded, assigned a tracking identifier. This is referenced in the analytical log book as needed to assure traceability to the original source.

d) All Balances, Dispensers, Pipettors, Refrigerators, Freezers and Thermometers are checked on a daily or other routine basis to specified tolerances.

D.1.5 Detection Limits

The laboratory shall utilize a test method that provides a detection limit that is appropriate and relevant for the intended use of the data. Detection limits shall be determined by the protocol in the mandated test method or applicable regulation, e.g., Method Detection Limit (MDL). If the protocol for determining detection limits is not specified, the selection of the procedure must reflect instrument limitations and the intended application of the test method. Refer to SOP T006, Determination of Detection Limits.

a) A detection limit study is not required for any component for which spiking solutions or quality control samples are not available such as temperature.

b) The detection limit shall be initially determined for the compounds of interest in each test method in a matrix in which there are not target analytes nor interferences at a concentration that would impact the results or the detection limit must be determined in the matrix of interest (see definition of matrix).

c) Detection limits must be determined each time there is a change in the test method that affects how the test is performed, or when a change in instrumentation occurs that affects the sensitivity of the analysis.

d) All samples processing steps of the analytical method shall be included in the determination of the detection limit.

e) All procedures used must be documented. Documentation must include the matrix type. All supporting data must be retained.

f) The laboratory must have established procedures to relate detection limits with quantitation limits.

g) The test method's quantitation limits must be established and must be above the detection limits.

D.1.6 Data Reduction

The procedures for data reduction, such as use of linear regression, shall be documented.

D.1.7 Quality of Standards and Reagents

a) The source of standards shall comply with 9.3.

b) Reagent Quality, Water Quality and Checks:

Formatted: Indent: Left: 0.98", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.41"

Formatted: Indent: Left: 0.99", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.15" + Indent at: 0.41"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Indent: Left: 0.99", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Indent: Left: 0.99", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Formatted: Indent: Hanging: 0.5", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 5 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.23"

Formatted: Justified, Indent: Left: 0.99", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.23"

Formatted: Indent: Left: 0.99", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.23"

Formatted: Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.23"

Formatted: Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.23"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.23"

Formatted: Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.23"

Formatted … [56]

Formatted … [57]

Formatted … [58]

Formatted … [59]

1) Reagents - In methods where the purity of reagents is not specified, analytical reagent grade shall be used. Reagents of lesser purity than those specified by the test method shall not be used. The labels on the container should be checked to verify that the purity of the reagents meets the requirements of the particular test method. Such information shall be documented.

2) Water - The quality of water sources shall be monitored and documented and shall meet method specified requirements.

3) The laboratory will verify the concentration of titrants in accordance with written laboratory procedures.

D.1.8 Selectivity

a) Absolute retention time and relative retention time aid in the identification of components in chromatographic analyses and to evaluate the effectiveness of a column to separate constituents. The laboratory shall develop and document acceptance criteria for retention time windows.

b) A confirmation shall be performed to verify the compound identification when positive results are detected on a sample from a location that has not been previously tested by the laboratory. Such confirmations shall be performed on organic tests such as pesticides, herbicides, or acid extractable or when recommended by the analytical test method except when the analysis involves the use of a mass spectrometer. Confirmation is required unless stipulated in writing by the client. All confirmation shall be documented.

c) The laboratory shall document acceptance criteria for mass spectral tuning.

D.1.9 Constant and Consistent Test Conditions

a) The laboratory shall assure that the test instruments consistently operate within the specifications required of the application for which the equipment is used.

b) Glassware Cleaning - Glassware shall be cleaned to meet the sensitivity of the test method.

Any cleaning and storage procedures that are not specified by the test method shall be documented in laboratory records and SOPs.

D.1.10 Method Validation - Modified Procedures, Non-Standard Methods, Additional Analytes

Often times, modifications to published methods are promulgated to allow the laboratory flexibility, increased productivity and, in some cases, it allows for better hazardous waste management, all while maintaining the quality of the data generated. But, this cannot be done without following standard method validation procedures to guarantee that the results achieved from the modified version are equal to or greater than the actual published or routinely accepted method.

Validation procedures are done to make sure that the sensitivity and selectivity of the process is appropriate for the method or analytes chosen. Interference checks are performed to show that the changes or additions will not contribute interferences to previous analytes or on-going processes. Accuracy and precision requirements are established, or previously defined, and used to demonstrate the capability of an analyst to perform the method, initially and on-going.

In the event that a non-standard method (significantly modified or newly-developed) is needed to meet client requirements, the method specifications and how they impact the project requirements must be relayed to the client for approval prior to beginning work on project samples. The client must understand the limits of the method, why it was developed and when it will be used on their project samples, and they must agree to its use.

Formatted: Justified, Indent: Hanging: 0.24", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.68"

Formatted: Justified, Indent: Left: 0.43", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.68"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.68"

Formatted: Justified, Indent: Left: 0.19", Hanging: 0.49", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 5 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Justified, Indent: Left: 0.19", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Formatted: Justified, Indent: Left: 0.19", Hanging: 0.49", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 5 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.19" + Indent at: 0.43"

Formatted: Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.19" + Indent at: 0.43"

Formatted: Justified, Indent: Left: 0.19", Hanging: 0.49", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 5 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Any significantly modified or newly-developed method (including the addition of analytes to established procedures) must be fully defined in a Standard Operating Procedure. The validation must be performed by qualified personnel, using appropriate reagents, standards and equipment/instrumentation and that process must be documented. The following items must be performed (as applicable to the method) and the completed documentation with all raw data provided to the Operations Manager and QA Manager for review prior to granting approval for use. A new method cannot be put into production without Operations and QA approval. For situations where NELAP approval is being sought, the method cannot be used for client samples until the certification has been received from the State, unless approval is given by the client

D.1.10.1 Significant Modification / New Method / Additional Analyte Documentation:

Prior to the acceptance of client samples for analysis, the following documentation, as applicable to the type of modification or method status, must be provided to both Operations and QA for review and approval.

1. Approved Standard Operating Procedure for Analytical or Preparation Processes. Include all related raw data for the SOP revision with the draft version.

   a) Modification of existing method: - Revised SOP with modifications clearly spelled out:

   b) New Method: - New SOP in NELAC format - QA will assign SOP number

   c) Additional Analytes: - Revised SOP with modifications clearly spelled out:

2. Method Detection Limit (MDL) Study: Compliant with 40CFR, Part 136.

   a) Include summary form and all raw data for the review

3. MDL Verification Standard spiked at 1-4x the MDL, or the level specified by the specific program or contract Example: 1-2x the MDL, reference specific program requirements.

   b) Recovery within 30 -150%, or a minimum response distinguishable from the established instrument noise level.

4. Reporting Limit Verification (when an MDL verification is not performed)

   a) For analytical methods, reprocess the low calibration standard as percent recovery – recovery between 50% and 150% is acceptable.

   b) For extraction methods, or where required by project or program, spike a blank matrix at the reporting limit and process through all steps of the procedure. Note the spike level and percent recoveries. Method defined control limits are used for recovery evaluation, or default recoveries between 40% and 160% if method defined limits are not available.

5. Tuning Check (as applicable to the method)

6. Degradation Check (as applicable to the method)

7. A Valid Initial Calibration and Verification

   a) Minimum of 5 sequential points, unless otherwise stated in the method or in-house SOP.

   b) Low calibration standard at or below the Reporting/Quantitation Limit

   c) Initial Calibration Verification Standard

Formatted: Indent: Hanging: 0.33", Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"

Formatted: Numbered + Level: 2 + Numbering Style: a, b, c, ... + Start at: 1 + Alignment: Left + Aligned at: 1.32" + Indent at: 1.66"

Formatted: Numbered + Level: 2 + Numbering Style: a, b, c, ... + Start at: 1 + Alignment: Left + Aligned at: 1.32" + Indent at: 1.66"

Formatted: Indent: Left: 1.32", Hanging: 0.33", Numbered + Level: 2 + Numbering Style: a, b, c, ... + Start at: 1 + Alignment: Left + Aligned at: 1.32" + Indent at: 1.66"

Formatted: Indent: Left: 0.98", Hanging: 0.34", Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"

Formatted: Indent: Left: 1.32", Hanging: 0.34", Numbered + Level: 2 + Numbering Style: a, b, c, ... + Start at: 1 + Alignment: Left + Aligned at: 1.32" + Indent at: 1.66"

Formatted: Indent: Hanging: 0.34", Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"

Formatted: Indent: Left: 0.98", Hanging: 0.35", Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"

Formatted: Numbered + Level: 2 + Numbering Style: a, b, c, ... + Start at: 1 + Alignment: Left + Aligned at: 1.32" + Indent at: 1.66"

Formatted: Justified, Indent: Hanging: 0.33", Numbered + Level: 2 + Numbering Style: a, b, c, ... + Start at: 1 + Alignment: Left + Aligned at: 1.32" + Indent at: 1.66"

Formatted: Indent: Hanging: 0.34", Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"

Formatted: Indent: Left: 0.99", Hanging: 0.34", Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"

Formatted: Indent: Left: 0.99", Hanging: 0.33", Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"

Formatted: Indent: Left: 1.32", Numbered + Level: 2 + Numbering Style: a, b, c, ... + Start at: 1 + Alignment: Left + Aligned at: 1.32" + Indent at: 1.66"

Formatted: Indent: Left: 1.33", Hanging: 0.33", Numbered + Level: 2 + Numbering Style: a, b, c, ... + Start at: 1 + Alignment: Left + Aligned at: 1.32" + Indent at: 1.66"

Formatted ... [60]

8. Retention Time Window Study

9. Second Column Confirmation for all analytes (as applicable to the method)

10. Inter-element Correction (as applicable to the method)

11. Linear Range Study (as applicable to the method)

12. GCMS Spectral Profile(s) (as applicable to the method)

13. Interference Check - Method Blank

a) Analysis of a blank matrix that has gone through all related steps, preparation and /or analysis, as applicable.

14. Acceptable PT Sample required for all new analytes where NELAP accreditation is being sought.

a) At least one PT sample (preferably two) required for all new methods

b) Where a PT sample is not available, or accreditation is not needed, accuracy can be measured through the use of a second source standard.

15. For California ELAP or State NELAP, process a real world sample for MS and MSD. The sample does not have to contain any target analytes but recoveries for surrogates, internal standards and spikes must be within lab or method defined criteria.

a) Use Tap Water for drinking water only methods, tap or other clean water source for ground, surface, etc. methods

b) Local Soil sample for SW-846 methods (if applying for soil or soil/water)

16. Initial Demonstration of Capability (IDOC) per analyst

a) 4 LCS for each matrix, spiked with all associated new analytes – most acceptance criteria are in the methods, if none, use an initial recovery range of 40-160% and an RPD of 30%.

b) Non-Standard methods - Follow the procedure in the 2003 NELAC Standards, Chapter 5 appendix C.3.3 (b).

17. Certification / Approval from Regulatory Agency where available.

Formatted: Indent: Left: 0.18", Hanging: 0.34", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"

Formatted: Indent: Left: 0.18", Hanging: 0.33", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"

Formatted: Indent: Left: 0.19", Hanging: 0.33", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"

Formatted: Indent: Left: 0.19", Hanging: 0.33", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"

Formatted: Indent: Left: 0.19", Hanging: 0.33", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"

Formatted: Indent: Left: 0.19", Hanging: 0.33", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"

Formatted: Indent: Left: 0.51", Hanging: 0.33", Numbered + Level: 2 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.32" + Indent at: 1.66"

Formatted: Indent: Left: 0.19", Hanging: 0.32", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"

Formatted: Indent: Left: 0.51", Hanging: 0.33", Numbered + Level: 2 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.32" + Indent at: 1.66"

Formatted: Indent: Left: 0.51", Hanging: 0.32", Numbered + Level: 2 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.32" + Indent at: 1.66"

Formatted: Justified, Indent: Left: 0.19", Hanging: 0.33", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"

Formatted: Indent: Left: 0.51", Hanging: 0.33", Numbered + Level: 2 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.32" + Indent at: 1.66"

Formatted: Indent: Left: 0.51", Hanging: 0.33", Numbered + Level: 2 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.32" + Indent at: 1.66"

Formatted: Indent: Left: 0.19", Hanging: 0.33", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"

Formatted … [61]

Formatted … [62]

Formatted … [63]

APPENDIX E - LIST OF ACCREDITED METHODS

- Arizona Department of Health Services - Laboratory ID AZ0781

  a) View at: http://www.eurofinsus.com/media/1.61879/arizona-cert_scope_031216.pdf

- California SWRCB ELAP - Laboratory ID 2944

  a) View at: http://www.eurofinsus.com/media/162063/ca-elap_calscience.pdf

- Guam Environmental Protection Agency - Laboratory ID E971101

  a) View at: http://www.eurofinsus.com/media/161875/guam-cert_foas_103115.pdf

- Hawaii Department of Health - Laboratory ID (None)

  a) View at: http://eurofinsus.com/media/161878/hawaii-cert_093015.pdf

- Kansas Department of Health & Environment - Laboratory ID E-10409

  a) View at: http://www.eurofinsus.com/media/16055/kansas1.pdf
  b) View at: http://www.eurofinsus.com/media/16056/kansas2.pdf

- Nevada Department of Conservation and Natural Resources – Laboratory ID CA001112013-1

  a) View at: http://www.eurofinsus.com/media/162008/nevada-cert-2015_.pdf

- Oklahoma Department of Environmental Quality - Laboratory ID 1311

  a) View at: http://www.eurofinsus.com/media/161882/oklahoma-cert_083115.pdf

- Oregon Environmental Laboratory Accreditation Program (NELAP Primary) - Laboratory ID CA300001

  a) View at: http://www.eurofinsus.com/media/161877/oregon-state-primary-nelap_-cert_012916.pdf

- Texas Commission of Environmental Quality – Laboratory ID T104704499-14-4

  a) View at: http://www.eurofinsus.com/media/161881/texas-cert_073115.pdf

- United States Department of Agriculture Certificate No. P330-10-00403, Permit to Receive Soil

  a) View at: http://eurofinsus.com/media/16042/usda_soil_permit.pdf

- United States Department of Agriculture - Authorization to Receive Plant Material

  b) View at: http://www.eurofinsus.com/media/162229/usda-plant-import-authorization_050615.pdf

- United States Army Corp of Engineers - Approval (EPA 8270 SIM - PCB Congeners)

  a) View at: http://www.eurofinsus.com/media/16039/dmmo_epa8270sim.pdf

Formatted: Indent: Hanging: 0.25", Bulleted + Level: 1 + Aligned at: 1.25" + Indent at: 1.49"

Formatted: Indent: Left: 1.41", Numbered + Level: 2 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.32" + Indent at: 1.66"

Formatted: Indent: Left: 1.24", Hanging: 0.25", Bulleted + Level: 1 + Aligned at: 1.25" + Indent at: 1.49"

Formatted: Bulleted + Level: 1 + Aligned at: 1.25" + Indent at: 1.49"

Formatted: Indent: Left: 1.24", Hanging: 0.25", Bulleted + Level: 1 + Aligned at: 1.25" + Indent at: 1.49"

Formatted: Indent: Left: 1.24", Hanging: 0.25", Bulleted + Level: 1 + Aligned at: 1.25" + Indent at: 1.49"

Formatted: Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.49" + Indent at: 1.74"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.49" + Indent at: 1.74"

Formatted: Indent: Left: 1.24", Hanging: 0.25", Bulleted + Level: 1 + Aligned at: 1.25" + Indent at: 1.49"

Formatted: Bulleted + Level: 1 + Aligned at: 1.25" + Indent at: 1.49"

Formatted: Bulleted + Level: 1 + Aligned at: 1.25" + Indent at: 1.49"

Formatted: Indent: Left: 1.24", Hanging: 0.25", Bulleted + Level: 1 + Aligned at: 1.25" + Indent at: 1.49"

Formatted: Indent: Left: 1.24", Hanging: 0.25", Bulleted + Level: 1 + Aligned at: 1.25" + Indent at: 1.49"

Formatted: Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.49" + Indent at: 1.74"

Formatted: Indent: Left: 1.24", Hanging: 0.25", Bulleted + Level: 1 + Aligned at: 1.25" + Indent at: 1.49"

Formatted: Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.49" + Indent at: 1.74"

Formatted: Indent: Left: 1.25", Bulleted + Level: 1 + Aligned at: 1.25" + Indent at: 1.49"

- **United States Department of Defense / Energy ANAB/ACLASS ELAP Certificate ADE-1864 and Fields of Accreditation**

  a) View at: http://www.eurofinsus.com/media/16049/dod_elap.pdf

- **United States Department of the Interior - Approval**

  b) View at: http://www.eurofinsus.com/media/16067/usbor.pdf

- **Utah Department of Health - Laboratory ID CA00111**

  a) View at: http://www.eurofinsus.com/media/161880/utah-cert_foas_103115.pdf

- **Washington Department of Ecology - Laboratory ID C916**

  a) View at: http://www.eurofinsus.com/media/16070/washington1.pdf
  b) View at: http://www.eurofinsus.com/media/16069/washington2_.pdf

Formatted: Indent: Hanging: 0.25", Bulleted + Level: 2 + Aligned at: 0.36" + Indent at: 0.62"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.61" + Indent at: 0.86"

Formatted: Indent: Hanging: 0.25", Bulleted + Level: 2 + Aligned at: 0.36" + Indent at: 0.62"

Formatted: Indent: Left: 0.61", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.61" + Indent at: 0.86"

Formatted: Indent: Left: 0.36", Bulleted + Level: 2 + Aligned at: 0.36" + Indent at: 0.62"

Formatted: Indent: Left: 0.36", Hanging: 0.24", Bulleted + Level: 2 + Aligned at: 0.36" + Indent at: 0.62"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.61" + Indent at: 0.85"

Formatted: Indent: Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.61" + Indent at: 0.85"

APPENDIX F-LIST OF PHYSICAL LOCATIONS

F.1 Main Laboratory

- 7440 Lincoln Way, Garden Grove, CA 92841-1427
- 714-895-5494 Fax 714-894-7501

F.2 Satellite Laboratory 1

- 7445 Lampson Avenue, Garden Grove, CA 92841-2903
- Fax 714-898-2036

F.3 Satellite Laboratory 2

- 11380 Knott Street, Garden Grove, CA 92841-1400

F.4 Concord, CA Service Center

- 5063 Commercial Circle, Suite H, Concord, CA 94520-8577
- 925-689-9022 Fax 925-689-9023

Formatted: Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.48"

Formatted: Outline numbered + Level: 3 + Numbering Style: Bullet + Aligned at: 1.48" + Indent at: 1.73"

Formatted: Indent: Left: 0.98", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.48"

Formatted: Outline numbered + Level: 3 + Numbering Style: Bullet + Aligned at: 1.48" + Indent at: 1.73"

Formatted: Indent: Left: 0.98", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.48"

Formatted: Indent: Left: 1.48", Hanging: 0.26", Outline numbered + Level: 3 + Numbering Style: Bullet + Aligned at: 1.48" + Indent at: 1.73"

Formatted: Indent: Left: 0.98", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.48"

Formatted: Indent: Left: 1.48", Hanging: 0.25", Outline numbered + Level: 3 + Numbering Style: Bullet + Aligned at: 1.48" + Indent at: 1.73"

APPENDIX G -SPECIAL PROGRAM REQUIREMENTS

F.1 United States Department of Defense / Energy Environmental Laboratory Accreditation Program

1. ECI participates and is accredited in the United States Department of Defense / Energy Environmental Laboratory Accreditation Program (DOD/DOE-ELAP).

2. The DOD/DOE ELAP will provide a means for laboratories to demonstrate conformance to the DOD/DOE Quality Systems Manual for Environmental Laboratories (DOD/DOE QSM) as authorized by DOD/DOE Instruction 4715.15, Environmental Quality Systems, December 2006 and as required by the DOD/DOE Policy and Guidelines for Acquisitions Involving Environmental Sampling or Testing, December, 2007. The DOD/DOE QSM is based on the National Environmental Laboratory Accreditation Conference (NELAC) Quality Systems standard (Chapter 5), which provides guidelines for implementing the international standard, ISO/IEC 17025, General Requirements for the Competence of Testing and Calibration Laboratories.

3. The DOD/DOE ELAP will apply to environmental programs / projects at DOD/DOE operations, activities, and installations, including Government-owned, contractor-operated facilities and formerly used defense sites, where testing is being performed in support of environmental restoration programs. The program will apply to all laboratories, including permanent, temporary, or mobile facilities, that generate definitive data, regardless of their size, volume of business, or field of accreditation; the collection of screening data will be governed by project specific requirements.

4. The current DOD/DOE Quality Systems Manual for Environmental Laboratories is Version 5.0, dated June 2013

5. Implementation of the DOD/DOE Quality Systems Manual for Environmental Laboratories Version 5.0, dated July 2013, will be phased in over the 2014-2015 time period.

6. The ECI Management will provide sufficient training, resources and other measures to ensure compliance with the DOD/DOE QSM as appropriate. (including but not limited to):

   a. Specific Standard Operating Procedures (SOPs) and / or Appendicles
   b. DOD/DOE compliant Laboratory Information Management System (LIMS) analytical test codes
   c. Specialized technician and chemist training
   d. Enhanced Quality Assurance (QA) oversight
   e. Project specific instruments
   f. Assigned Project Management personnel
   g. Quality Assurance Project Plans (QAPP)
   h. DOD/DOE analytical data reporting qualifiers
   i. Calibration and reference materials that meet DOD/DOE requirements.

Formatted: Justified, Indent: Hanging: 0.24", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.37"

Formatted: Justified, Indent: Left: 0.11", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.37"

Formatted: Justified, Indent: Left: 0.11", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.37"

Formatted: Justified, Indent: Left: 0.11", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.37"

Formatted: Justified, Indent: Left: 0.11", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.37"

Formatted: Justified, Indent: Left: 0.11", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.37"

Formatted: Numbered + Level: 2 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.36" + Indent at: 0.61"

Formatted: Indent: Left: 0.36", Hanging: 0.25", Numbered + Level: 2 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.36" + Indent at: 0.61"

Formatted: Numbered + Level: 2 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.36" + Indent at: 0.61"

Formatted: Indent: Left: 0.37", Hanging: 0.25", Numbered + Level: 2 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.36" + Indent at: 0.61"

Formatted: Indent: Hanging: 0.25", Numbered + Level: 2 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.36" + Indent at: 0.61"

APPENDIX H - LISTING OF MAJOR ANALYTICAL INSTRUMENTATION

GC/MS SYSTEMS

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
GC/MS-K	**HP** 6890	US00024158	1998	**Air**	XP
	HP5973	US82311263	1998		
	Entech 71OOA	0063	1998		
	Entech 7016CA	00142	1998		
GC/MS-L	HP 6890	US00023714	1998	Volatiles	XP
	Agilent 5973	US82311287	1998		
	Tekmar Atomx	US09163001	2009		
GC/MS-M	HP 6890	US00028876	1999	Volatiles	XP
	HP 5973	US9192601	1999		
	Tekmar Stratum	US08283015	2010		
	Varian Archon	MS0903W013	2010		
GC/MS-0	Agilent 6890N	US00034260	2000	**LUFT-TPPH**	XP
	Agilent 5973	US94240048	2000		
	Tekmar 3100	US02261003			
	Varian Archon	13863	2002		
GC/MS-P	Agilent 6890	US00034661	2000	Semivolatiles	XP
	Agilent 5973N	US94240038	2000		
	Agilent G2613A (Injector)	CN35234549	2000		
	Agilent G2614A (Tray)	US04109505	2000		
GC/MS-Q	Agilent 6890	US00037519	2000	Volatiles	XP
	Agilent 5973	US03340458	2000		
	Tekmar Stratum	US13099007	2013		
	Varian Archon	13386	2000		
GC/MS-R	Agilent 6890	US00037782	2000	Volatiles	XP
	Agilent 5973	US03340489	2000		
	Tekmar Stratum	US12111001	2012		
	Varian Archon	14040	2003		
GC/MS-S	Agilent 6890	US00030897	2000	Summa QC	XP
	Agilent 5973	US03340414	2000		
	Tekmar Autocan	US06047025	2006		
GC/MS-T	Agilent 6890	US00039185	2000	Volatiles	XP
	Agilent 5973	US03940628	2000		
	Tekmar Atomx	US11048001	2011		
GC/MS-U	Agilent 6890	US00036171	2001	Summa QC	XP
	Agilent 5973	US02450134	2001		
	Tekmar Autocan	US08169005	2002		
GC/MS-V	Agilent 6890	US00036172	2001	Air	XP

	Agilent 5973	US02450131	2001		
	Entech 71OOA	1092	2005		
	Entech 7016CA	1041	2005		
GC/MS-W	Agilent 6890	US00036170	2001	Volatiles	XP
	Agilent 5973	US02450128	2001		
	Tekmar Stratum	US09154005	2010		
	Varian Archon	13573	2001		
GC/MS-X	Agilent 6890N	US10203064	2002	Air	XP
	Agilent 5973	US10462129	2002		
GC/MS-Y	Agilent 6890	US10203153	2002	Semivolatiles	XP
	Agilent 5973	US10442209	2002		
	Agilent G2613A (Injector)	US00211064	2002		
	Agilent G2614A (Tray)	CN64942239	2002		
GC/MS-Z	Agilent 6890N	US10225110	2002	Volatiles	XP
	Agilent 5973	US21842958	2002		
	Tekmar Stratum	US12115008	2012		
	Varian Archon	15278	2008		
GC/MS-AA	Agilent 6890N	US10225149	2002	Air	XP
	Agilent 5973N	US21843250	2002		
	Entech 71OOA	1045	2003		
	Entech 7016CA	1183	2004		
	Entech 7016CA	1212	2004		
GC/MS-BB	Agilent 6890N	US1023004	2002	Volatiles	XP
	Agilent 5973N	US21843288	2002		
	Tekmar Stratum	US08283014	2012		
	Varian Archon	15208	2007		
GC/MS-CC	Agilent 6890N	US10233039	2002	Volatiles	XP
	Agilent 5973N	US21843272	2002		
	Tekmar Stratum	US10272001	2011		
	Varian Archon	13431	2002		
GC/MS-DD	Agilent 6890N	US10239018	2002	Air	XP
	Agilent 5973N	US21843913	2002		
	Entech 71OOA	1432			
	Entech 7016CA	1018	2002		
	Entech 7016CA	1187			
GC/MS-EE	Agilent 6890N	US10248096	2003	Summa QC	XP
	Agilent 5973N	US21844395	2003		
	Tekmar Autocan	US99362027	1999		
GC/MS-GG	Agilent 6890N	CN10337014	2003	Marine Lab	XP
	Agilent 5973N	US33246020	2003		

	Agilent GC 80 SPME	CH00213565	2011		
GC/MS-HH	Agilent 6890N	CN10337015	2003	Air	XP
	Agilent 5973	US30945837	2003		
	Entech 71OOA	1081	2003		
	Entech 7016CA	1012	2003		
	Entech 7016CA	1038	2003		
GC/MS-11	Agilent 6890	CN10517039	2005	Air	XP
	Agilent 5973	US44647341	2005		
	Entech 71OOA	1458	2008		
	Entech 7016CA	1098	2005		
	Entech 7016CA	1225	2008		
GC/MS-JJ	Agilent 6890N	CN10547073	2005	Volatiles	XP
	Agilent 5973	US53941344	2005		
	Tekmar Stratum	US10230002	2010		
	Varian Archon	14529	2005		
GC/MS-KK	Agilent 6890	CN10545117	2005	Air	XP
	Agilent 5973	US53941343	2005		
	Entech 71OOA	1221	2005		
	Entech 7016CA	1207			
	Entech 7016CA	1210			
GC/MS-LL	Agilent 6890N	CN10651084	2007	Volatiles	XP
	Agilent 59758	US63214670	2007		
	Tekmar 3100	US01317008	2002		
	Varian Archon	MS0902W026	2006		
GC/MS-MM	Agilent 6890N	CN10651076	2007	Semivolatiles	XP
	Agilent 59758	US62715103	2007		
	Agilent G2913A (Injector)	CN51825044	2007		
	Agilent G2614A (Tray)	CN51833057	2007		
GC/MS-NN	Agilent 7890A	CN10717056	2007	Air	XP
	Agilent 5975C	US71215995	2007		
	Entech 71OOA	1291	2012		
	Entech 7016CA	1211			
	Entech 7150	45	2010		
	Entech 7410	138	2010		
GC/MS-00	Agilent 7890A	CN10745139	2007	Volatiles	XP
	Agilent 5975C	US73317841	2007		
	Tekmar Stratum	US07277008	2009		
	Varian Archon	14697	2008		
GC/MS-PP	Agilent 7890A	CN10744086	2007	Volatiles	XP
	Agilent 5975C	US73317584	2007		

	Tekmar Stratum	US07277012	2009		
	Tekmar SOLATek	US09051008	2009		
GC/MS-QQ	Agilent 7890A	CN10742034	2007	Volatiles	XP
	Agilent 5975C	US71216778	2007		
	Tekmar Stratum	US07277018	2008		
	Tekmar SOLATek	US08032004	2008		
GC/MS-RR	Agilent 7890A	CN10730015	2007	Volatiles	XP
	Agilent 5975C	US73317844	2007		
	Tekmar Stratum	US08032004	2008		
	Tekmar SOLATek	US08032006	2008		
GC/MS-SS	Agilent 7890A	CN10803049	2007	Semivolatiles	XP
	Agilent 5975C	US80618497	2007		
	Agilent G2613A (Injector)	US81801206	2007		
	Agilent G2614A (Tray)	CN80246945	2007		
GC/MS-TT	Agilent 7890A	CN10806032	2007	Semivolatiles	XP
	Agilent 5975C	US80618456	2007		
	Agilent G2613A (Injector)	CN80246390	2007		
	Agilent G2614A (Tray)	CN80246936	2007		
GC/MS-UU	Agilent 7890A	CN10805004	2007	Volatiles	XP
	Agilent 5975C	US71215984	2007		
	Tekmar Stratum	US08087006	2008		
	Varian Archon	15287	2008		
GC/MS-W	Agilent 7890A	CN10805094	2007	Volatiles	XP
	Agilent C5975	US80118376	2007		
	Tekmar 3100	US02203002	2001		
	Tekmar SOLATek	US09050003	2008		
GC/MS-WW	Agilent 7890A	CN10803015	2007	Volatiles	XP
	Agilent 5975C	US80118375	2007		
	Tekmar Atomx	US11034002	2011		
GC/MS-XX	Agilent 7890A	CN10815050	2008	Volatiles	XP
	Agilent 5975C	US80828968	2008		
	Tekmar Stratum	US14097001	2014		
	Varian Archon	15273	2008		
GC/MS-YY	Agilent 7890A	CN10814115	2008	Air	XP
	Agilent C5975	US80828967	2008		
	Entech 71OOA	1431	2008		
	Entech 7016CA	1208	2008		
	Entech 7016CA	1214	2008		
GC/MS-ZZ	Agilent 7890A	CN10814050	2008	Air	XP
	Agilent 5975C	US80828953	2008		

	Markes TD-100	G800K10173	2011		
GC/MS-AAA	Agilent 7890A	CN10812068	2008	Semivolatiles	XP
	Agilent 5975C	US80828988	2008		
	Agilent G2613A (Injector)	CN70438717	2008		
	Agilent G2614A (Tray)	CN64942222	2008		
GC/MS-888	Agilent 7890A	CN10947130	2009	Semivolatiles	XP
	Agilent 5975C	US93414124	2009		
	Agilent 7693 (Tray)	CN94701470	2009		
	Agilent 7693 (Injector)	CN11200098	2009		
GC/MS-CCC	Agilent 7890A	CN10947129	2009	Semivolatiles	XP
	Agilent 5975C	US93414097	2009		
	Agilent 7693 (Tray)	CN94901515	2009		
	Agilent 7693 (Injector)	CN95002678	2009		
GC/MS-DDD	Agilent 7890A	CN10031142	2009	Semivolatiles	XP
	Agilent 5975C	US10197302	2009		
	Agilent 7693 (Tray)	CN10210002	2009		
	Agilent 7693 (Injector)	CN10140077	2009		
GC/MS-EEE	Agilent 7890A	CN10241112	2009	Semivolatiles	XP
	Agilent 5975C	US10257401	2009		
	Agilent 7693 (Tray)	CN10210100	2009		
	Agilent 7693 (Injector)	CN10230009	2009		
GC/MS-FFF	Agilent 7890A	CN10391179	2010	Volatiles	XP
	Agilent 5975C	US10407502	2010		
	Tekmar Atomx	US10200002	2010		
GC/MS-GGG	Agilent 7890A	CN10401096	2010	Volatiles	XP
	Agilent 5975C	US10287508	2010		
	Tekmar Atomx	US10246002	2010		
GC/MS-HHH	Agilent 7890A	CN10521074	2010	Semivolatiles	Win ?
	Agilent 5975C	CN11030007	2010		
	Agilent 7693 (Tray)	US11077507	2010		
	Agilent 7693 (Injector)	CN11050288	2010		
GC/MS-111	Agilent 7890A	CN10521075	2010	Semivolatiles	Win ?
	Agilent 5975C	US11077506	2010		
	Agilent 7693 (Tray)	CN11030009	2010		
	Agilent 7693 (Injector)	CN11050291	2010		
GC/MS-JJJ	Agilent 7890A	CN11441070	2011	Semivolatiles	Win ?
	Agilent 5975C	US11447702	2011		
	Agilent 7693 (Tray)	CN11440045	2011		
	Agilent 7693 (Injector)	CN11390136	2011		
GC/MS-KKK	Agilent 7890A	CN11441059	2011	Air	Win ?
	Agilent 5975C	US11447704	2011		

	Entech 71OOA	1384	2008		
	Entech 7016CA	1212	2008		
	Entech 7016CA	1183	2007		
GC/MS-LLL	Agilent 7890A	CN12031151	2012	Air	Win ?
	Agilent 5975C	US12097802	2012		
	Entech 71OOA	1290	2012		
	Entech 7016CA	1041	2005		
GC/MS-MMM	Agilent 7890A	CN12261027	2012	Air	Win ?
	Agilent 5975C	US12262A09	2012		
	Markes TD-100	G800k10257	2012		
GC/MS-NNN	Agilent 7890A	CN14073088	2014	Semivolatiles	Win ?
	Agilent 5975C	US14052222	2014		
	Agilent 7693 (Tray)	CN13500019	2014		
	Agilent 7693 (Injector)	CN14020017	2014		
GC/MS-000	Agilent 78908	CN14103035	2014	Air	Win ?
	Agilent 5977A	US1410J201	2014		
	Entech 7200	1161	2014		
	Entech 70160	1421	2014		

GC TRI PLEQUAD SYSTEMS

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
GC/T0-1	Agilent 7890A	US11041024	2011	Marine Lab	Win ?
	Agilent 7000 TO/MS	US11046401	2011		
	Agilent 7693 (Tray)	CN11030015	2011		
	Agilent 7693 (Injector)	CN11050297	2011		
GC/T0-2	Agilent 7890A	US11291011	2011	Marine Lab	Win ?
	Agilent 7000 TO/MS	US11196604	2011		
	Agilent 7693 (Tray)	CN11180027	2011		
	Agilent 7693 (Injector)	CN95002669	2011		

GC SYSTEMS

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
GC-1	HP 5890 Series II Detector(s): PID/FID	3310A48771	1987	LUFT-GRO	2000
	Tekmar 3100	US01362002	2004		
	Varian Archon	15301	2008		
GC-4	HP 5890 Detector(s): PID/FID	2750A17251	1989	LUFT-GRO	XP
	014560	8239040			
	Varian Archon	13142	1999		

GC-8	HP 5890 Series II PID/FID	3033A31219	1990	LUFT-GRO	XP
	Tekmar 3100	US02249008	2002		
	Varian Archon	MS1010W015	2008		
GC-9	HP 5890 Series II Detector(s): FID/FID	3033A32951	1991	Semivolatiles	NT
GC-12	HP 5890 Series II Detector(s): FID/TCD	3118A35448	1991	Semivolatiles	NT
GC-13	HP 5890 Series II FID/TCD	3033A32929	1990	Air	XP
GC-14	HP 5890 Series II Detector(s): FPO	3126A36770	1991	Air	XP
GC-18	HP 5890 Series II Detector(s): PID/FID	3235A44156	1992	LUFT-GRO	2000
	EST Encon	512080906			
	Varian Archon	15307	2008		
GC-21	HP 5890 Series II Detector(s): PID/FID	3336A51475	1994	LUFT-GRO	XP
	Tekmar 3100	US02331005	2007		
	Varian Archon	MS0902W025	2008		
GC-22	HP 5890 Series II+ Detector(s): PID/FID	3336A61360	1994	LUFT-GRO	XP
	Tekmar 3100	US02233006	2008		
	Varian Archon	14699	2006		
GC-24	HP 5890 Series II+ Detector(s): PID/FID	3336A53949	1994	LUFT-GRO	2000
	Tekmar 3000	98194007	1998		
	Varian Archon	13864	2004		
GC-25	HP 5890 Series II+ Detector(s): PID/FID	2921A23805	1994	LUFT-GRO	XP
	Tekmar 3100	314009			
	Varian Archon	13470	2001		
GC-26	HP 6890 Detector(s): NPD/NPD	US00001017	1995	Semivolatiles	XP
	G1513A (Injector)	CN12620285	1995		
	G1514A (Tray)	US83304659	1995		
GC-29	HP 5890 Series II Detector(s): PID/FID	3310A47430	2000	LUFT-GRO	XP
	Tekmar 3100	US02249004	2002		
	Varian Archon	13874	2002		
GC-31	HP 6890 Detector(s): ECO/ECO	US00037979	2000	Semivolatiles	XP
	G2613A (Injector)	CN43138313	2000		
	G2614A (Tray)	CN71543642	2000		

GC-34	HP 5890 Series II Detector(s): FID	3033A32699	2000	Air	XP
GC-35	Agilent 6890N Detector(s): NPD/NPD	US10206061	2002	Semivolatiles	XP
	G2613A (Injector)	US81501043	2002		
	G2614A (Tray)	US83501663	2002		
GC-36	Agilent 6890N Detector(s): FID/TCD	US10346058	2004	Air	XP
GC-37	Agilent 6890N Detector(s): ECD/ECD	CN10350094	2004	Marine Lab	XP
GC-38	HP 5890 Series II Detector(s): FID	3029A30188	1995	Air	XP
GC-40	Agilent 7890N Detector(s): ECD/ECD	CN10647089	2007	Semivolatiles	XP
	G2913A (Injector)	CN715400009	2007		
	G2614A (Tray)	CN64842106	2007		
GC-41	Agilent 7890N Detector(s): ECD/ECD	CN10650013	2007	Semivolatiles	XP
	G2913A (Injector)	CN70538721	2007		
	G2614A (Tray)	CN43130148	2007		
GC-42	Agilent 6890N Detector(s): PID/FID	CN10647056	2007	LUFT-GRO	XP
	Tekmar 3100	US01274007			
	Varian Archon	14370	2004		
GC-43	Agilent 6890N Detector(s): FID	CN10720004	2007	Air	XP
GC-44	Agilent 6890N Detector(s): FID/FID	CN10721103	2007	Semivolatiles	XP
	G2913A (Injector)	CN71840418	2007		
	G2614A (Tray)	CN71843829	2007		
GC-45	Agilent 7890A Detector(s): FID/FID	CN10808107	2007	LUFT-ORO	XP
	G2913A (Injector)	CN81949025	2007		
	G2614A (Tray)	CN80747427	2007		
GC-46	Agilent 7890A Detector(s): FID/FID	CN1080815	2007	LUFT-ORO	XP
	G2913A (Injector)	CN81949036			
	G2614A (Tray)	US83201509			
GC-47	Agilent 7890A Detector(s): FID/FID	CN10819056	2008	LUFT-ORO	XP
	G2913A (Injector)	CN81748778	2008		
	G2614A (Tray)	CN81748307	2008		
GC-48	Agilent 7890A Detector(s): FID/FID	CN10819057	2008	LUFT-ORO	XP

	G2913A (Injector)	CN64837502	2008		
	G2614A (Tray)	CN64541796	2008		
GC-49	Agilent 7890A Detector(s): FID/FID	CN10820151	2008	LUFT-ORO	XP
	G2913A (Injector)	CN71549035	2008		
	G2614A (Tray)	CN82048589	2008		
GC-50	Agilent 7890A Detector(s): FID/FID	CN10820150	2008	LUFT-ORO	XP
	G2913A (Injector)	CN80546905	2008		
	G2614A (Tray)	CN82048581	2008		
GC-51	Agilent 7890A Detector(s): ECD/ECD	CN10822026	2008	Semivolatiles	XP
	G2913A (Injector)	CN82049336	2008		
	G2614A (Tray)	CN82148694	2008		
GC-52	Agilent 7890N Detector(s): FID	CN10824005	2008	Air	XP
GC-53	Agilent 6890N Detector(s): FID	US00002691	2000	Air	XP
GC-54	Agilent 7890A Detector(s): FPD	US10840051	2008	Air	XP
GC-55	Agilent 7890N Detector(s): TCD	CN10844112	2008	Air	XP
GC-56	Agilent 7890N Detector(s): FID	CN10847124	2009	LUFT-GRO	XP
	01 Eclipse	D647466449P			
	Varian Archon	15139	2007		
GC-57	Agilent 7890N Detector(s): ECD/ECD	CN10847113	2009	LUFT-GRO	XP
	01 Eclipse	D81466987P			
	Varian Archon	15140	2007		
GC-58	Agilent 7890N	CN10942196	2009	Semivolatiles	XP
	Agilent 7693 (Tray)	CN64937563	2009		
	Agilent 7693 (Injector)	CN81748311	2009		
GC-59	Agilent 7890N Detector(s): FID	CN10041127	2009	Air	XP
GC-60	Agilent 6890N Detector(s): FID	US10247091	2003	Air	XP
GC-61	Agilent 6890N Detector(s): FID	US00007963	1998	Air	XP
GC-62	Agilent 6890N Detector(s): FID	US00036172	2001	Air	XP
GC-63	Agilent 7890A Detector(s): ECD/ECD	CN12151152	2012	Marine	XP

GC-64	Agilent 6890A Detector(s): FID	US00030941	1999	Air	XP
GC-65	Agilent 7890A Detector(s): TCD	CN12111151	2012	Air	XP
GC-66	Agilent 7890A Detector(s): FID Agilent 7693 (Tray) Agilent 7693 (Injector)	CN12421146 CN12320016 CN12300140	2012	Semivolatiles	XP

Inductively Coupled Plasma Spectrophotometers (ICP)

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
ICP-7	PE Optima 7300 DV	077C8120401	2008	Metals	XP
	ESI SC FAST	4DX-F1-TSP	2013		
ICP-8	PE Optima 8300		2014	Metals	Win ?
	ESI SC4 optiFAST Dxi		2014		

Inductively Coupled Plasma/Mass Spectrometers (ICP/MS)

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
ICP/MS-3	PE ELAN DRC-e	AH 14610812	2009	Metals	XP
	ESI SC4 DX	X4DX5HSTSP16110413			
ICP/MS-4	PE ELAN DRC-e	AH 13440801	2009	Metals	XP
	ESI SC4 DX	X4DX5HSTSP16110603			
ICP/MS-5	PE NexION 300D	81DN1120502	2011	Metals	XP
	ESI SC4 DX	FST04-TSP-091203	2001		

Flame Atomic Absorption Spectrometers (FAA)

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
FAA-3	PE PinAAcle 900F	PFAS11090701	2011	Metals	Win ?

Mercury Analyzers

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
HG-4	PE FIMS-400	401S2030103	2005	Metals	XP
HG-5	PE FIMS-400	401S5070901	2005	Metals	XP
HG/AF-1	Teledyne Hydra II	1095	2011	Metals	Win ?

High Performance Liquid Chromatographs (HPLC)

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
HPLC-5	Variable Wave. Det.	JP116144U1	2001	Semivolatiles	XP

Agilent 1100 HPLC	Column Compartment	DE11120911	2001		
	Quat. Pump	DE11114727	2001		
	Degasser	JP05029389	2001		
	Autosampler	DE11115637	2001		
HPLC-6 Agilent 1100 HPLC	Variable Wave. Det.	JP11414177	2001	Semivolatiles	XP
	Quat. Pump	DE11114712	2001		
	Degasser	JP05029404	2001		
	Autosampler	DE11115492	2001		
HPLC-7 Agilent 1100 HPLC	Variable Wave. Det.	DE43602867	2004	Semivolatiles	XP
	Isa Pump	DE409006799	2004		
	Column Compartment	DE111210117	2004		
	Autosampler	DE33225927	2004		
Pickering	Pinnacle PCX	513305	2013		
HPLC-8 Agilent 1200 HPLC	Multi. Wave. Det.	DE60555324		Semivolatiles	XP
	Isa Pump	DE62956826			
	Fraction Collector	DE60555134			
	Autosampler	DE63055195			

Liquid Chromatography/Mass Spectrometry (LC/MS/MS)

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
LC/TQ-1	Varian 1200L Triple Quad	3060	2005	Inorganics	XP
	Varian Prostar 210	4151	2005		
	Varian Prostar 210	4152	2005		
	Varian 410 Autosampler	50062	2005		
LC/TQ-2	Agilent 6430 LC/MS Triple Quad	SG11077104	2013	Inorganics	7
	Agilent 1260 Quat Pump	DEAB707001	2013		
	Agilent 1260 ALS	DEAAC17936	2013		
TOC-4	01 Soil Module Detector(s): IR	C339776273	2003	Inorganics	XP
TOC-5	01 Soil Module Detector(s): IR	C726776952	2007	Inorganics	XP
TOC-6	01 Aurora 1030	J025730749P	2011	Inorganics	XP
	OI 1088 NS	J025730749P	2011		
TOC-8	01 Aurora 1030	N248731638P	2012	Inorganics	XP
	01 1088 *N S*	E248788640	2012		
IC-7	Dionex ICS-1000 Detector(s): Conductivity	3100486	2003	Inorganics (Anions)	XP
IC-8	Dionex ICS-2000 Detector(s): Conductivity	4100279	2004	Inorganics (Perchlorate)	XP

IC-9	Dionex ICS-1000 Detector(s): Conductivity	8120823	2008	Inorganics (Anions)	XP
IC-10	Dionex ICS-1000 Detector(s): Conductivity	8120822	2008	Inorganics (Anions)	XP
IC-11 Dionex ICS-3000	Variable Wave. Detector	8120958	2009	Inorganics (Cr(VI))	XP
	Single Pump	9010071	2009		
	Column Comp.	8120362	2009		
	AS-DV Autosampler	10100586	2009		
IC-12 Dionex ICS-3000	Variable Wave. Detector	9060673	2009	Inorganics (Cr(VI))	XP
	Single Pump	9060616	2009		
	Column Comp.	9010928	2009		
IC-13	Dionex ICS-1100 Detector(s): Conductivity	9120764	2009	Inorganics	XP
IC-14 Dionex ICS-5000	Variable Wave. Detector	9100584		Inorganics	XP
	Single Pump	10100152			
	Column Comp.	10100022			
	AS-DV Autosampler	10100586			
IC-15	Dionex ICS-1100 Detector(s): Conductivity	14038039	2014	Inorganics	XP
	AS-DV Autosampler	14037446	2014		
ACA1	01 3360 Flow Analyzer Detector(s): UV	751893730	2007	Inorganics	XP
UV-4	Thermo Detector(s): UV	3DUK232006	2007	Inorganics	XP
UV-5	Thermo Detector(s): UV	3DUK228001	2007	Inorganics	XP
UV-7	Agilent 8453 Detector(s): Diode Array	CN22807187	2008	Inorganics	XP
UV-8	Agilent 8453 Detector(s): Diode Array	CN22808466	2010	Inorganics	XP
UV-9	Agilent 8453 Detector(s): Diode Array	CN22809400	2013	Inorganics	XP

FT-IR Spectrometer

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
IR-2	P.E. Spectrum Two	89327	2011	LUFT-DRO	Win ?

Automated Extractors

Designation	Manufacturer/Model	Serial Number	Acquired	Department
ASE-1	Dionex ASE-200	98120515	1999	Marine Lab
ASE-2	Dionex ASE-200	99090112	1999	Extractions

ASE-3	Dionex ASE-300	1100597	2002	Extractions
ASE-4	Dionex ASE-300	1100598	2002	Extractions
ASE-5	Dionex ASE-200	07040191	2007	Marine Lab
ASE-6	Dionex ASE-200	07010483	2007	Extractions
ASE-7	Dionex ASE-350	08080167	2010	Extractions
ASE-8	Dionex ASE-350	09020620	2010	Extractions
ASE-9	Dionex ASE-350	10090204	2012	Extractions
ASE-10	Dionex ASE-350	10090546	2012	Extractions

Solid Phase Extraction Unit

Designation	Manufacturer/Model	Serial Number	Acquired	Department
SPE-1	Horizon Tech/ 4790	11-1576	2010	Extractions
SPE-2	Horizon Tech/ 4790	11-1577	2010	Extractions
SPE-3	Horizon Tech/ 4790	11-1578	2010	Extractions
SPE-4	Horizon Tech/ 4790	11-1579	2010	Extractions
SPE-5	Horizon Tech/ 4790	11-1580	2010	Extractions
SPE-6	Horizon Tech/ 4790	11-1581	2010	Extractions
SPE-7	Horizon Tech/ 4790	11-1582	2010	Extractions
SPE-8	Horizon Tech/ 4790	11-1583	2010	Extractions

Misc. Shaker/Rotators

Designation	Manufacturer/Model	Serial Number	Acquired	Department
Rotator 7	Associated Design	3740-12BRE-11	?	Extractions
Rotator 9	Heidolf/REAX 20	120702298	?	Extractions
Rotator 3	Associated Design	1897	?	Extractions
Rotator 2	Associated Design	1282	?	Extractions
Rotator 8	Associated Design	2171	?	Extractions
Rotator 1	Associated Design	1697	?	Extractions
	Thermo MAXQ 2508	105253-3	?	Extractions
	Thermo MAXQ 3000	185905-68	?	Extractions
	Thermo MAXQ 3000	1411080905883	?	Extractions
	Southwest Sci. IncuShaker	1411080905883	?	Extractions
	Thermo MAXQ 3000	1411080398252	?	Extractions
	Thermo MAXQ 3000	141071288276	?	Extractions

Extraction Equip.

Designation	Manufacturer/Model	Serial Number	Acquired	Department
DVP001	Horizon DryVap Cone.	1131	?	Extractions
DVP001	Horizon DryVap Cone.	1377	?	Extractions

	Gerhardt SoxTherm	1803	2014	Extractions
	Gerhardt SoxTherm	1849	2014	Extractions
	Gerhardt SoxTherm	1555	2014	Extractions
	Gerhardt SoxTherm	2032	2014	Extractions
	FMS PowerVap Cone.	E-0235	2014	Extractions
	FMS PowerVap Cone.	E-0236	2014	Extractions

Particle Size Analyzer

Designation	Manufacturer/Model	Serial Number	Acquired	Department	OS
PSA-1	B.C. LS13320	AT39390	2011	Marine Lab	XP

Gas Mixer

Designation	Manufacturer/Model	Serial Number	Acquired	Department
Mixer 1	Environics Series 2000	1490	1995	Air
Mixer 2	Environics Series 2000	4618	2009	Air

Wet Chemistry

Designation	Manufacturer/Model	Serial Number	Acquired	Department
PH 1	Fisher Accumet Basic	176	1997	10
PH 4	Fisher Accumet Basic	AB81210901	2004	10
ISE1	Thermo Sci. Orion Star	E03578	2011	10
SC 2	Amber Science 3082	108039	2001	10
SGS	Amber Science 2052	1106043	2011	10
TUR 3	HF Scientific Micro 100	301269	2003	10
10 01	Fisher ISOTemp Oven	40300024	2005	10
10 07	Fisher ISOTemp 6509 Oven	1580080398315	2012	10
10 08	Fisher ISOTemp 6509 Oven	1580080398313	2012	10
10 10	Fisher ISOTemp 6509 Oven	613128-624	2013	10
10 13	Fisher ISOTemp 6509 Oven	612568-551	2013	10
Thermo 01	Thermo Sci. FD1535M	152991101110630	2013	10
BOD 1	Thermo Auto. 10060000	A0067	2003	10
IC 04	Fisher 11-679-25C Incubator	2018080505659	2012	10
Balance 13	Fisher A-250	25275	1997	10
Balance 14	Ohaus E02140	11120030978	1998	10
Balance 13	Sartorious ME 235P	16503597	2004	10

	Fisher low temp incubator	2018080505659	10

Referigerators/Incubators

Designation	Manufacturer/Model	Serial Number	Acquired	Department
	Fisher low temp incubator	2018080505659	?	10
FG-23	True Manufacturing T-23	7251068	?	Extractions
FG-24	True Manufacturing T-23	1-3453096	?	Extractions
FG-25	True Manufacturing T-23	1-3496118	?	Extractions

Lab Water Systems

Designation	Manufacturer/Model	Serial Number	Acquired	Department
	Barnstead EasyPure RoDi	1332060134165		LUFT
	Barnstead Diamond RO	1266071286485		VOA
	Barnstead NANOpure 7143	491510-421		VOA
	Barnstead E-Pure 04641	1090090114250		10
	Barnstead E-Pure 04641	229758-32		LUFT D

Glassware Drying Kilns

Designation	Manufacturer/Model	Serial Number	Acquired	Department
Kiln-1	LL Kilns DaVinci	T3427-D-480-3P	2013	
Kiln-2	LL Kilns DaVinci	090111-F-CKG	2012	

Misc. Ovens

Designation	Manufacturer/Model	Serial Number	Acquired	Department
VOA-1	VWR 1325F	4094404		VOA
VOA-2	VWR 1350FM	400503		VOA
VOA-3	VWR 1325F	6109006		VOA
10-06	VWR 1350FM	1101302		VOA

IT Equip.

Designation	Manufacturer/Model	Serial Number	Acquired	Department
NAS-1	EMC CLARiiON Array	AMP00103500986	2010	Lincoln
NAS-2	EMC CLARiiON Array	AMP00103500987	2010	Lampson
	HP ProCurve switch 5406zl	SG04SU23M		Lampson
	HP ProCurve switch 5406zl	1N030TI1YZ		Lincoln
	Cisco 3800 router	FTX1143A4GP		Lampson
	Cisco 3800 router	FTX1143A4GQ		Lincoln
Server	Dell PowerEdge R900	FQBFDFI		Lampson

Server	Dell PowerEdge R900	3T8TKH1		Lincoln
Server	Dell PowerEdge 2650	JZR6F61		Lincoln
Server	Dell PowerEdge 2950	8MJWKH1		Lincoln
Server	Dell PowerEdge R720	5JB2TW1		Lincoln
UPS Batt. B/U	APC Symetra LX	ZA0624031279		Lampson
UPS Batt. B/U	Powerware PW9170	660C120AAAAAAAP		Lincoln

~~QUALITY SYSTEMS MANUAL FOR ENVIRONMENTAL ANALYTICAL SERVICES~~

~~Ia/science~~

~~* nvironmental~~

~~6'aboratories, Inc.~~

~~Version 5.3~~
~~July 2010~~

~~Prepared By~~

~~Calscience Environmental Laboratories, Inc.~~
~~7440 Lincoln Way~~
~~Garden Grove, CA 92841-1427~~
~~Telephone: (714) 895-5494~~
~~Facsimile: (714) 894-7501~~

~~Based On~~
~~National Environmental Laboratory Accreditation Program (NELAP)~~
~~Chapter 5 (Quality Systems)~~
~~NELAC Standard Effective July 01,2004~~

Larry Lem
QUALITY ASSURANCE MANAGER

~~Virginia Huang~~
~~TECHNICAL DIRECTOR~~

Steven L. Lane
~~LABORATORY DIRECTOR~~

TABLE OF CONTENTS
QUALITY SYSTEMS MANUAL

PREFACE TO THE QUALITY SYSTEMS MANUAL 4
ACROYNM LIST 5
QUALITY SYSTEMS 6
1.0 SCOPE 6
2.0 REFERENCES 6
3.0 DEFINITIONS 6
4.1 ORGANIZATION AND MANAGEMENT 7
4.2 Legal Definition of Laboratory 7
4.3 Organization 7
5.1 QUALITY SYSTEM – ESTABLISHMENT, AUDITS, ESSENTIAL QUALITY CONTROLS, AND DATA VERIFICATION 8
5.2 Establishment 8
5.3 Quality Systems Manual (QSM) Elements 9
a) Policy Statement 9
b) Organization and Management Structure 10
c) Relationships 10
d) Records Procedures 10
e) Job Descriptions, Roles and Responsibilities 13
f) Approved Siganatories 21
g) Policies on Traceability of Measurements 21
h) List of Methods 21
i) Review of New Work 21
j) Calibration Procedures 21
k) Sample Receiving and Handling 21
l) Major Equipment 22
m) Calibration, Verification and Maintenance of Equipment 22
n) Verification Practices 22
o) Corrective Actions 23
p) Permitting Exceptions and Departures 24
q) Complaints 24
r) Confidentialty / Proprietary Rights 24
s) Audits and Data Review 24
t) Personnel Experience and Training 25
u) Ethics Policy Statement 25
v) Reporting of Results 27
w) Table of Contents, References, Glossaries and Appendices 29
5.4 Audits 29
5.3.1 Internal Audits 29
5.3.2 Managerial Review 29
5.3.3 Audit Review 29
5.3.4 Performance Audits 30
5.3.5 Corrective Actions 30
5.4 Essential Quality Control Procedures 30
6.1 PERSONNEL 31
6.2 General Requirements for Laboratory Staff 31
6.3 Laboratory Management Responsibilities 32
6.4 Records 33
7.1 PHYSICAL FACILITIES – ACCOMMODATION AND ENVIRONMENT 33
7.2 Environment 33
7.3 Work Areas 33
8.0 EQUIPMENT AND REFERENCE MATERIALS 34
9.1 MEASUREMENT TRACEABILITY AND CALIBRATION 35

9.2 General Requirements 35
9.3 Traceability of Calibration 35
9.4 Reference Standards 35
9.5 Calibration 35
9.5.1 Support Equipment 36
9.5.2 Instrument Calibration 36
10.1 TEST METHODS AND STANDARD OPERATING PROCEDURES 38
10.2 Methods Documentation 38
10.2.1 Standard Operating Procedures (SOPs) Administrative 38
10.2.2 Standard Operating Procedures (SOPs) Analytical 39
10.3 Exceptionally Permitting Departures from Documented Policies / Procedures 40
10.4 Test Methods 41
10.5 Demonstration of Capability 41
10.6 Sample Aliquots 41
10.7 Data Verification 41
10.8 Documentation and Labeling of Standards and Reagents 41
10.9 Computers and Electronic Data Related Requirements 41
11.1 SAMPLE HANDLING, SAMPLE ACCEPTANCE POLICY AND SAMPLE RECEIPT 42
11.2 Sample Tracking 42
11.3 Sample Acceptance Policy 42
11.4 Sample Receipt Protocols 43
11.5 Storage Conditions 44
11.6 Sample Disposal 45
12.1 RECORDS 45
12.2 Record Keeping System and Design 45
12.3 Records Management and Storage 46
12.4 Laboratory Sample Tracking 46
12.4.1 Sample Handling 46
12.4.2 Laboratory Support Activities 47
12.4.3 Analytical Records 47
12.4.4 Administrative Records 48
13.0 LABORATORY REPORT FORMAT AND CONTENTS 48
14.0 SUBCONTRACTING ANALYTICAL SAMPLES 50
15.0 OUTSIDE SUPPORT SERVICES AND SUPPLIES 50
16.0 INQUIRIES AND COMPLAINTS 50
APPENDIX B - GLOSSARY 54
APPENDIX C - DEMONSTRATION OF CAPABILITY 63
C.1 PROCEDURE FOR DEMONSTRATION OF CAPABILITY 63
C.2 CERTIFICATION STATEMENT 64
APPENDIX D - ESSENTIAL QUALITY CONTROL REQUIREMENTS 66
D.1 CHEMICAL TESTING 66
D1.1 Positive and Negative Controls 66
D1.2 Analytical Variability / Reproducability 67
D1.3 Method Evaluation 67
D1.4 Analytical Measurement Uncertainty 67
D1.5 Detection Limits 69
D1.6 Data Reduction 70
D1.7 Quality of Standards and Reagents 70
D1.8 Selectivity 70
D1.9 Constant and Consistent Test Conditions 71

~~PREFACE TO THE QUALITY SYSTEMS MANUAL~~

~~Purpose~~

~~The purpose of this document is to provide implementation guidance on the establishment and management of quality systems for Calscience Environmental Laboratories, Inc and is based on the National Environmental Laboratory Accreditation Conference's (NELAC) Quality System requirements.~~

~~Background~~

~~To be accredited under the National Environmental Laboratory Accreditation Program (NELAP), laboratories shall have a comprehensive quality system in place, the requirements for which are outlined in NELAP Chapter 5 (Quality Systems).~~

~~Project Specific Requirements~~

~~Project-specific requirements or regulations may supersede requirements contained in this manual. The laboratory bears the responsibility for meeting all **State requirements**. Nothing in this document relieves the laboratory from complying with contract requirements, or with **Federal, State, and/or local regulations**.~~

~~Results and Benefits~~

- ~~**Standardization of Processes** – Because this manual provides the laboratory with a comprehensive set of requirements that meet the needs of many clients, as well as the NELAP, the laboratory may use it to create a standardized quality system. Ultimately, this standardization saves laboratory resources by establishing one set of consistent requirements for all environmental work. Primarily, the laboratory bears the responsibility for meeting all State requirements as outlined in their respective certification programs.~~

- ~~**Deterrence of Improper, Unethical, or Illegal Actions** – Improper, unethical, or illegal activities committed by only a few laboratories have implications throughout the industry, with negative impacts on all laboratories. This manual establishes a minimum threshold program for all laboratories to use to deter and detect improper, unethical, or illegal actions.~~

- ~~**Foundations for the Future** – A standardized approach to quality systems, shared by laboratories and the NELAP, paves the way for the standardization of other processes. For example, this manual might serve as a platform for a standardized strategy for Performance Based Measurement System (PBMS) implementation.~~

~~Document Format~~

~~This Calscience Environmental Laboratories, Inc. (Calscience) *Quality Systems Manual* (QSM) is designed to implement NELAP Chapter 5 (Quality Systems) and the NELAP Chapter 5 document serves as the primary text for this implementation manual. This Calscience QMS is also a complement to NELAP chapter 5. The section numbering has been changed from that of NELAP Chapter 5 as the manual is meant to be a stand-alone document. The number 5 has been eliminated from all section and subsection headings. However, second-level numbering has been retained to ensure maintenance of a parallel organization to the NELAC Quality Systems requirements. For instance, Section 5.4.2 in NELAP Chapter 5 (referencing Chapter 5 of the NELAC standards) is equivalent to Section 4.2 in this manual. In addition, there is one set of NELAC appendices.~~

ACROYNM LIST

ºC: Degrees Celsius
ANSI/ASQC: American National Standards Institute/American Society for Quality Control
ASTM: American Society for Testing and Materials
CAS: Chemical Abstract Service
CCV: Continuing calibration verification
CFR: Code of Federal Regulations
CLP: Contract Laboratory Program
COC: Chain of custody
CV: Coefficient of variation
DO: Dissolved oxygen
DOC: Demonstration of capability
DQOs: Data quality objectives
EPA: Environmental Protection Agency
g/L: Grams per liter
GC/MS: Gas chromatography/mass spectrometry
ICP-MS: Inductively coupled plasma-mass spectrometer
ICV: Initial calibration verification
ID: Identifier
ISO/IEC: International Standards Organization/International Electrotechnical Commission
LCS: Laboratory control sample
LCSD: Laboratory control sample duplicate
LQMP: Laboratory Quality Management Plan
MDL: Method detection limit
mg/kg: Milligrams per kilogram
MS: Matrix spike
MSD: Matrix spike duplicate
NELAC: National Environmental Laboratory Accreditation Conference
NELAP: National Environmental Laboratory Accreditation Program
NIST: National Institute of Standards and Technology
OSHA: Occupational Safety and Health Administration
PBMS: Performance Based Measurement System
PC: Personal computer
PCBs: Polychlorinated biphenyls
PT: Proficiency testing
QA: Quality assurance
QAD: Quality Assurance Division (EPA)
QAMS: Quality Assurance Management Section
QAPP: Quality Assurance Project Plan
QSM: Quality Systems Manual
QC: Quality control
RL: Reporting limit
RPD: Relative percent difference
RSD: Relative standard deviation
SD: Serial dilutions
SOP: Standard operating procedure
TSS: Total suspended solids
UV: Ultraviolet
VOC: Volatile organic compound

QUALITY SYSTEMS

Quality Systems include all quality assurance (QA) policies and quality control (QC) procedures that are delineated in a Quality Systems Manual (QSM) and followed to ensure and document the quality of the analytical data. Calscience, accredited under the National Environmental Accreditation Program (NELAP), assures implementation of all QA policies and the applicable QC procedures specified in this Manual. The QA policies, which establish essential QC procedures, are applicable to all areas of Calscience, regardless of size and complexity.

The intent of this document is to provide sufficient detail about quality management requirements so that all accrediting authorities evaluate laboratories consistently and uniformly.

The National Environmental Laboratory Accreditation Institute (TNI) is committed to the use of Performance Based Measurement Systems (PBMS) in environmental testing and provides the foundation for PBMS implementation in these standards. While this standard may not currently satisfy all the anticipated needs of PBMS, NELAC will address future needs within the context of State statutory and regulatory requirements and the finalized EPA implementation plans for PBMS.

Chapter 5 is organized according to the structure of ISO/IEC 17025, 1999. Where deemed necessary, specific areas within this Chapter may contain more information than specified by ISO/IEC 17025.

All items identified in this QSM shall be available for on-site inspection or data audit.

1.0 SCOPE

a) This QSM sets the general requirements that Calscience must successfully demonstrate to be recognized as competent to perform specific environmental tests.

b) This QSM includes additional requirements and information for assessing competence or for determining compliance by the organization or accrediting authority that grants approval.

   If more stringent standards or requirements are included in a mandated test method or by regulation, the laboratory demonstrates that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed.

c) Calscience uses this QSM in the development and implementation of its quality systems. Accreditation authorities use this NELAC based standard to assess the competence of environmental laboratories.

2.0 REFERENCES

See Appendix A.

3.0 DEFINITIONS

The relevant definitions from ISO/IEC Guide 2, ANSI/ASQC E-4, 1994, the EPA "Glossary of Quality Assurance Terms and Acronyms," and the *International vocabulary of basic and general terms in metrology (VIM)* are applicable. The most relevant is quoted in Appendix A, Glossary, of Chapter 1 of NELAC, together with further definitions applicable for the purposes of this Standard.

~~4.1 ORGANIZATION AND MANAGEMENT~~

~~4.2 Legal Definition of Laboratory~~

~~Calscience is legally definable as evidenced by its business license, and current California Department of Health Services Environmental Laboratory Accreditation Program (CADHS ELAP) certificate. It is organized and operates in such a way that its facilities meet the requirements of the Standard. See the graphical presentations of the Organization and QA responsibility in Figures 1 and 2, respectively.~~

~~4.3 Organization~~

~~Calscience:~~

~~a) Has a managerial staff with the authority and resources necessary to discharge their duties;~~

~~b) Has processes to ensure that its personnel are free from any commercial, financial and other undue pressure that adversely affect the quality of their work;~~

~~c) Is organized in such a way that confidence in its independence of judgment and integrity is maintained at all times;~~

~~d) Specifies and documents the responsibility, authority, and interrelationship of all personnel who manage, perform or verify work affecting the quality of calibrations and tests;~~

~~Such documentation includes:~~

~~1) A clear description of the lines of responsibility in the laboratory, and is proportioned such that adequate supervision is ensured, and~~

~~2) Job descriptions for all positions.~~

~~e) Provides supervision by persons familiar with the calibration or test methods and procedures, the objective of the calibration or test, and the assessment of the results.~~

~~The ratio of supervisory to non-supervisory personnel ensures adequate supervision and adherence to laboratory procedures and accepted techniques.~~

~~f) Has a technical director who has overall responsibility for the technical operation of Calscience.~~

~~The technical director certifies that personnel who perform the tests for which the laboratory is accredited have the appropriate educational and/or technical background. Such certification is documented.~~

~~The technical director meets the requirements specified in the Accreditation Process. (See NELAC Section 4.1.1.1.)~~

~~g) Has a quality assurance manager who has responsibility for the quality system and its implementation.~~

~~The quality assurance officer has direct access to the technical director and to the highest level of management at which decisions are made regarding laboratory policy or resources.~~

~~The quality assurance manager (and/or his/her designees):~~

1) Serves as the focal point for QA/QC activities, and is responsible for the oversight and/or review of quality control data;

2) Has functions independent from laboratory operations for which she/he has quality assurance oversight;

3) Is able to evaluate data objectively and perform assessments without outside (e.g., managerial) influence;

4) Has documented training and/or experience in QA/QC procedures and is knowledgeable in the quality system, as defined under NELAC;

5) Has a general knowledge of the analytical test methods for which data review is performed;

6) Arranges for and conduct internal audits as per Calscience QSM section 5.3 annually; and

7) Notifies Calscience management of deficiencies in the quality system and monitors corrective action.

h) Nominates, by way of the "Alternates List," deputies in case of absence of the technical director and/or the quality assurance officer;

i) Calscience makes every effort to ensure the protection of its clients' information as confidential and proprietary.
   ii) Calscience is sensitive to the fact that much of the analytical work performed for clientele may be subject to litigatory processes. Calscience, therefore, holds all information in strict confidence with laboratory release only to the client.
   iii) Information released to entities other than the client is performed only upon written request from the client.
   iv) Due to the investigative nature of most site assessments, analytical information may become available to regulatory agencies or other evaluating entities during site assessment of the laboratory for the specific purpose of attaining laboratory certifications, accreditations, or evaluation of laboratory qualification for future work. During these occurrences, the laboratory will make every effort to maintain the confidence of client specific information.

j) For purposes of qualifying for and maintaining accreditation, participates in a proficiency test program as outlined in Chapter 2 of NELAC. Results of Calscience's performance in rounds of proficiency testing are available by request.

5.1 QUALITY SYSTEM – ESTABLISHMENT, AUDITS, ESSENTIAL QUALITY CONTROLS, AND DATA VERIFICATION

5.2 Establishment

Calscience establishes and maintains quality systems based on the required elements contained in this Manual and appropriate to the type, range and volume of environmental testing activities it undertakes.

a) The elements of this quality system are documented in this quality manual.

b) The quality documentation is available for use by all laboratory personnel.

c) The laboratory defines and documents its policies and objectives for, and its commitment to accepted laboratory practices and quality of testing services.

d) The laboratory management ensures that these policies and objectives are documented in the quality manual and are communicated to, understood and implemented by all laboratory personnel concerned.

i. All staff members are issued a copy of the quality manual at the commencement of work at Calscience. Employees read and endorse the following statement when they receive their quality manual: "By signature below, I acknowledge that I have received a copy of Revision [number] of Calscience's Quality Assurance Program Manual dated [effective date of the subject manual]. Furthermore, I agree to read and abide by the policies contained therein."

ii. A controlled copy of the quality manual is also available at the designated data reduction areas.

e) The quality manual is maintained current under the responsibility of the quality assurance officer. This manual is reviewed on an annual basis or more frequently, and revised as necessary. The review process begins in January of each year, and concludes on/before March of the same year. Where no revision is required, the manual is reissued in its entirety and review is scheduled for January of the following year.

5.3 Quality Systems Manual (QSM) Elements

This quality systems manual and related quality documentation state Calscience's policies and operational procedures established in order to meet the requirements of this Standard.

This Manual lists on the title page: a document title; the laboratory's full name and address; the name, address, and telephone number of individuals responsible for the laboratory; the name of the quality assurance manager; the identification of all major organizational units that are covered by this quality manual and the effective date of the version.

This quality manual and related quality documentation also contains:

a) A quality ***policy statement***, including objectives and commitments, by top management;

i. Calscience Environmental Laboratories, Inc. (Calscience) is committed to providing the highest quality environmental analytical services available. To ensure the production of scientifically sound, legally defensible data of known and proven quality, an extensive Quality Assurance program has been developed and implemented. This document, Calscience's Quality Systems Manual for Environmental Analytical Services, presents an overview of the essential elements of our Quality Assurance program. Calscience has modeled this systems manual after EPA guidelines as outlined in "Guidance for Quality Assurance Project Plans (EPA QA/G-5)", Office of Monitoring Systems and Quality Assurance, Office of Research and Development, U.S. EPA, EPA/240-R-02/009 December 2002. Calscience's QA Program is closely monitored at the Corporate, Divisional, and Group levels, and relies on clearly defined objectives, well-documented procedures, a comprehensive quality assurance/quality control system, and management support for its effectiveness.

ii. This QA Program Systems Manual is designed to control and monitor the quality of data generated at Calscience. The essential elements described herein are geared toward generating data that is in compliance with federal regulatory requirements specified under the Clean Water Act, the Safe Drinking Water Act, the Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation, and Liability Act, and applicable amendments, and state and DoD/DoE equivalents. Although the quality control requirements of these various programs are not completely consistent, each of the programs base data quality

~~judgments on the following three types of information, the operational elements of each being described elsewhere in this manual.~~

- ~~Data which indicates the overall qualifications of the laboratory to perform environmental analyses;~~
- ~~Data which measures the laboratory's daily performance using a specific method; and~~
- ~~Data which measures the effect of a specific matrix on the performance of a method.~~

~~iii. It is important to note that the QA guidelines presented herein will always apply unless adherence to specific Quality Assurance Project Plans (QAPPs) or client and/or regulatory agency specific requirements are directed. In these cases, the elements contained within specified direction or documentation shall supersede that contained herein.~~

~~iv. This manual is a living document subject to periodic modifications to comply with regulatory changes and technological advancements. All previous versions of this document are obsolete. Users are urged to contact Calscience to verify the current revision of this document.~~

~~b) The organization and management structure of the laboratory, its place in any parent organization and relevant organizational charts;~~

~~See Figure 1 Organizational Chart, and Figure 2 QA Responsibility Chart.~~

~~c) The relationship between management, technical operations, support services and the quality system;~~

~~d) Procedures to ensure that all records required under the NELAP are retained, as well as procedures for control and maintenance of documentation through a document control system which ensures that all standard operating procedures, manuals, or documents clearly indicate the time period during which the procedure or document was in force;~~

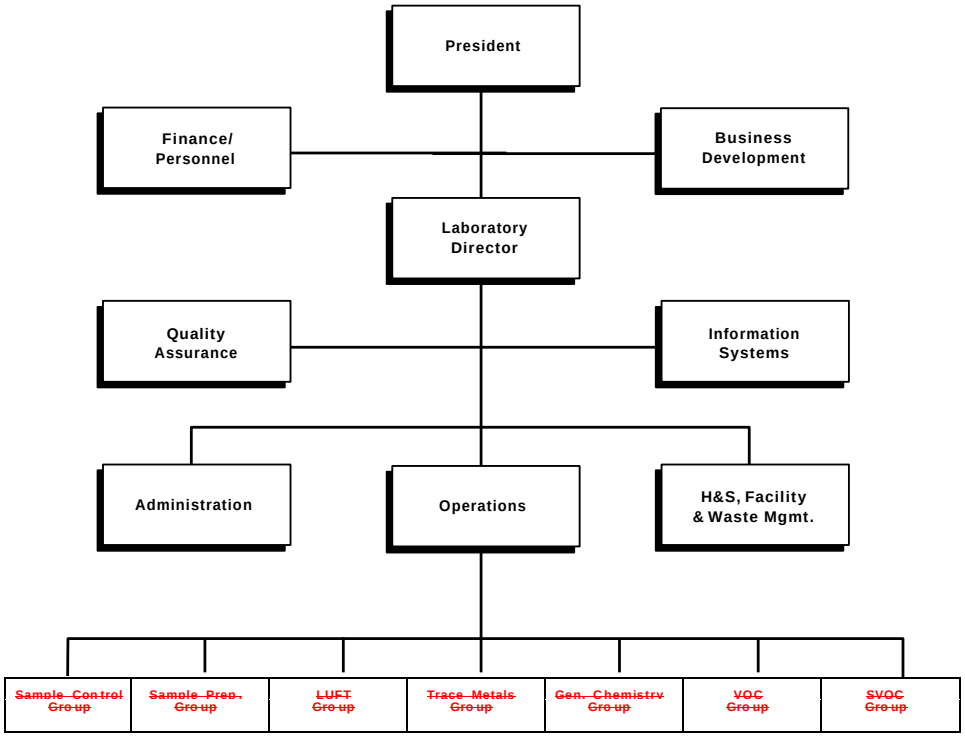
~~i. Ensuring a high quality work product in the environmental laboratory not only requires adherence to the quality issues discussed in the previous sections, but also requires the ability to effectively archive, restore, and protect the records that are generated.~~

~~ii. Procedures are in place to ensure that all records are retained. In addition, a documentation control system is employed to clearly indicate the time period during which a standard operating procedure, manual, or document was in force. These procedures are outlined in the laboratory standard operating procedure SOP-T002.~~

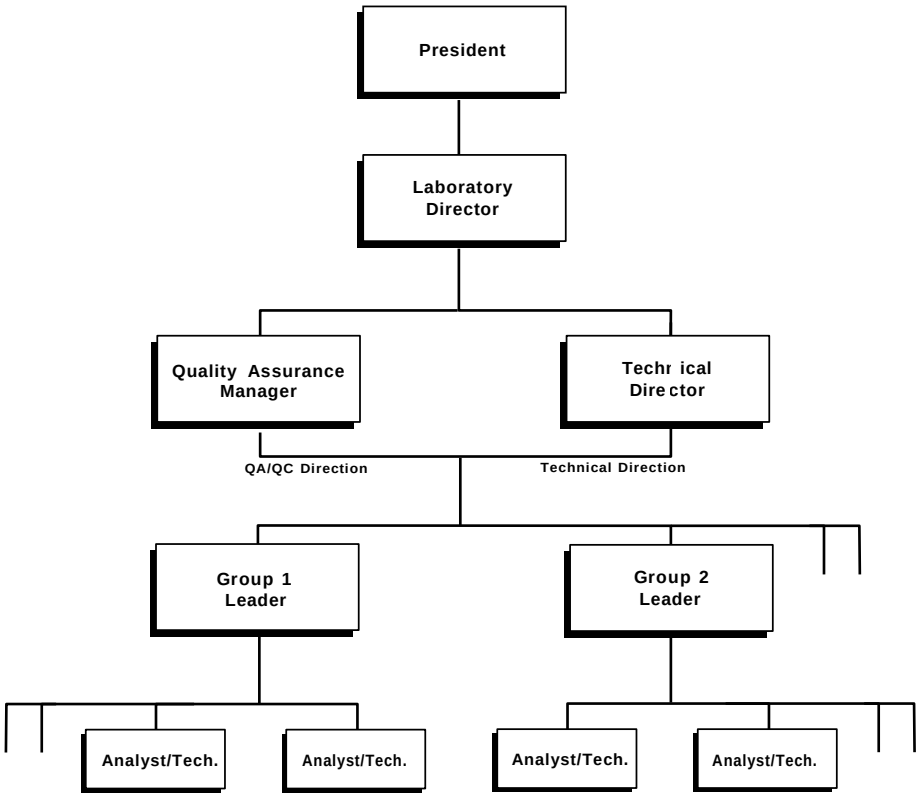
~~iii. All laboratory logbooks, instrument response printouts, completed analytical reports, chain-of-custodies, and laboratory support documentation are stored for a minimum of five years. Project specific data are stored in sequentially numbered project files and include copies of the applicable laboratory logbooks, instrument response printouts, completed analytical reports, chain-of-custodies, and any other pertinent supporting documentation.~~

~~iv. When complete, the project specific data are high speed optically scanned and transformed into digital CD media. Additional copies of these records are created at the time of scanning and are stored off-site for protection of the data. These records are stored for a minimum of five years.~~

~~FIGURE 1: ORGANIZATIONAL CHART~~



~~FIGURE 2: QA RESPONSIBILITY CHART~~



v. Access to all systems is limited by use of log-in and password protection and is maintained by the system administrator.

There are four forms of electronic data that are generated in the laboratory and a synopsis of the archiving of these data follows:

LIMS Database
Backup frequency: Daily
Backup media: Hard Disk
Backup software: MS SQL Server Backup
Backup versions kept: Ten previous versions
Onsite copy: Redundancy by using mirrored hard drive
Instrument Data
Backup frequency: Weekly
Backup media: Quantum 4000 DLT Raid Tape and DLT Tape
Backup software: Computer Associates ArcServIT
Backup versions kept: All versions
Offsite copy: One

Manual Data
Backup frequency: Weekly
Backup media: Quantum 4000 DLT Raid Tape and DLT Tape
Backup software: Computer Associates ArcServIT
Backup versions kept: All versions
Offsite copy: One

Hard Copy Data
Backup media: Digital CD
Backup software: Xerox Pagis
Backup versions kept: All versions
Offsite copy: One

vi. All electronic records are stored for a minimum of five years.

e) Job Descriptions, Roles and Responsibilities

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to their job function and the quality program as a whole.

The responsibility for quality lies with every employee at Calscience. As such, all employees have access to the Quality Assurance Manual and are responsible for knowing the content of this manual and upholding the standards therein. Each employee is expected to conduct themselves in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs. The following descriptions define the primary roles and their relationship to the Quality Assurance Program.

Laboratory Director:

Calscience's Laboratory Director, through its President, is the final authority on all issues dealing with data quality and has the authority to require that procedures be amended or discontinued, or analytical results voided or repeated. He or she also has the authority to suspend or terminate employees on the grounds of non-compliance with QA/QC procedures. In addition, the Laboratory Director:

- ~~Ensures that Calscience remains current with all regulations which affect operations and disseminate all such changes in regulatory requirements to the QA Manager, Technical Director, and Group Leaders;~~
- ~~Provide one or more Technical Directors for the appropriate fields of testing. The name(s) of the Technical Director will be included in the national database. (The Laboratory Director may also act in the Technical Director capacity.) If the Technical Director is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director must designate another full time staff member meeting the qualifications of the Technical Director to temporarily perform this function. If the absence exceeds 65 consecutive calendar days, the primary accrediting authority must be notified in writing;~~
- ~~Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented;~~
- ~~Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work;~~
- ~~Oversees the development and implementation of the QA Program which assures that all data generated will be scientifically sound, legally defensible, and of known quality;~~
- ~~In conjunction with the QA Manager, conducts annual reviews of the QA Program;~~
- ~~Oversees the implementation of new and revised QA procedures to improve data quality;~~
- ~~Ensures that appropriate corrective actions are taken to address analyses Identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director;~~
- ~~Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to;~~
- ~~Oversees all laboratory accreditation efforts; and~~
- ~~Oversees in-house training on quality assurance and control.~~

~~Operations Manager:~~

~~The Operations Manager manages and directs the analytical production sections of the laboratory. He or she reports directly to the Laboratory Director and assists in determining the most efficient instrument utilization. More specifically, they:~~

- ~~Evaluates the level of internal/external non-conformances for all departments;~~
- ~~Continuously evaluates production capacity and improves capacity utilization;~~
- ~~Continuously evaluates turnaround time and addresses any problems that may hinder meeting the required and committed turnaround time from the various departments;~~
- ~~Develops and improves the training of all analysts in cooperation with the Laboratory Director, QA Manager and Group Leaders, and in compliance with regulatory requirements;~~
- ~~Ensures that scheduled instrument maintenance is completed;~~
- ~~Is responsible for efficient utilization of supplies;~~
- ~~Constantly monitors and modifies the processing of samples through the departments; and~~
- ~~Maintains sufficient personnel, equipment and supplies to achieve production goals.~~

~~Quality Assurance Manager:~~

~~The QA Manager has full authority through the Laboratory Director in matters dealing within the laboratory. The QA Manager can make recommendations to the Laboratory Director regarding the suspension or termination of employees on the grounds of non-compliance with QA/QC procedures. An alternate QA Manager is always assigned. In the absence of the primary designate, the alternate will act in the QA Manager's capacity with the full authority of the position as allowed by Calscience governing documents. In addition, the QA Manager performs the following:~~

- ~~Maintains and updates the QAM on an annual basis;~~
- ~~Implements Calscience's QA Program;~~
- ~~Monitors the QA Program within the laboratory to ensure complete compliance with its objectives, QC procedures, holding times, and compliance with client or project specific data quality objectives;~~
- ~~Distributes performance evaluation (PE) samples on a routine basis to ensure the production of data that meets the objectives of its QA Program;~~
- ~~Maintains all SOPs used at Calscience;~~
- ~~Maintains records and archives of all PE results, audit comments, and customer inquiries concerning the QA program;~~
- ~~Performs statistical analyses of QC data and establish controls that accurately reflect the performance of the laboratory;~~
- ~~Conducts periodic performance and system audits to ensure compliance with the elements of Calscience's QA Program;~~
- ~~Prescribes and monitors corrective action;~~
- ~~Serves as in-house client representative on all project inquiries involving data quality issues;~~
- ~~Coordinates data review process to ensure that thorough reviews are conducted on all project files;~~
- ~~Develops revisions to existing SOPs;~~
- ~~Reports the status of in-house QA/QC to the Laboratory Director;~~
- ~~Maintains records and archives of all QA/QC data including but not limited to method detection limit (MDL) studies, accuracy and precision control charts, and completed log books; and~~
- ~~Conducts and/or otherwise ensures that an adequate level of QA/QC training is conducted within the laboratory.~~

~~Quality Assurance Assistant:~~

~~The QA Assistant reports to the QA Manager and performs the following functions:~~

- ~~Assists the QA Manager and lab staff with internal audits, corrective action review and overall implementation of the QA program;~~
- ~~Generates and reviews, in conjunction with the QA Manager, Control Charts and Method Detection Limit (MDL) studies;~~
- ~~Reviews and revises SOPs as needed;~~
- ~~Distributes new SOPs to all applicable lab areas.~~

~~Business Development Director:~~

~~The Business Development Director reports to the Laboratory Director and serves as the interface between the laboratory's technical departments and the laboratory's clients. The staff consists of the Project Management team, Business Development team and satellite office Operations Managers. With the overall goal of total client satisfaction, the functions of this position are outlined below:~~

- ~~Technical training and growth of the Project Management team;~~
- ~~Business liaison for the Project Management team;~~
- ~~Human resource management of the Project Management team;~~
- ~~Responsible for the review and negotiation of client contracts and terms and conditions;~~
- ~~Responsible for establishing standard fee schedules for the laboratory;~~
- ~~Responsible for preparation of proposals and quotes for clients and client prospects;~~
- ~~Accountable for response to client inquiries concerning sample status;~~

- ~~Responsible for assistance to clients regarding the resolution of problems concerning Chains-of-Custody;~~
- ~~Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory;~~
- ~~Notifying the department managers of incoming projects and sample delivery schedules;~~
- ~~Accountable to clients for communicating sample progress in daily status meeting with agreed-upon due dates;~~
- ~~Responsible for discussing with client any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff;~~
- ~~Responsible for staff familiarization with specific quotes, sample log-in review, and final report completeness; and~~
- ~~Ensure that all non-conformance conditions are reported to the QA Manager, Operations Manager, and/or Laboratory Director via the Corrective Action process.~~

~~Technical Directors:~~

~~The Technical Director(s) report directly to the Laboratory Director. They are accountable for all analyses and analysts within their scope of responsibility. The scope of responsibility ranges from the new-hire process and existing technology through the ongoing training and development programs for existing analysts.~~

~~Specific responsibilities include, but are not limited to:~~

- ~~Coordinating, writing, and reviewing test methods and SOPs, with regard to quality, integrity, regulatory requirements and efficient production techniques;~~
- ~~Reviewing and approving, with input from the QA Manager and Business Development Manager, business proposals, in accordance with established procedures for the review of requests and contracts. This procedure addresses the adequate definition of methods to be used for analysis and any limitations, the laboratory's capability and resources, the client's expectations. Differences are resolved before the contract is signed and work begins. A system documenting any significant changes is maintained, as well as pertinent discussions with the client regarding his requirements or the results of the analyses during the performance of the contract. All work subcontracted by the laboratory must be approved and requested by the client. Any deviations from the contract must be disclosed to the client. Once the work has begun, any amendments to the contract must be discussed with the client and so documented;~~
- ~~Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process and providing technical and troubleshooting expertise on routine and unusual or complex problems;~~
- ~~Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis; and~~
- ~~Coordinates audit responses with supervisors and QA Manager.~~

~~Group Leaders:~~

~~The Group Leaders report directly to the Operations Manager. They have the authority to accept or reject data based on pre-defined QC criteria. In addition, with the approval of the QA Manager, the Group Leaders may accept data that falls outside of normal QC limits if, in his or her professional judgment, there are technical justifications for the acceptance of such data. The circumstances must be well documented and any need for corrective action identified must be defined and initiated. The authority of the Group Leaders in QC related matters results directly from the QA Manager. The Group Leaders also~~

- ~~Actively support the implementation of Calscience's QA Program;~~
- ~~Ensure that their employees are in full compliance with Calscience's QA Program;~~
- ~~Maintain accurate SOPs (by reviewing and implementing updates) and enforce routine compliance with SOPs;~~
- ~~Conduct technical training of new staff and when modifications are made to existing procedures;~~
- ~~Maintain a work environment which emphasizes the importance of data quality;~~
- ~~Ensure all logbooks are current, reviewed and properly labeled or archived;~~
- ~~Ensure that all non-conformance conditions are reported to the QA Manager, Operations Manager, and/or Laboratory Director via Corrective Action reports;~~
- ~~Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Director, Operations Manager, and/or QA Manager. Each is responsible for 100% of the data review and documentation, nonconformance issues, and the timely and accurate completion of performance evaluation samples and MDLs, for his/her department;.~~
- ~~Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and using appropriate documentation techniques;.~~
- ~~Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He or she is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments;~~
- ~~Provide written responses to external and internal audit issues; and~~
- ~~Provide support to all levels of Calscience Management.~~

~~Sample Control Group Leader:~~

~~The Sample Control Group Leader reports to the Operations Manager. The responsibilities are outlined below:~~

- ~~Direct the receipt, handling, labeling and proper storage of samples in compliance with laboratory procedures and policies;~~
- ~~Oversee the training of Sample Control Technicians regarding the above items;~~
- ~~Direct the logging of incoming samples into the LIMS and ensure the verification of data entry from login;~~
- ~~Oversee all sample courier operations;~~
- ~~Acts as a liaison between Project Managers and Analytical departments in respect to handling rush orders and resolving inconsistencies and problems with chain-of-custody forms, and routing of subcontracted analyses; and~~
- ~~Oversees the handling of samples in accordance with the Waste Disposal SOP, the Hazardous Waste Contingency Plan in the Chemical Hygiene/Safety Manual, and the U. S. Department of Agriculture requirements.~~

~~Laboratory Analysts~~

~~Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the group leader or supervisor. The responsibilities of the analysts are listed below:~~

- ~~Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, the Data Integrity Policy, and project-specific QA plans honestly, accurately, timely, safely, and in the most cost-effective manner.~~
- ~~Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on work sheets, bench sheets, preparation logbook, and/or a Non-Conformance report;~~

- ~~Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to the Group Leader and/or the QA Manager;~~
- ~~Perform 100% review of the data generated prior to entering and submitting for secondary level review; and~~
- ~~Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.~~

~~Laboratory Technicians:~~

- ~~Prepare samples for analysis by weighing, extracting or digesting, filtering, or concentrating samples; and~~
- ~~Prepare method specific QC Samples with each preparation batch. All personnel must adhere to all QC procedures specified in the analytical method and in accordance to procedures or policies and are responsible for the full documentation of these procedures.~~

~~Project Manager:~~

~~The Project Manager normally reports to the Senior Project Manager and/or Business Development Director. Typical responsibilities include:~~

- ~~Serving as the laboratories' primary point of contact for assigned clients;~~
- ~~Working with laboratory chemists to resolve questions on data;~~
- ~~Scheduling of courier deliveries and pick-ups;~~
- ~~Tracking the progress of all laboratory production efforts;~~
- ~~Advising clients of any scheduling conflicts, possible delays, or other problems which may arise;~~
- ~~Resolving any questions or issues that clients may have with regard to our services, especially our reports;~~
- ~~Preparation of bottle kits for use by clients in their sampling efforts (as necessary);~~
- ~~Reviewing of reports/EDDs (Electronic Data Deliverables) as necessary prior to release;~~
- ~~Invoice preparation and review prior to release to client;~~
- ~~Serving as back-up contact person for other Project Managers in the event of his/her absence;~~
- ~~Coordination of all subcontracting efforts for projects assigned;~~
- ~~Preparation and implementation of program QAPPs (Quality Assurance Project Plans), if needed;~~
- ~~Preparation of project Case Narratives, as needed; and~~
- ~~Assembly of full data packages in accordance with company or client protocol, as needed.~~

~~Project Management Assistant:~~

~~The Project Management Assistant normally receives direction from the Project Manager(s) for which he/she is assigned. Typical responsibilities include:~~

- ~~Working with laboratory chemists to resolve questions on data;~~
- ~~Scheduling of courier deliveries and pick-ups;~~
- ~~Tracking the progress of all laboratory production efforts;~~
- ~~Advising clients of any scheduling conflicts, possible delays, or other problems which may arise;~~
- ~~Resolving any questions or issues that clients may have with regard to our services, especially our reports;~~
- ~~Preparation of bottle kits for use by clients in their sampling efforts;~~
- ~~Reviewing of reports/EDDs (Electronic Data Deliverables) prior to release;~~

- ~~Invoice preparation and review prior to release to client;~~
- ~~Serving as back-up contact person for the project managers in the event of his/her absence;~~
- ~~Coordination of all subcontracting efforts for projects assigned; and~~
- ~~Preparation and implementation of program QAPPs (Quality Assurance Project Plans), if needed.~~
- ~~As part of the administrative staff, this person may also be required to answer phones, do occasional filing, mailing, etc.~~

~~Environmental Health & Safety Manager:~~

~~The Health and Safety Manager reports to the Laboratory Director and ensures that systems are maintained for the safe operation of the laboratory. The EHS Manager is responsible to:~~

- ~~Conduct ongoing, necessary safety training and conduct new employee safety orientation;~~
- ~~Assist in developing and maintaining the Chemical Hygiene/Safety Manual;~~
- ~~Oversee the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed; and~~
- ~~Complete accident reports, follow up on root causes and define corrective actions.~~

~~Hazardous Waste Coordinator:~~

~~The Hazardous Waste Coordinator reports directly to the Environmental Health & Safety Manager. The duties of the HWC consist of:~~

- ~~Staying current with the hazardous waste regulations and continuing training on hazardous waste issues;~~
- ~~Contacting the hazardous waste subcontractors for review of procedures and opportunities for minimization of waste;~~
- ~~Supervise the recording of the transfer of samples from refrigerated conditions to ambient conditions [in the sample disposal log sheets (SDLS)];~~
- ~~Check the records in SDLS against the logbook (LIMS) records;~~
- ~~Coordinate the collection of waste throughout the laboratory that will be disposed of through "Lab Packs";~~
- ~~Coordinate and supervise Hazardous Waste Technician(s);~~
- ~~Dispose of solid waste to an assigned Tote;~~
- ~~Supervise the recording and disposal of acid and soil with methylene chloride extracts into appropriate drums;.~~
- ~~Prepare and discharge treated wastewater to the sewer system;~~
- ~~Maintain Uniform Hazardous Waste Manifest files;~~
- ~~Prepare weekly sample disposal schedules;~~
- ~~Coordinate and schedule waste pick-up;~~
- ~~Check all waste containers for appropriate labels; and~~
- ~~Maintain safe housekeeping and practices.~~

~~Education and Experience~~

~~Calscience makes every effort to hire analytical staff that posses a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions are made based upon experience and an individual's ability to learn as there are many in the industry that are more than competent, experts perhaps, who have not earned a college degree.~~

~~Selection of qualified individuals for employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Experience and specialized~~

~~training may be accepted in lieu of a college degree (basic lab skills such as using a balance, aseptic or quantitation techniques, etc. are also considered).~~

~~Included in Section 5.2 (e) of this Quality Assurance Manual are the basic job titles and personnel responsibilities for anyone who manages, performs or verifies work affecting the quality of the environmental testing that the laboratory performs. Minimum education and training requirements are summarized in the following table:~~

~~When an analyst does not meet these minimum requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Group Leader, and are considered an analyst in training. The person supervising an analyst in training is directly accountable for the quality of the analytical data and must review and approve data and associated corrective actions.~~

~~Job Type~~	~~Education~~	~~Experience~~
~~Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), Titrimetric and Gravimetric Analyses,~~	~~H.S. Diploma or GED~~	~~On the job training~~
~~GFAA, CVAA, FLAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC~~	~~A college degree in an applied science or 2 years of college and at least 1 year of college chemistry, or~~	~~2 years prior analytical experience is required~~
~~ICP, ICPMS, Long List or complex chromatography (e.g., Pest, PCB, Herb, HPLC, etc.), GCMS~~	~~A college degree in an applied science or 2 years of college chemistry, or~~	~~5 years of prior analytical experience in~~
~~Spectra Interpretation~~	~~A college degree in an applied science or 2 years of college Chemistry, and~~	~~2 years relevant experience Or, 5 years of prior analytical experience~~
~~Group Leaders – Advanced Instrumentation~~	~~Bachelors Degree in an applied science with 16 semester hours in chemistry An advanced (MS, PhD.) degree may substitute for one year of experience, and~~	~~2 years experience in the analytical technique for environmental analysis of representative analytes for which they will oversee~~
~~Group Leaders – Wet Chemistry (Basic Skills)~~	~~Associates degree in an applied science or 2 years of college with 16 semester hours in Chemistry, and~~	~~2 years relevant experience~~

f) Identification of the laboratory's approved signatories; at a minimum, the title page of the quality manual has the signed and dated concurrence (with appropriate titles) of all responsible parties including the QA manager, technical director, and the laboratory director;

g) The laboratory's procedures for achieving traceability of measurements;

h) A list of all test methods under which the laboratory performs its accredited testing may be found in the Index of Standard Operating Procedures, a separate document.

i) Mechanisms for ensuring that the laboratory reviews all new work to ensure that it has the appropriate facilities and resources before commencing such work;

j) Reference to the calibration and/or verification test procedures used;

Calibration procedures and verification of acceptability for each set of required calibrations are defined in Section 13 (Calibration) and Section 12 (Quality Control) of each standard operating procedure.

k) Procedures for handling samples received;

The generation of quality analytical data begins with the collection of the sample and, therefore, the integrity of the sample collection process is of importance to Calscience. Samples must be collected in such a way that foreign material is not introduced into the samples and that analytes of interest do not escape from the samples or degrade prior to their analysis. To ensure sample integrity and representativeness, the following items must be considered:

- ⇨ Samples must be collected in appropriate containers. In general, glass containers are used for organic analytes and polyethylene for inorganic/metal analytes;
- ⇨ Only new sample containers which are certified and documented clean in accordance with U.S. EPA OSWER Directive No. 9240.0-0.05 specifications shall be provided by Calscience for sample collection;
- ⇨ Certain extremely hazardous samples or samples that have the potential to become extremely hazardous will not be accepted. These include (but are not limited to)
  1. Radioactive samples that exceed background levels
  2. Biohazardous samples (medical wastes, body fluids, etc.)
  3. Explosive samples (Flash or gunpowder, ammunition, flares, etc.)
  4. Neurological or other toxic agents (Sarin, Anthrax, Ricin, etc.)

Calscience's chain-of-custody document is used to forward samples from the client to the laboratory. As the basic elements of most all chain-of-custody (COC)documents are similar, clientele may choose to use their own chain-of-custody document to forward samples to Calscience.

Any discrepancies in the COC must be documented on the Sample Receipt Form and resolved prior to analysis of samples. Further guidance may be found in SOP T100 "Sample Receipt and Log-In Procedures".

Upon receipt by Calscience, samples proceed through an orderly processing sequence designed to ensure continuous integrity of both the sample and its documentation from sample receipt through its analysis and beyond.

All coolers that are received by the Sample Control Group undergo a preliminary examination in accordance with Part A of the Sample Receipt Form. Specifically, each sample is carefully examined for label identification, proper container (type and volume), chemical preservation when applicable, container condition, and chain-of-custody documentation consistency with sample labels. Discrepancies are noted on the Sample Receipt Form, the chain-of-custody and, if possible,

discussed with the client prior to his or her departure. If this is not possible, the discrepancies are communicated to the client for resolution prior to the completion of the log-in process. The temperature of the cooler is measured and, with other observations, is recorded in Part B of the Sample Receipt Form. Additional comments are recorded in Part C of the Sample Receipt Form.

During the log-in process each sample is assigned a unique laboratory identification number through a computerized Laboratory Information Management System (LIMS), which stores all essential project information. Calscience maintains multiple security levels of access into LIMS to prevent unauthorized tampering/release of sample and project information.

Once all analyses for a sample have been completed and the sample container is returned to Sample Control, it shall remain in refrigerated storage for a period not less than 30 days following sample receipt unless the client requests return/forwarding of the sample. Following the 30-day refrigerated storage period, the samples are placed into ambient storage for another period not less than 30 days after which the samples are bulked into drums for later disposal.

Extended storage may be requested at prevailing per sample rates.

l) Reference to the major equipment and reference measurement standards used as well as the facilities and services used by the laboratory in conducting tests;

A list of major equipment is kept up-to-date on the List of Major Assets. This, as well as a list of reference measurement standards and their certificates of calibration, is maintained by the QA Manager or in the respective departments.

m) Reference to procedures for calibration, verification and maintenance of equipment;
Laboratory SOPs (T042, T050 and T051) are available to staff for calibration, verification and maintenance of equipment.

n) Reference to verification practices which may include interlaboratory comparisons, proficiency testing programs, use of reference materials and internal quality control schemes;

Instrument calibration is required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity such that required reporting limits can be met. Each instrument is calibrated with standard solutions appropriate to the type of instrument and the linear range established for the analytical method. The manufacturer's guidelines, the analytical method, and/or the requirements of special contracts determine the frequency of calibration and the concentration of calibration standards, whichever is most applicable. The following are very general guidelines and are not meant to be all-inclusive. Detailed calibration procedures are specified in the SOP for each method performed.

Gas Chromatography/Mass Spectroscopy (GC/MS): Each day prior to analysis of samples, all GC/MS instruments are tuned with 4-bromofluorobenzene (BFB) for VOCs and decafluorotriphenylphosphine (DFTPP) for SVOCs in accordance with the tuning criteria specified in the applicable methods. Samples are not analyzed until the method-specific tuning requirements have been met.

After the tuning criteria are met, the instrument is then calibrated for all target analytes and an initial multipoint calibration curve established. Alternatively, the previous calibration curve may be used if validated by a calibration verification (CV) standard. All target analytes are represented in the calibration and certain key target analytes referred to as system performance calibration compounds (SPCCs) and calibration check compounds (CCCs) are used for curve acceptance determination. For the initial calibration to be deemed acceptable, the SPCCs and CCCs must meet established acceptance criteria and must be re-evaluated and meet the acceptance criteria, at a minimum, every twelve (12) hours thereafter.

~~Non-GC/MS Chromatography: The field of chromatography involves a variety of instrumentation and detectors. While calibration standards and control criteria vary depending upon the type of system and analytical methodology required for a specific analysis, the general principles of calibration apply uniformly. Each chromatographic system is calibrated prior to sample analysis. An initial multipoint calibration curve is generated using all target analytes. All target analytes must meet the acceptance criteria for the calibration to be deemed acceptable. The continued validity of the initial multipoint calibration is verified every 12 hours using a calibration verification (CV) standard containing all target analytes. If the CV fails to meet the acceptance criteria, the system is re-calibrated and all samples analyzed since the last acceptable CV must be re-analyzed.~~

~~Inductively Coupled Plasma Emission Spectroscopy: Initial calibration consists of a calibration blank (CB) plus one calibration standard. The calibration is verified by the re-analysis of the standard and initial calibration verification (ICV) standard. If the standard and the ICV fail to meet the acceptance criteria, the initial calibration is considered invalid and is re-performed.~~

~~Continuing calibration verification (CCV) consists of a mid-concentration standard plus a calibration blank (CB) analyzed every 10 samples and at the end of the sequence. If the CCV and/or CB fail to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV and/or CB must be re-analyzed.~~

~~ICP/MS Spectroscopy: Each day prior to the analysis of samples, all ICP/MS instruments undergo mass calibration and resolution checks prior to initial calibration. Initial calibration consists of a calibration blank (CB) and at least one calibration standard. The calibration is verified by the re-analysis of the standard and initial calibration verification (ICV) standards. If the standard and the ICV fail to meet the acceptance criteria, the initial calibration is considered invalid and is re-performed.~~

~~Continuing calibration verification (CCV) consists of a mid-concentration standard plus a calibration blank (CB) analyzed every 10 samples and at the end of the sequence. If the CCV and/or CB fail to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV and/or CB must be re-analyzed.~~

~~Flame and Graphite Furnace Atomic Absorption Spectroscopy: Initial calibration consists of a calibration blank plus a low, medium, and high calibration standard. Continuing calibration verification (CCV) consists of midpoint calibration standard plus a calibration blank (CB) analyzed every 10 samples and at the end of the sequence. If the CCV and/or CB fail to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV and/or CB must be re-analyzed. If the calibration blanks contain target analyte concentrations exceeding the acceptance limits, the cause must be determined and corrected.~~

~~General Inorganic Analyses: General inorganic (non-metal) analyses involve a variety of instrumental and wet chemistry techniques. While calibration procedures vary depending on the type of instrumentation and methodology, the general principles of calibration apply universally. Each system or method is initially calibrated using standards prior to analyses being conducted with continual verification that the calibration remains acceptable throughout analytical processing. If continual calibration verification fails to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV must be re-analyzed.~~

~~o) Procedures to be followed for feedback and corrective action whenever testing discrepancies are detected, or departures from documented policies and procedures occur;~~

~~These procedures may be found in SOP-T015 (Correction/Prevention of Errors in Test Records) and SOP-T022 (Corrective/Preventive Actions).~~

p) The laboratory management arrangements for permitting exceptions and departures from documented policies and procedures or from standard specifications;

Calscience's SOPs are in substantial conformity with their corresponding published method references. Departure from approved SOPs shall be approved if necessary or appropriate due to the nature or composition of the sample or otherwise based on the reasonable judgment of Calscience's Laboratory Director, Technical Director, or QA Manager. Departures shall be made on a case-by-case basis consistent with recognized standards of the industry. In no case shall departures be approved without written communication between Calscience and the affected client.

q) Procedures for dealing with complaints;

Procedures for dealing with complaints may be found in SOP-T018, Handling of Inquiries and Complaints.

r) Procedures for protecting confidentiality (including national security concerns) and proprietary rights;

Calscience is sensitive to the fact that much of the analytical work performed for clientele may be subject to litigatory processes. Calscience, therefore, holds all information in strict confidence with laboratory release only to the client or designee. Information released to entities other than the client is performed only upon written, facsimile or e-mail request from the client.

Due to the investigative nature of most site assessments, analytical information may become available to regulatory agencies or other evaluating entities during site assessment of the laboratory for the specific purpose of attaining laboratory certifications, accreditations, or evaluation of laboratory qualification for future work. During these occurrences, the laboratory will make its best effort to maintain the confidence of client specific information.

s) Procedures for audits and data review;

Calscience participates in a wide variety of system and performance audits conducted by numerous federal and state agencies, as well as through its major clientele. These audits are conducted to verify that analytical data produced conforms to industry standards on a routine basis.

A System Audit is a qualitative evaluation of the measurement systems utilized at Calscience, specifically, that Calscience has, in place, the necessary facilities, staff, procedures, equipment, and instrumentation to generate acceptable data. This type of audit typically involves an on-site inspection of the laboratory facility, operations, and interview of personnel by the auditing agency.

A Performance Audit verifies the ability of Calscience to correctly identify and quantitate compounds in blind check samples. This type of audit normally is conducted by the auditing agency through laboratory participation in round robin Performance Evaluation (PE) programs. Examples of current PE program involvement include those offered by commercial suppliers like ERA (WS/WP/SOIL and DMR-QA), or other inter-laboratory studies not required for certification but done to ensure laboratory performance, as well as programs administered by major industry.

Outliers in required PE samples will be investigated and corrective actions documented using the Corrective/Preventive Action Record.

Should the result of any audit detect a significant error, which has been identified to adversely affect released data, the situation shall be thoroughly investigated. Corrective measures shall be enacted to include system re-evaluation, the determined affect on released data and client notification, as necessary. These measures shall be documented using the Corrective/Preventive Action Record.

~~t) Processes/procedures for establishing that personnel are adequately experienced in the duties they are expected to carry out and are receiving any needed training;~~

~~Quality control begins prior to sample(s) receipt at the laboratory. The selection of well qualified personnel, based upon education and/or experience is the first step in successful laboratory management. A thorough screening of job applicants and selection of the best candidate to fulfill a well defined need is as important an aspect of a successful QA/QC program as a careful review of analytical data.~~

~~Employee training and approval procedures used at Calscience are specified in SOP-T010, "Employee Training", and includes but is not limited to the following:~~

- ~~A thorough understanding of the applicable regulatory method and Calscience SOP;~~
- ~~A review of Calscience's QA Program Manual and thorough understanding of the specifics contained therein that are directly related to the analysis to be performed;~~
- ~~Instruction by the applicable Group Leader on all aspects of the analytical procedure;~~
- ~~Performance of analyses under supervision of experienced laboratory personnel, which shall include analysis of blind QC check samples, when deemed appropriate;~~
- ~~Participation in in-house seminars on analytical methodologies and procedures;~~
- ~~Participation in job related seminars outside of the laboratory; and~~
- ~~Participation in conventions and meetings, i.e., ACS, etc.~~

~~u) Ethics policy statement developed by the laboratory and processes/procedures for educating and training personnel in their ethical and legal responsibilities including the potential punishments and penalties for improper, unethical, or illegal actions;~~

~~A vital part of Calscience Environmental Laboratories' analytical laboratory services is their Laboratory Ethics Training Program. An effective program starts with an Ethics Policy Statement that is supported by all staff, and is reinforced with initial and ongoing ethics training.~~

~~"It shall be the policy of Calscience to conduct all business with integrity and in an ethical manner. It is a basic and expected responsibility of each staff member and manager to hold to the highest ethical standard of professional conduct in the performance of all duties."~~

~~A proactive ethics training program is the most effective means of deterring and detecting improper, unethical, or illegal actions in the laboratory. There are six facets to the program: (1) clearly define improper, unethical, and illegal actions; (2) outline elements of prevention and detection programs for improper, unethical, or illegal actions; and (3) identify examples of inappropriate (i.e., potentially fraudulent) laboratory practices; (4) Annual Ethics and Data Integrity Training to be documented and maintained in the personnel file of each employee., (5) Documented training on new revisions of the Quality Systems Manual (QSM) and for new employees as needed. (6) Signed Ethics and Data Integrity Agreement (to be completed for new employees and annually threrafter)~~

~~Definition of Improper, Unethical, and Illegal Actions~~

~~Improper actions are defined as deviations from contract-specified or method-specified analytical practices and may be intentional or unintentional.~~

~~Unethical or illegal actions are defined as the deliberate falsification of analytical or quality assurance results, where failed method or contractual requirements are made to appear acceptable.~~

~~Prevention of laboratory improper, unethical, or illegal actions begins with a zero-tolerance philosophy established by management. Improper, unethical, or illegal actions are detected through the implementation of oversight protocols.~~

Prevention and Detection Program for Improper, Unethical, or Illegal Actions

Calscience management has implemented a variety of proactive measures to promote prevention and detection of improper, unethical, or illegal activities. The following components constitute the basic program:

- Data Integrity Standard Operating Procedure (SOP) T065
- Data Integrity Documentation Procedures
- An Ethics and Data Integrity Agreement that is read and signed by all personnel;
- Initial and annual ethics training;
- Internal audits;
- Inclusion of anti-fraud language in subcontracts;
- Analyst notation and sign-off on manual integration changes to data;
- Active use of electronic audit functions when they are available in the instrument software; and
- A "no-fault" policy that encourages laboratory personnel to come forward and report fraudulent activities.

A proactive, "beyond the basics" approach to the prevention of improper, unethical, or illegal actions are a necessary part of laboratory management. As such, in addition to the requirements above, Calscience has a designated ombudsman (data integrity officer) to whom laboratory personnel can report improper, unethical, or illegal practices, or provide routine communication of training, lectures, and changes in policy intended to reduce improper, unethical, or illegal actions.

Examples of Improper, Unethical, or Illegal Practices

Documentation that clearly shows how all analytical values were obtained are maintained by Calscience and supplied to the data user as needed. To avoid miscommunication, Calscience clearly documents all errors, mistakes, and basis for manual integrations within the project file and case narrative as applicable. Notification is also made to the appropriate supervisor so that appropriate corrective actions can be initiated. Gross deviations from specified procedures are investigated for potential improper, unethical, or illegal actions, and findings of fraud are fully investigated by senior management. Examples of improper, unethical, or illegal practices are identified below:

- Improper use of manual integrations to meet calibration or method QC criteria (for example, peak shaving or peak enhancement are considered improper, unethical, or illegal actions if performed solely to meet QC requirements);
- Intentional misrepresentation of the date or time of analysis (for example, intentionally resetting a computer system's or instrument's date and/or time to make it appear that a time/date requirement was met);
- Falsification of results to meet method requirements;
- Reporting of results without analyses to support (i.e., dry-labbing);
- Selective exclusion of data to meet QC criteria (for example, initial calibration points dropped without technical or statistical justification);
- Misrepresentation of laboratory performance by presenting calibration data or QC limits within data reports that are not linked to the data set reported, or QC control limits presented within QAPP that are not indicative of historical laboratory performance or used for batch control;
- Notation of matrix inference as basis for exceeding acceptance limits (typically without implementing corrective actions) in interference-free matrices (for example, method blanks or laboratory control samples);
- Unwarranted manipulation of computer software (for example, improper background subtraction to meet ion abundance criteria for GC/MS tuning, chromatographic baseline manipulations);
- Improper alteration of analytical conditions (for example, modifying EM voltage, changing GC temperature program to shorter analytical run time) from standard analysis to sample analysis;

- ~~Misrepresentation of QC samples (for example, adding surrogates after sample extraction, omitting sample preparation steps for QC samples, over- or underspiking); and~~
- ~~Reporting of results from the analysis of one sample for those of another.~~

~~v) Reference to procedures for reporting analytical results;~~

~~Standard operating procedures pertaining to the reporting of results are available to all laboratory personnel. They are: SOP-T009, Significant Figures, Rounding, and Reporting of Results; SOP-T025, Reporting of Tentatively Identified Compounds (TICs); and T-026, Reporting of Data Qualifiers.~~

~~All analytical data generated within Calscience is thoroughly checked for accuracy and completeness. The data validation process consists of data generation, reduction, and four levels of review as described below.~~

~~The analyst generating the analytical data has the primary responsibility for its correctness and completeness. All data is generated and reduced following protocols specified in the appropriate SOPs. Each analyst reviews the quality of his or her work based upon an established set of guidelines specified in the SOPs or as specified by project requirements. The analyst reviews the data package to ensure that:~~

- ~~Holding times have not been exceeded;~~
- ~~Sample preparation information is correct and complete;~~
- ~~Analysis information is correct and complete;~~
- ~~The appropriate procedures were employed;~~
- ~~Analytical results are correct and complete;~~
- ~~All associated QC is within established control limits and, if not, out-of-control forms are completed thoroughly explaining the cause and corrective action taken;~~
- ~~Any special sample preparation and analytical requirements have been met; and~~
- ~~Documentation is complete, i.e., all anomalies in the preparation and analysis have been documented; out-of-control forms, if required, are complete, etc.~~

~~The data reduction and validation steps are documented, signed, and dated by the analyst on the QC Review coversheet accompanying each data package. This initial review step, performed by the analyst, is designated as primary review. The analyst then forwards the data package to his or her Group Leader, or designated data reviewer, who performs a secondary review. Secondary reviews consist of an independent check equivalent to that of the primary review and are designed to ensure that:~~

- ~~Calibration data is scientifically sound, appropriate to the method, and completely documented;~~
- ~~QC data is within established guidelines or reported with appropriate clarification/qualification;~~
- ~~Qualitative identification of sample components is correct;~~
- ~~Quantitative results are correct;~~
- ~~Documentation is complete and any anomalies properly addressed and documented;~~
- ~~The data is ready for incorporation into the final report package; and~~
- ~~The data package is complete and ready for archiving.~~

~~A significant component of the secondary review is the documentation of any errors that have been identified and corrected during the review process. Calscience believes that the data package that is submitted for a secondary review should be free from errors. Errors that are discovered are documented and formally transmitted to the appropriate Group Leader. The cause of the errors are then addressed by additional training or clarification of procedures (SOP revisions) to ensure that similar errors do not recur and high quality data will be generated.~~

~~Signature of Data Reviewer and the date of review document the completion of secondary reviews on the QC Review coversheet. These constitute approval for data release and generation of analytical report.~~

~~During both of the QC review processes, 100% of the raw data associated with the entire project is available to the reviewer. Data packages are checked back to the raw data as deemed necessary by the reviewer.~~

~~Following draft report generation, the report is reviewed by the Project Manager to ensure that the data set and quality control data is complete and meets the specific requirements of the project. When available, the data is also evaluated against historical site information. Once all requested analytical work has been verified as complete, a final report is generated and signed by the Project Manager.~~

~~Following approval for release by the Project Manager, the Quality Assurance Manager or Designee to ensure that the analytical and quality control data is correct performs a final review. The Quality Assurance Manager may review 10% of the project files back to the raw data as an additional check.~~

~~A variety of reporting formats, from Portable Document File (PDF), normal typed reports to computerized data tables to complex reports discussing regulatory issues are available. In general, Calscience reports contain the following information.~~

~~Analytical Data~~

~~Analytical data is reported by sample identification (both client and laboratory) and test. Pertinent information including date(s) sampled, received, prepared, and analyzed; any required data qualifiers are included on each results page. The reporting limit for each method analyte is also listed. Additional data may include Method Detection Limits (MDLs).~~

~~QC Data~~

~~A QC Summary is provided with each final report. Unless otherwise specified in a QAPP or requested by the client, QC Summaries include results for method blanks, matrix spikes, matrix spike duplicates, and surrogate spikes. Laboratory control sample and method blank surrogates are routinely included if matrix interference results in a QC outlier. The effective control limits for the reported QC values are also provided on the QC Summary as well as explanations for any QC outliers. Case Narratives may be included as appropriate.~~

~~As required for the project, data reports from "results only" through "full CLP" will be generated and provided. Included in this range are reports for the major DoD programs including NFESC, AFCEE, and USACE.~~

~~Methodology~~

~~References for the preparative and analytical methodology employed is included on all preliminary or final analytical reports.~~

~~Signatory~~

~~Final reports are ready for release to the client following review and approval by the Project Manager, as evidenced by his/her signature on the final report cover page.~~

~~Preliminary Data~~

~~Upon client request, preliminary data shall be released prior to completion of a full QC review. Preliminary data is subject to change pending QC review and, therefore, shall be clearly marked as "Preliminary, QC Pending" and not include a signature of approval. This qualification is provided as notification to the client that the data review process has not been completed yet and that the data is subject to possible modification resulting therefrom.~~

~~Revised Data~~

~~Analytical reports that have been revised for any reason from the original sent report shall be noted as being revised with a report note, case narrative or indication as to the revision.~~

~~Formatting~~

~~At a minimum, an analytical report shall consist of the Report Cover Page, Analytical Results, QA/QC Data (Default), Footnotes/Comments Page, Sample Receipt Form and COC. Paginated reports shall be employed for all reports unless used for non-NELAP analysis.~~

~~w) A Table of Contents and applicable lists of references and glossaries, and appendices.~~

~~5.4 Audits~~

~~5.4.1 Internal Audits~~

~~The laboratory arranges streamlined quarterly and comprehensive annual internal audits to verify that its operations continue to comply with the requirements of the laboratory's said quality system. The quality assurance officer or the Quality Assurance Assistant plans and organizes audits as required by a predetermined schedule and requested by management. The Quality Assurance Assistant, independent of the activity to be audited, will carry out such audits. Personnel do not audit their own activities except when it can be demonstrated that an effective audit will be carried out. Where the audit findings cast doubt on the correctness or validity of the laboratory's calibrations or test results, the laboratory takes immediate corrective action and immediately notifies, in writing, any client whose work was involved.~~

~~Any outside audit findings will also be included in the Internal Audits.~~

~~5.4.2 Managerial Review~~

~~Calscience management conducts an annual review of its quality system and its testing and calibration activities to ensure its continuing suitability and effectiveness and to introduce any necessary changes or improvements in the quality system and laboratory operations. This review takes account of reports from managerial and supervisory personnel, the outcome of recent internal audits, assessments by external bodies, the results of inter-laboratory comparisons or proficiency tests, any changes in the volume and type of work undertaken, feedback from clients, corrective actions, and other relevant factors. The laboratory shall have a procedure for review by management, and maintain records of review findings and actions.~~

~~5.4.3 Audit Review~~

~~All audit and review findings and any corrective actions that arise from them are documented. The laboratory management ensures that these actions are discharged within the agreed time frame as indicated in the quality manual and/or SOPs.~~

5.4.4 Performance Audits

In addition to periodic audits, the laboratory ensures the quality of results provided to clients by implementing checks to monitor the quality of the laboratory's analytical activities. Examples of such checks are:

a) Internal quality control procedures using statistical techniques (see Section 5.4 below);

b) Participation in proficiency testing or other interlaboratory comparisons;

c) Use of certified reference materials and/or in-house quality control using secondary reference materials as specified in Calscience QSM Section 5.4;

d) Replicate testing using the same or different test methods;

e) Re-testing of retained samples;

e) Correlation of results for different but related analysis of a sample (for example, total phosphorus should be greater than or equal to orthophosphate).

5.4.5 Corrective / Preventive Actions

a) In addition to providing acceptance criteria and specific protocols for corrective/preventive actions in SOP-T022, the laboratory implements general procedures to be followed to determine when departures from documented policies, procedures and quality control have occurred. These procedures include but are not limited to the following:

   1) Identify the individual(s) responsible for assessing each QC data type;

   2) Identify the individual(s) responsible for initiating and/or recommending corrective/preventive actions;

   3) Define how the analyst shall treat a data set if the associated QC measurements are unacceptable;

   4) Specify how out-of-control situations and subsequent corrective actions are to be documented; and

   5) Specify procedures for management (including the QA officer) to review corrective/preventive action reports.

b) To the extent possible, sample results are reported only if all quality control measures are acceptable. If a quality control measure is found to be out of control, and the data are to be reported, all samples associated with the failed quality control measure are reported with the appropriate data qualifier(s).

5.5 Essential Quality Control Procedures

These general quality control principles apply, where applicable, to all testing at Calscience. The manner in which each is implemented is dependent on the types of tests performed by the laboratory and is further described in Appendix D and in SOP-T020 (Internal Quality Control Checks. The standards for any given test type assures that the applicable principles are addressed:

a) All laboratories have detailed written protocols in place to monitor the following quality controls:

1) Positive and negative controls (blanks, spikes, reference toxicants, etc.) to monitor tests;

2) Tests to define the variability and/or repeatability of the laboratory results such as replicates;

3) Measures to assure the accuracy of the test method including calibration and/or continuing calibrations, use of certified reference materials, proficiency test samples, or other measures;

4) Measures to evaluate test method capability, such as detection limits and quantitation limits or range of applicability such as linearity;

5) Selection of appropriate formulae to reduce raw data to final results such as regression analysis, comparison to internal/external standard calculations, and statistical analyses;

6) Selection and use of reagents and standards of appropriate quality;

7) Measures to assure the selectivity of the test for its intended purpose; and

8) Measures to assure constant and consistent test conditions (both instrumental and environmental) where required by the test method, such as temperature, humidity, light, or specific instrument conditions.

b) All quality control measures are assessed and evaluated on an on-going basis, and quality control acceptance criteria are used to determine the usability of the data. (See Appendix D.)

c) The laboratory has procedures for the development of acceptance/rejection criteria where no method or regulatory criteria exist. (See Calscience QSM Section 11.2, Sample Acceptance Policy.)

d) The quality control protocols specified in the method manual (Calscience QSM Section 10.1.2) is followed. Calscience ensures that the essential standards outlined in NELAC 5, Appendix D, or mandated methods or regulations (whichever are more stringent) are incorporated into the method manuals. When it is not apparent which is more stringent the QC in the mandated method or regulations is to be followed.

The essential quality control measures for testing are found in Appendix D.

6.1 PERSONNEL

6.2 General Requirements for Laboratory Staff

Calscience's testing departments have a sufficient level of personnel with the necessary education, training, technical knowledge and experience to perform the assigned functions.

All personnel are responsible for complying with all quality assurance/quality control requirements that pertain to their organizational/technical function. Each technical staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular function and a general knowledge of laboratory operations, test methods, quality assurance/quality control procedures and records management.

~~6.3 Laboratory Management Responsibilities~~

~~In addition to Calscience QSM Section 4.2.d, the laboratory management:~~

~~a) Defines the minimum level of qualification, experience and skills necessary for all positions in the laboratory. In addition to education and/or experience, basic laboratory skills such as using a balance and quantitative techniques, are considered.~~

~~b) Ensures that all technical laboratory staff members demonstrate capability in the activities for which they are responsible. Such demonstration is documented (See Appendix C).~~

~~Note: In departments with specialized "work cells" (a well-defined group of analysts that together perform the method analysis), the group as a unit meets the above criteria and this demonstration is fully documented.~~

~~c) Ensures that the training of each member of the technical staff is kept up-to-date (on-going) by the following:~~

~~1) Keeping evidence on file that demonstrates that each employee has read, understood, and is using the latest version of the laboratory's in-house quality documentation that relates to his/her job responsibilities.~~

~~2) Documenting training courses or workshops on specific equipment, analytical techniques, or laboratory procedures.~~

~~3) Documenting employee attendance at training courses on ethical and legal responsibilities including the potential punishments and penalties for improper, unethical or illegal actions. Keeping on file evidence that demonstrates that each employee has read, acknowledges, and understands their personal ethical and legal responsibilities including the potential punishments and penalties for improper, unethical or illegal actions.~~

~~4) Maintains up-to-date analyst training records that contain a certification that technical personnel have read, understood and agreed to perform the most recent version of the test method (the approved method or standard operating procedure as defined by the laboratory document control system, Calscience QSM Section 5.2.d) and documentation of continued proficiency by at least one of the following once per year:~~

~~i. Acceptable performance of a blind sample (single blind to the analyst);~~

~~ii. Another demonstration of capability;~~

~~iii. Successful analysis of a blind performance sample on a similar test method using the same technology (e.g., GC/MS volatiles by purge and trap for Methods 524.2, 624, or 5035/8260) would only require documentation for one of the test methods;~~

~~iv. At least four consecutive laboratory control samples with acceptable levels of precision and accuracy;~~

~~v. If i-iv cannot be performed, analysis of authentic samples with results statistically indistinguishable from those obtained by another trained analyst.~~

~~d) Documents all analytical and operational activities of the laboratory;~~

~~e) Supervises all personnel employed by the laboratory;~~

f) Ensures that all sample acceptance criteria (Calscience QSM Section 11.0) are verified and that samples are logged into the sample tracking system and properly labeled and stored.

g) Documents the quality of all data reported by the laboratory.

h) Develops a proactive program for the prevention and detection of improper, unethical, or illegal actions. Components of this program could include: internal proficiency testing (single and double blind); post-analysis electronic and magnetic tape audits; effective reward program to improve employee vigilance and co-monitoring; and separate SOPs identifying appropriate and inappropriate laboratory and instrument manipulation practices.

6.4 Records

Records on the relevant qualifications, training, skills and experience of the technical personnel are maintained by the laboratory (see Calscience QSM Section 6.2.c), including records on demonstrated proficiency for each laboratory test method, such as the criteria outlined in Calscience QSM Section 10.2.1 for chemical testing.

7.1 PHYSICAL FACILITIES – ACCOMMODATION AND ENVIRONMENT

7.2 Environment

a) Laboratory accommodations, test areas, energy sources, lighting, heating and ventilation are such that they facilitate proper performance of tests.

b) The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of the measurements. Particular care shall be taken when such activities are undertaken at sites other than the permanent laboratory premises.

c) The laboratory shall provide for the effective monitoring, control and recording of environmental conditions as appropriate. Such environmental conditions may include biological sterility, dust, electromagnetic interference, humidity, main voltage, temperature, and sound and vibration levels.

d) In instances where monitoring or control of any of the above-mentioned items is specified in a test method or by regulation, the laboratory meets and documents adherence to the laboratory facility requirements.

7.3 Work Areas

a) There is effective separation between neighboring areas when the activities therein are incompatible including volatile organic chemicals handling areas.

b) Access to and use of all areas affecting the quality of these activities are defined and controlled.

c) Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality.

d) Workspaces are available to ensure an unencumbered work area. Work areas include:

1) Access and entryways to the laboratory;

2) Sample receipt areas;

3) Sample storage areas;

4) Chemical and waste storage areas; and

5) Data handling and storage areas.

8.0 EQUIPMENT AND REFERENCE MATERIALS

a) Calscience is furnished with all items of equipment (including reference materials) required for the correct performance of tests for which accreditation is maintained. Note that Calscience does not use equipment outside its permanent control.

b) All equipment is properly maintained, inspected, and cleaned. Maintenance procedures are documented.

c) Any equipment item that has been subjected to overloading or mishandling, or that gives suspect results, or has been shown by verification or otherwise to be defective, is taken out of service, clearly identified and wherever possible stored at a specified place until it has been repaired and shown by calibration, verification or test to perform satisfactorily. The laboratory shall examine the effect of this defect on previous calibrations or tests.

d) When appropriate, each item of equipment, including reference materials, is labeled, marked, or otherwise identified to indicate its calibration status.

e) Records are maintained of each major item of equipment and all reference materials significant to the tests performed. These records include documentation on all routine and non-routine maintenance activities in assigned log books and reference material verifications.

The records include:

1) The name of the item of equipment;

2) The manufacturer's name, type identification, and serial number or other unique identification;

3) Date received and date placed in service (if available);

4) Current location, where appropriate;

5) If available, condition when received (e.g., new, used, reconditioned);

6) Copy of the manufacturer's instructions, where available;

7) Dates and results of calibrations and/or verifications and date of the next calibration and/or verification;

8) Details of maintenance carried out to date and planned for the future; and

9) History of any damage, malfunction, modification or repair.

9.1 MEASUREMENT TRACEABILITY AND CALIBRATION

9.2 General Requirements

All measuring operations and testing equipment having an effect on the accuracy or validity of tests are calibrated and/or verified before being put into service and on a continuing basis. The laboratory has an established program for the calibration and verification of its measuring and test equipment. This includes balances, thermometers and control standards.

9.3 Traceability of Calibration

a) The overall program of calibration and/or verification and validation of equipment is designed and operated so as to ensure that measurements made by the laboratory are traceable to national standards of measurement.

b) Calibration certificates indicate the traceability to national standards of measurement and provide the measurement results and associated uncertainty of measurement and/or a statement of compliance with an identified metrological specification. The laboratory maintains records of all such certification in the QA office.

c) Where traceability to national standards of measurement is not applicable, the laboratory provides satisfactory evidence of correlation of results, for example, by participation in a suitable program of interlaboratory comparisons, proficiency testing, or independent analysis.

9.4 Reference Standards

a) Reference standards of measurement held by the laboratory (such as Class S or equivalent weights, or traceable thermometers) are used for calibration only and for no other purpose, unless it can be demonstrated that their performance as reference standards has not been invalidated. A body that can provide traceability calibrates reference standards of measurement. Where possible, this traceability is to a national standard of measurement.

b) There is a program of calibration and verification for reference standards.

i. Two weeks prior to their date of calibration expiration, individual thermometers are removed from service and replaced by newly calibrated units from the supplier.

ii. Calscience keeps two sets of Class S weights on hand for use in the laboratory. One set is used for daily calibration checks, and the second set is kept for back-up use should the first set be damaged, lost or otherwise compromised. The second set of weights is also place in service when the daily use set is shipped off site for recalibration.

iii. Analytical balances are serviced and calibrated on a routine, annual schedule.

c) Where relevant, reference standards and measuring and testing equipment are subjected to in-service checks between calibrations and verifications. Reference materials are traceable. Where possible, traceability is to national or international standards of measurement, or to national or international standard reference materials.

9.5 Calibration

Calibration requirements are divided into two parts: (1) requirements for analytical support equipment, and (2) requirements for instrument calibration. In addition, the requirements for instrument calibration are divided into initial instrument calibration and continuing instrument calibration verification.

~~9.5.1 Support Equipment~~

~~These standards apply to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, temperature measuring devices (including thermometers and thermistors), thermal/pressure sample preparation devices and volumetric dispensing devices (such as Eppendorf®, or automatic dilutor/dispensing devices) if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume.~~

~~a) All support equipment is maintained in proper working order. The records of all repair and maintenance activities, including service calls is kept.~~

~~b) All support equipment is calibrated or verified at least annually, using NIST traceable references when available, over the entire range of use. The results of such calibration are within the specifications required of the application for which this equipment is used or:~~

~~1) The item is removed from service until repaired; or~~

~~2) The laboratory maintains records of established correction factors to correct all measurements.~~

~~c) Raw data records are retained to document equipment performance.~~

~~d) Prior to use on each working day, balances, ovens, refrigerators, freezers, and water baths are checked in the expected use range, with NIST traceable references where available. The acceptability for use or continued use is according to the needs of the analysis or application for which the equipment is being used.~~

~~e) Mechanical volumetric dispensing devices including burettes (except Class A glassware) is checked for accuracy on at least a quarterly use basis. Glass microliter syringes are to be considered in the same manner as Class A glassware, comes with a certificate attesting to established accuracy or the accuracy is initially demonstrated and documented by the laboratory.~~

~~9.5.2 Instrument Calibration~~

~~This manual specifies the essential elements that define the procedures and documentation for initial instrument calibration and continuing instrument calibration verification to ensure that the data are of known quality and be appropriate for a given regulation or decision. This manual does not specify detailed procedural steps ("how to") for calibration, but establishes the essential elements for selection of the appropriate technique(s). This approach allows flexibility and permits the employment of a wide variety of analytical procedures and statistical approaches currently applicable for calibration. If more stringent standards or requirements are included in a mandated test method or by regulation, the laboratory demonstrates that such requirements are met. If it is not apparent which standard is more stringent, then the requirements of the regulation or mandated test method are to be followed.~~

~~Note: In the following sections, initial instrument calibration is directly used for quantitation and continuing instrument calibration verification is used to confirm the continued validity of the initial calibration.~~

~~9.5.2.1 Initial Instrument Calibrations~~

~~The following items are essential elements of initial instrument calibration:~~

a) The details of the initial instrument calibration procedures including calculations, integrations, acceptance criteria and associated statistics are included or referenced in the test method SOP. When initial instrument calibration procedures are referenced in the test method, the referenced material is retained by the laboratory and is available for review.

b) Sufficient raw data records are retained to permit reconstruction of the initial instrument calibration, e.g., calibration date, test method, instrument, analysis date, each analyte name, analyst's initials or signature; concentration and response, calibration curve or response factor; or unique equation or coefficient used to reduce instrument responses to concentration.

c) Sample results are quantitated from the initial instrument calibration and may not be quantitated from any continuing instrument calibration verification.

d) All initial instrument calibrations is verified with a standard obtained from a second manufacturer or lot. Traceability shall be to a national standard, when available.

e) Criteria for the acceptance of an initial instrument calibration is established, e.g., correlation coefficient or relative percent difference. The criteria used is appropriate to the calibration technique employed.

f) Results of samples not bracketed by initial calibration standards (within calibration range) are reported as having less certainty, e.g., defined qualifiers or flags or explained in the case narrative. As determined by the method, the lowest calibration standard is at or above the detection limit.

g) If the initial instrument calibration results are outside established acceptance criteria, corrective actions are performed. Data associated with an unacceptable initial instrument calibration is not reported.

h) Calibration standards include concentrations at or below the regulatory limit/decision level, if the laboratory knows these limits/levels, unless these concentrations are below the laboratory's demonstrated detection limits (See Calscience QSM Section Appendix D.1.4 Detection Limits).

i) If a reference or mandated method does not specify the number of calibration standards, the minimum number is two, not including blanks or a zero standard. The laboratory's standard operating procedure defines the number of points for establishing the initial instrument calibration.

9.5.2.2 Continuing Instrument Calibration Verification

When an initial instrument calibration is not performed on the day of analysis, the validity of the initial calibration is verified prior to sample analyses by a continuing instrument calibration verification with each analytical batch. The following items are essential elements of continuing instrument calibration verification:

a) The details of the continuing instrument calibration procedure, calculations and associated statistics must be included or referenced in the test method SOP.

b) A continuing instrument calibration verification must be repeated at the beginning and end of each analytical batch. The concentrations of the calibration verification shall be varied within the established calibration range. If an internal standard is used, only one continuing instrument calibration verification must be analyzed per analytical batch.

c) Sufficient raw data records must be retained to permit reconstruction of the continuing instrument calibration verification, e.g., test method, instrument, analysis date, each analyte name, concentration and response, calibration curve or response factor, or unique equations or coefficients used to

~~convert instrument responses into concentrations. Continuing calibration verification records must explicitly connect the continuing verification data to the initial instrument calibration.~~

~~d) Criteria for the acceptance of a continuing instrument calibration verification must be established, e.g., relative percent difference.~~

~~e) If the continuing instrument calibration verification results obtained are outside established acceptance criteria, corrective actions must be performed. If routine corrective action procedures fail to produce a second (consecutive and immediate) calibration verification within acceptance criteria, then the laboratory shall demonstrate performance after corrective action with two consecutive successful calibration verifications, or a new instrument calibration must be performed. If the laboratory has not demonstrated acceptable performance, sample analyses shall not occur until a new initial calibration curve is established and verified.~~

~~As an exception, sample data associated with an unacceptable calibration verification may be reported as qualified data under the following special conditions:~~

~~i. When the acceptance criteria for the continuing calibration verification are exceeded high, i.e., high bias and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise the samples affected by the unacceptable calibration verification are reanalyzed after a new calibration curve has been established, evaluated and accepted.~~

~~ii. When the acceptance criteria for the continuing calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable verification are reanalyzed after a new calibration curve has been established, evaluated and accepted.~~

~~10.1 TEST METHODS AND STANDARD OPERATING PROCEDURES~~

~~10.2 Methods Documentation~~

~~a) The laboratory has documented instructions on the use and operation of all relevant equipment, on the handling and preparation of samples and for calibration and/or testing, where the absence of such instructions could jeopardize the calibrations or tests.~~

~~b) All instructions, standards, manuals, and reference data relevant to the work of the laboratory are maintained up-to-date and be readily available to the staff.~~

~~10.1.1 Standard Operating Procedures (SOPs) Administrative~~

~~Calscience maintains standard operating procedures that accurately reflect all phases of current laboratory activities such as instrument operation, assessing data integrity, corrective actions, handling customer complaints, reporting of test results, etc.~~

~~a) These documents, for example, may be equipment manuals provided by the manufacturer or internally written documents.~~

~~b) The test methods may be copies of published methods as long as any changes or selected options in the methods are documented and included in the SOP. (See 10.1.2.)~~

~~c) Copies of all SOPs are accessible to all personnel.~~

d) The SOPs are organized.

e) Each SOP clearly indicates the effective date of the document, the revision number and the signatures of the approving authorities.

10.1.2 Standard Operating Procedures (SOPs) Analytical

a) The laboratory has and maintains SOPs for each accredited analyte or test method.

b) This SOP may consist of copies of published or referenced test methods or standard operating procedures that have been written by the laboratory. In cases where modifications to the published method have been made by the laboratory or where the referenced test method is ambiguous or provides insufficient detail, these changes or clarifications are clearly described. Each test method includes or references where applicable:

1) Identification of the test method;
2) Applicable matrix or matrices;
3) Detection limit;
4) Scope and application, including components to be analyzed;
5) Summary of the test method;
6) Definitions;
7) Interferences;
8) Safety;
9) Equipment and supplies;
10) Reagents and standards;
11) Sample collection, preservation, shipment, and storage;
12) Quality control;
13) Calibration and standardization;
14) Procedure;
15) Calculations;
16) Method performance;
17) Pollution prevention;
18) Data assessment and acceptance criteria for quality control measures;
19) Corrective actions for out-of-control data;
20) Contingencies for handling out-of-control or unacceptable data;
21) Waste management;
22) References; and
23) Any tables, diagrams, flowcharts, and validation data.

Laboratory procedures other than preparative or analytical procedure may use a shortened format as outlined in SOP T001.

10.2 Exceptionally Permitting Departures from Documented Policies / Procedures

a) If it is necessary to depart from a documented procedure or policy due to circumstances outside of Calscience's control or due to conditions encountered while preparing or analyzing a sample, the following will be documented.

1) The nature of the exception
2) How the data or procedure may be impacted
3) Any Corrective Action that may be needed.
4) Any approval from a client that may be required.
5) Approval by management to report or proceed with the exception.
6) A Case Narrative with the Final Report explaining the exception.

~~10.3 Test Methods~~

~~The laboratory uses appropriate test methods and procedures for all tests and related activities within its responsibility (including, as applicable, sample collection, sample handling, transport and storage, sample preparation and sample analysis). The method and procedures shall be consistent with the accuracy required, and with any standard specifications relevant to the calibrations or tests concerned.~~

~~a) When the use of specific test methods for a sample analysis is mandated or requested, only those methods are used.~~

~~b) Where test methods are employed that are not required, as in the Performance Based Measurement System approach, the methods are fully documented and validated (see Calscience QSM Section 10.2.1 and Appendix C), and are available to the client and other recipients of the relevant reports.~~

~~10.4 Demonstration of Capability~~

~~a) Prior to acceptance and institution of any test method, satisfactory demonstration of method capability is required. (See Calscience QSM Section Appendix C and 6.2.b.) This demonstration does not test the performance of the method in real world samples, but in the applicable and available clean matrix (sample of a matrix is which no target analytes or interferences are present at concentrations that impact the results of a specific test method), e.g., water, solids and air. In addition, for analytes that do not lend themselves to spiking, the demonstration of capability may be performed using quality control samples.~~

~~b) Continuing demonstration of method performance, as per the quality control requirements in Appendix D (such as laboratory control samples) is required.~~

~~c) In cases where Calscience analyzes samples using a test method that has been in use by the laboratory before July 1999, and there have been no significant changes in instrument type, personnel or test method, the continuing demonstration of method performance and the analyst's documentation of continued proficiency shall be acceptable. The laboratory shall have records on file to demonstrate that an initial demonstration of capability is not required.~~

~~d) In all cases, the appropriate forms, such as the Certification Statement (Appendix C), is completed and retained by the laboratory to be made available upon request. The laboratory retains all associated supporting data necessary to reproduce the analytical results summarized in the Certification Statement. (See Appendix C for an example of a Certification Statement.)~~

~~e) Demonstration of capability is completed each time there is a significant change in instrument type, personnel, or test method.~~

~~f) In departments with specialized "work cell(s)" (a group consisting of analysts with specifically defined tasks that together perform the test method), the group as a unit must meet the above criteria and this demonstration of capability is fully documented.~~

~~g) When a work cell is employed, and the members of the cell change, the new employee(s) must work with an experienced analyst in that area of the work cell where they are employed. This new work cell must demonstrate acceptable performance through acceptable continuing performance checks (appropriate sections of Appendix D, such as laboratory control samples). Such performance is documented and the four preparation batches following the change in personnel must not result in the failure of any batch acceptance criteria, e.g., method blank and laboratory control sample, or the~~

demonstration of capability must be repeated. In addition, if the entire work cell is changed or replaced, the new work cell must perform the demonstration of capability (Appendix C).

h) Performance of the work cell is linked to the training records of the individual members of the work cell (See Calscience QSM Section 6.2).

10.5 Sample Aliquots

Where sampling (as in obtaining sample aliquots from a submitted sample) is carried out as part of the test method, the laboratory shall use documented procedures and appropriate techniques to obtain representative subsamples. Reference SOP M230 "Homogenization and Compositing of Solid, Soil and Sediment sample" for further guidance.

10.6 Data Verification

Calculations and data transfers are subject to appropriate checks.

a) The laboratory has Standard Operating Procedures that ensure that the reported data are free from transcription and calculation errors.

b) The laboratory has Standard Operating Procedures that ensure that all quality control measures are reviewed, and evaluated before data are reported.

c) The laboratory has Standard Operating Procedures that address manual calculations including manual integrations.

10.7 Documentation and Labeling of Standards and Reagents

Documented procedures exist for the purchase, receipt and storage of consumable materials used for the technical operations of the laboratory.

a) The laboratory retains records for all standards, reagents and media including the manufacturer/vendor, the manufacturer's Certificate of Analysis or purity (if supplied), the date of receipt, recommended storage conditions, and an expiration date after which the material is not used, unless the laboratory verifies its suitability for testing use.

b) Original containers (such as those provided by the manufacturer or vendor) are labeled with an expiration date.

c) Records are maintained on reagent and standard preparation. These records indicate traceability to purchased stocks or neat compounds, reference to the method of preparation, date of preparation, expiration date and preparer's initials.

d) All containers of prepared reagents and standards bear a unique identifier and expiration date and are linked to the documentation requirements in Calscience QSM Section 10.5.c above.

10.8 Computers and Electronic Data Related Requirements

Where computers, automated equipment, or microprocessors are used for the capture, processing, manipulation, recording, reporting, storage or retrieval of test data, Calscience ensures that:

a) All requirements of the NELAC Standard (i.e., Chapter 5 of NELAC) are met;

b) Computer software is tested and documented to be adequate for use, e.g., internal audits, personnel training, focus point of QA and QC;

c) Procedures are established and implemented for protecting the integrity of data. Such procedures include, but are not limited to, integrity of data entry or capture, data storage, data transmission and data processing;

d) Computer and automated equipment are maintained to ensure proper functioning and provided with the environmental and operating conditions necessary to maintain the integrity of calibration and test data; and

e) It establishes and implements appropriate procedures for the maintenance of security of data including the prevention of unauthorized access to, and the unauthorized amendment of, computer records.

11.1 SAMPLE HANDLING, SAMPLE ACCEPTANCE POLICY AND SAMPLE RECEIPT

While Calscience does not have control of field sampling activities, the following are essential to ensure the validity of the laboratory's data.

11.2 Sample Tracking

a) The laboratory has a documented system for uniquely identifying the items to be tested, to ensure that there can be no confusion regarding the identity of such items at any time. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates. The laboratory assigns a unique identification (ID) code to each sample container received in the laboratory. (The use of container shape, size, or other physical characteristic, such as amber glass, or purple top, is not an acceptable means of identifying the sample.)

b) This laboratory code is maintained as an unequivocal link with the unique field ID code assigned each container.

c) The laboratory ID code is placed on the sample container as a durable label.

d) The laboratory ID code is entered into the laboratory records (see Calscience QSM Section 11.3.d) and is the link that associates the sample with related laboratory activities such as sample preparation or calibration.

e) In cases where the sample collector and analyst are the same individual or the laboratory pre-assigns numbers to sample containers, the laboratory ID code may be the same as the field ID code.

11.3 Sample Acceptance Policy

The laboratory has a written sample acceptance policy that clearly outlines the circumstances under which samples are accepted or rejected. Data from any samples that do not meet the following criteria are flagged in an unambiguous manner, and the nature of the variation is clearly defined. The sample acceptance policy is available to sample collection personnel and includes, but is not limited to, the following areas of concern:

a) Proper, full, and complete documentation, that includes sample identification, the location, date and time of collection, collector's name, preservation type, sample type and any special remarks concerning the sample;

b) Proper sample labeling that includes a unique identification and a labeling system for the samples with requirements concerning the durability of the labels (water resistant) and the use of indelible ink;

c) Use of appropriate sample containers;

d) Adherence to specified holding times;

e) Adequate sample volume. Sufficient sample volume must be available to perform the necessary tests; and

f) Procedures to be used when samples show signs of damage, contamination or inadequate preservation.

g) Samples are NOT accepted if classified as extremely hazardous, reference section 5.2 k for examples.

11.4 Sample Receipt Protocols

a) Upon receipt, the condition of the sample, including any abnormalities or departures from standard condition as prescribed in the relevant test method, is recorded. All items specified in Calscience QSM Section 11.2 above are checked.

1) All samples that require cold temperature preservation are considered acceptable if the arrival temperature is within 2°C of the required temperature or the method-specified range. For samples with a specified temperature of 4°C, samples with a temperature ranging from just above the freezing temperature of water to 6°C shall be acceptable. Samples that are hand delivered to the laboratory immediately after collection may not meet these criteria. In these cases, the samples shall be considered acceptable if there is evidence that the chilling process has begun, such as arrival on ice.

2) The laboratory shall implement procedures for checking chemical preservation using readily available techniques, such as pH or free chlorine, prior to or during sample preparation or analysis.

With the exception of residual chlorine measurements in aquatic toxicity samples, certain measurements, such a pH, are performed and recorded just prior to analysis.

b) The results of all checks are recorded.

c) When there is any doubt as to the item's suitability for testing, when the sample does not conform to the description provided, and when the test required is not fully specified, the laboratory makes every attempt to consult the client for further instruction before proceeding. The laboratory establishes whether the sample has received all necessary preparation, or whether sample preparation has yet to be performed. If the sample does not meet the sample receipt acceptance criteria listed in this standard, the laboratory:

1) Retains correspondence and/or records of conversations concerning the final disposition of rejected samples; or

2) Fully documents any decision to commence with the analysis of samples not meeting acceptance criteria.

i. The condition of these samples is, at a minimum, noted on the chain of custody record or transmittal form, and laboratory receipt documents.

ii. The analysis data is/are appropriately "qualified" on the final report.

d) The laboratory utilizes a permanent chronological record such as a logbook or electronic database to document receipt of all sample containers.

1) This sample receipt log records the following:

i. Client/Project Name;

ii. Date and time of laboratory receipt;

iii. Unique laboratory ID code (see Calscience QSM Section 11.1); and

iv. Signature or initials of the person making the entries.

2) During the login process, the following information is linked to the log record or included as a part of the log. If such information is recorded/documented elsewhere, that document becomes part of the laboratory's permanent records, easily retrievable upon request, and readily available to individuals who will process the sample. Note: The placement of the laboratory ID number on the sample container is not considered a permanent record.

i. The field ID code that identifies each container is linked to the laboratory ID code in the sample receipt log.

ii. The date and time of sample collection is linked to the sample container and to the date and time of receipt in the laboratory.

iii. The requested analyses (including applicable approved test method numbers) are linked to the laboratory ID code.

iv. Any comments resulting from inspection for sample rejection are linked to the laboratory ID code.

e) All documentation (i.e., memos or transmittal forms) that are conveyed to the laboratory by the sample submitter is retained.

f) A complete chain of custody record form is maintained.

11.5 Storage Conditions

The laboratory has documented procedures and appropriate facilities to avoid deterioration, contamination, and damage to the sample during storage, handling, preparation, and testing; any relevant instructions provided with the item are followed. Where items must be stored or conditioned under specific environmental conditions, these conditions are maintained, monitored, and recorded.

a) Samples are stored according to the conditions specified by preservation protocols:

1) Samples that require thermal preservation are stored under refrigeration at +/-2° of the specified preservation temperature unless method-specified criteria exist. For samples with a specified storage temperature of 4°C, storage at a temperature above the freezing point of water to 6°C is acceptable.

2) Samples are stored away from all standards, reagents, food, and other potentially contaminating sources. Samples are stored in such a manner to prevent cross contamination.

b) Sample fractions, extracts, leachates, and other sample preparation products are stored according to Calscience QSM Section 11.4.a above or according to specifications in the test method.

c) When a sample or portion of a sample needs to be held secure (for example, for reasons of record, safety or value, or to enable check calibrations or tests to be performed later), the laboratory has storage and security arrangements that protect the condition and integrity of the secured items or portions concerned.

11.6 Sample Disposal

The laboratory has standard operating procedures for the disposal of samples, digestates, leachates and extracts or other sample preparation products.

12.1 RECORDS

The laboratory maintains a record system to suit its particular circumstances and comply with any applicable regulations. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the test report for a minimum of five years.

There are two levels of sample handling: 1) sample tracking and 2) legal chain of custody protocols that are used for evidentiary or legal purposes. All essential requirements for sample tracking (e.g., chain of custody form) are outlined in Calscience QSM Sections 12.1, 12.2 and 12.3. Calscience has a written SOP that describes how it will carry out legal chain of custody for example, ASTM D 4840-95 and Manual for the Certification of Laboratories Analyzing Drinking Water, March 1997, Appendix A.

12.2 Record Keeping System and Design

The Calscience record keeping system allows historical reconstruction of all laboratory activities that produced the analytical data. The history of the sample is readily understood through the documentation. This includes inter-laboratory transfers of samples and/or extracts.

a) The records include the identity of personnel involved in sampling, sample receipt, preparation, calibration or testing.

b) All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification, are documented.

c) The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes, e.g., set format for naming electronic files.

d) All changes to records are signed or initialed by responsible staff. The reason for the signature or initials is clearly indicated in the records such as "sampled by," "prepared by," or "reviewed by."

e) All generated data, except those that are generated by automated data collection systems, are recorded directly, promptly, and legibly in permanent ink.

f) Entries in records are not be obliterated by methods such as erasures, overwritten files or markings. All corrections to record-keeping errors are made by one line marked through the error. The individual making the correction signs (or initials) and dates the correction. These criteria also apply to electronically maintained records.

g) Refer to 10.6 for Computer and Electronic Data.

12.3 Records Management and Storage

a) All records (including those pertaining to calibration and test equipment), certificates and reports are safely stored, and held secure and in confidence to the client. NELAP-related records are available to the accrediting authority.

b) All records, including those specified in Calscience QSM Section 12.3, are retained for a minimum of five years from generation of the last entry in the records. The laboratory maintains all information necessary for the historical reconstruction of data. Records stored only on electronic media are supported by the hardware and software necessary for their retrieval.

c) Records that are stored or generated by computers or personal computers have hard copy or write-protected backup copies.

d) The laboratory has an established record management system for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation storage and reporting.

e) Access to archived information is documented with an access log. These records are protected against fire, theft, loss, environmental deterioration, vermin, and in the case of electronic records, electronic or magnetic sources.

f) The laboratory has a plan to ensure that the records are maintained or transferred according to the clients' instructions (see 4.1.8.e of NELAC) in the event of Laboratory Transfer of Ownership, Going out of Business or Bankruptcy. In all cases, appropriate regulatory and state legal requirements concerning laboratory records will be followed. Reference SOP T-002 for detailed policies and procedures for handling of client records and data in these situations.

12.4 Laboratory Sample Tracking

12.4.1 Sample Handling

A record of all procedures to which a sample is subjected while in Calscience's possession is maintained. These include but are not limited to all records pertaining to:

a) Sample preservation, including appropriateness of sample container and compliance with holding time requirement;

b) Sample identification, receipt, acceptance or rejection, and log-in;

c) Sample storage and tracking, including shipping receipts, sample transmittal forms (chain of custody form); and

d) Documentation procedures for the receipt and retention of test items, including all provisions necessary to protect the integrity of samples.

~~12.4.2 Laboratory Support Activities~~

~~In addition to documenting all the above-mentioned activities, the following is retained:~~

~~a) All original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts work sheets and data output records (chromatograms, strip charts, and other instrument response readout records);~~

~~b) A written description or reference to the specific test method used, which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value;~~

~~c) Copies of final reports;~~

~~d) Archived standard operating procedures;~~

~~e) Correspondence relating to laboratory activities for a specific project;~~

~~f) All corrective/preventive action reports, audits and audit responses;~~

~~g) Proficiency test results and raw data; and,~~

~~h) Results of data review, verification, and cross-checking procedures.~~

~~12.4.3 Analytical Records~~

~~The essential information associated with analyses, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:~~
~~a) Laboratory sample ID code;~~

~~b) Date of analysis and time of analysis if the method-specified holding time is 72 hours or less, or when time critical steps are included in the analysis, e.g., extractions, and incubations;~~

~~c) Instrument identification and instrument operating conditions/parameters (or reference to such data);~~

~~d) Analysis type;~~

~~e) All manual calculations e.g., manual integrations;~~

~~f) Analyst's or operator's initials/signature;~~

~~g) Sample preparation including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;~~

~~h) Sample analysis;~~

~~i) Standard and reagent origin, receipt, preparation, and use;~~

~~j) Calibration criteria, frequency and acceptance criteria;~~

~~k) Data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;~~

~~l) Quality control protocols and assessment;~~

m) Electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and

n) Method performance criteria including expected quality control requirements.

12.4.4 Administrative Records

The following are maintained:

a) Personnel qualifications, experience and training records;

b) Records of demonstration of capability for each analyst; and

c) A log of names, initials and signatures for all individuals who are responsible for signing or initialing any laboratory record.

13.0 LABORATORY REPORT FORMAT AND CONTENTS

The results of each test, or series of tests carried out by the laboratory must be reported accurately, clearly, unambiguously and objectively. The results normally reported in a test report and include all the information necessary for the interpretation of the test results and all information required by the method used. Some regulatory reporting requirements or formats, such as monthly operating reports may not require all items listed below, however, Calscience will provide all the required information to their client for use in preparing such regulatory reports.

a) Except as discussed in 13.b, each report to an outside client includes at least the following information (those prefaced with "where relevant" are not mandatory):

1) A title, e.g., "Analytical Report," or "Test Certificate," "Certificate of Results" or "Laboratory Results";

2) Name and address of laboratory, and location where the test was carried out if different from the address of the laboratory and phone number with name of contact person for questions;

3) Unique identification of the certificate or report (such as serial number) and of each page, and the total number of pages;

This requirement may be presented in several ways:

i. The total number of pages may be listed on the first page of the report as long as the subsequent pages are identified by the unique report identification and consecutive numbers, or

ii. Each page is identified with the unique report identification, the pages are identified as a number of the total report pages (example: 3 of 10, or 1 of 20).

Other methods of identifying the pages in the report may be acceptable as long as it is clear to the reader that discrete pages are associated with a specific report, and that the report contains a specified number of pages.

4) Name and address of client, where appropriate and project name if applicable;

5) Description and unambiguous identification of the tested sample including the client identification code;

6) Identification of test results derived from any sample that did not meet NELAC sample acceptance requirements such as improper container, holding time, or temperature;

7) Date of receipt of sample, date and time of sample collection, date(s) of performance test, and time of sample preparation and/or analysis if the required holding time for either activity is less than or equal to 72 hours;

8) Identification of the test method used, or unambiguous description of any nonstandard method used;

9) If the laboratory collected the sample, reference to sampling procedure;

10) Any deviations from (such as failed quality control), additions to or exclusions from the test method (such as environmental conditions), and any nonstandard conditions that may have affected the quality of results, and including the use and definitions of data qualifiers.

11) Measurements, examinations and derived results, supported by tables, graphs, sketches, and photographs as appropriate, and any failures identified; identify whether data are calculated on a dry weight or wet weight basis; identify the reporting units such as µg/l or mg/kg;

12) When required, a statement of the estimated uncertainty of the test results;

13) A signature and title, or an equivalent electronic identification of the person(s) accepting responsibility for the content of the certificate or report (however produced), and date of issue;

14) At the Calscience's discretion, a statement to the effect that the results relate only to the items tested or to the sample as received by the laboratory;

15) At the Calscience's discretion, a statement that the certificate or report shall not be reproduced except in full, without the written approval of the laboratory;

16) Clear identification of all test data provided by outside sources, such as subcontracted laboratories, clients, etc.; and

17) Clear identification of numerical results with values outside of quantitation limits.

b) Where the certificate or report contains results of tests performed by subcontractors, these results are clearly identified by subcontractor name or applicable accreditation number.

c) After issuance of the report, the laboratory report remains unchanged. Material amendments to a calibration certificate, test report or test certificate after issue may be made only in the form of a further document, or data transfer, including the statement "Supplement to Test Report or Test Certificate, serial number . . . [or as otherwise identified]", or equivalent form of wording. Such amendments meet all the relevant requirements of the NELAC Standard.

d) Calscience notifies clients promptly, in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any calibration certificate, test report or test certificate or amendment to a report or certificate.

e) The laboratory will, where clients require transmission of test results by telephone, telex, facsimile or other electronic or electromagnetic means, follow documented procedures that ensure that the requirements of this Standard are met and that confidentiality is preserved.

f) Calscience will certify that all its NELAC-certified test results reported meet all requirements of NELAC or provide reasons and/or justification if they do not.

14.0 SUBCONTRACTING ANALYTICAL SAMPLES

When Calscience subcontracts work whether because of unforeseen circumstances (e.g. workload, need for further expertise or temporary incapacity) or on a continuing basis (e.g. through client direction, contractual arrangement or permanent subcontracting), this work shall be placed with a laboratory accredited under NELAP for the tests to be performed or with a laboratory that meets applicable statutory and requirements for performing the tests and submitting the results of tests performed. The laboratory performing the subcontracted work shall be indicated in the final report.

a) Calscience will advise its client via written, facsimile or e-mail notification of its intention to subcontract any portion of the testing to another party in cases when unforeseen circumstances occur. Calscience shall gain approval by the client preferably in writing, facsimile or via e-mail response.

b) Calscience may subcontract samples on a continuing basis without written, facsimile or e-mail notification under the following (but not limited to) cases:

   1) Client direction or instruction
   2) Contractual specification or requirement
   3) Project historical precedent

c) Calscience retains records demonstrating that the above requirements have been met.

d) If the samples to be subcontracted are submitted to Calscience under special regulatory, agency or governmental accreditation, Example: Department of Defense (Navy), that have more comprehensive or differing quality criteria, Example: DoD QSM for Environmental Laboratories January 2006, then the subcontract laboratory MUST have certification for the subcontracted analysis from the same entity and MUST have undergone similar assessment as the primary laboratory for the subcontracted component. Written authorization from the client or authorizing body must be obtained prior to usage of each subcontract laboratory.

15.0 OUTSIDE SUPPORT SERVICES AND SUPPLIES

Calscience does not procure outside services and supplies, other than those referred to in this Manual.

16.0 INQUIRIES AND COMPLAINTS

Calscience SOP-T018 addresses the policies and procedures for the resolution of inquiries and complaints received from clients or other parties about the laboratory's activities. Where an inquiry or complaint, or any other circumstance, raises doubt concerning the laboratory's compliance with the laboratory's policies or procedures, or with the requirements of this manual or otherwise concerning the quality of the laboratory's calibrations or tests, the laboratory shall ensure that those areas of activity and responsibility involved are promptly audited in accordance with NELAC Section 5.3.1. Records of the complaint and subsequent actions are maintained and are available for audits.

~~NELAC APPENDICES~~

APPENDIX A - REFERENCES

NELAC Standards, Chapters 1-6. July 12, 2002, Effective July 01, 2004.

40 CFR Part 136, Appendix A, paragraphs 8.1.1 and 8.2.

American Association for Laboratory Accreditation April 1996. General Requirements for Accreditation.

"American National Standards Specification and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs (ANSI/ASQC E-4)," 1994.

ASTM E1598-94 Conducting Early Seedling Growth Tests, American Society for Testing and Materials, West Conshocken, PA 1999.

ASTM E11676-97 Conducting a Laboratory Soil Toxicity Test with Lumbricid Earthworm *Eisenia foetida*, American Society for Testing and Materials, West Conshocken, PA 1999.

Catalog of Bacteria, American Type Culture Collection, Rockville, MD.

EPA 2185 - Good Automated Laboratory Practices, 1995 available at www.epa.gov/docs/etsdwe1/irm_galp/

EPA/600/3-89/013 Ecological Assessment of Hazardous Waste Sites, Office of Research and Development, Washington, DC, 1991.

EPA/503/8-91/001 Evaluation of Dredged Material Proposed for Ocean Disposal – Testing Manual. Office of Water, Washington, DC, 1991.

EPA/600/4-90/031 Manual for Evaluation of Laboratories Performing Aquatic Toxicity Tests, Office of Research and Development, Washington, DC, 1991.

EPA/600/3-88/029 Protocol for Short-term Toxicity Screening of Hazardous Wastes, Office of Research and Development, Washington, DC, 1991.

EPA/600/4-90/027F Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, 4th Ed., Office of Research and Development, Washington, DC, 1993.

EPA/823/B-98/004 Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Inland Testing Manual. Office of Water, Washington, DC, 1994.

EPA/600/R-94/025 Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods, Office of Research and Development, Washington, DC, 1994.

EPA/600/R-94/024 Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Office of Research and Development, Washington, DC, 1994.

EPA/600/4-91/002 Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, 3rd Ed., Office of Research and Development, Washington, DC, 1994.

EPA/600/4-91/003 Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Marine and Estuarine Organisms, 2nd Ed., Office of Research and Development, Washington, DC, 1994.

~~"Glossary of Quality Assurance Terms and Acronyms," Quality Assurance Division, Office of Research and Development, USEPA.~~

~~"Guidance on the Evaluation of Safe Drinking Water Act Compliance Monitoring Results from Performance Based Methods," September 30, 1994, Second draft.~~

~~International vocabulary of basic and general terms in metrology (VIM): 1984. Issued by BIPM, IEC, ISO and OIML.~~

~~ISO Guide 3534-1: "Statistics, vocabulary and symbols - Part 1: Probability and general statistical terms."~~

~~ISO Guide 7218: Microbiology - General Guidance for Microbiological Examinations.~~

~~ISO Guide 8402: 1986. Quality – Vocabulary.~~

~~ISO Guide 9000: 1994. Quality management and quality assurance standards - Guidelines for selection and use.~~

~~ISO Guide 9001: 1994. Quality Systems - Model for quality assurance in design/development, production, installation and servicing~~

~~ISO Guide 9002: 1994. Quality systems - Model for quality assurance in production and installation.~~

~~ISO/IEC Guide 2: 1986. General terms and their definitions concerning standardization and related activities.~~

~~ISO/IEC 17025: 1999. General requirements for the competence of calibration and testing laboratories.~~

~~"Laboratory Biosafety Manual," World Health Organization, Geneva, 1983.~~

~~Manual for the Certification of Laboratories Analyzing Drinking Water, Revision 4, EPA 815-B-97-001.~~

~~Manual of Method for General Bacteriology, Philipp Gerhard et al., American Society for Microbiology, Washington, D.C. 1981.~~

~~Performance Based Measurement System, EPA EMMC Method Panel, PBMS Workgroup, 1996.~~

APPENDIX B - GLOSSARY

The following definitions are used in the text of Quality Systems. In writing this document, the following hierarchy of definition references were used: ISO 8402, ANSI/ASQC E-4, EPA's Quality Assurance Division Glossary of Terms, and finally definitions developed by NELAC. The source of each definition, unless otherwise identified, is the Quality Systems Committee.

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (NELAC)

Accrediting Authority: The Territorial, State, or Federal agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation. (NELAC) [1.5.2.3]

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analysis Duplicate: The second measurement of the target analyte(s) performed on a single sample or sample preparation.

Analyst: The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (NELAC)

Analytical Reagent (AR) Grade: Designation for the high purity of certain chemical reagents and solvents given by the American Chemical Society. (Quality Systems)

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of NELAC). (NELAC)

Audit: A systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity. (EPA-QAD)

Batch: Environmental samples, which are prepared and/or analyzed together with the same process and personnel using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same NELAC-defined matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples. (NELAC Quality Systems Committee)

Blank: A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Blind Sample: A sub-sample for analysis with a composition known to the submitter. The analyst/ laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process. (NELAC)

Calibration: To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements. (NELAC)

Calibration Curve: The graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (NELAC)

Calibration Method: A defined technical procedure for performing a calibration. (NELAC)

Calibration Standard: A substance or reference material used to calibrate an instrument. (QAMS)

Certified Reference Material (CRM): A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30 – 2.2)

Chain of Custody Form: A record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; collector; time of collection; preservation; and requested analyses. (NELAC)

Compromised Samples: Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions compromised samples are not analyzed. If emergency situations require analysis, the results must be appropriately qualified. (NELAC)

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

- Second column confirmation;
- Alternate wavelength;
- Derivatization;
- Mass spectral interpretation;
- Alternative detectors; or
- Additional cleanup procedures. (NELAC)

Conformance: An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ ASQC E4-1994)

Corrective Action: The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality (i.e., that they meet specified acceptance criteria). (NELAC)

Data Reduction: The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (EPA-QAD)

Deficiency: An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC)

Demonstration of Capability: A procedure to establish the ability of the analyst to generate acceptable accuracy. (NELAC)

Desorption Efficiency: The mass of target analyte recovered from sampling media, usually a sorbent tube, divided by the mass of target analyte spiked on to the sampling media expressed as a percentage. Sample target analyte masses are usually adjusted for the desorption efficiency. (NELAC)

Detection Limit: The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit. (NELAC)

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

Duplicate Analyses: The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA- QAD)

Holding Times (Maximum Allowable Holding Times): The maximum times that samples may be held prior to analysis and still be considered valid or not compromised. (40 CFR Part 136)

Inspection: An activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic. (ANSI/ ASQC E4-1994)

Internal Standard: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method. (NELAC)

Instrument Blank: A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Laboratory: A body that calibrates and/or tests. (ISO 25)

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system. (NELAC)

Laboratory Duplicate: Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently. (NELAC)

Limit of Detection (LOD): The lowest concentration level that can be determined by a single analysis and with a defined level of confidence to be statistically different from a blank. See also Method Detection Limit, Detection Limit, and Quantitation Limit. (Analytical Chemistry, 55, p. 2217, December 1983, modified)

Manager (however named): The individual designated as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual. (NELAC)

Matrix: The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

- Aqueous: Any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.
- Drinking Water: Any aqueous sample that has been designated a potable or potential potable water source.
- Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.
- Non-aqueous Liquid: Any organic liquid with <15% settleable solids.
- Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.
- Solids: Includes soils, sediments, sludges and other matrices with >15% settleable solids.
- Chemical Waste: A product or by-product of an industrial process that results in a matrix not previously defined.
- Air: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter or other device. (NELAC)

Matrix Spike (spiked sample or fortified sample): A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency. (QAMS)

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): A second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte. (QAMS)

May: Denotes permitted action, but not required action. (NELAC)

Media: Material that supports the growth of a microbiological culture.

Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. (NELAC)

Method Detection Limit: The minimum concentration of a substance (an analyte) 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. (40 CFR Part 136 Appendix B)

Must: Denotes a requirement that must be met. (Random House College Dictionary)

National Accreditation Database: The publicly accessible database listing the accreditation status of all laboratories participating in NELAP. (NELAC)

National Environmental Laboratory Accreditation Conference (NELAC): A voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP. (NELAC)

National Environmental Laboratory Accreditation Program (NELAP): The overall National Environmental Laboratory Accreditation Program of which NELAC is a part. (NELAC)

~~**Negative Control:** Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (NELAC)~~

~~**Objective Evidence:** Any documented statement of fact, other information, or record, either quantitative or qualitative, pertaining to the quality of an item or activity, based on observations, measures, or tests that can be verified. (ASQC)~~

~~**Performance Audit:** The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (NELAC)~~

~~**Performance Based Measurement System (PBMS):** A set of processes wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner. (NELAC)~~

~~**Positive Control:** Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects. (NELAC)~~

~~**Precision:** The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (NELAC)~~

~~**Preservation:** Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample. (NELAC)~~

~~**Proficiency Testing:** A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (NELAC) [2.1]~~

~~**Proficiency Testing Program:** The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (NELAC)~~

~~**Proficiency Test Sample (PT):** A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (QAMS)~~

~~**Protocol:** A detailed written procedure for field and/or laboratory operation (e.g., sampling, and analysis) which must be strictly followed. (EPA- QAD)~~

~~**Pure Reagent Water:** Shall be water (defined by national or international standard) in which no target analytes or interferences are detected as required by the analytical method. (NELAC)~~

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

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

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

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

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (NELAC)

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC. (ANSI/ ASQC E-41994)

Quantitation Limits: Levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported at a specific degree of confidence. (NELAC)

Range: The difference between the minimum and the maximum of a set of values. (EPA-QAD)

Raw Data: Any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, data and verified accurate by signature), the exact copy or exact transcript may be submitted. (EPA-QAD)

Reagent Blank (method reagent blank): A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (QAMS)

Record Retention: The systematic collection, indexing and storing of documented information under secure conditions. (EPA-QAD)

Reference Material: A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30- 2.1)

Reference Method: A method of known and documented accuracy and precision issued by an organization recognized as competent to do so. (NELAC)

Reference Standard: A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM-6.08)

Reference Toxicant: The toxicant used in performing toxicity tests to indicate the sensitivity of a test organism and to demonstrate the laboratory's ability to perform the test correctly and obtain consistent results (see Chapter 5, Appendix D, Section 2.1.f). (NELAC)

Replicate Analyses: The measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)

Requirement: Denotes a mandatory specification; often designated by the term "shall". (NELAC)

Sampling Media: Material used to collect and concentrate the target analytes(s) during air sampling such as solid sorbents, filters, or impinger solutions.

Selectivity: (Analytical chemistry) The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. (EPA-QAD)

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

Shall: Denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled. (ANSI)

Should: Denotes a guideline or recommendation whenever noncompliance with the specification is permissible. (ANSI)

Spike: A known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes. (NELAC)

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies. (ASQC)

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

Standardized Reference Material (SRM): A certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method. (EPA-QAD)

Supervisor (however named): The individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses. (NELAC)

Surrogate: A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes. (QAMS)

Systems Audit (also Technical Systems Audit): A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Director: Individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory. (NELAC)

Test: A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate. (ISO/IEC Guide 2-12.1, amended)

Test Method: An adoption of a scientific technique for a specific measurement problem, as documented in a laboratory SOP. (NELAC)

Testing Laboratory: Laboratory that performs tests. (ISO/ IEC Guide 2 - 12.4)

Test Sensitivity/Power: The minimum significant difference (MSD) between the control and test concentration that is statistically significant. It is dependent on the number of replicates per concentration, the selected significance level, and the type of statistical analysis (see Chapter 5, Appendix D, Section 2.4.a). (NELAC)

Tolerance Chart: A chart in which the plotted quality control data is assessed via a tolerance level (e.g. +/- 10% of a mean) based on the precision level judged acceptable to meet overall quality/data use requirements instead of a statistical acceptance criteria (e.g. +/- 3 sigma) (applies to radiobioassay laboratories). (ANSI)

Traceability: The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM - 6.12)

Validation: The process of substantiating specified performance criteria. (EPA- QAD)

Verification: Confirmation by examination and provision of evidence that specified requirements have been met. (NELAC)

NOTE: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment.

The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.

Work Cell: A well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented. (NELAC)

Sources:

American Society for Quality Control (ASQC), Definitions of Environmental Quality Assurance Terms, 1996

American National Standards Institute (ANSI), Style Manual for Preparation of Proposed American National Standards, Eighth Edition, March 1991

ANSI/ASQC E4, 1994

ANSI N42.23- 1995, Measurement and Associated Instrument Quality Assurance for Radiobioassay Laboratories

International Standards Organization (ISO) Guides 2, 30, 8402

International Vocabulary of Basic and General Terms in Metrology (VIM): 1984. Issued by BIPM, IEC, ISO and OIML

National Institute of Standards and Technology (NIST)

National Environmental Laboratory Accreditation Conference (NELAC), July 1998 Standards

Random House College Dictionary

~~U.S. EPA Quality Assurance Management Section (QAMS), Glossary of Terms of Quality Assurance Terms, 8/31/92 and 12/6/95~~

~~U.S. EPA Quality Assurance Division (QAD)~~

~~40 CFR, Part 136~~

~~Webster's New World Dictionary of the American Language~~

~~APPENDIX C - DEMONSTRATION OF CAPABILITY~~

~~C.1 PROCEDURE FOR DEMONSTRATION OF CAPABILITY~~

~~A demonstration of capability (DOC) must be made prior to using any test method, and at any time there is a change in instrument type, personnel or test method. (See NELAC 10.2.1.)~~

~~Note: Where tests are performed by specialized "work cells" (a well-defined group of analysts that together perform the method analysis), the work cell as a unit meets the above criteria and this demonstration is fully documented.~~

~~In general, this demonstration does not test the performance of the method in real world samples, but in the applicable and available clean matrix (a sample of a matrix in which no target analytes or interferences are present at concentrations that impact the results of a specific test method), e.g., water, solids and air. However, before any results are reported using this method, actual sample spike results may be used to meet this standard, i.e., at least four consecutive matrix spikes within the last twelve months. In addition, for analytes that do not lend themselves to spiking, e.g., TSS, the demonstration of capability may be performed using quality control samples.~~

~~All demonstrations shall be documented through the use of the form in this appendix.~~

~~The following steps, which are adapted from the EPA test methods published in 40 CFR Part 136, Appendix A, are performed if required by mandatory test method or regulation. Note: For analytes for which spiking is not an option and for which quality control samples are not readily available, the 40 CFR approach is one way to perform this demonstration. The laboratory documents that other approaches to DOC are adequate, and this is documented in the laboratory's Quality Manual.~~

~~a) A quality control sample is obtained from an outside source. If not available, the QC sample may be prepared by the laboratory using stock standards that are prepared independently from those used in instrument calibration.~~

~~b) The analyte(s) is diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified, or if unspecified, to a concentration approximately 10 times the method-stated or laboratory-calculated method detection limit.~~

~~c) At least four aliquots are prepared and analyzed according to the test method either concurrently or over a period of days.~~

~~d) Using all of the results, the mean recovery ($\bar{X}$) is calculated in the appropriate reporting units (such as µg/L) and the standard deviations of the population sample (n-1) (in the same units) for each parameter of interest. When it is not possible to determine mean and standard deviations, such as for presence/absence and logarithmic values, the laboratory will assess performance against established and documented criteria.~~

~~e) Compare the information from (d) above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory-generated acceptance criteria (if there are no established mandatory criteria). If all parameters meet the acceptance criteria, the analysis of actual samples may begin. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.~~

~~f) When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to 1) or 2) below.~~

1) Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with c) above.

2) Beginning with c) above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with c).

C.2 CERTIFICATION STATEMENT

The following certification statement shall be used to document the completion of each demonstration of capability. A copy of the certification statement shall be retained in the personnel records of each affected employee (see Calscience QSM Section 6.3 and 12.3.4.b.).

~~Demonstration of Capability~~
~~Certification Statement~~

~~Date: Page of~~
~~Laboratory Name:~~
~~Laboratory Address:~~
~~Analyst(s) Name(s):~~

~~Matrix:~~
~~(examples: laboratory pure water, soil, air, solid, biological tissue)~~

~~Method number, SOP#, Rev #, and Analyte, or Class of Analytes or Measured Parameters:~~
~~(examples: barium by 200.7, trace metals by 6010, benzene by 8021, etc.)~~

~~We, the undersigned, CERTIFY that:~~

~~1. The analysts identified above, using the cited test method(s), which is in use at this facility for the analyses of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.~~

~~2. The test method(s) was performed by the analyst(s) identified on this certification.~~

~~3. A copy of the test method(s) and the laboratory-specific SOPs are available for all personnel on-site.~~

~~4. The data associated with the demonstration capability are true, accurate, complete and self-explanatory (1).~~

~~5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized assessors.~~

~~Technical Director's Name and Title~~	~~Signature~~	~~Date~~
~~Quality Assurance Officer's Name~~	~~Signature~~	~~Date~~

~~This certification form must be completed each time a demonstration of capability study is completed.~~

~~(1) True: Consistent with supporting data.~~
~~Accurate: Based on good laboratory practices consistent with sound scientific principles/practices.~~
~~Complete: Includes the results of all supporting performance testing.~~
~~Self-explanatory: Data properly labeled and stored so that the results are clear and require no additional explanation.~~

~~(Note: Form may be modified so long as the essential items are included in the updated form)~~

~~APPENDIX D - ESSENTIAL QUALITY CONTROL REQUIREMENTS~~

~~The quality control protocols specified by the laboratory's method manual (10.1.2) shall be followed. The laboratory shall ensure that the essential standards outlined in Appendix D are incorporated into their method manuals.~~

~~All quality control measures shall be assessed and evaluated on an ongoing basis and quality control acceptance criteria shall be used to determine the validity of the data. The laboratory shall have procedures for the development of acceptance/rejection criteria where no method or regulatory criteria exists.~~

~~The requirements from the body of Chapter 5, e.g., Section 5.4, apply to all types of testing. The specific manner in which they are implemented is detailed in each of the sections of this Appendix, i.e., chemical testing.~~

~~D.1 CHEMICAL TESTING~~

~~D.1.1 Positive and Negative Controls~~

~~a) Negative Controls~~

~~1) Method Blanks - Shall be performed at a frequency of one per preparation batch of samples per matrix type. The results of this analysis shall be one of the QC measures to be used to assess the batch. The source of contamination must be investigated and measures taken to correct, minimize or eliminate the problem if~~

~~i) the blank contamination exceeds a concentration greater than 1/10 of the measured concentration of any sample in the associated sample batch or~~

~~ii) the blank contamination exceeds the concentration present in the samples and is greater than 1/10 of the specified regulatory limit.~~

~~Any sample associated with the contaminated blank shall be reprocessed for analysis or the results reported with appropriate data qualifying codes.~~

~~b) Positive Controls~~

~~1) Laboratory Control Sample (LCS) - (QC Check Samples) Shall be analyzed at a minimum of 1 per preparation batch of 20 or less samples per matrix type, except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to assess the batch. NOTE: The matrix spike (see 2 below) may be used in place of this control as long as the acceptance criteria are as stringent as for the LCS.~~

~~2) Matrix Spikes (MS) - Shall be performed at a frequency of one out of every 20 samples per matrix type prepared over time, except for analytes for which spiking solutions are not available such as, total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in a matrix spike may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the spike.~~

~~3) Surrogates - Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate~~

is not available. Poor surrogate recovery may indicate a problem with the sample composition and shall be reported to the client whose sample produced the poor recovery.

4) If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene, and PCBs in Method 608), the test method has an extremely long list of components or components that are incompatible, a representative number (minimum of 10%) of the listed components may be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit-specified analytes, and other client-requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

D.1.2 Analytical Variability/Reproducibility

Matrix Spike Duplicates (MSDs) or Laboratory Duplicates - Shall be analyzed at a minimum of 1 in 20 samples per matrix type per sample extraction or preparation method. The laboratory shall document its procedure to select the use of appropriate type of duplicate. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in the duplicates may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the duplicate.

D.1.3 Method Evaluation

In order to ensure the accuracy of the reported result, the following procedures shall be in place:

a) Demonstration of Analytical Capability - (Section 10.2.1) shall be performed initially (prior to the analysis of any samples) and with a significant change in instrument type, personnel, matrix or test method.

b) Calibration - Calibration protocols specified in Section 9.4 shall be followed.

c) Proficiency Test Samples - The results of such analyses (4.2.j or 5.3.4) shall be used by the laboratory to evaluate the ability of the laboratory to produce accurate data.

D.1.4 Analytical Measurement Uncertainty Estimation

When estimating analytical measurement uncertainty, all significant components of uncertainty must be identified and quantified. Components that affect analytical measurement uncertainty include sampling, handling, transport, storage, preparation and testing. A typical environmental laboratory will have the greatest contribution to uncertainty in the storage, preparation and testing portion of the analytical train, hence the estimation can be limited to those three areas, assuming all other factors are within recommended guidelines for sample size, container type, preservation (chemical, temperature, temporal) and handling/transport. If the latter are *NOT* within guidelines then these additional estimations of variability must be accounted for, and may supersede the laboratory contribution to uncertainty.

Definitive references and procedural manuals for calculating Analytical Measurement Uncertainty are listed below. Note that there are different theories on the "best" way to estimate uncertainty, it is up to the end user to determine that which best meets their project needs.

a) "Environmental Analytical Measurement Uncertainty Estimation – Nested Hierarchical Approach", William Ingersoll, Defense Technical Information Center # ADA396946, 2001

b) "Quantifying Uncertainty in Analytical Measurement", EuraChem / CITAC Guide CG 4, Second Edition, QUAM 2000.1

c) "Quantifying Measurement Uncertainty in Analytical Chemistry – A Simplified Practical Approach", Thomas W. Vetter, National Institute of Standards and Technology

The process in general involves the following steps:

1. Specify the Measurand – Write down a clear statement of what is being measured, including the relationship between the measurand and the input quantities, i.e., measured quantities, constants, calibration standard values, etc.

2. Identify uncertainty sources – This will include sources that contribute to the uncertainty on the parameters in the relationships identified in step 1, but may include other sources and must include sources arising from chemical assumptions.

3. Quantify uncertainty components – Measure or estimate the size of the uncertainty component associated with each potential source of uncertainty identified. It is often possible to estimate or determine a single contribution to uncertainty from the aggregate of multiple sources.

4. Calculate combined uncertainty – The information obtained in step 3 will consist of a number of quantified contributions to overall uncertainty, whether associated with individual sources or with the combined effects of several sources.

The process outlined above relates to the measurement of uncertainty for the preparative / analytical laboratory procedure. However, there are uncertainty contributions from other factors outside the preparative / analytical procedure. These can be controlled to a great extent by specifying uniform and standardized training or conditions.

Examples:

Human Factors

a) All personnel at Calscience undergo documented training in the method and / or instrument used. Minimum levels of education or experience are required.

b) Initial and continuing Demonstrations of Capability (DOC) must be performed and documented prior to and in continuance of analytical work related to their areas of responsibilities.

c) Blind Proficiency Testing samples are analyzed twice a year to gauge each department, matrix and method.

d) Data Integrity and Ethics Training are provided to new employees and on an annual basis to all employees.

Accommodation and Environmental Conditions

a) Calscience has standardized operating procedures for transport, storage and tracking of samples, extracts and digests through out the laboratory. All incoming orders are logged into a Laboratory Information System that assigns a specific identifier code to each work order, sample container and analytical result.

b) The sample control areas are secured with restricted access using card key portals. Internal chain of custody is available if the project requires.

c) The laboratory has over 35,000 sq ft of laboratory space with temperature controlled and air positive or negative environmental controls.

d) Regular safety inspections are performed to identify potentially hazardous conditions and to ensure general cleanliness.

Environmental Test Methods and Method Validation

a) All methods in use have Standard Operating Procedures (SOPs) based upon published methods from the EPA, ASTM, Standard Methods or other established body. These are controlled documents assigned to each department. An annual review is performed.

b) Each method has internal and external quality control criteria for preparative efficiency, instrument performance, calibration, continuing method performance and possible matrix effects as appropriate.

c) Ongoing Proficiency Testing program.

Equipment and Instrumentation

a) Each instrument in use has performance parameters that must be evaluated to specific standards based on the established method prior to any analytical use.

b) Routine and preventative maintenance is performed to maintain optimum operational performance.

c) Complex instrument systems are covered under manufacturer service contracts as appropriate.

Measurement Traceability

a) Every reagent used must meet the indicated purity and fitness for usage as referenced in the method SOPs.

b) All calibration standards are certified by the manufacturer to meet or exceed purity levels as recorded in the accompanying Certificate of Traceability to NIST or other standards verification.

c) Each reagent, standard or working standard is recorded, assigned a tracking identifier. This is referenced in the analytical log book as needed to assure traceability to the original source.

d) All Balances, Dispensers, Pipettors, Refrigerators, Freezers and Thermometers are checked on a daily or other routine basis to specified tolerances.

D.1.5 Detection Limits

The laboratory shall utilize a test method that provides a detection limit that is appropriate and relevant for the intended use of the data. Detection limits shall be determined by the protocol in the mandated test method or applicable regulation, e.g., Method Detection Limit (MDL). If the protocol for determining detection limits is not specified, the selection of the procedure must reflect instrument limitations and the intended application of the test method.

a) A detection limit study is not required for any component for which spiking solutions or quality control samples are not available such as temperature.

b) The detection limit shall be initially determined for the compounds of interest in each test method in a matrix in which there are not target analytes nor interferences at a concentration that would impact the results or the detection limit must be determined in the matrix of interest (see definition of matrix).

c) Detection limits must be determined each time there is a change in the test method that affects how the test is performed, or when a change in instrumentation occurs that affects the sensitivity of the analysis.

d) All samples processing steps of the analytical method shall be included in the determination of the detection limit.

e) All procedures used must be documented. Documentation must include the matrix type. All supporting data must be retained.

f) The laboratory must have established procedures to relate detection limits with quantitation limits.

g) The test method's quantitation limits must be established and must be above the detection limits.

D.1.6 Data Reduction

The procedures for data reduction, such as use of linear regression, shall be documented.

D.1.7 Quality of Standards and Reagents

a) The source of standards shall comply with 9.2.

b) Reagent Quality, Water Quality and Checks:

1) Reagents - In methods where the purity of reagents is not specified, analytical reagent grade shall be used. Reagents of lesser purity than those specified by the test method shall not be used. The labels on the container should be checked to verify that the purity of the reagents meets the requirements of the particular test method. Such information shall be documented.

2) Water - The quality of water sources shall be monitored and documented and shall meet method specified requirements.

3) The laboratory will verify the concentration of titrants in accordance with written laboratory procedures.

D.1.8 Selectivity

a) Absolute retention time and relative retention time aid in the identification of components in chromatographic analyses and to evaluate the effectiveness of a column to separate constituents. The laboratory shall develop and document acceptance criteria for retention time windows.

b) A confirmation shall be performed to verify the compound identification when positive results are detected on a sample from a location that has not been previously tested by the laboratory. Such confirmations shall be performed on organic tests such as pesticides, herbicides, or acid extractable or when recommended by the analytical test method except when the analysis involves the use of a mass spectrometer. Confirmation is required unless stipulated in writing by the client. All confirmation shall be documented.

c) The laboratory shall document acceptance criteria for mass spectral tuning.

~~D.1.9 Constant and Consistent Test Conditions~~

~~a) The laboratory shall assure that the test instruments consistently operate within the specifications required of the application for which the equipment is used.~~

~~b) Glassware Cleaning - Glassware shall be cleaned to meet the sensitivity of the test method.~~

~~Any cleaning and storage procedures that are not specified by the test method shall be documented in laboratory records and SOPs.~~

END OF DOCUMENT

ATTACHMENT C

Sample Label and Chain of Custody

ADVANCED GEoSERVICES CoRP. 1055 Andrew Drive, Suite A West Chestl[ffotill!(ania 19380 FAll: (lf10) BMJ-91911	PROJECT NO._____

SAMPLE IDENTIFICATION NUMBER	REMARKS:
COLLECTION INFORMATION 0 COMPOSITE D GRAB DATE: TIME: BY:	
TESTING REQUIRED	PRESERVATIVES ADDED
RECEIVING LAB	LAB SAMPLE NO.

EXIDE TECHNOLOGIES

VERNON, CALIFDRNIA

Scale:	SAMPLE LABEL
Originated By: J.M.S.	
Drawn By: M.J.P.	
Checked By: P.G.S.	Advanced GeoServices Corp. 1055 Andrew Drive, Suite A West Chester, Pennsylvania 19380 (610) 840-9100 FAX (610) 840-9199
Project Mgr: P.G.S.	
Dwg No. 2002-967-11-05	Project No. 2002-967-11
Issued:	!ATTACHMENT D

*:\Projects\2002\2002967-Vernon Smelter Corrective Active\Cad\2002-967-11\2002-967-11-07.dwg

																						Preservatives					
																						H2SO4	HCL	HNO3	NaOH	NONE	Remarks

Relinqui Shedby		Received by	
Relinquishedby		Received by:	
Relinquished by.		Received by:	
Relinquishedby			
Relinquishedby		Receivedby:	

:\Projects\2002\200296?-Vernon Smelter Corrective Active\Cad\2002-967-11\2002-967-11-08.dwg

Page 2: [1] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.42", Outline numbered + Level: 3 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.05"

Page 2: [2] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 0.62", Hanging: 0.42", Outline numbered + Level: 3 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.05"

Page 2: [3] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.41", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 11 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.04"

Page 2: [4] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Numbered + Level: 2 + Numbering Style: I, II, III, … + Start at: 1 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.04"

Page 2: [5] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.41", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.04"

Page 2: [6] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 0.62", Hanging: 0.41", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.04"

Page 2: [7] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.42", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.04"

Page 2: [8] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 0.62", Hanging: 0.42", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.04"

Page 2: [9] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.42", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.04"

Page 2: [10] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.41", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.04"

Page 2: [11] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 0.62", Hanging: 0.41", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.04"

Page 2: [12] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.42", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.04"

Page 2: [13] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 0.62", Hanging: 0.42", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 13 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.04"

Page 2: [14] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Centered, Indent: Left: 0.12", Hanging: 0.49", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.13" + Indent at: 0.46"

Page 2: [15] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.42", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.04"

Page 2: [16] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 0.62", Hanging: 0.41", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.62" + Indent at: 1.04"

Page 2: [17] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Centered, Indent: Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 4 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.62"

Page 3: [18] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 1", Hanging: 0.49", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"

Page 3: [19] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.33", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.33"

Page 3: [20] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 1", Hanging: 0.5", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.33"

Page 3: [21] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.41", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.5" + Indent at: 1.91"

Page 3: [22] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 1.5", Hanging: 0.42", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.5" + Indent at: 1.91"

Page 10: [23] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.13" + Indent at: 0.37"

Page 34: [24] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Justified, Indent: Left: 0.11", Hanging: 0.51", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Page 35: [25] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Justified, Indent: Left: 1", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.24"

Page 37: [26] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Justified, Indent: Left: 0.99", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.23"

Page 38: [27] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.17" + Indent at: 0.43"

Page 38: [28] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" +

Indent at: 0.67"

Page 38: [29] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.67"

Page 38: [30] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 0.43", Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.67"

Page 38: [31] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 0.43", Hanging: 0.26", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.67"

Page 39: [32] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Justified, Indent: Left: 1.39", Hanging: 0.35", Numbered + Level: 2 + Numbering Style: i, ii, iii, … + Start at: 1 + Alignment: Left + Aligned at: 1.42" + Indent at: 1.74"

Page 45: [33] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 1.24", Hanging: 0.26", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1.25" + Indent at: 1.49"

Page 45: [34] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Justified, Indent: Left: 0.99", Hanging: 0.49", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 2 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Page 45: [35] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Justified, Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Page 45: [36] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Justified, Indent: Left: 0.99", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Page 47: [37] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Justified, Indent: Left: 0.98", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.23"

Page 48: [38] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.12" + Indent at: 0.37"

Page 48: [39] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 0.13", Hanging: 0.49", Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.14" + Indent at: 0.63"

Page 50: [40] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Justified, Indent: Left: 0.42", Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.43" + Indent at: 0.68"

Page 53: [41] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 0.98", Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Page 53: [42] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 0.99", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Page 53: [43] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 0.99", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.24"

Page 53: [44] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 0.99", Hanging: 0.5", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Page 53: [45] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.24"

Page 53: [46] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.24", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.24"

Page 53: [47] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 0.99", Hanging: 0.26", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.24"

Page 53: [48] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 0.98", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.98" + Indent at: 1.24"

Page 54: [49] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Page 54: [50] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.25", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.18" + Indent at: 0.43"

Page 54: [51] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.24", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.44" + Indent at: 0.68"

Page 54: [52] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.25", Numbered + Level: 2 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 0.44" + Indent at: 0.68"

Page 55: [53] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Justified, Indent: Left: 1.26", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 3 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Page 55: [54] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Justified, Indent: Left: 1.26", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 3 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Page 55: [55] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 1.26", Hanging: 0.24", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 3 + Alignment: Left + Aligned at: 1.24" + Indent at: 1.49"

Page 81: [56] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 1", Hanging: 0.5", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 5 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Page 81: [57] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Hanging: 0.49", Outline numbered + Level: 3 + Numbering Style: 1, 2, 3, … + Start at: 5 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.49"

Page 81: [58] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.23"

Page 81: [59] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 1", Numbered + Level: 1 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 0.99" + Indent at: 1.23"

Page 83: [60] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 1.32", Hanging: 0.34", Numbered + Level: 2 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.32" + Indent at: 1.66"

Page 84: [61] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 0.51", Hanging: 0.32", Numbered + Level: 2 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.32" + Indent at: 1.66"

Page 84: [62] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 0.51", Hanging: 0.33", Numbered + Level: 2 + Numbering Style: a, b, c, … + Start at: 1 + Alignment: Left + Aligned at: 1.32" + Indent at: 1.66"

Page 84: [63] Formatted **Wortham, Carol@DTSC** **8/17/2015 2:52:00 PM**

Indent: Left: 0.19", Hanging: 0.33", Numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 1 + Alignment: Left + Aligned at: 1" + Indent at: 1.32"