

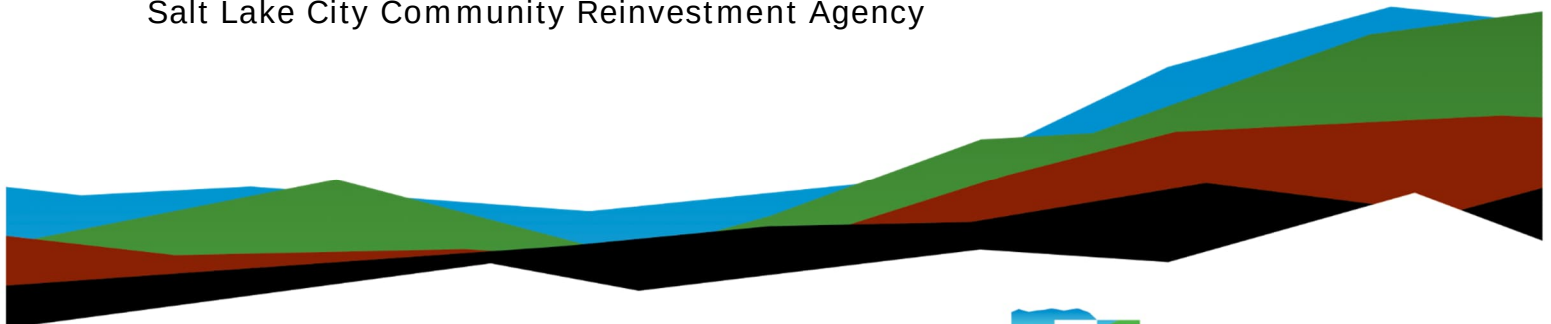
Remedial Action Plan

Salt Lake City Former Schovaers Electronics
EPA Brownfields Cleanup Grant
22 South Jeremy Street, Salt Lake City, Utah
EPA Cooperative Agreement No. 96884401
ACRES ID 199723

March 17, 2026 | Terracon Project No. 61247165 |
Revision 2



Prepared for:
Salt Lake City Community Reinvestment Agency



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March 17, 2026

Salt Lake City Community Reinvestment Agency
451 South State Street, Room 418
Salt Lake City, Utah 84111

Attn: Austin Taylor
Project Manager
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P: (435) 705-3519

Re: Remedial Action Plan
Salt Lake City Former Schovaers Electronics EPA Brownfields Cleanup Grant
22 South Jeremy Street, Salt Lake City, Utah
EPA Cooperative Agreement 96884401
ACRES ID 199723
Terracon Project No. 61247165, Revision 2

Dear Mr. Taylor:

Terracon Consultants, Inc. (Terracon), has prepared this Remedial Action Plan (RAP) for submission to the Utah Department of Environmental Quality (UDEQ) Voluntary Cleanup Program (VCP) on behalf of the Salt Lake City Community Reinvestment Agency (CRA) as part of an Environmental Protection Agency (EPA) Brownfields Cleanup grant for the Former Schovaers Electronics site (site or former Schovaers site).

Remedial action is required to address environmental impacts identified at the site referenced above. Terracon prepared this RAP on behalf of CRA, to address remedial actions required prior to redevelopment and use of the site.

Should you have any questions or require additional information, please do not hesitate to contact our office.

Sincerely,

Terracon Consultants, Inc.

A handwritten signature in black ink, appearing to read 'Jill Hernandez'.

Jill Hernandez, PE
Senior Project Manager

A handwritten signature in black ink, appearing to read 'Marwan Salameh'.

Marwan Salameh, PE
Senior Engineer

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1.0 Introduction

Terracon Consultants, Inc. (Terracon), has prepared this Remedial Action Plan (RAP) at the request of the Salt Lake City Community Reinvestment Agency (CRA), to address environmental impacts identified at the former Schovaers site in compliance with the attached Quality Assurance Project Plan (QAPP) ([Appendix C](#)).

1.1 Site Location, Site Description, and Proposed Land Use

The site is located at 22 South Jeremy Street, Salt Lake City, Utah ([Exhibit 1](#); [Appendix A](#)). The site is an approximately 0.34-acre parcel of land (Parcel ID. 15-02-204-007-0000), United States Environmental Protection Agency (EPA) ACRES ID #199723, which is currently owned by Salt Lake City Redevelopment Agency, doing business as CRA. The site was formerly a circuit board manufacturing facility and was used for electroplating from 1977 to 2017. The warehouse building was constructed in 1956 and is approximately 6,000 square feet in size, constructed of concrete block walls, brick, and slab-on-grade concrete floors. An approximately 306-square-foot (sq-ft) wood, concrete block, and concrete slab-on-grade, loading dock is attached to the north portion of the building. An approximately 672 sq-ft wooden garage is located in the northwest portion of the site, adjacent to the west-adjacent building. An approximately 55 sq-ft wooden shed is located adjacent to the west of the loading dock ([Exhibit 2](#), [Appendix A](#)).

Pavement bounds the building on the north and east, extending to the property line. Bare ground bounds the building on the west, extending to the property line, except for the portion occupied by the garage. The site is located in an industrial area with derelict sites, with properties affected by contaminants associated with hazardous substances, particulate matter, and petroleum. Adjacent properties consist of a former plating facility to the north, a stone and metal fabricating facility to the east (across Jeremy Street), Folsom Trail to the south (in the location of an approximate former railroad alignment), followed by an automotive repair facility, a marble and granite store, and an unnamed commercial or industrial facility to the west.

The CRA plans to repurpose the property for retail or light industrial use to increase neighborhood vibrancy along the new Folsom Trail.

1.2 Background

The site was developed for residential use from at least 1898 through the mid-1940s, when the residences were demolished. The current commercial structure was constructed in 1956. The building was originally occupied by an electrical supply company, then a wholesale upholstery business prior to Schovaers Electronics occupying the building from 1977 through April 2017. The building was occupied by an appliance store from 2019 through 2022, after which it has remained vacant.



Soil, groundwater, and soil vapor impacts above EPA and Utah Department of Environmental Quality (UDEQ) regulatory standards for metals and volatile organic compounds (VOCs) were identified during previous site investigations, as detailed in [Section 2.0](#).

Surrounding properties of historical or current environmental concern include documented hexavalent chromium and 1,1,1, trichloroethane (TCA) impacts at the former north-adjacent metal plating facility; potential impacts associated with the former south-adjacent railroad operation, laundry equipment sales, and automotive repair facilities; former northeast-adjacent chemical, soap, and laboratory facilities; a forge operated on the east-adjacent property; and flooring and recycling facilities operated adjacent to the west.

This RAP has been designed to remediate and mitigate environmental impacts to address the health and safety of future occupants of the building and address down-gradient impacts.

2.0 Previous Environmental Assessments

Multiple investigations were conducted at the site as follows:

- Phase I Environmental Assessment, Salt Lake Redevelopment Agency Blight Study, North Temple Street Corridor Blight Study Area N4
South Temple to 100 South and 800 West to 900 West, Salt Lake City, Utah
Dated: June 21, 2010
Prepared by: Wasatch Environmental, Inc.
For: Lewis Young Robertson & Burningham, Inc.
- Phase I Environmental Assessment, Schovaers Electronics
22 South Jeremy Street, Salt Lake City, Salt Lake County, Utah
Dated: August 31, 2015
Prepared by: Terracon
For: Redevelopment Agency of Salt Lake City
- Asbestos and Hazardous Materials Survey, North Temple Brownfields Assessment, EPA Cooperative Agreement No. 96809601, Hazardous Substance Grant for Redevelopment Agency of Salt Lake City, Schovaers Electronics Facility
22 South Jeremy Street, Salt Lake City, Utah
Dated: January 18, 2016
Prepared by: Terracon
For: Redevelopment Agency of Salt Lake City



- Phase II Environmental Assessment, North Temple Brownfields Assessment, EPA Cooperative Agreement No. 96809601, Hazardous Substance Grant for Redevelopment Agency of Salt Lake City, Schovaers Electronics Facility

22 South Jeremy Street, Salt Lake City, Utah

Dated: February 8, 2016
Prepared by: Terracon
For: Redevelopment Agency of Salt Lake City
- Phase I Environmental Assessment, Schovaers Electronics

22 South Jeremy Street, Salt Lake City, Salt Lake County, Utah

Dated: February 14, 2018
Prepared by: Terracon
For: Salt Lake County
- Phase II Environmental Assessment (Final), Salt Lake County Brownfields Assessment, EPA Cooperative Agreement No. 96835701, Hazardous Materials and Petroleum Grant for Salt Lake County, Schovaers Electronics

22 South Jeremy Street, Salt Lake City, Salt Lake County, Utah

Dated: January 9, 2019
Prepared by: Terracon
For: Salt Lake County
- Phase I Environmental Assessment

22 South Jeremy Street, Salt Lake City, Salt Lake County, Utah

Dated: July 8, 2022
Prepared by: Terracon
For: Redevelopment Agency of Salt Lake City
- Phase II Environmental Site Assessment, Schovaers Electronics, EPA Cooperative Agreement No. 96897201,

25 South 900 West and 28 South 800 West, Salt Lake City, Salt Lake County, Utah

Dated: October 7, 2025
Prepared by: Terracon
For: Salt Lake County
- Phase II Environmental Site Assessment, Schovaers Electronics Off-Site Delineation, EPA Cooperative Agreement No. 96897201,

25 South 900 West and 28 South 800 West, Salt Lake City, Salt Lake County, Utah

Dated: October 7, 2025
Prepared by: Terracon
For: Salt Lake County



Subsurface investigations have been conducted at the site, starting in 2016. Most recently, Terracon implemented the scope of work outlined in the Schovaers Electronics Off-Site Delineation Work Plan, designed to update and further delineate the impacts identified at the site to ensure the most successful outcome of the remediation event. Portions of the work conducted in May 2025 were funded by the Salt Lake County Brownfields Assessment Grant (EPA Cooperative Agreement #96897201) for the scope of services not included in EPA Brownfields Cleanup Grant (Cooperative Agreement 96884401).

Monitoring wells were installed to collect updated groundwater data and further delineate the extent of the groundwater plume. Sub-slab vapor data and indoor air data samples were collected to document current site conditions. Details of the 2025 sampling events are included in [Section 5](#). Reports detailing the 2025 sampling event results were provided to Salt Lake County in separate reports, as referenced in [Section 9.0](#) (Terracon, 2025a and 2025b).

Impacted soil, groundwater, and soil vapor were identified at the site during the site investigations, as follows:

2.1 Soil

Arsenic was reported at concentrations above the EPA Industrial Regional Screening Level (RSL) in soil samples collected from the site at depths ranging from 1 to 11 feet below ground surface (bgs). The arsenic concentrations appeared typical of arsenic concentrations encountered within the Salt Lake Valley except for one sample near the interior plating room sump (SE-SB-21), which appeared indicative of metal contamination. Trichloroethene (TCE) was reported in one sample collected from the same sampling location adjacent to the sump at a concentration above the EPA Industrial RSL.

Hexavalent chromium, lead, bromodichloromethane, and additional TCE sampling locations had concentrations exceeding their respective EPA Residential RSLs but were below the EPA Industrial RSLs. Hexavalent chromium was previously reported at concentrations above the EPA Industrial RSL; however, under the EPA regulatory screening change effective November 2024, the exterior soil concentrations no longer exceed the EPA Industrial RSL.

The remainder of the analyzed VOCs and metals were below the applicable soil screening criteria ([Exhibit 3](#), [Appendix A](#) and [Tables 1 through 2](#), [Appendix B](#)).

2.2 Groundwater

Concentrations of TCE in multiple groundwater samples located in the southwest portion of the site exceeded the EPA Maximum Contaminant Level (MCL) and Target Groundwater Concentration (TGC) Vapor Intrusion Screening Level (VISL) for a commercial exposure scenario. Additional groundwater samples located in the same general area also exceeded the EPA Tap Water RSL or TGC VISL for a residential exposure scenario. Chloroform was reported in the west portion of the site at concentrations above the TGC VISL for a



commercial exposure scenario and in additional monitoring wells at concentrations above the TGC VISL for a residential exposure scenario. Dissolved arsenic and hexavalent chromium were reported in groundwater samples at concentrations above the EPA Tap Water RSLs but below their respective EPA MCLs. The remainder of the analyzed VOCs and metals were below the applicable screening criteria ([Exhibit 4](#), [Appendix A](#) and [Tables 3 and 4](#), [Appendix B](#)). Groundwater is generally encountered at approximately 9 to 10 feet bgs, with an estimated flow direction to the west, with variations to the northwest and southwest ([Exhibit 2](#), [Appendix A](#)).

2.3 Soil Vapor

Concentrations of TCE in each of the soil vapor samples collected from the site exceeded the EPA Commercial and/or Residential VISLs. Naphthalene was reported in one sub-slab soil vapor sample at a concentration above the EPA Commercial VISL and in another sub-slab soil vapor sample at a concentration above the EPA Residential VISL. Chloroform was reported in two sub-slab soil vapor samples at concentrations exceeding the EPA Commercial VISL. The remainder of the analyzed VOCs were below the EPA VISLs ([Exhibit 5](#), [Appendix A](#) and [Table 5](#), [Appendix B](#)).

2.4 Indoor Air

Concentrations of TCE in each of the four indoor air samples collected at the site exceeded the EPA Commercial and/or Residential VISLs. Chloroform, 1,2-dichloroethane (EDC), benzene, and carbon tetrachloride were reported in each of the four indoor air samples at concentrations exceeding the EPA Residential VISLs. The remainder of the analyzed VOCs were below the EPA VISLs ([Exhibit 6](#), [Appendix A](#) and [Table 6](#), [Appendix B](#)).

3.0 Public Comment

Public notice of this RAP will be published prior to implementation for two consecutive days on the Salt Lake City website (slc.gov), two local newspaper publications, and mailed and/or hand-delivered to adjacent landowners. The public notice will provide 30 calendar days for public comments to be submitted. If public comments are received, UDEQ will address them. A copy of the draft public notice is provided in [Appendix D](#).

4.0 Remedial Objectives

4.1 Conceptual Site Model

Various industrial and commercial operations were conducted at the former Schovaers site, including chrome-plating operations and solvent use. Metal-plating associated with the site's circuit board manufacturing operation was conducted in the plating room in the southwest

portion of the existing building. The plating fluids were drained in the plating room and overflow water from the plating tanks was drained onto flooring constructed of wood pallets above concrete, then collected in a sump, extending approximately 4 feet below the floor grade, adjacent to a wastewater treatment system in the southeast portion of the plating room. The treated wastewater was discharged into the sanitary sewer system, located east of the site in Jeremy Street. Hazardous filter press sludge cake generated from wastewater treatment was collected in drums. Impacts were encountered during previous investigations near the sump and lateral sewer piping. A hole was reported in a corroded drum containing wastewater filter cake materials during an inspection conducted by UDEQ in 2014. Corrosive etching chemicals were historically observed leaking out of the west and south building seams and concrete flooring. A liner was subsequently installed in the plating room to improve wastewater collection in the sump and to inhibit seepage to the exterior soil. The approximate locations of the plating room, sump, and sanitary sewer connection are depicted on [Exhibits 2 through 7 \(Appendix A\)](#).

A discussion of potential risk exposure pathways associated with the identified site impacts are evaluated below:

- Direct contact with or ingestion of soil: Soil impacts exceeding a commercial/industrial standard were identified in a localized area beneath the interior sump. Exposure to soil impacts exceeding the commercial/industrial screening level is limited to soil that may be encountered during site remediation. If the soil impact is not remediated, it could be an exposure point for future construction workers during site redevelopment.
- Leaching to groundwater: Soil impacts exceeding a commercial/industrial standard were identified inside the building but are not exposed to infiltration. Shallow groundwater in this area is not used for bathing, irrigation, or drinking water purposes. Metal- and VOC-impacted source material will be removed. This exposure pathway is considered incomplete.
- Potable consumption of groundwater: A review of UDEQ water rights did not identify potable water wells installed within the known extents of the impacted groundwater plume. The nearest water supply well depicted on the map obtained from the Utah Division of Water Rights online map is an irrigation water supply well located approximately 800 feet to the southwest of the site and was installed in 1904. A copy of the water right search map is included in [Appendix E](#). This exposure pathway is considered incomplete.
- Vapor inhalation: Elevated soil vapor concentrations are present due to historical solvent releases. The vapor intrusion pathway for the site will be addressed with the proposed source-area soil removal, in-situ chemical reduction (ISCR), and biologically enhanced reductive dechlorination of VOCs in groundwater, and installation of a vapor intrusion mitigation system (VIMS) below the existing building, as appropriate.

4.2 Cleanup Goals/Action Levels

According to the CRA's North Temple Project Area 2015–2019 Strategic Plan, the CRA's priorities for the Folsom Corridor are to “Engage in pre-development activities for the rehabilitation of the Folsom Avenue corridor as a public space and development corridor.” Terracon understands that the CRA intends to repurpose the property for retail or light industrial use, utilizing the current building. With this anticipated exposure scenario, the following screening levels will be used as the Cleanup Standards for the Site.

- Soil: EPA's most recent RSLs for industrial soil or site-specific risk-based standards, as noted below
- Groundwater: EPA's most recent MCLs for drinking water and EPA's most recent TGC VISLs for commercial exposure scenarios
- Soil Vapor: EPA's most recent Target Sub-slab and Near-source Soil Gas Concentration (TSSNSGC) VISLs for commercial exposure scenarios
- Indoor Air: EPA's Indoor Air for commercial exposure scenarios
- Site-specific Risk-based Standards: A background threshold value (BTV) was calculated for arsenic to estimate the site-specific background arsenic concentration in the soil ([Appendix F](#)). Arsenic concentrations were evaluated based on presumed uncontaminated soils collected at depth during previous Phase II Environmental Site Assessments (ESAs) conducted in 2015, 2018, and 2025. The BTV was calculated based on the 95% upper tolerance limit (UTL) using the EPA ProUCL Calculator, Version 5.2. The tests and outliers that exceeded a 5% significance level were excluded from the BTV calculation. Outlier tests were run for arsenic for the soil samples collected during these Phase II ESAs. An arsenic concentration of 52.9 milligrams per kilogram (mg/kg) reported in a sample collected near the sump was discarded due to failing the outlier test ([Appendix F](#)). The calculated BTV for arsenic was 21.4 mg/kg. The arsenic concentrations reported in the soil samples collected from the site, except for the single outlier from the sump area, were equal to or below the calculated BTV. As a result, arsenic concentrations in shallow exterior soils can be considered representative of background conditions.

Cleanup objectives are as follows:

- Commercial Redevelopment: Facilitate future commercial or light industrial site use and/or redevelopment.
- Remove Impacted Soil: Excavate and remove metal- and VOC-impacted soils inside the building to remove source material and decrease potential vapor intrusion and exposure to future construction workers.
- Reduce Vapor Intrusion Potential: Mitigate VOC vapors in the subsurface to reduce the vapor intrusion potential.

- **Reduce Impacted Groundwater:** Reduce the concentrations of VOCs in groundwater that contribute to vapor intrusion to indoor air.
- **Building interior:** Reduce potential exposure to hazardous building materials and metal impacts in the building interior. Staining on the walls and floors will be covered with multiple layers of paint, epoxy, and/or drywall, depending on the renovation plans of the building. Hazardous building materials will be addressed according to local regulatory requirements during renovations.

5.0 Baseline Data Collection

Site characterization data was collected in 2016 and 2018, and baseline characterization was conducted in May 2025, to assess the current condition of groundwater and the potential for vapor intrusion prior to the proposed groundwater and vapor intrusion mitigation.

One round of groundwater sampling was conducted to evaluate current groundwater conditions and dissolved concentrations of chemicals of concern. The current concentrations of chemicals of concern and groundwater flow direction will be used to assess potential adjustments to the proposed groundwater remediation strategy and the effectiveness of remediation. [Section 5.1](#) details the baseline groundwater sampling event.

To assess the current potential for vapor intrusion into the building and aid in the appropriate design to mitigate vapor intrusion, one sub-slab vapor and indoor air sampling event was conducted inside the building in May 2025 representing baseline conditions, and a second sub-slab vapor and indoor air sampling event will be conducted after the groundwater injection event to assess effectiveness of remediation. [Section 5.2](#) details the vapor evaluation strategy.

The May 2025 groundwater and vapor data will be used for adjusting, as necessary, the proposed groundwater and soil vapor remedial strategies outlined in this RAP to treat groundwater and address the potential for vapor intrusion.

5.1 Monitoring Well Installation and Baseline Groundwater Sampling

A baseline groundwater sampling event was conducted in May 2025 to obtain site characterization data prior to implementation of remedial actions. The data was used to assess existing groundwater conditions, the potential for off-site migration of TCE-impacted groundwater, and to provide data for evaluation of the proposed injections.

Prior to collection of groundwater samples, eight (8), two-inch PVC monitoring wells (MW-1 through MW-8) were installed using a direct push drill rig for groundwater monitoring purposes. The monitoring wells were installed to depths ranging from approximately 12 to 15 feet bgs with 10-foot, 0.010-inch machine slotted screens. The monitoring well annuli were backfilled with 10/20 silica sand up to approximately one foot above the screened



interval, followed by a hydrated bentonite seal up to the well vault. Flush-mount, traffic-rated well vaults were installed in concrete at the ground surface. The wells were developed by removing at least three well volumes following installation, and the top-of-casings were surveyed. Boring logs and field notes were recorded during the fieldwork. Soil samples were field screened with a photoionization detector (PID) to assess potential presence of volatile organic vapors. No soil samples were collected during the monitoring well installation due to the number of soil samples previously collected from the site. The groundwater samples were collected with new, disposable bailers following development and well purging. Groundwater samples and quality control samples were analyzed for VOCs by EPA Method 8260. The monitoring well locations are depicted on [Exhibit 2 \(Appendix A\)](#). Development/purge water was drummed and staged at the site pending waste characterization and disposal at an appropriate disposal facility.

Depth-to-groundwater was measured prior to sample collection for assessment of the groundwater gradient. Sampling procedures followed and will continue to follow Terracon Standard Operating Procedures (SOPs) included in the QAPP ([Appendix C](#)). No additional off-site delineation is included in this task. If additional delineation of off-site groundwater impacts is necessary, a separate work plan will be prepared for submittal to UDEQ.

5.2 Sub-slab Vapor and Indoor Air Sampling

A baseline vapor sampling event was conducted for assessment of current vapor conditions and the potential for vapor intrusion prior to implementation of remedial actions.

Four sub-slab vapor pins were installed inside the building. The vapor points were completed with a Vapor Pin™ assembly consisting of a permanent flush-mount stainless steel barb fitting with a silicone sleeve to seal the hole. The sub-slab vapor points were allowed to equilibrate at least twenty-four hours prior to sample collection. Each sample was collected over a 5-minute period using individually certified, 1-liter Summa™ stainless steel canisters supplied by H&P Mobile Geochemistry, Inc. (H&P). The sub-slab vapor samples were analyzed for VOCs by EPA Method TO-15.

Four indoor air samples co-located with the vapor pin sample locations were collected for assessment of VOCs in ambient indoor air. The canister sample inlets were placed within a typical breathing zone height of approximately three to five feet above the floor. The ambient air samples were collected over a 24-hour period using a flow-control device affixed to an individually certified, six-liter capacity, Summa stainless steel canister supplied by H&P. The indoor air samples were analyzed for VOCs by EPA Method TO-15.

The locations of the sub-slab vapor pins and indoor air samples are depicted on [Exhibit 7 \(Appendix A\)](#).

Based on the concentrations above the risk-based EPA RSLs, remediation is required to reduce exposure risks to site receptors.



6.0 Remedial Action Plan

This RAP has been developed to reduce existing metal and/or VOC impacts at the site within soil, groundwater, and soil vapor. Remediation of the site will include: removal of the plating room sump, lateral sewer piping, a floor drain, and impacted soil inside the building; ISCR/biological reduction injections, as necessary based on groundwater monitoring data; and testing and installation of a VIMS, as necessary based on vapor monitoring data.

Remedial actions will address on-site soil, groundwater, and soil vapor that have been impacted by metals and/or VOCs from the former metal plating operations that were conducted at the site. The following sections detail the proposed RAP, including:

- an estimated schedule of the remedial and reporting activities
- a description of work to be completed
- a description of methods intended to be used to segregate impacted soil from non-impacted soil at the site, as necessary
- a description of soil management intended to allow for the proper disposal of soil and debris removed from the site
- a description of engineering and institutional controls designed to be incorporated as part of site redevelopment
- a description of the site safety responsibilities and contingency actions to be implemented, if necessary
- a contingency plan if unanticipated contamination is encountered.

6.1 Scheduling and Coordination

The tentative project schedule is provided in the following table. Actual dates may vary depending on permit approvals and subcontractor availability. Terracon will manage the project and coordinate with CRA and remediation contractors. Injection permits, notifications (Blue Stakes of Utah Utility Notification Center, soil disposal acceptance approval request, soil transport/disposal manifests, etc.) will be obtained by Terracon or our subcontractors prior to the commencement of remedial activities. The elements of the project schedule are presented in the ensuing sections.



Activity	Planned Start	Planned Completion
Baseline Groundwater and Vapor Characterization	Completed in accordance with EPA approval and in conjunction with additional assessment requested by UDEQ, as funded by the Salt Lake County Brownfields Assessment Grant (EPA Cooperative Agreement #96897201) for the scope of services not included in EPA Brownfields Cleanup Grant (Cooperative Agreement 96884401).	
Permitting, Utility Locating, Removal of Sump, Lateral Sewer Piping, Drain, Injections, Backfilling and Concrete Replacement	Within 5 months following receipt of RAP approval	Report within 2 months following completion of excavation and injection activities
Soil Vapor Monitoring and VIMS Pilot Test, if necessary	Soil vapor sampling within 5 months following completion of groundwater injections. Pilot testing following receipt of soil vapor sampling results, if necessary	The soil vapor monitoring report will be included in one of the semi-annual groundwater monitoring reports. Confirmation of VIMS necessity within 7 months of completion of groundwater injections Conduct a VIMS pilot test within 9 months following completion of groundwater injections
VIMS Design and Installation, if necessary	VIMS design within 2 weeks following completion of VIMS pilot test	Design plans will be submitted for review and approval prior to VIMS installation. VIMS design, complete within 3 months following completion of VIMS pilot test VIMS installation within 6 months of completion of system design Report within 2 months following completion of VIMS installation
Semi-annual Groundwater Monitoring	First event within 4 months following injections, then semi-annually thereafter	Reports within 4 weeks following receipt of the analytical results



Activity	Planned Start	Planned Completion
Agency Reviews of Baseline Groundwater Report, Remediation Report, Semi-annual Groundwater Reports, and VIMS Design (if needed)	Within one week of receipt of the draft report	Within approximately 4 weeks of receipt of the draft report
Site Management Plan	Within one week following the post-remediation monitoring events and/or installation of the VIMS (prior to site occupancy)	Within approximately 6 weeks of the planned start date
Issue Final Reports	Within 7 days of receipt of Agency comments on draft reports	

*No field work will be conducted until formal approval of the RAP is received by the agency and documented.

6.2 Pre-excavation Sampling and Abatement

Prior to excavation within the building interior, a sample will be collected from the water in the sump for a typical waste disposal profile (E.T. Profile) and wipe samples will be collected in accordance with the National Institute for Occupational Safety and Health (NIOSH) surface wipe method from the sump, east wall, and concrete for analysis of total RCRA-8 metals by EPA 6000 and 7000 Method Series and hexavalent chromium by analytical method SM 3500 Cr-B for waste characterization purposes, as detailed in the QAPP ([Appendix C](#)).

A portion of the east plating room wall adjacent to the door needs to be removed for excavation equipment access. Gypsum drywall was previously documented as Category II non-friable regulated asbestos-containing material (RACM) with 3.5 percent chrysotile. Due to the expiration of the previous asbestos and hazardous materials survey, the survey of the wall materials will be updated prior to abatement for adherence to UDEQ and Utah Division of Air Quality (UDAQ) regulations under Administrative Code R307-801 – Asbestos Rule. Written notification of planned RACM removal activities will be submitted to UDAQ at least 10 working days prior to the commencement of asbestos abatement activities. Asbestos abatement personnel, which are certified by UDAQ, will conduct the wall RACM abatement and then remove the portion the wall required for plating room equipment access.

6.3 Sump, Sewer Lateral, Floor Drain, and Impacted Soil Removal

The sump and a portion of the associated lateral sewer piping connection to the sanitary sewer system will be removed from inside the building [Exhibit 7 \(Appendix A\)](#). Impacted soils in and adjacent to the sump in the plating room and along the sewer lateral to the nearest drain will be removed. Details of the excavation are provided below.

- Concrete flooring covering the proposed excavation area will be cut and removed. Concrete removal required to access the features and to excavate soil is anticipated to be approximately 35 to 40 cubic yards.
- The sump feature will be removed, along with up to 20 lateral feet of sewer lateral piping to the nearest floor drain. The drain feature will also be removed.
- It is assumed that up to 2 lateral feet of soil surrounding the 4-foot deep sump and up to 9 feet of soil below the floor, which is approximately 3 to 4 feet above the ground surface, will be excavated in the sump area. The excavation is anticipated to extend below the depth of VOC and metal impacts previously identified in soil in the sump area. Groundwater is not anticipated to be encountered during the sump and sewer lateral excavation, based on the depth to groundwater encountered in the site monitoring wells at approximately 9 feet bgs or deeper and the excavation depth extending approximately 5 to 6 feet bgs. If groundwater is encountered during the excavation, the vertical depth of the excavation will be considered complete, a confirmation soil sample will be collected above the groundwater table, and the injections described in [Section 6.4](#) will be used to address the groundwater impacts and associated saturated soils. No groundwater dewatering will be conducted.
- It is assumed that up to 20 lateral feet of soil will be excavated up to three feet wide and five feet deep during removal of the sewer pipe.
- Total excavated soil beneath and around the sump and sewer lateral is anticipated to be up to approximately 20 to 25 cubic yards.
- The concrete, sump, sewer lateral, and floor drain will be disposed of at an appropriately permitted facility.
- Following the excavation activities, confirmation soil samples will be collected from the extents of excavation for laboratory analysis.
 - For the sump removal and sump excavation area, one grab sample will be collected from each of the four walls of the excavation and one from the floor.
 - For the sewer line removal to the floor drain, a total of seven grab confirmation samples will be collected after excavation. One set of grab confirmation samples (two wall samples and a floor sample) will be collected midway along the excavation line, and one set (three wall samples and a floor sample) will be collected at the termination of the excavation at the floor drain.
 - Up to ten opportunity samples will be collected if additional impacts are observed during the interior excavation or for additional excavation confirmation soil sampling, if needed.



- The confirmation and opportunity grab samples will be analyzed for VOCs by EPA Method 8260 and arsenic by EPA Method 6020. Additional analytes may be considered, based on field observations, if unique impacts are apparent during the excavation.
- If the initial confirmation samples exceed the cleanup action levels, the excavation will be expanded to the extent practicable and additional confirmation sampling will be conducted; however, the extent of the excavation may be limited by safety and/or structural concerns. If the final confirmation soil samples exceed applicable regulatory standards, the impacted area and necessary precautions will be identified in the Site Management Plan (SMP) detailed in [Section 8.0](#).
- Excavated soil will be stockpiled within the building pending waste characterization, as required by the disposal facility prior to off-site disposal. One 5-point composite sample will be collected from the stockpile for waste characterization and disposal facility selection, in accordance with disposal facility requirements. The stockpiled soil to be analyzed for VOCs will be collected as a grab sample. If the impacted soil is characterized as a RCRA-regulated hazardous waste, the waste will be segregated and the hazardous waste will be sent to an approved hazardous waste landfill. The sump, floor drain, and sewer lateral piping will not be replaced.
- The excavation areas will be backfilled with clean and compacted imported gravel fill, and the surface will be patched with concrete to match the existing floor grade.
- Best management practices (BMPs) will be employed in adherence with standard industry practices, as described in Section 5.9 of the QAPP.

6.4 Injections

Terracon will apply to the Utah Department of Water Quality (DWQ) for an Underground Injection Control permit, prior to conducting injection work. Following issuance of the injection permit and utility clearance, a combination of Regenesis products, including oleic acids (oil) and lactates/polylactates (3D-Microemulsion), zero valent iron (S-MicroZVI), and live microbes (BioDechlor Inoculum) will be injected into the subsurface to reduce VOCs to concentrations more protective of site occupants and to control potential off-site migration of impacted groundwater. The remediation approach is intended to promote abiotic in-situ chemical reduction (ISCR) and biologically enhanced reductive dechlorination of VOCs.

Approximately 4,000 pounds of 3D-Microemulsion, 900 pounds of S-MicroZVI, and 29 liters of BioDechlor Inoculum will be injected into 21 locations from 10 to 25 feet bgs utilizing either a bottom-up or top-down technique based on the subsurface lithology encountered. The injection points will be spaced on approximately 12.5-foot centers for a total treatment area of approximately 3,325 square feet. The 3D Microemulsion and S-MicroZVI injectant will be mixed above grade with approximately 7,600 gallons of water prior to the injections. The BioDechlor Inoculum will be either injected with anaerobic water or slipstreamed with nitrogen gas into the same injection points as the 3D Microemulsion and S-MicroZVI injections. The injections will be completed with direct push methods within the plating room and southwest/west exterior portion of the site. The approximate location of the

proposed injection treatment area is depicted with a yellow outline on [Exhibit 7, Appendix A](#). The quantities listed above are estimates; the extent and quantities may be slightly adjusted in the field, based on field observations, subsurface obstructions, etc. Upon completion of an injection at a specific location, tooling will be removed, and the borehole backfilled in accordance with state requirements.

6.5 Materials Management

Terracon will characterize, profile, and dispose of excavated sump, sewer piping, drain materials, soil, and purged groundwater in accordance with industry standards and applicable RCRA regulations. Purged water will be placed in labeled, traffic-rated, 55-gallon drums and secured on site pending waste disposal at appropriate disposal facilities. Empty containers from the injection events will be washed and disposed of by the injection contractor.

6.6 Vapor Sampling and Vapor Intrusion Mitigation System (VIMS)

6.6.1 Confirmation Sub-slab Vapor and Indoor Air Sampling

A second round of vapor sampling will be conducted to assess the need for design of the VIMS, following the groundwater injections and prior to final design and installation of the VIMS. The four existing sub-slab vapor pins will be utilized, and four indoor air samples will be collected using the same methodology and analyses as described in Section 5.2.2.

6.6.2 Vapor Mitigation Pilot Testing

If vapor intrusion exceeds the commercial/industrial screening levels based on the analytical results from the second (post-remediation) vapor sampling event, vapor mitigation pilot testing, design, and installation will be conducted to address accumulation of sub-slab soil vapor associated with residual groundwater impacts following the groundwater injections.

The pilot testing will be conducted to assess the blower flow rate, vacuum flow rate, and radius of influence to assess whether sufficient air flow is possible and that a minimum 0.01 inches negative H₂O pressure can be achieved below the floor slab.

The pilot testing will be conducted using one sub-slab, one-inch vapor extraction point (VEP) and six ¾-inch sub-slab vacuum monitoring points installed with a drill. The VEP will consist of a one-inch diameter steel pipe installed through the six-inch concrete floor slab. The VEP will be sealed at the surface and connected to a flexible hose to the inlet of a 1.5 horsepower, 60 cubic foot per minute blower fan with a vacuum inlet of two inches of water, or similar. Vacuum and flow monitoring ports, a ball valve, and dilution valve will be installed between the VEP and the vacuum blower.

The ball valve will be throttled at 1/3 open, 2/3 open, and fully open during the testing to create three separate vacuums and flow rates. At each vacuum/flow, the following monitoring equipment will be used:



- VEP vacuum (digital vacuum gauge with a vacuum minimum detection limit (MDL) of 0.01 inch of water)
- VEP flow (vapor velocity anemometer)
- Digital vacuum gauge with a vacuum MDL of 0.001 inch of water
- PID to assess VOCs in extracted vapors at the outlet of a 4-inch flexible hose used to convey the extracted vapors from the outlet of the blower to the exterior of the building.

To assess that the extracted vapors are not explosive, at the beginning of the test the two-inch ball valve will be closed then opened slowly, and the bleed air valve will be left fully open while monitoring the lower explosive limit (LEL) of the extracted vapors. Once the two-inch ball valve is fully open, the dilution air valve will be incrementally closed while monitoring the LEL to confirm that the vapors are not explosive.

6.6.3 VIMS Design and Installation

If the vapor characterization data indicates the potential for vapor intrusion and the need for a VIMS following injection and excavation activities, we anticipate that a sub-slab depressurization system will be installed under the existing floor slab. The system will use a vacuum blower to induce negative pressure below the floor slab. For this type of system to be effective, there needs to be a coarse or permeable layer supporting the floor slab to allow for air flow. If impacts are identified in multiple zones, VIMS verification sampling will be extended to other portions of the building. If the required negative pressure is not achieved during pilot testing with the existing concrete slab, the slab may need to be removed and replaced, modified, or a multiple zone system may need to be employed.

Specific details of the VIMS design will be provided to UDEQ for review and approval prior to installation of the system. The VIMS design will be based on the findings of the soil vapor sampling and pilot testing results.

6.7 Contingency Plan

If unanticipated impacts are discovered during implementation of the RAP, UDEQ will be notified, the RAP will be revised and amended as necessary to address the issues or deviations to the plans herein, and the actions discussed in this section will be implemented. Workers will be advised to be observant for obvious signs that impacted materials have been encountered. These may include the following:

- undocumented Underground Storage Tanks associated with heating oil, diesel, gasoline, or other products
- strong or unusual chemical odors
- obvious physical signs of industrial or other waste, including ash, cinders, tars, sludges, powders, resins, liquids, or containers (drums, totes, buckets, etc.)
- unlabeled drums or containers



- buried metal objects such as tanks and groundwater production wells
- buried building materials that may contain asbestos-containing material (ACM)
- co-workers who suddenly become ill on the site.

A Terracon environmental representative will be present on-site during remediation activities to assist in the identification and management of impacted soils. If a Terracon field representative is not on-site when potential contamination is encountered, the site contractors will be required to temporarily stop work in the immediate area to allow for the Terracon representative to mobilize to the site. The contractor will immediately notify CRA, or their representative, who will in turn notify Terracon.

6.8 Quality Control

To ensure that high quality, reliable data are consistently collected, and that data is comparable to previous investigations, QA procedures will be followed throughout the investigation. Quality assurance procedures include investigation objectives outlined in this RAP and collecting and analyzing field and laboratory QC samples. Details of the quality control procedures are provided in the QAPP ([Appendix C](#)).

6.9 Remedial Action Implementation Site Controls

6.9.1 Site Security

During the implementation of the RAP, the contractor will control access to the property by blocking the site to non-essential personnel. The excavation and any temporary stockpiles will be located inside a building, which will be locked as necessary, to restrict and protect access from non-essential personnel.

6.9.2 Runoff Control

The excavation contractor will implement a site-specific Storm Water Pollution Prevention Plan (SWPPP) to protect nearby surface waters, prevent surface runoff, and prevent transportation of mud and debris off-site onto adjacent streets. As part of the SWPPP, temporary stockpiles will be placed on ≥6 mil plastic layer or on an impervious surface. As necessary, BMPs may include using a straw wattle, covering the stormwater drain south/southwest of the building, or other appropriate measures during the exterior injections to mitigate potential daylighting concerns.

6.9.3 Decontamination of Equipment

Prior to leaving the site, equipment will be decontaminated to avoid transportation of impacted soils off the site. A decontamination area will be specified where visible soil will be brushed off or sprayed from the heavy equipment, such as on the tires, loading buckets, tools, and other equipment that may contain residual soils from the injection and excavation activities.

6.9.4 Dust Control

Dust control will be implemented, as needed, by the remediation contractor. A formal Fugitive Emissions Control Plan is not anticipated to be required for submittal to the DAQ; however, if visible dust is generated, the work site will be wetted, interior fans will be used, or work will be suspended until conditions permit work to continue. Soil transported off-site will be covered with a tarp.

7.0 Post Remediation Monitoring and Reporting

7.1 Post RAP Implementation Groundwater Monitoring

Following the completion of the excavation and injections, four rounds of semi-annual groundwater monitoring will be conducted using monitoring wells MW-1 through MW-5, which were installed during baseline site characterization activities. The groundwater samples will be collected with new, disposable bailers following the SOPs and details provided in the QAPP and will be analyzed for VOCs by EPA Method 8260. Details of the proposed sampling methods are detailed in the QAPP ([Appendix C](#)). The groundwater monitoring data will be used to assess the effectiveness of the groundwater remediation and monitor migration of impacts.

Off-site impacted groundwater that is attributable to the historical operations at the site will continue to be evaluated for potential action following the remediation activities.

7.2 Post RAP Implementation Reporting

Following completion of the soil excavation and groundwater injections, a report will be prepared documenting the results of the excavation, injections, and confirmation sampling. Following completion of the VIMS installation, a report will be prepared documenting the completion of the installation. Reports will be prepared to document the monitoring events.

8.0 Site Management Plan and Controls

If required, a Site Management Plan (SMP) and Environmental Covenant will be prepared following the remedial activities. The SMP will specify controls required to manage receptor risk resulting from residual impacted site media and ongoing monitoring requirements based on the post-remediation monitoring results. The SMP would be prepared following the post-remediation monitoring events and installation of the VIMS and prior to site occupancy, if necessary.

If impacted materials remain on-site after remediation, Institutional Controls and Engineering Controls will be used to restrict access to impacted materials. CRA will enter an Environmental Covenant with the UDEQ that outlines the continuing obligations and activity



and use limitations associated with any environmental impacts remaining at the site due to residual groundwater, soil vapor, or soil impacts.

9.0 References

Terracon, 2022. Analysis of Brownfield Cleanup Alternatives (ABCA), Schovaers Electronics, 22 South Jeremy Street, Salt Lake City, Utah, EPA Cooperative Agreement No. 96835701, EPA ACRES Property ID #199723, Terracon Project Number 61177082 Task P, November 4, 2022.

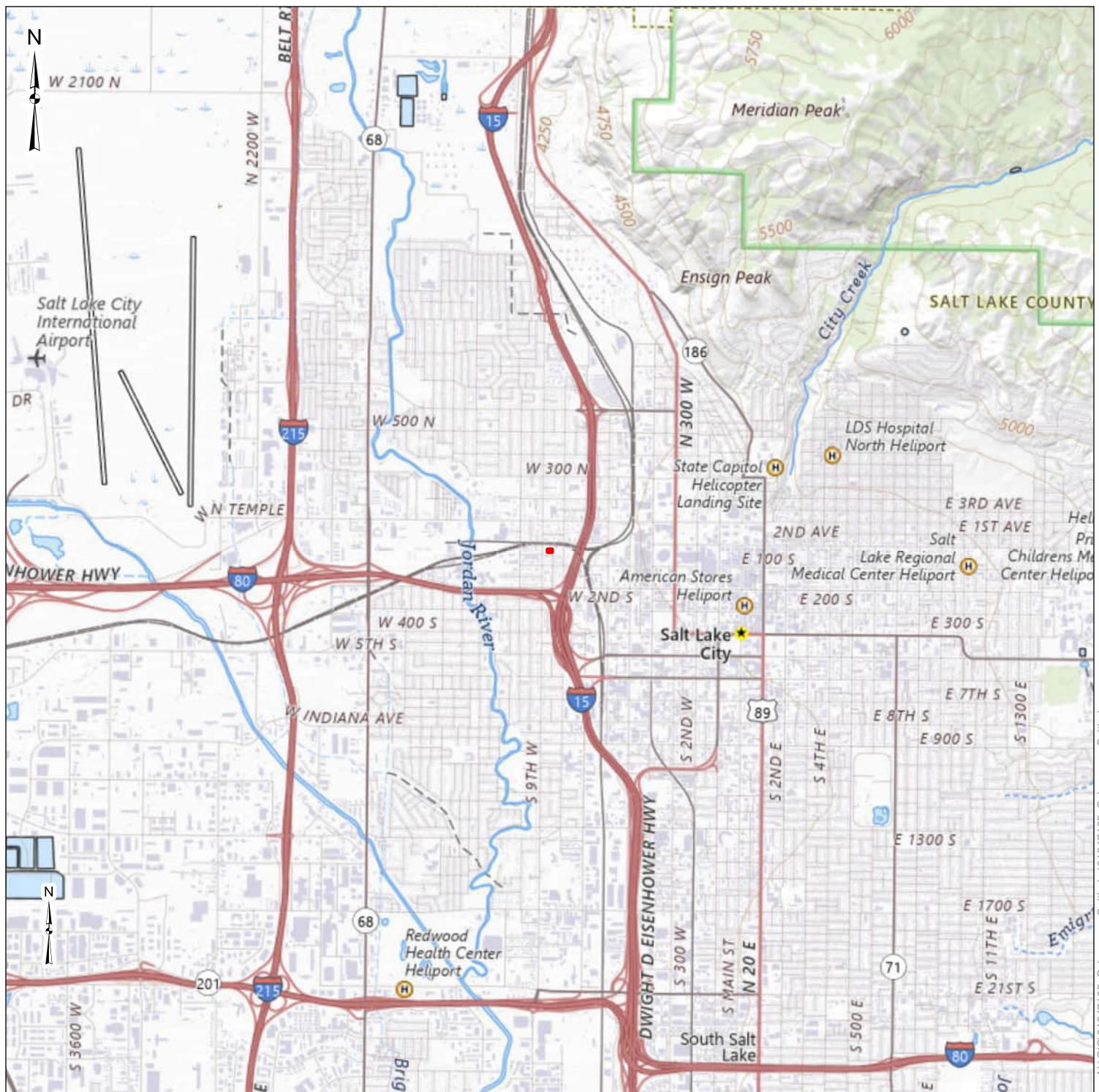
Terracon, 2024. Quality Assurance Project Plan, Salt Lake City Former Schovaers Cleanup Grant, EPA Cooperative Agreement No. 96884401, Terracon Project No. 61247165, March 13, 2026.

Terracon, 2025a. Phase II Environmental Site Assessment, Schovaers Electronics, 22 South Jeremy Street, Salt Lake City, Salt Lake County, Utah, EPA Cooperative Agreement No. 96897201, EPA ACRES Property ID #199723, Salt Lake County Brownfields Assessment Grant, Terracon Project No. 61237386 Task 3.16, July 17, 2025.

Terracon, 2025b. Phase II Environmental Site Assessment, Schovaers Electronics Off-Site Delineation, 25 South 900 West and 28 South 800 West, Salt Lake City, Salt Lake County, Utah, EPA Cooperative Agreement No. 96897201, EPA ACRES IDs #266897 and #252588, Salt Lake County Brownfields Assessment Grant, Terracon Project No. 61237386 Task 3.30, October 7, 2025.

Appendix A

Exhibits



Approximate Site Boundary

Feet
0 2,000 4,000 8,000

DATA SOURCES:
ESRI - Basemaps

Project No.:	61247165
Date:	Dec 2024
Drawn By:	AST
Reviewed By:	ABA



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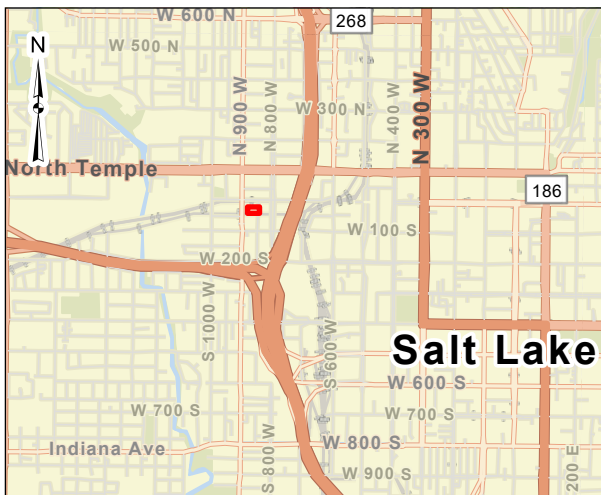
Topographic Site Overview

Schovaers Electronics
22 South Jeremy Street
Salt Lake City, Utah

Exhibit

1

N:\GIS\61247165 - Schovaers - Salt Lake\61247165 - Schovaers - Salt Lake.aprx



Soil Boring

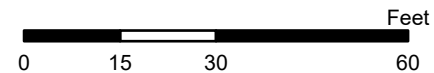
- ◆ 2015
- ◆ 2018
- Sewer Line
- Sump

Plating Room

Approximate Site Boundary

Soil Exceedances

- Exceeds Background Arsenic Concentration and Industrial RSL for Trichloroethene



DATA SOURCES:
ESRI - Basemaps

Arsenic was reported above the Industrial RSL in most samples; however, the concentrations were typical of arsenic concentrations generally encountered in Salt Lake County.

Project No.:	61247165
Date:	Dec 2024
Drawn By:	AST
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Soil Exceedance Map

Schovaers Electronics
22 South Jeremy Street
Salt Lake City, Utah

Exhibit

3



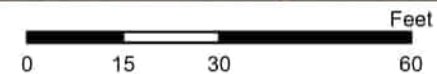
Soil Boring

- ◆ 2015
- ◆ 2018
- Sewer Line
- Sump
- Plating Room

— Approximate Site Boundary

Groundwater Exceedances

- Exceeds MCL for Trichloroethene (0.005 mg/l)
- Exceeds MCL (0.005 mg/l) and Commercial TGC VISL (0.00743 mg/l) for Trichloroethene



DATA SOURCES:
ESRI - Basemaps

Project No.:
61247165
Date:
Mar 2025
Drawn By:
AST
Reviewed By:
ABA

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Groundwater Exceedance Map, 2015 and 2018

Schovaers Electronics
22 South Jeremy Street
Salt Lake City, Utah

Exhibit

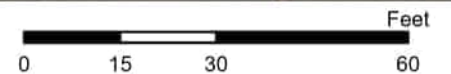
4A



- Monitoring Well
- Sewer Line
- Sump
- Plating Room
- Approximate Site Boundary

Groundwater Exceedances May 2025

- Exceeds Residential TGC VISL for Chloroform
- Exceeds Commercial TGC VISL for Chloroform
- Exceeds MCL and Residential TGC VISL for Trichloroethene



DATA SOURCES:
ESRI - Basemaps

Project No.:
61237386

Date:
Jul 2025

Drawn By:
AST

Reviewed By:
ABA

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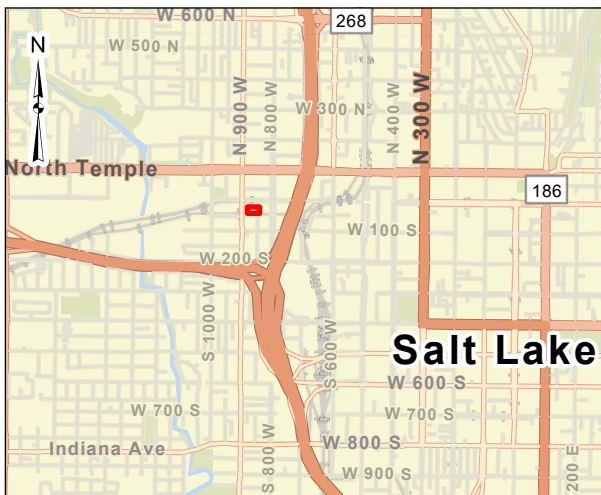
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Groundwater Exceedance Map, 2025

Schovaers Electronics
22 South Jeremy Street
Salt Lake City, Utah

Exhibit

4B



- ▲ Sub Slab Vapor Sample (2018)
- Sewer Line
- Sump
- Plating Room

- Approximate Site Boundary

Sub Slab Vapor Exceedances

- Exceeds Commercial VISL for Naphthalene
- Exceeds Commercial VISL for Trichloroethene



DATA SOURCES:
ESRI - Basemaps

Project No.:
61247165

Date:
Dec 2024

Drawn By:
AST

Reviewed By:
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Soil Vapor Exceedance Map, 2018

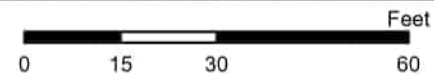
Schovaers Electronics
22 South Jeremy Street
Salt Lake City, Utah

Exhibit

5A



- Soil Vapor Exceedances, May 2025**
- Vapor Pin
 - Sewer Line
 - Sump
 - Plating Room
 - Approximate Site Boundary
 - Exceeds Residential VISL
 - Exceeds Commercial VISL



DATA SOURCES:
ESRI - Basemaps

Project No.:
61237386
Date:
Jul 2025
Drawn By:
AST
Reviewed By:
ABA

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Soil Vapor Exceedance Map, 2025

Schovaers Electronics
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Salt Lake City, Utah

Exhibit

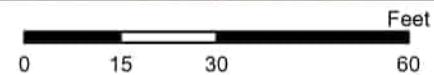
5B



- Indoor Air Sample
- Sewer Line
- Sump
- Plating Room
- Approximate Site Boundary

Indoor Air Exceedances, May 2025

- Exceeds Residential VISL
- Exceeds Commercial VISL



DATA SOURCES:
ESRI - Basemaps

Project No.:
61237386

Date:
Jul 2025

Drawn By:
AST

Reviewed By:
ABA

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Indoor Air Exceedance Map, 2025

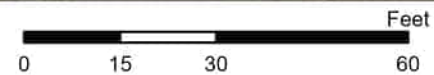
Schovaers Electronics
22 South Jeremy Street
Salt Lake City, Utah

Exhibit

6



- Monitoring Well
- ▲ Vapor Pin
- Indoor Air Sample
- Sewer Line
- Soil Boring
 - 2015
 - 2018
 - Proposed Excavation Area
 - Proposed Injection Area
- Sump
- Plating Room
- Approximate Site Boundary



DATA SOURCES:
ESRI - Basemaps

Project No.:
61247165

Date:
Jan 2026

Drawn By:
AST

Reviewed By:
ABA



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Midvale, UT

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Investigation and Remediation Locations

Schovaers Electronics
25 South 900 West, 28 South 800 West
Salt Lake City, Utah

Exhibit

7

Appendix B

Tables

Table 1 - Metals and pH in Soil
Schovaers Electronics - 22 South Jeremy Street, Salt Lake City, Utah
Terracon Project No. 61247165

Lab Sample ID				L800774-02		L800774-05		L800774-08		L800774-11		L800774-14		L800774-17		L800774-20		L800774-23		L800774-26		L800774-29		L800774-32	
Client Sample ID				SE-SB-01 1'-2 FT		SE-SB-02 1'-2 FT		SE-SB-03 1.5'-2 FT		SE-SB-04 1'-2 FT		SE-SB-05 5'-6.5 FT		SE-SB-06 5'-6.5 FT		SE-SB-07 1'-2 FT		SE-SB-08 0.5'-1.5 FT		SE-SB-09 1'-2 FT		SE-SB-10 0.5'-1 FT		SE-SB-11 1'-1.5 FT	
Date Collected				11/11/2015		11/11/2015		11/11/2015		11/11/2015		11/11/2015		11/11/2015		11/11/2015		11/12/2015		11/12/2015		11/12/2015		11/12/2015	
Method	Analyte	CAS #	Units	Residential RSL ¹	Industrial RSL ²	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
6010B	ANTIMONY	7440-36-0	mg/kg	31	470	<0.75		<0.75		<0.75		1.82	J	<0.75		<0.75		<0.75		1.93	J	<0.75		1.27	J
6010B	ARSENIC	7440-39-2	mg/kg	0.68	3	4.62		8.77		8.47		8.33		17.5		10		16.5		15.2		12.4		15.1	
6010B	BERYLLIUM	7440-41-7	mg/kg	160	2300	1.11		0.761		0.851		0.641		0.742		0.228	J	0.887		1.46		0.525		0.561	
6010B	CADMIUM	7440-43-9	mg/kg	7.1	100	0.285	J	0.736		0.251	J	0.87		0.181	J	0.403	J	0.0943	J	0.408	J	0.481	J	1.52	
6010B	CHROMIUM	7440-47-3	mg/kg	120000	1800000	13.4		13		8.71		13.8		13.7		5.96		14.8		6.66		11.6		16.4	
3060A/7 196A	CHROMIUM, HEXAVALENT	18540-29-9	mg/kg	0.95	20	1.71	J	3.25		11.3		18.4	J6	1.13	J	<0.64		4.14		<0.64		0.993	J	<0.64	
6010B	COPPER	7440-50-8	mg/kg	3100	47000	56.6		48.4		39.6		44.5		37.3		19.6		58.6		49.8		22.2		48.7	
6010B	LEAD	7439-92-1	mg/kg	200	800	36.7		127		45.2		129		41.7		14.5		31.7		194		56		252	
7471A	MERCURY	7439-97-6	mg/kg	7.1	30	0.025	J	0.18		0.025		0.171		0.0186	J	0.0213	J	0.116		0.414		0.142		0.971	
6010B	NICKEL	7440-02-0	mg/kg	1400	17000	16.2		14.5		14		13.2		16.1		5.45		23.5		5.63		10.2		17.4	
6010B	SELENIUM	7782-49-2	mg/kg	390	5800	<0.74		<0.74		<0.74		<0.74		1.27	J	<0.74		1.4	J	<0.74		<0.74		<0.74	
6010B	SILVER	7440-22-4	mg/kg	390	5800	<0.28		<0.28		<0.28		4.11		<0.28		<0.28		<0.28		<0.28		<0.28		<0.28	
6010B	THALLIUM	7440-28-0	mg/kg	0.78	12	<0.65		<0.65		<0.65		<0.65		<0.65		<0.65		<0.65		<0.65		<0.65		<0.65	
6010B	ZINC	7440-66-6	mg/kg	23000	350000	86.3		97.6		61.6		138		80.4		27.1		91.6		92.7		71		209	
9045D	pH		NE su	NE	NE	8.41		7.83		7.52		8.20		8.06		8.28		8.17		8.6		8.5		8.22	

Table 1 - Metals and pH in Soil
Schovaers Electronics - 22 South Jeremy Street, Salt Lake City, Utah
Terracon Project No. 61247165

Lab Sample ID		L800774-35	L800774-38	L800774-41	L800774-44	L995461-21	L995461-22	L995461-23	L995461-24	L995461-18	L995461-19	L995461-15	L995461-16																
Client Sample ID		SE-SB-12 1-1.5 FT	SE-SB-13 1-2 FT	SE-SB-14 1-2 FT	SE-SB-15 1-2 FT	SE-SB-16 (2.5)	SE-SB-16 (5)	SE-SB-17 (2.5)	SE-SB-17 (5)	SE-SB-18 (3)	SE-SB-18 (8)	SE-SB-19 (4)	SE-SB-19 (8)																
Date Collected		11/12/2015	11/11/2015	11/11/2015	11/11/2015	05/17/2018	05/17/2018	05/17/2018	05/17/2018	05/17/2018	05/17/2018	05/17/2018	05/17/2018																
Method	Analyte	CAS #	Units	Residential RSL ¹	Industrial RSL ²	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q								
6010B	ANTIMONY	7440-36-0	mg/kg	31	470	<0.75		<0.75		<0.75		<0.75		NA	NA	NA		<0.810		<0.875		<0.853		<1.00					
6010B	ARSENIC	7440-38-2	mg/kg	0.68	3	10.1		7.1		5.87		5.05		NA	NA	NA		6.25		1.6	J	17.5		5.62					
6010B	BERYLLIUM	7440-41-7	mg/kg	160	2300	0.493		1.09		0.616		0.86		NA	NA	NA		0.335		0.135	J	0.544		1.04					
6010B	CADMIUM	7440-43-9	mg/kg	7.1	100	0.761		0.657		0.426	J	0.435	J	NA	NA	NA		0.303	J	0.294	J	2.16		0.597	J				
6010B	CHROMIUM	7440-47-3	mg/kg	120000	1800000	10.5		22.2		11.1		13.2		NA	NA	NA		11.6		6.72		17.7		23.4					
3060A/7 196A	CHROMIUM, HEXAVALENT	18540-29-9	mg/kg	0.95	20	1.75	J	7.18		2.65		1.76	J	<0.702		1.16	J	0.844	J	<0.779		<0.692		<0.747		1.5	J	0.855	J
6010B	COPPER	7440-50-8	mg/kg	3100	47000	53.3		43.6		41		55.2		NA	NA	NA		10.3		10.8		49		55.5					
6010B	LEAD	7439-92-1	mg/kg	200	800	140		44		45.2		41.1		NA	NA	NA		12.4		7.31		299		29.7					
7471A	MERCURY	7439-97-6	mg/kg	7.1	30	0.386		0.057		0.044		0.014	J	NA	NA	NA		0.0189	J	0.00652	J	0.26		0.0163	J				
6010B	NICKEL	7440-02-0	mg/kg	1400	17000	10.6		26.9		15.2		16.1		NA	NA	NA		8.82		5.03		10.1		21.9					
6010B	SELENIUM	7782-49-2	mg/kg	390	5800	<0.74		<0.74		<0.74		<0.74		NA	NA	NA		1.07	J	0.944	J	<0.842		<0.988					
6010B	SILVER	7440-22-4	mg/kg	390	5800	<0.28		<0.28		<0.28		<0.28		NA	NA	NA		<0.303		<0.327		<0.319		<0.374					
6010B	THALLIUM	7440-28-0	mg/kg	0.78	12	<0.65		<0.65		<0.65		<0.65		NA	NA	NA		<0.702		<0.758		<0.739		<0.868					
6010B	ZINC	7440-66-6	mg/kg	23000	350000	118		109		64		72.7		NA	NA	NA		33.9		18.5		210		92					
9045D	pH	NE	su	NE	NE	8.89		8.13		8.83		8.31		NA	NA	NA		8.48	T8	8.31	T8	8.01	T8	8.19	T8				

Table 1 - Metals and pH in Soil
Schovaers Electronics - 22 South Jeremy Street, Salt Lake City, Utah
Terracon Project No. 61247165

Lab Sample ID		L995461-12		L995461-13		L995461-01		L995461-02		L995461-04		L995461-05		L995461-09		L995461-10		L995461-07		L995461-08	
Client Sample ID		SE-SB-20 (3)		SE-SB-20 (11)		SE-SB-21 (3)		SE-SB-21 (7)		SE-SB-22 (3)		SE-SB-22 (7)		SE-SB-23 (3)		SE-SB-23 (10)		SE-SB-24 (9)		SE-SB-24 (7)	
Date Collected		05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018	
Method	Analyte	CAS #	Units	Residential RSL ¹	Industrial RSL ²	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
6010B	ANTIMONY	7440-36-0	mg/kg	31	470	<0.886		<0.910		<0.839	J6	<0.981		<0.977		<0.834		<0.956		<0.811	
6010B	ARSENIC	7440-38-2	mg/kg	0.68	3	11.9		9.83		5.74		52.9		8.78		6.05		3.63		21.4	
6010B	BERYLLIUM	7440-41-7	mg/kg	160	2300	0.457		0.524		0.622		0.78		1.38		0.612		0.351		1.24	
6010B	CADMIUM	7440-43-9	mg/kg	7.1	100	0.278	J	0.44	J	1.27		2.53		0.331	J	0.819		0.378	J	1.05	
6010B	CHROMIUM	7440-47-3	mg/kg	120000	1800000	14.2		15.4		15		19.3		31.1		16.3		20.3		28.2	
3060A/7 196A	CHROMIUM, HEXAVALENT	18540-29-9	mg/kg	0.95	20	<0.756		<0.776		<0.716		<0.837		<0.834		<0.712		<0.694		0.918	J
6010B	COPPER	7440-50-8	mg/kg	3100	47000	13.9		34.6		13.7		101		66.5		25.6		9.94		64.3	
6010B	LEAD	7439-92-1	mg/kg	200	800	11.6		19.2		51.8		508		51.5		143		30.6		62.8	
7471A	MERCURY	7439-97-6	mg/kg	7.1	30	0.0155	J	0.0122	J	0.0836		1.42		0.0769		0.874		0.0509		0.0278	
6010B	NICKEL	7440-02-0	mg/kg	1400	17000	11.2		12.9		17.1		10.6		25.4		11		8.44		39.4	
6010B	SELENIUM	7782-49-2	mg/kg	390	5800	<0.874		2.53		1.75	J	1.16	J	<0.964		<0.823		<0.803		1.87	J
6010B	SILVER	7440-22-4	mg/kg	390	5800	<0.331		<0.340		<0.313		0.439	J	<0.365		<0.311		<0.304		<0.357	
6010B	THALLIUM	7440-28-0	mg/kg	0.78	12	<0.768		<0.788		<0.727		<0.850		<0.847		<0.723		<0.705		<0.828	
6010B	ZINC	7440-66-6	mg/kg	23000	350000	31.4		49.1		94	J6	280		126		99.5		41.1		111	
9045D	pH	NE	su	NE	NE	8.71	T8	8.37	T8	8.43	T8	7.64	T8	8.69	T8	10.7	T8	8.63	T8	8.18	T8

- 1 - Environmental Protection Agency Regional Screening Levels for Residential soil (November 2024; Target Hazard Quotient=1, Target Risk=10⁻⁶).
2 - Environmental Protection Agency Regional Screening Levels for Industrial soils (November 2024; Target Hazard Quotient=1, Target Risk=10⁻⁶).
Bold values were reported above laboratory reporting limit. *Italicized* values indicate reporting limits above the Screening Levels.
CAS: Chemical Abstracts Service, mg/kg: milligrams per kilogram, NA: not analyzed, NE: not established, su: standard unit.
< : Not reported at or above the indicated analytical reporting limit
Q: Qualifiers -
J: The identification of the analyte is acceptable; the reported value is an estimate.
J3: The associated batch QC was outside the established quality control range for precision.
J6: The sample matrix interfered with the ability to make any accurate determination; spike value is low.
O1: The analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference.
T8: Sample(s) received past/too close to holding time expiration.

Table 2 - Volatile Organic Compounds in Soil
Schovaers Electronics - 22 South Jeremy Street, Salt Lake City, Utah Lake City, Utah
Terracon Project No. 61241765

Lab Sample ID						L800774-03	L800774-06	L800774-09	L800774-12	L800774-15	L800774-18	L800774-21	L800774-24	L800774-27	L800774-30	L800774-33	L800774-36	L800774-39	L800774-42	L800774-45	
Client Sample ID						SE-SB-01 10-10.5 FT	SE-SB-02 10-10.5 FT	SE-SB-03 10-10.5 FT	SE-SB-04 10-10.5 FT	SE-SB-05 10-11.5 FT	SE-SB-06 12.5-13 FT	SE-SB-07 10-10.5 FT	SE-SB-08 9.5-10.5 FT	SE-SB-09 14-14.5 FT	SE-SB-10 8.5-9 FT	SE-SB-11 9.5-10 FT	SE-SB-12 10-10.5 FT	SE-SB-13 10-10.5 FT	SE-SB-14 10-10.5 FT	SE-SB-15 10-10.5 FT	
Date Collected						11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/11/2015	11/11/2015	
Analyte (Method 8260B)	CAS #	Units	Residential RSL ¹	Industrial RSL ²	UDEQ ISL ³	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
ACETONE	67-64-1	mg/kg	70000	1100000	NE	<0.05		<0.05		<0.05		<0.05		<0.05		<0.05		<0.05		<0.05	
ACRYLONITRILE	107-13-1	mg/kg	0.25	1.1	NE	<0.00895		<0.00895		<0.00895	J3	<0.00895		<0.00895		<0.00895		<0.00895		<0.00895	
BENZENE	71-43-2	mg/kg	1.2	5.1	0.2	<0.00135		<0.00135		<0.00135		<0.00135		<0.00135		<0.00135		<0.00135		<0.00135	
BROMOBENZENE	108-86-1	mg/kg	290	1800	NE	<0.00142		<0.00142		<0.00142		<0.00142		<0.00142		<0.00142		<0.00142		<0.00142	
BROMODICHLOROMETHANE	75-27-4	mg/kg	0.29	1.3	NE	<0.00127		<0.00127		<0.00127		<0.00127		<0.00127		<0.00127		<0.00127		<0.00127	
BROMOFORM	75-25-2	mg/kg	19	86	NE	<0.00212		<0.00212		<0.00212		<0.00212		<0.00212		<0.00212		<0.00212		<0.00212	
BROMOMETHANE	74-83-9	mg/kg	6.8	30	NE	<0.0067		<0.0067		<0.0067		<0.0067		<0.0067		<0.0067		<0.0067		<0.0067	
N-BUTYLBENZENE	104-51-8	mg/kg	3900	58000	NE	<0.00129		<0.00129		<0.00129		<0.00129		<0.00129		<0.00129		<0.00129		<0.00129	
SEC-BUTYLBENZENE	135-98-8	mg/kg	7800	120000	NE	<0.001		<0.001		<0.001		<0.001		<0.001		<0.001		<0.001		<0.001	
TERT-BUTYLBENZENE	98-06-6	mg/kg	7800	120000	NE	<0.00103		<0.00103		<0.00103		<0.00103		<0.00103		<0.00103		<0.00103		<0.00103	
CARBON TETRACHLORIDE	56-23-5	mg/kg	0.65	2.9	NE	<0.00164		<0.00164		<0.00164		<0.00164		<0.00164		<0.00164		<0.00164		<0.00164	
CHLOROBENZENE	108-90-7	mg/kg	280	1300	NE	<0.00106		<0.00106		<0.00106		<0.00106		<0.00106		<0.00106		<0.00106		<0.00106	
CHLORODIBROMOMETHANE	124-48-1	mg/kg	8.3	39	NE	<0.00186		<0.00186		<0.00186		<0.00186		<0.00186		<0.00186		<0.00186		<0.00186	
CHLOROETHANE	75-00-3	mg/kg	5400	23000	NE	<0.00473		<0.00473		<0.00473		<0.00473		<0.00473		<0.00473		<0.00473		<0.00473	
2-CHLOROETHYL VINYL ETHER	110-78-8	mg/kg	NE	NE	NE	<0.0117	J4	<0.0117		<0.0117		<0.0117		<0.0117	J4	<0.0117	J4	<0.0117		<0.0117	
CHLOROFORM	67-66-3	mg/kg	0.32	1.4	NE	<0.00114		<0.00114		<0.00114		<0.00114		<0.00114		<0.00114		<0.00114		<0.00114	
CHLOROMETHANE	74-87-3	mg/kg	110	460	NE	<0.00188		<0.00188		<0.00188		<0.00188		<0.00188		<0.00188		<0.00188		<0.00188	
2-CHLOROTOLUENE	95-49-8	mg/kg	1600	23000	NE	<0.0015		<0.0015		<0.0015		<0.0015		<0.0015		<0.0015		<0.0015		<0.0015	
4-CHLOROTOLUENE	106-43-4	mg/kg	1600	23000	NE	<0.0012		<0.0012		<0.0012		<0.0012		<0.0012		<0.0012		<0.0012		<0.0012	
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	mg/kg	0.0053	0.064	NE	<0.00525		<0.00525		<0.00525	J3	<0.00525		<0.00525		<0.00525		<0.00525		<0.00525	
1,2-DIBROMOETHANE	106-93-4	mg/kg	0.036	0.16	NE	<0.00172		<0.00172		<0.00172		<0.00172		<0.00172		<0.00172		<0.00172		<0.00172	
DIBROMOMETHANE	74-95-3	mg/kg	24	99	NE	<0.00191		<0.00191		<0.00191		<0.00191		<0.00191		<0.00191		<0.00191		<0.00191	
1,2-DICHLOROBENZENE	95-50-1	mg/kg	1800	9300	NE	<0.00152		<0.00152		<0.00152		<0.00152		<0.00152		<0.00152		<0.00152		<0.00152	
1,3-DICHLOROBENZENE	541-73-1	mg/kg	NE	NE	NE	<0.0012		<0.0012		<0.0012		<0.0012		<0.0012		<0.0012		<0.0012		<0.0012	
1,4-DICHLOROBENZENE	106-46-7	mg/kg	2.6	11	NE	<0.00113		<0.00113		<0.00113		<0.00113		<0.00113		<0.00113		<0.00113		<0.00113	
DICHLORODIFLUOROMETHANE	75-71-8	mg/kg	87	370	NE	<0.00356		<0.00356		<0.00356		<0.00356		<0.00356		<0.00356		<0.00356		<0.00356	
1,1-DICHLOROETHANE	75-34-3	mg/kg	3.6	16	NE	<0.000995		<0.000995		<0.000995		<0.000995		<0.000995		<0.000995		<0.000995		<0.000995	
1,2-DICHLOROETHANE	107-06-2	mg/kg	0.46	2	NE	<0.00132		<0.00132		<0.00132		<0.00132		<0.00132		<0.00132		<0.00132		<0.00132	
1,1-DICHLOROETHENE	75-35-4	mg/kg	4.8	20	NE	<0.00152		<0.00152		<0.00152		<0.00152		<0.00152		<0.00152		<0.00152		<0.00152	
CIS-1,2-DICHLOROETHENE	156-59-2	mg/kg	63	370	NE	<0.00118		<0.00118		<0.00118		<0.00118		<0.00118		<0.00118		<0.00118		<0.00118	
TRANS-1,2-DICHLOROETHENE	156-60-5	mg/kg	70	300	NE	<0.00132		<0.00132		<0.00132		<0.00132		<0.00132		<0.00132		<0.00132		<0.00132	
1,2-DICHLOROPROPANE	78-87-5	mg/kg	2.5	11	NE	<0.00179		<0.00179		<0.00179		<0.00179		<0.00179		<0.00179		<0.00179		<0.00179	
1,1-DICHLOROPROPENE	75-35-4	mg/kg	4.8	20	NE	<0.00158		<0.00158		<0.00158		<0.00158		<0.00158		<0.00158		<0.00158		<0.00158	
1,3-DICHLOROPROPANE	142-28-9	mg/kg	1600	23000	NE	<0.00104		<0.00104		<0.00104		<0.00104		<0.00104		<0.00104		<0.00104		<0.00104	
CIS-1,3-DICHLOROPROPENE	10061-01-5	mg/kg	NE	NE	NE	<0.00131		<0.00131		<0.00131		<0.00131		<0.00131		<0.00131		<0.00131		<0.00131	
TRANS-1,3-DICHLOROPROPENE	10061-02-6	mg/kg	NE	NE	NE	<0.00134		<0.00134		<0.00134		<0.00134		<0.00134		<0.00134		<0.00134		<0.00134	
2,2-DICHLOROPROPANE	594-20-7	mg/kg	NE	NE	NE	<0.0014		<0.0014		<0.0014		<0.0014		<0.0014		<0.0014		<0.0014		<0.0014	
DI-ISOPROPYL ETHER	108-20-3	mg/kg	2200	9400	NE	<0.00124		<0.00124		<0.00124		<0.00124		<0.00124		<0.00124		<0.00124		<0.00124	
ETHYLBENZENE	100-41-4	mg/kg	5.8	25	5	<0.00148		<0.00148		<0.00148		<0.00148		<0.00148		<0.00148		<0.00148		<0.00148	
HEXACHLORO-1,3-BUTADIENE	87-68-3	mg/kg	1.2	5.3	NE	<0.00171		<0.00171		<0.00171		<0.00171		<0.00171		<0.00171		<0.00171		<0.00171	
ISOPROPYLBENZENE	98-82-8	mg/kg	1900	9900	NE	<0.00122		<0.00122		<0.00122		<0.00122		<0.00122		<0.00122		<0.00122		<0.00122	
P-ISOPROPYLTOLUENE	99-87-6	mg/kg	170	1100	NE	<0.00102		<0.00102		<0.00102		<0.00102		<0.00102		<0.00102		<0.00102		<0.00102	
1,4-DIOXANE	123-91-1	mg/kg	5.3	24	NE	<0.00186		<0.00186		<0.00186		<0.00186		<0.00186		<0.00186		<0.00186		<0.00186	
2-BUTANONE (MEK)	78-93-3	mg/kg	27000	190000	NE	<0.0234		<0.0234		<0.0234	J3	<0.0234		<0.0234		<0.0234		<0.0234		<0.0234	
METHYLENE CHLORIDE	75-09-2	mg/kg	57	1000	NE	0.0073	J	<0.005		<0.005		<0.005		0.0063	J	0.00703	J	<0.005		<0.005	
4-METHYL-2-PENTANONE (MIBK)	108-10-1	mg/kg	33000	140000	NE	<0.0094		<0.0094		<0.0094	J3	<0.0094		<0.0094		<0.0094		<0.0094		<0.0094	
METHYL TERT-BUTYL ETHER	1634-04-4	mg/kg	47	210	0.3	<0.00106		<0.00106		<0.00106		<0.00106		<0.00106		<0.00106		<0.00106		<0.00106	
NAPHTHALENE	91-20-3	mg/kg	2	8.6	51	<0.005		<0.005		<0.005		<0.005		<0.005		<0.005		<0.005		<0.005	
N-PROPYLBENZENE	103-65-1	mg/kg	3800	24000	NE	<0.00103		<0.00103		<0.00103		<0.00103		<0.00103		<0.00103		<0.00103		<0.00103	
STYRENE	100-42-5	mg/kg	6000	35000	NE	<0.00117		<0.00117		<0.00117		<0.00117		<0.00117		<0.00117		<0.00117		<0.00117	
1,1,1,2-TETRACHLOROETHANE	630-20-6	mg/kg	2	8.8	NE	<0.00132		<0.00132		<0.00132		<0.00132		<0.00132		<0.00132		<0.00132		<0.00132	
1,1,2,2-TETRACHLOROETHANE	79-34-5	mg/kg	0.6	2.7	NE	<0.00182		<0.00182		<0.00182		<0.00182		<0.00182		<0.00182		<0.00182		<0.00182	
1,1,2-TRICHLOROTRIFLUOROETHANE	76-13-1	mg/kg	6700	28000	NE	<0.00182		<0.00182		<0.00182		<0.00182		<0.00182		<0.00182		<0.00182		<0.00182	
TETRACHLOROETHENE	127-18-4	mg/kg	24	100	NE	<0.00138		<0.00138		<0.00138		<0.00138		<0.00138		<0.00138		<0.00138		<0.00138	
TOLUENE	108-88-3	mg/kg	4900	47000	9	<0.00217		<0.00217		<0.00217		<0.00217		<0.00217		<0.00217		<0.00217		<0.00217	
1,2,3-TRICHLOROBENZENE	87-61-6	mg/kg	63	93																	

Table 2 - Volatile Organic Compounds in Soil
Schovaers Electronics - 22 South Jeremy Street, Salt Lake City, Utah Lake City, Utah
Terracon Project No. 61241765

Lab Sample ID						L995461-18		L995461-19		L995461-15		L995461-16		L995461-12		L995461-13		L995461-01		L995461-02		L995461-04		L995461-05		L995461-09		L995461-10		L995461-07		L995461-08	
Client Sample ID						SE-SB-18 (3)		SE-SB-18 (8)		SE-SB-19 (4)		SE-SB-19 (8)		SE-SB-20 (3)		SE-SB-20 (11)		SE-SB-21 (3)		SE-SB-21 (7)		SE-SB-22 (3)		SE-SB-22 (7)		SE-SB-23 (3)		SE-SB-23 (10)		SE-SB-24 (3)		SE-SB-24 (7)	
Date Collected						05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018	
Analyte (Method 8260B)	CAS #	Units	Residential RSL ¹	Industrial RSL ²	UDEQ ISL ³	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
ACETONE	67-64-1	mg/kg	70000	1100000	NE	0.0177	J J3	0.0211	J	<0.0156	J3	<0.0183	J3	<0.0162	J3	<0.0166	J3	<0.0153	J3	<0.0191	J3	<0.0178	J3	0.0169	J J3	0.023	J J3	<0.0175	J3	<0.0175	J3	0.0417	J3
ACRYLONITRILE	107-13-1	mg/kg	0.25	1.1	NE	<0.00205		<0.00222		<0.00216		<0.00254		<0.00224		<0.00230		<0.00213		<0.00265		<0.00247		<0.00211		<0.00206		<0.00242		<0.00242		<0.00224	
BENZENE	71-43-2	mg/kg	1.2	5.1	0.2	<0.000432		<0.000467		<0.000455		<0.000534		<0.000472		<0.000485		<0.000448		0.0178		<0.000521		<0.000445		<0.000434		<0.000510		<0.000511		0.0103	
BROMOBENZENE	108-86-1	mg/kg	290	1800	NE	<0.00113		<0.00123		<0.00119		<0.00140		<0.00124		<0.00127		<0.00118		<0.00146		<0.00137		<0.00117		<0.00114		<0.00134		<0.00134		<0.00124	
BROMODICHLOROMETHANE	75-27-4	mg/kg	0.29	1.3	NE	<0.000851		<0.000919		<0.000896		<0.00105		<0.000931		<0.000956		<0.000882		0.46		<0.00103		<0.000876		<0.000855		<0.00100		<0.00101		<0.000929	
BROMOFORM	75-25-2	mg/kg	19	86	NE	<0.00646		<0.00698		<0.00680		<0.00798		<0.00706		<0.00725		<0.00669		<0.00837		<0.00779		<0.00665		<0.00649		<0.00762		<0.00764		<0.00705	
BROMOMETHANE	74-83-9	mg/kg	6.8	30	NE	<0.00400		<0.00432		<0.00421		<0.00494		<0.00437		<0.00449		<0.00414		<0.00518		<0.00482		<0.00411		<0.00401		<0.00472		<0.00473		<0.00436	
N-BUTYLBENZENE	104-51-8	mg/kg	3900	58000	NE	<0.00415		<0.00448		<0.00437		<0.00513		<0.00453		<0.00466		<0.00430		0.0067	J	<0.00500		<0.00427		<0.00417		<0.00489		<0.00490		<0.00453	
SEC-BUTYLBENZENE	135-98-8	mg/kg	7800	120000	NE	<0.00273		<0.00295		<0.00288		<0.00338		<0.00299		<0.00307		<0.00283		<0.00354		<0.00330		<0.00281		<0.00275		<0.00322		<0.00322		<0.00299	
TERT-BUTYLBENZENE	98-06-6	mg/kg	7800	120000	NE	<0.00167		<0.00181		<0.00176		<0.00207		<0.00183		<0.00188		<0.00173		<0.00217		<0.00202		<0.00172		<0.00168		<0.00198		<0.00198		0.00191	J
CARBON TETRACHLORIDE	56-23-5	mg/kg	0.65	2.9	NE	<0.00117		<0.00126		<0.00123		<0.00144		<0.00128		<0.00131		<0.00121		<0.00152		<0.00141		<0.00120		<0.00117		<0.00138		<0.00137		<0.00127	
CHLOROBENZENE	108-90-7	mg/kg	280	1300	NE	<0.000619		<0.000669		<0.000652		<0.000765		<0.000677		<0.000695		<0.000641		<0.000802		<0.000746		<0.000637		<0.000622		<0.000730		<0.000731		<0.000676	
CHLORODIBROMOMETHANE	124-48-1	mg/kg	8.3	39	NE	<0.000486		<0.000525		<0.000512		<0.000601		<0.000531		<0.000546		<0.000504		<0.000630		<0.000586		<0.000500		<0.000488		<0.000574		<0.000574		<0.000530	
CHLOROETHANE	75-00-3	mg/kg	5400	23000	NE	<0.00117		<0.00126		<0.00123		<0.00144		<0.00128		<0.00131		<0.00121		<0.00152		<0.00141		<0.00120		<0.00117		<0.00138		<0.00137		<0.00127	
2-CHLOROETHYL VINYL ETHER	110-78-8	mg/kg	NE	NE	NE	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
CHLOROFORM	67-66-3	mg/kg	0.32	1.4	NE	<0.000448		<0.000484		<0.000472		<0.000554		<0.000490		<0.000503		<0.000464		0.0117		<0.000541		0.000929	J	<0.000450		<0.000529		<0.000530		0.00185	J
CHLORMETHANE	74-87-3	mg/kg	110	460	NE	<0.00150		<0.00162		<0.00158		<0.00186		<0.00164		<0.00169		<0.00156		<0.00195		<0.00181		<0.00155		<0.00151		<0.00177		<0.00177		<0.00163	
2-CHLOROTOLUENE	95-49-8	mg/kg	1600	23000	NE	<0.000994		<0.00107		<0.00105		<0.00123		<0.00109		<0.00112		<0.00103		<0.00129		<0.00120		<0.00102		<0.000998		<0.00117		<0.00117		<0.00108	
4-CHLOROTOLUENE	106-43-4	mg/kg	1600	23000	NE	<0.00122	J4	<0.00132		<0.00129	J4	<0.00151	J4	<0.00133	J4	<0.00137	J4	<0.00126	J4	<0.00158	J4	<0.00147	J4	<0.00126	J4	<0.00123	J4	<0.00144	J4	<0.00144	J4	<0.00133	J4
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	mg/kg	0.0053	0.064	NE	<0.00551		<0.00595		<0.00580		<0.00681		<0.00602		<0.00619		<0.00571		<0.00674		<0.00664		<0.00567		<0.00553		<0.00650		<0.00651		<0.00601	
1,2-DIBROMOETHANE	106-93-4	mg/kg	0.036	0.16	NE	<0.000567		<0.000613		<0.000597		<0.000701		<0.000620		<0.000637		<0.000588		<0.000735		<0.000684		<0.000584		<0.000570		<0.000669		<0.000671		<0.000619	
DIBROMOMETHANE	74-95-3	mg/kg	24	99	NE	<0.00108		<0.00117		<0.00114		<0.00134		<0.00118		<0.00121		<0.00112		<0.00140		<0.00130		<0.00111		<0.00109		<0.00127		<0.00128		<0.00118	
1,2-DICHLOROENZENE	95-50-1	mg/kg	1800	9300	NE	<0.00157		<0.00169		<0.00165		<0.00194		<0.00171		<0.00176		<0.00162		<0.00203		<0.00189		<0.00161		<0.00157		<0.00185		<0.00185		<0.00170	
1,3-DICHLOROENZENE	541-73-1	mg/kg	NE	NE	NE	<0.00184		<0.00198		<0.00193		<0.00227		<0.00201		<0.00206		<0.00190		<0.00238		<0.00221											

Table 3 - Dissolved Metals in Groundwater
Schovaers Electronics - 22 South Jeremy Street, Salt Lake City, Utah
Terracon Project No. 61247165

Lab Sample ID		L800774-01	L800774-04	L800774-07	L800774-10	L800774-13	L800774-16	L800774-19	L800774-22	L800774-25	L800774-28	L800774-31															
Client Sample ID		SE-SB-01	SE-SB-02	SE-SB-03	SE-SB-04	SE-SB-05	SE-SB-06	SE-SB-07	SE-SB-08	SE-SB-09	SE-SB-10	SE-SB-11															
Date Collected		11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015															
Method	Analyte	CAS #	Units	Tapwater RSL	EPA MCL	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q						
6020	ANTIMONY	7440-36-0	mg/l	0.0078	0.006	0.000748	J	0.00483		0.00094	J	<0.00021		0.000916	J	0.00124	J	0.000543	J	<0.00021		0.000371	J	0.000457	J	0.000477	J
6020	ARSENIC	7440-38-2	mg/l	0.000052	0.01	0.00383		0.00526		0.0015	J	0.00158	J	0.00182	J	0.00203	0.00147	J	0.000981	J	0.00712	0.000928	J	0.00405			
6010B	BERYLLIUM	7440-41-7	mg/l	0.025	0.004	<0.0007		<0.0007		<0.0007		<0.0007		<0.0007		<0.0007	<0.0007		<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007			
6010B	CADMIUM	7440-43-9	mg/l	0.0018	0.005	<0.0007		<0.0007		<0.0007		<0.0007		<0.0007		<0.0007	<0.0007		<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007			
6010B	CHROMIUM ³	7440-47-3	mg/l	22	0.1	<0.0014		<0.0014		<0.0014		<0.0014		<0.0014		<0.0014	<0.0014		<0.0014	<0.0014	<0.0014	<0.0014	<0.0014	<0.0014			
7199	CHROMIUM, HEXAVALENT	18540-29-9	mg/l	0.00011	NE	<0.00015		0.0002	J	<0.00015		0.0002	J	0.0004	J	0.0002	J	0.0003	J	<0.00015		<0.00015		<0.00015		<0.00015	
6010B	COPPER	7440-50-8	mg/l	0.8	1.3	<0.0053		<0.0053		<0.0053		<0.0053		<0.0053		<0.0053	<0.0053		<0.0053	<0.0053	<0.0053	<0.0053	<0.0053	<0.0053			
6020	LEAD	7439-92-1	mg/l	0.010	0.010	0.000251	J	0.000313	J	<0.00024		<0.00024		<0.00024		<0.00024	<0.00024		<0.00024	0.000402	J	0.000263	J	<0.00024			
7470A	MERCURY	7439-97-6	mg/l	0.00063	0.002	<0.000049		<0.000049		<0.000049		0.0000493	J	<0.000049		<0.000049	<0.000049		<0.000049	<0.000049	<0.000049	<0.000049	<0.000049	<0.000049			
6010B	NICKEL ⁴	7440-02-0	mg/l	0.39	NE	0.00556	J	0.00702	J	0.00556	J	<0.0049		0.00539	J	0.00819	J	0.00718	J	<0.0049	<0.0049		0.00752	J	0.00577	J	
6010B	SELENIUM	7782-49-2	mg/l	0.1	0.05	<0.0074		<0.0074		0.0101		<0.0074		<0.0074		<0.0074	<0.0074		<0.0074	<0.0074	<0.0074	<0.0074	<0.0074	<0.0074			
6010B	SILVER	7440-22-4	mg/l	0.094	NE	<0.0028		<0.0028		<0.0028		<0.0028		<0.0028		<0.0028	<0.0028		<0.0028	<0.0028	<0.0028	<0.0028	<0.0028	<0.0028			
6020	THALLIUM	7440-28-0	mg/l	0.0002	0.002	<0.00019		<0.00019		<0.00019		<0.00019		<0.00019		<0.00019	<0.00019		<0.00019	<0.00019	<0.00019	<0.00019	<0.00019	<0.00019			
6010B	ZINC	7440-66-6	mg/l	6	NE	0.0141	J	0.0168	J	<0.0059		<0.0059		<0.0059		<0.0059	<0.0059		<0.0059	<0.0059	<0.0059	<0.0059	<0.0059	<0.0059			
FM	pH	NE	su	NE	NE	6.41		6.51		6.29		6.31		6.36		6.49	6.66		6.44	6.43		6.41	6.65				

Table 3 - Dissolved Metals in Groundwater
Schovaers Electronics - 22 South Jeremy Street, Salt Lake City, Utah
Terracon Project No. 61247165

Lab Sample ID		L800774-34	L800774-37	L800774-40	L800774-43	L995461-25	L995461-20	L995461-17	L995461-14	L995461-03	L995461-06	L995461-11																	
Client Sample ID		SE-SB-12	SE-SB-13	SE-SB-14	SE-SB-15	SE-SB-17	SE-SB-18	SE-SB-19	SE-SB-20	SE-SB-21	SE-SB-22	SE-SB-23																	
Date Collected		11/12/2015	11/11/2015	11/11/2015	11/11/2015	05/17/2018	05/17/2018	05/17/2018	05/17/2018	05/17/2018	05/17/2018	05/17/2018																	
Method	Analyte	CAS #	Units	EPA Tapwater RSL	EPA MCL	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q								
6020	ANTIMONY	7440-36-0	mg/l	0.0078	0.006	0.000279	J	0.00112	J	0.000428	J	0.000991	J	<0.000754		<0.000754		<0.000754		0.000851	J	<0.000754							
6020	ARSENIC	7440-38-2	mg/l	0.000052	0.01	0.0013	J	0.00418	J	0.00191	J	0.00175	J	0.00114	J	0.00376	J	<0.000250		0.000283	J	0.00111	J	0.000613	J				
6010B	BERYLLIUM	7440-41-7	mg/l	0.025	0.004	<0.0007		<0.0007		<0.0007		<0.0007		<0.000700		<0.000700		<0.000700		<0.000700		<0.000700		<0.000700					
6010B	CADMIUM	7440-43-9	mg/l	0.0018	0.005	<0.0007		<0.0007		<0.0007		<0.0007		<0.000700		<0.000700		<0.000700		<0.000700		<0.000700		<0.000700					
6010B	CHROMIUM ³	7440-47-3	mg/l	22	0.1	<0.0014		<0.0014		<0.0014		<0.0014		<0.00140		<0.00140		<0.00140		0.00164	J	<0.00140		<0.00140					
7199	CHROMIUM, HEXAVALENT	18540-29-9	mg/l	0.00011	NE	0.0002	J	<0.00015		<0.00015		<0.00015		0.0000234	J	<0.0000200		0.000116		0.000096		0.0000857		0.000217		0.0000572	J	0.0000572	J
6010B	COPPER	7440-50-8	mg/l	0.8	1.3	<0.0053		<0.0053		<0.0053		<0.0053		0.000530	J	<0.000530		0.000530		0.000530		0.000530		0.000530		0.000530			
6020	LEAD	7439-92-1	mg/l	0.010	0.010	0.00026	J	0.00274	J	0.000255	J	0.00024		0.000256	J	<0.000240		0.000388	J	<0.000240		<0.000240		<0.000240		<0.000240			
7470A	MERCURY	7439-97-6	mg/l	0.00063	0.002	<0.000049		<0.000049		<0.000049		<0.000049		<0.0000490		<0.0000490		<0.0000490		<0.0000490		<0.0000490		<0.0000490		<0.0000490			
6010B	NICKEL ¹	7440-02-0	mg/l	0.39	NE	<0.0049		<0.0049		<0.0049		<0.0049		0.00707	J	<0.00490		0.00590	J	<0.00490		<0.00490		0.00531	J	<0.00490			
6010B	SELENIUM	7782-49-2	mg/l	0.1	0.05	<0.0074		<0.0074		<0.0074		<0.0074		<0.00740		<0.00740		<0.00740		<0.00740		<0.00740		<0.00740		<0.00740			
6010B	SILVER	7440-22-4	mg/l	0.094	NE	<0.0028		<0.0028		<0.0028		<0.0028		<0.00280		<0.00280		<0.00280		<0.00280		<0.00280		<0.00280		<0.00280			
6020	THALLIUM	7440-28-0	mg/l	0.0002	0.002	<0.00019		<0.00019		<0.00019		<0.00019		<0.000190		<0.000190		<0.000190		<0.000190		<0.000190		<0.000190		<0.000190			
6010B	ZINC	7440-66-6	mg/l	6	NE	<0.0059		0.00704	J	<0.0059		<0.0059		0.0203	J	0.0167	J	0.0219	J	0.00948	J	0.0155	J	0.0193	J	0.0225	J		
FM	pH	NE	su	NE	NE	6.68		6.31		6.35		6.13		7		7		7		7		7		7		7			

¹ Environmental Protection Agency Regional Screening Levels for Tapwater (November 2024; Target Hazard Quotient=1, Target Risk=10⁻⁶).

² Environmental Protection Agency Maximum Contaminant Level (November 2024; Target Hazard Quotient=1, Target Risk=10⁻⁶).

³ EPA Tapwater RSL is for Chromium III (soluble salts)

⁴ EPA Tapwater RSL is for Nickel Oxide.

Bold values were reported above laboratory reporting limit. *Italicized* values indicate reporting limits above the Screening Levels.

CAS: Chemical Abstracts Service. FM: field measure. mg/l: milligrams per liter. NE: not established. su: standard unit.

< : Not reported at or above the indicated analytical reporting limit

Q: Qualifiers -

J: The identification of the analyte is acceptable; the reported value is an estimate.

J6: The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Table 4A - Volatile Organic Compounds in Groundwater, 2015 and 2018
Schovaers Electronics - 22 South Jeremy Street, Salt Lake City, Utah
Terracon Project No. 61247165

Lab Sample ID								L800774-01	L800774-04		L800774-07	L800774-10		L800774-13	L800774-16		L800774-19	L800774-22		L800774-25	L800774-28			
Client Sample ID								SE-SB-01	SE-SB-02		SE-SB-03	SE-SB-04		SE-SB-05	SE-SB-06		SE-SB-07	SE-SB-08		SE-SB-09	SE-SB-10			
Date Collected								11/11/2015	11/11/2015		11/11/2015	11/11/2015		11/11/2015	11/11/2015		11/11/2015	11/12/2015		11/12/2015	11/12/2015			
Analyte (Method 8260B)	CAS #	Units	EPA RSL Tapwater ¹	EPA MCL ²	Utah ISL ³	EPA TGC Residential VISL ⁴	EPA TGC Commercial VISL ⁵	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	
ACETONE	67-64-1	mg/l	18	NE	NE	NE	NE	<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		
ACROLEIN	107-02-8	mg/l	0.000042	NE	NE	0.00418	0.0176	<0.00887		<0.00887	J5	<0.00887		<0.00887		<0.00887		<0.00887		<0.00887		<0.00887		
ACRYLONITRILE	107-13-1	mg/l	0.000052	NE	NE	0.00732	0.032	<0.00187		<0.00187		<0.00187		<0.00187		<0.00187		<0.00187		<0.00187		<0.00187		
BENZENE	71-43-2	mg/l	0.00046	0.005	0.005	0.00159	0.00693	<0.000331		<0.000331		<0.000331		<0.000331		<0.000331		<0.000331		<0.000331		<0.000331		
BROMOBENZENE	108-86-1	mg/l	0.062	NE	NE	0.62	2.6	<0.000352		<0.000352		<0.000352		<0.000352		<0.000352		<0.000352		<0.000352		<0.000352		
BROMODICHLOROMETHANE	75-27-4	mg/l	0.00013	0.08	NE	0.000876	0.00382	<0.00038		<0.00038		<0.00038		<0.00038		<0.00038		<0.00038		<0.00038		<0.00038		
BROMOFORM	75-25-2	mg/l	0.0033	0.08	NE	0.117	0.51	<0.000469		<0.000469		<0.000469		<0.000469		<0.000469		<0.000469		<0.000469		<0.000469		
BROMOMETHANE	74-83-9	mg/l	0.0075	NE	NE	0.0174	0.073	<0.000866		<0.000866		<0.000866		<0.000866		<0.000866		<0.000866		<0.000866		<0.000866		
N-BUTYLBENZENE	104-51-8	mg/l	1	NE	NE	NE	NE	<0.000361		<0.000361		<0.000361		<0.000361		<0.000361		<0.000361		<0.000361		<0.000361		
SEC-BUTYLBENZENE	135-98-8	mg/l	2	NE	NE	NE	NE	<0.000365		<0.000365		<0.000365		<0.000365		<0.000365		<0.000365		<0.000365		<0.000365		
TERT-BUTYLBENZENE	98-06-6	mg/l	0.69	NE	NE	NE	NE	<0.000399		<0.000399		<0.000399		<0.000399		<0.000399		<0.000399		<0.000399		<0.000399		
CARBON TETRACHLORIDE	56-23-5	mg/l	0.00046	0.005	NE	0.000415	0.00181	<0.000379		<0.000379		<0.000379		<0.000379		<0.000379		<0.000379		<0.000379		<0.000379		
CHLOROBENZENE	108-90-7	mg/l	0.078	0.1	NE	0.41	1.72	<0.000348		<0.000348		<0.000348		<0.000348		<0.000348		<0.000348		<0.000348		<0.000348		
CHLORODIBROMOMETHANE	124-48-1	mg/l	0.00087	0.08	NE	NE	NE	<0.000327		<0.000327		<0.000327		<0.000327		<0.000327		<0.000327		<0.000327		<0.000327		
CHLOROETHANE	75-00-3	mg/l	8.3	NE	NE	9.19	38.6	<0.000453		<0.000453		<0.000453		<0.000453		<0.000453		<0.000453		<0.000453		<0.000453		
2-CHLOROETHYL VINYL ETHER	110-75-8	mg/l	NE	NE	NE	NE	NE	<0.00301		<0.00301	J3, J6	<0.00301		<0.00301		<0.00301		<0.00301		<0.00301		<0.00301		
CHLOROFORM	67-66-3	mg/l	0.00022	0.08	NE	0.000814	0.00355	<0.000324		<0.000324		<0.000324		<0.000324		<0.000324		<0.000324		<0.000324		<0.000324		
CHLOROMETHANE	74-87-3	mg/l	0.19	NE	NE	0.26	1.09	<0.000276		<0.000276		<0.000276		<0.000276		<0.000276		<0.000276		<0.000276		<0.000276		
2-CHLOROTOLUENE	95-49-8	mg/l	0.24	NE	NE	NE	NE	<0.000375		<0.000375		<0.000375		<0.000375		<0.000375		<0.000375		<0.000375		<0.000375		
4-CHLOROTOLUENE	106-43-4	mg/l	0.25	NE	NE	NE	NE	<0.000351		<0.000351		<0.000351		<0.000351		<0.000351		<0.000351		<0.000351		<0.000351		
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	mg/l	3.34E-07	0.0002	NE	0.0000281	0.00034	<0.00133		<0.00133		<0.00133		<0.00133		<0.00133		<0.00133		<0.00133		<0.00133		
1,2-DIBROMOETHANE	106-93-4	mg/l	0.0000075	0.00005	NE	0.000176	0.000769	<0.000381		<0.000381		<0.000381		<0.000381		<0.000381		<0.000381		<0.000381		<0.000381		
DIBROMOMETHANE	74-95-3	mg/l	0.0083	NE	NE	0.124	0.521	<0.000346		<0.000346		<0.000346		<0.000346		<0.000346		<0.000346		<0.000346		<0.000346		
1,2-DICHLOROBENZENE	95-50-1	mg/l	0.3	0.6	NE	2.66	11.2	<0.000349		<0.000349		<0.000349		<0.000349		<0.000349		<0.000349		<0.000349		<0.000349		
1,3-DICHLOROBENZENE	541-73-1	mg/l	NE	NE	NE	NE	NE	<0.00022		<0.00022		<0.00022		<0.00022		<0.00022		<0.00022		<0.00022		<0.00022		
1,4-DICHLOROBENZENE	106-46-7	mg/l	0.00048	0.075	NE	0.00259	0.0113	<0.000274		<0.000274		<0.000274		<0.000274		<0.000274		<0.000274		<0.000274		<0.000274		
DICHLORODIFLUOROMETHANE	75-71-8	mg/l	0.2	NE	NE	0.00744	0.0312	<0.000551		<0.000551		<0.000551		<0.000551		<0.000551		<0.000551		<0.000551		<0.000551		
1,1-DICHLOROETHANE	75-34-3	mg/l	0.0028	NE	NE	0.00764	0.0334	<0.000259		<0.000259		<0.000259		<0.000259		<0.000259		<0.000259		<0.000259		<0.000259		
1,2-DICHLOROETHANE	107-06-2	mg/l	0.00017	0.005	NE	0.00224	0.00978	<0.000361		<0.000361		<0.000361		<0.000361		<0.000361		<0.000361		<0.000361		<0.000361		
1,1-DICHLOROETHENE	75-35-4	mg/l	0.0082	0.007	NE	0.00387	0.0163	<0.000398		<0.000398		<0.000398		<0.000398		<0.000398		<0.000398		<0.000398		<0.000398		
CIS-1,2-DICHLOROETHENE	156-59-2	mg/l	0.025	0.07	NE	0.25	1.05	<0.00026		<0.00026		<0.00026		<0.00026		<0.00026	0.0192	<0.00026		<0.00026		<0.00026		
TRANS-1,2-DICHLOROETHENE	156-60-5	mg/l	0.068	0.1	NE	0.109	0.457	<0.000396		<0.000396		<0.000396		<0.000396		<0.000396	0.000412	J	<0.000396		<0.000396		<0.000396	
1,2-DICHLOROPROPANE	78-87-5	mg/l	0.00085	0.005	NE	0.00658	0.0287	<0.000306		<0.000306		<0.000306		<0.000306		<0.000306	<0.000306		<0.000306		<0.000306		<0.000306	
1,1-DICHLOROPROPENE	563-58-6	mg/l	NE	NE	NE	NE	NE	<0.000352		<0.000352		<0.000352		<0.000352		<0.000352	<0.000352		<0.000352		<0.000352		<0.000352	
1,3-DICHLOROPROPANE	142-28-9	mg/l	0.37	NE	NE	NE	NE	<0.000366		<0.000366		<0.000366		<0.000366		<0.000366	<0.000366							

Table 4A - Volatile Organic Compounds in Groundwater, 2015 and 2018
Schovaers Electronics - 22 South Jeremy Street, Salt Lake City, Utah
Terracon Project No. 61247165

Lab Sample ID								L800774-01		L800774-04		L800774-07		L800774-10		L800774-13		L800774-16		L800774-19		L800774-22		L800774-25		L800774-28	
Client Sample ID								SE-SB-01		SE-SB-02		SE-SB-03		SE-SB-04		SE-SB-05		SE-SB-06		SE-SB-07		SE-SB-08		SE-SB-09		SE-SB-10	
Date Collected								11/11/2015		11/11/2015		11/11/2015		11/11/2015		11/11/2015		11/11/2015		11/11/2015		11/12/2015		11/12/2015		11/12/2015	
Analyte (Method 8260B)	CAS #	Units	EPA RSL Tapwater ¹	EPA MCL ²	Utah ISL ³	EPA TGC Residential VISL ⁴	EPA TGC Commercial VISL ⁵	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
1,2,4-TRICHLOROBENZENE	120-82-1	mg/l	0.0012	0.07	NE	0.0359	0.151	<0.000355		<0.000355		<0.000355		<0.000355		<0.000355		<0.000355		<0.000355		<0.000355		<0.000355		<0.000355	
1,1,1-TRICHLOROETHANE	71-55-6	mg/l	8	0.2	NE	7.42	31.1	<0.000319		<0.000319		<0.000319		<0.000319		<0.000319		<0.000319		<0.000319		<0.000319		<0.000319		<0.000319	
1,1,2-TRICHLOROETHANE	79-00-5	mg/l	0.00028	0.005	NE	0.00521	0.0228	<0.000383		<0.000383		<0.000383		<0.000383		<0.000383		<0.000383		<0.000383		<0.000383		<0.000383		<0.000383	
TRICHLOROETHENE	79-01-6	mg/l	0.00049	0.005	NE	0.00119	0.00743	<0.000398		<0.000398		0.00487		0.00727		0.00739		0.0255		0.0109		<0.000398		<0.000398		0.000917	J
TRICHLOROFLUOROMETHANE	75-69-4	mg/l	5.2	NE	NE	NE	NE	<0.0012		<0.0012		<0.0012		<0.0012		<0.0012		<0.0012		<0.0012		<0.0012		<0.0012		<0.0012	
1,2,3-TRICHLOROPROPANE	96-18-4	mg/l	0.00000075	NE	NE	0.0223	0.0937	<0.000807		<0.000807		<0.000807		<0.000807		<0.000807		<0.000807		<0.000807		<0.000807		<0.000807		<0.000807	
1,2,4-TRIMETHYLBENZENE	95-63-6	mg/l	0.056	NE	NE	0.248	1.04	<0.000373		<0.000373		<0.000373		<0.000373		<0.000373		<0.000373		<0.000373		<0.000373		<0.000373		<0.000373	
1,2,3-TRIMETHYLBENZENE	526-73-8	mg/l	0.055	NE	NE	0.351	1.47	<0.000321		<0.000321		<0.000321		<0.000321		<0.000321		<0.000321		<0.000321		<0.000321		<0.000321		<0.000321	
1,3,5-TRIMETHYLBENZENE	108-67-8	mg/l	0.06	NE	NE	0.175	0.733	<0.000387		<0.000387		<0.000387		<0.000387		<0.000387		<0.000387		<0.000387		<0.000387		<0.000387		<0.000387	
VINYL CHLORIDE	75-01-4	mg/l	0.000019	0.002	NE	0.000147	0.00245	<0.000259		<0.000259		<0.000259		<0.000259		<0.000259		<0.000259		<0.000259		<0.000259		<0.000259		<0.000259	
XYLENES, TOTAL	1330-20-7	mg/l	0.19	10	10	0.385	1.62	<0.00106		<0.00106		<0.00106		<0.00106		<0.00106		<0.00106		<0.00106		<0.00106		<0.00106		<0.00106	

Table 4A - Volatile Organic Compounds in Groundwater, 2015 and 2018
Schovaers Electronics - 22 South Jeremy Street, Salt Lake City, Utah
Terracon Project No. 61247165

Lab Sample ID								L800774-31	L800774-34	L800774-37	L800774-40	L800774-43	L995461-25	L995461-20	L995461-17	L995461-14	L995461-03	L995461-06	L995461-11
Client Sample ID								SE-SB-11	SE-SB-12	SE-SB-13	SE-SB-14	SE-SB-15	SE-SB-17	SE-SB-18	SE-SB-19	SE-SB-20	SE-SB-21	SE-SB-22	SE-SB-23
Date Collected								11/12/2015	11/12/2015	11/11/2015	11/11/2015	11/11/2015	05/17/2018	05/17/2018	05/17/2018	05/17/2018	05/17/2018	05/17/2018	05/17/2018
Analyte (Method 8260B)	CAS #	Units	EPA RSL Tapwater ¹	EPA MCL ²	Utah ISL ³	EPA TGC Residential VISL ⁴	EPA TGC Commercial VISL ⁵	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
ACETONE	67-64-1	mg/l	18	NE	NE	NE	NE	<0.01		<0.01		<0.01		<0.01		<0.0100		<0.0100	
ACROLEIN	107-02-8	mg/l	0.000042	NE	NE	0.00418	0.0176	<0.00887		<0.00887		<0.00887		<0.00887		<0.00887		<0.00887	
ACRYLONITRILE	107-13-1	mg/l	0.000052	NE	NE	0.00732	0.032	<0.00187		<0.00187		<0.00187		<0.00187		<0.00187		<0.00187	
BENZENE	71-43-2	mg/l	0.00046	0.005	0.005	0.00159	0.00693	<0.000331		<0.000331		<0.000331		<0.000331		<0.000331		<0.000331	
BROMOBENZENE	108-86-1	mg/l	0.062	NE	NE	0.62	2.6	<0.000352		<0.000352		<0.000352		<0.000352		<0.000352		<0.000352	
BROMODICHLOROMETHANE	75-27-4	mg/l	0.00013	0.08	NE	0.000876	0.00382	<0.00038		<0.00038		<0.00038		<0.000380		<0.000380		<0.000380	
BROMOFORM	75-25-2	mg/l	0.0033	0.08	NE	0.117	0.51	<0.000469		<0.000469		<0.000469		<0.000469		<0.000469		<0.000469	
BROMOMETHANE	74-83-9	mg/l	0.0075	NE	NE	0.0174	0.073	<0.000866		<0.000866		<0.000866		<0.000866		<0.000866		<0.000866	
N-BUTYLBENZENE	104-51-8	mg/l	1	NE	NE	NE	NE	<0.000361		<0.000361		<0.000361		<0.000361		<0.000361		<0.000361	
SEC-BUTYLBENZENE	135-98-8	mg/l	2	NE	NE	NE	NE	<0.000365		<0.000365		<0.000365		<0.000365		<0.000365		<0.000365	
TERC-BUTYLBENZENE	98-06-6	mg/l	0.69	NE	NE	NE	NE	<0.000399		<0.000399		<0.000399		<0.000399		<0.000399		<0.000399	
CARBON TETRACHLORIDE	56-23-5	mg/l	0.00046	0.005	NE	0.000415	0.00181	<0.000379		<0.000379		<0.000379		<0.000379		<0.000379		<0.000379	
CHLOROBENZENE	108-90-7	mg/l	0.078	0.1	NE	0.41	1.72	<0.000348		<0.000348		<0.000348		<0.000348		<0.000348		<0.000348	
CHLORODIBROMOMETHANE	124-48-1	mg/l	0.00087	0.08	NE	NE	NE	<0.000327		<0.000327		<0.000327		<0.000327		<0.000327		<0.000327	
CHLOROETHANE	75-00-3	mg/l	8.3	NE	NE	9.19	38.6	<0.000453		<0.000453		<0.000453		<0.000453		<0.000453		<0.000453	
2-CHLOROETHYL VINYL ETHER	110-75-8	mg/l	NE	NE	NE	NE	NE	<0.00301		<0.00301		<0.00301		<0.00301		<0.00301		<0.00301	
CHLOROFORM	67-66-3	mg/l	0.00022	0.08	NE	0.000814	0.00355	<0.000324		<0.000324		<0.000324		<0.000324		<0.000324		<0.000324	
CHLOROMETHANE	74-87-3	mg/l	0.19	NE	NE	0.26	1.09	<0.000276		<0.000276		<0.000276		<0.000276		<0.000276		<0.000276	
2-CHLOROTOLUENE	95-49-8	mg/l	0.24	NE	NE	NE	NE	<0.000375		<0.000375		<0.000375		<0.000375		<0.000375		<0.000375	
4-CHLOROTOLUENE	106-43-4	mg/l	0.25	NE	NE	NE	NE	<0.000351		<0.000351		<0.000351		<0.000351		<0.000351		<0.000351	
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	mg/l	3.34E-07	0.0002	NE	0.0000281	0.00034	<0.00133		<0.00133		<0.00133		<0.00133		<0.00133		<0.00133	
1,2-DIBROMOETHANE	106-93-4	mg/l	0.0000075	0.00005	NE	0.000176	0.000769	<0.000381		<0.000381		<0.000381		<0.000381		<0.000381		<0.000381	
DIBROMOMETHANE	74-95-3	mg/l	0.0083	NE	NE	0.124	0.521	<0.000346		<0.000346		<0.000346		<0.000346		<0.000346		<0.000346	
1,2-DICHLOROBENZENE	95-50-1	mg/l	0.3	0.6	NE	2.66	11.2	<0.000349		<0.000349		<0.000349		<0.000349		<0.000349		<0.000349	
1,3-DICHLOROBENZENE	541-73-1	mg/l	NE	NE	NE	NE	NE	<0.00022		<0.00022		<0.00022		<0.000220		<0.000220		<0.000220	
1,4-DICHLOROBENZENE	106-46-7	mg/l	0.00048	0.075	NE	0.00259	0.0113	<0.000274		<0.000274		<0.000274		<0.000274		<0.000274		<0.000274	
DICHLORODIFLUOROMETHANE	75-71-8	mg/l	0.2	NE	NE	0.00744	0.0312	<0.000551		<0.000551		<0.000551		<0.000551		<0.000551		<0.000551	
1,1-DICHLOROETHANE	75-34-3	mg/l	0.0028	NE	NE	0.00764	0.0334	<0.000259		<0.000259		<0.000259		<0.000259		<0.000259		<0.000259	
1,2-DICHLOROETHANE	107-06-2	mg/l	0.00017	0.005	NE	0.00224	0.00978	<0.000361		<0.000361		<0.000361		<0.000361		<0.000361		<0.000361	
1,1-DICHLOROETHENE	75-35-4	mg/l	0.0082	0.007	NE	0.00387	0.0163	<0.000398		<0.000398		<0.000398		<0.000398		<0.000398		<0.000398	
CIS-1,2-DICHLOROETHENE	156-59-2	mg/l	0.025	0.07	NE	0.25	1.05	<0.00026		<0.00026		<0.00026		<0.000260		<0.000260		<0.000260	
TRANS-1,2-DICHLOROETHENE	156-60-5	mg/l	0.068	0.1	NE	0.109	0.457	<0.000396		<0.000396		<0.000396		<0.000396		<0.000396		<0.000396	
1,2-DICHLOROPROPANE	78-87-5	mg/l	0.00085	0.005	NE	0.00658	0.0287	<0.000306		<0.000306		<0.000306		<0.000306		<0.000306		<0.000306	
1,1-DICHLOROPROPENE	563-58-6	mg/l	NE	NE	NE	NE	NE	<0.000352		<0.000352		<0.000352		<0.000352		<0.000352		<0.000352	
1,3-DICHLOROPROPANE	142-28-9	mg/l	0.37	NE	NE	NE	NE	<0.000366		<0.000366		<0.000366		<0.000366		<0.000366		<0.000366	
CIS-1,3-DICHLOROPROPENE	10061-01-5	mg/l	NE	NE	NE	NE	NE	<0.000418		<0.000418		<0.000418		<0.000418		<0.000418		<0.000418	
TRANS-1,3-DICHLOROPROPENE	10061-02-6	mg/l	NE	NE	NE	NE	NE	<0.000419		<0.000419		<0.000419		<0.000419		<0.000419		<0.000419	
2,2-DICHLOROPROPANE	594-20-7	mg/l	NE	NE	NE	NE	NE	<0.000321		<0.000321		<0.000321		<0.000321		<0.000321		<0.000321	
DI-ISOPROPYL ETHER	108-20-3	mg/l	1.5	NE	NE	6.97	29.3	<0.00032		<0.00032		<0.00032		<0.000320		<0.000320		<0.000320	
ETHYLBENZENE	100-41-4	mg/l	0.0015	0.7	0.7	0.00349	0.0152	<0.000384		<0.000384		<0.000384		<0.000384		<0.000384		<0.000384	
HEXACHLORO-1,3-BUTADIENE	87-68-3	mg/l	0.00014	NE	NE	0.000303	0.00132	<0.000256		<0.000256		<0.000256		<0.000256		<0.000256		<0.000256	
ISOPROPYLBENZENE	98-82-8	mg/l	0.45	NE	NE	0.887	3.73	<0.000326		<0.000326		<0.000326		<0.000326		<0.000326		<0.000326	
P-ISOPROPYLTOLUENE	99-87-6	mg/l	0.021	NE	NE	0.0928	0.39	<0.00035		<0.00035		<0.00035		<0.000350		<0.000350		<0.000350	
1,4-DIOXANE	123-91-1	mg/l	0.00046	NE	NE	2.86	12.5	<0.000597		<0.000597		<0.000597		NA		NA		NA	
2-BUTANONE (MEK)	78-93-3	mg/l	5.6	NE	NE	2240	9410	<0.00393		<0.00393		<0.00393		<0.00393		<0.00393		<0.00393	
METHYLENE CHLORIDE	75-09-2	mg/l	0.011	0.005	NE	0.763	9.23	<0.001		<0.001		<0.001		<0.00100		<0.00100		<0.00100	
4-METHYL-2-PENTANONE (MIBK)	108-10-1	mg/l	6.3	NE	NE	555	2330	<0.00214		<0.00214		<0.00214		<0.00214		<0.00214		<0.00214	
METHYL TERT-BUTYL ETHER	1634-04-4	mg/l	0.014	NE	0.2	0.45	1.97	<0.000367		<0.000367		<0.000367		<0.000367		<0.000367		<0.000367	
NAPHTHALENE	91-20-3	mg/l	0.00012	NE	0.7	0.00459	0.0201	<0.001		<0.001		<0.001		<0.00100	J3	<0.00100	J3	<0.00100	J3
N-PROPYLBENZENE	103-65-1	mg/l	0.66	NE	NE	2.43	10.2	<0.000349		<0.000349		<0.000349		<0.000349		<0.000349		<0.000349	
STYRENE	100-42-5	mg/l	1.2	0.1	NE	9.28	39	<0.000307		<0.000307		<0.000307		<0.000307		<0.000307		<0.000307	
1,1,1,2-TETRACHLOROETHANE	630-20-6	mg/l	0.00057	NE	NE	0.00371	0.0162	<0.000385		<0.000385		<0.000385		<0.000385		<0.000385		<0.000385	
1,1,2,2-TETRACHLOROETHANE	79-34-5	mg/l	0.000076	NE	NE	0.00323	0.0141	<0.00013		<0.00013		<0.00013		<0.000130		<0.000130		<0.000130	
1,1,2-TRICHLOROTRIFLUOROETHANE	76-13-1	mg/l	10	NE	NE	0.242	1.02	<0.000303		<0.000303		<0.000303		<0.000303		<0.000303		<0.000303	
TETRACHLOROETHENE	127-18-4	mg/l	0.011	0.005	NE	0.0149	0.0652	<0.000372		<0.000372		<0.000372		<0.000372		<0.000372		<0.000372	
TOLUENE	108-88-3	mg/l	1.1	1.0	1.0	19.2	80.7	<0.00078		<0.00078		<0.00078		<0.000412		<0.000412		<0.000412	
1,2,3-TRICHLOROBENZENE	87-61-6	mg/l	0.007	NE	NE	NE	NE	<0.00023		<0.00023		<0.00023		<0.000230	J3	<0.000230	J3	<0.000230	J3

Table 4A - Volatile Organic Compounds in Groundwater, 2015 and 2018
Schovaers Electronics - 22 South Jeremy Street, Salt Lake City, Utah
Terracon Project No. 61247165

Lab Sample ID								L800774-31		L800774-34		L800774-37		L800774-40		L800774-43		L995461-25		L995461-20		L995461-17		L995461-14		L995461-03		L995461-06		L995461-11	
Client Sample ID								SE-SB-11		SE-SB-12		SE-SB-13		SE-SB-14		SE-SB-15		SE-SB-17		SE-SB-18		SE-SB-19		SE-SB-20		SE-SB-21		SE-SB-22		SE-SB-23	
Date Collected								11/12/2015		11/12/2015		11/11/2015		11/11/2015		11/11/2015		05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018		05/17/2018	
Analyte (Method 8260B)	CAS #	Units	EPA RSL Tapwater ¹	EPA MCL ²	Utah ISL ³	EPA TGC Residential VISL ⁴	EPA TGC Commercial VISL ⁵	Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result	
								Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q	
1,2,4-TRICHLOROBENZENE	120-82-1	mg/l	0.0012	0.07	NE	0.0359	0.151	<0.000355		<0.000355		<0.000355		<0.000355		<0.000355		<0.000355		<0.000355		<0.000355		<0.000355		<0.000355		<0.000355		<0.000355	
1,1,1-TRICHLOROETHANE	71-55-6	mg/l	8	0.2	NE	7.42	31.1	<0.000319		<0.000319		<0.000319		<0.000319		<0.000319		<0.000319		<0.000319		<0.000319		<0.000319		<0.000319		<0.000319		<0.000319	
1,1,2-TRICHLOROETHANE	79-00-5	mg/l	0.00028	0.005	NE	0.00521	0.0228	<0.000383		<0.000383		<0.000383		<0.000383		<0.000383		<0.000383		<0.000383		<0.000383		<0.000383		<0.000383		<0.000383		<0.000383	
TRICHLOROETHENE	79-01-6	mg/l	0.00049	0.005	NE	0.00119	0.00743	0.000542	J	<0.000398		<0.000398		<0.000398		<0.000398		0.0195		0.00251		<0.000398		0.000834	J	0.0766		0.00888		0.0107	
TRICHLOROFLUOROMETHANE	75-69-4	mg/l	5.2	NE	NE	NE	NE	<0.0012		<0.0012		<0.0012		<0.0012		<0.0012		<0.00120		<0.00120		<0.00120		<0.00120		<0.00120		<0.00120		<0.00120	
1,2,3-TRICHLOROPROPANE	96-18-4	mg/l	0.00000075	NE	NE	0.0223	0.0937	<0.000807		<0.000807		<0.000807		<0.000807		<0.000807		<0.000807		<0.000807		<0.000807		<0.000807		<0.000807		<0.000807		<0.000807	
1,2,4-TRIMETHYLBENZENE	95-63-6	mg/l	0.056	NE	NE	0.248	1.04	<0.000373		<0.000373		<0.000373		<0.000373		<0.000373		<0.000373		<0.000373		<0.000373		<0.000373		<0.000373		<0.000373		<0.000373	
1,2,3-TRIMETHYLBENZENE	526-73-8	mg/l	0.055	NE	NE	0.351	1.47	<0.000321		<0.000321		<0.000321		<0.000321		<0.000321		<0.000321		<0.000321		<0.000321		<0.000321		<0.000321		<0.000321		<0.000321	
1,3,5-TRIMETHYLBENZENE	108-67-8	mg/l	0.06	NE	NE	0.175	0.733	<0.000387		<0.000387		<0.000387		<0.000387		<0.000387		<0.000387		<0.000387		<0.000387		<0.000387		<0.000387		<0.000387		<0.000387	
VINYL CHLORIDE	75-01-4	mg/l	0.000019	0.002	NE	0.000147	0.00245	<0.000259		<0.000259		<0.000259		<0.000259		<0.000259		<0.000259		<0.000259		<0.000259		<0.000259		<0.000259		<0.000259		<0.000259	
XYLENES, TOTAL	1330-20-7	mg/l	0.19	10	10	0.385	1.62	<0.00106		<0.00106		<0.00106		<0.00106		<0.00106		<0.00106		<0.00106		<0.00106		<0.00106		<0.00106		<0.00106		<0.00106	

¹ Environmental Protection Agency Regional Screening Levels for Tapwater (November 2024; Target Hazard Quotient=1, Target Risk=10⁻⁶).
² Environmental Protection Agency Maximum Contaminant Level (November 2024; Target Hazard Quotient=1, Target Risk=10⁻⁶).
³ Utah Department of Environmental Quality Initial Screening Level (isl)
⁴ Environmental Protection Agency Residential Target Groundwater Concentration (May 2018; Target Hazard Quotient=1, Target Risk=10⁻⁶).
⁵ Environmental Protection Agency Industrial Target Groundwater Concentration (May 2018; Target Hazard Quotient=1, Target Risk=10⁻⁶).
Bold values were reported above laboratory reporting limit. *Italicized* values indicate reporting limits above the Screening Levels.
CAS: Chemical Abstracts Service, mg/l: milligrams per liter, NA: not analyzed, NE: not established
< : Not reported at or above the indicated analytical reporting limit
Q: Qualifiers -
J: The identification of the analyte is acceptable; the reported value is an estimate.
J3: The associated batch QC was outside the established quality control range for precision.
J5: The sample matrix interfered with the ability to make any accurate determination; spike value is high.
J6: The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Table 4B - Volatile Organic Compounds in Groundwater, 2025
Schovaers Electronics, 22 South Jeremy Street, Salt Lake City, Utah
Terracon Project No. 61237186 Task 3.16

Lab Sample ID									L1863004-01				L1863004-02				L1863004-03				L1863004-04				L1863004-05				L1863004-06			
Client Sample ID									MW-1				MW-2				MW-3				MW-4				MW-5				MW-104			
Date Collected									5/22/2025				05/22/2025				05/22/2025				05/22/2025				05/22/2025							
Analyte	CAS	Method	Units	MCL	TGC VISL Residential	TGC VISL Commercial	ISL	Tier 1	Result	Q	MDL	RDL	Result	Q	MDL	RDL	Result	Q	MDL	RDL	Result	Q	MDL	RDL	Result	Q	MDL	RDL	Result	Q	MDL	RDL
ACETONE	67-64-1	8260B	mg/l	NE	NE	NE	NE	NE	<0.0500		0.0113	0.05	<0.0500		0.0113	0.05	<0.0500	J6	0.0113	0.05	<0.0500		0.0113	0.05	<0.0500		0.0113	0.05	<0.0500		0.0113	0.05
ACROLEIN	107-02-8	8260B	mg/l	NE	0.00418	0.0176	NE	NE	<0.0500	J4	0.00254	0.05	<0.0500	J4	0.00254	0.05	<0.0500	J4 J5	0.00254	0.05	<0.0500	J4	0.00254	0.05	<0.0500	J4	0.00254	0.05	<0.0500	J4	0.00254	0.05
ACRYLONITRILE	107-13-1	8260B	mg/l	NE	0.00732	0.032	NE	NE	<0.0100		0.000671	0.01	<0.0100		0.000671	0.01	<0.0100		0.000671	0.01	<0.0100		0.000671	0.01	<0.0100		0.000671	0.01	<0.0100		0.000671	0.01
BENZENE	71-43-2	8260B	mg/l	0.005	0.00159	0.00693	0.005	0.3	<0.00100		0.0000941	0.001	<0.00100		0.0000941	0.001	0.000104	J	0.0000941	0.001	<0.00100		0.0000941	0.001	0.000160	J	0.0000941	0.001	<0.00100		0.0000941	0.001
BROMOBENZENE	108-86-1	8260B	mg/l	NE	0.62	2.6	NE	NE	<0.00100		0.000118	0.001	<0.00100		0.000118	0.001	<0.00100		0.000118	0.001	<0.00100		0.000118	0.001	<0.00100		0.000118	0.001	<0.00100		0.000118	0.001
BROMODICHLOROMETHANE	75-27-4	8260B	mg/l	0.08	0.000876	0.00382	NE	NE	<0.00100		0.000136	0.001	0.000652	J	0.000136	0.001	0.000263	J	0.000136	0.001	<0.00100		0.000136	0.001	<0.00100		0.000136	0.001	<0.00100		0.000136	0.001
BROMOFORM	75-25-2	8260B	mg/l	0.08	0.117	0.51	NE	NE	<0.00100		0.000129	0.001	<0.00100		0.000129	0.001	<0.00100		0.000129	0.001	<0.00100		0.000129	0.001	<0.00100		0.000129	0.001	<0.00100		0.000129	0.001
BROMOMETHANE	74-83-9	8260B	mg/l	NE	0.0174	0.073	NE	NE	<0.00500		0.000605	0.005	<0.00500		0.000605	0.005	<0.00500		0.000605	0.005	<0.00500		0.000605	0.005	<0.00500		0.000605	0.005	<0.00500		0.000605	0.005
N-BUTYLBENZENE	104-51-8	8260B	mg/l	NE	NE	NE	NE	NE	<0.00100		0.000157	0.001	<0.00100		0.000157	0.001	<0.00100		0.000157	0.001	<0.00100		0.000157	0.001	<0.00100		0.000157	0.001	<0.00100		0.000157	0.001
SEC-BUTYLBENZENE	135-98-8	8260B	mg/l	NE	NE	NE	NE	NE	<0.00100		0.000125	0.001	<0.00100		0.000125	0.001	<0.00100		0.000125	0.001	<0.00100		0.000125	0.001	<0.00100		0.000125	0.001	<0.00100		0.000125	0.001
TERT-BUTYLBENZENE	98-06-6	8260B	mg/l	NE	NE	NE	NE	NE	<0.00100		0.000127	0.001	<0.00100		0.000127	0.001	<0.00100		0.000127	0.001	<0.00100		0.000127	0.001	<0.00100		0.000127	0.001	<0.00100		0.000127	0.001
CARBON TETRACHLORIDE	56-23-5	8260B	mg/l	0.005	0.000415	0.00181	NE	NE	<0.00100		0.000128	0.001	<0.00100		0.000128	0.001	<0.00100		0.000128	0.001	<0.00100		0.000128	0.001	<0.00100		0.000128	0.001	<0.00100		0.000128	0.001
CHLOROBENZENE	108-90-7	8260B	mg/l	0.1	0.41	1.72	NE	NE	<0.00100		0.000116	0.001	<0.00100		0.000116	0.001	<0.00100		0.000116	0.001	<0.00100		0.000116	0.001	<0.00100		0.000116	0.001	<0.00100		0.000116	0.001
CHLORODIBROMOMETHANE	124-48-1	8260B	mg/l	0.08	NE	NE	NE	NE	<0.00100		0.00014	0.001	0.000183	J	0.00014	0.001	<0.00100		0.00014	0.001	<0.00100		0.00014	0.001	<0.00100		0.00014	0.001	<0.00100		0.00014	0.001
CHLOROETHANE	75-00-3	8260B	mg/l	NE	9.19	38.6	NE	NE	<0.00500		0.000192	0.005	<0.00500		0.000192	0.005	<0.00500		0.000192	0.005	<0.00500		0.000192	0.005	<0.00500		0.000192	0.005	<0.00500		0.000192	0.005
CHLOROFORM	67-66-3	8260B	mg/l	0.08	0.000814	0.00355	NE	NE	0.00194	J	0.000111	0.005	0.00730		0.000111	0.005	0.00515		0.000111	0.005	0.000579	J	0.000111	0.005	0.00346	J	0.000111	0.005	0.000504	J	0.000111	0.005
CHLOROMETHANE	74-87-3	8260B	mg/l	NE	0.26	1.09	NE	NE	<0.00250		0.00096	0.0025	<0.00250		0.00096	0.0025	<0.00250		0.00096	0.0025	<0.00250		0.00096	0.0025	<0.00250		0.00096	0.0025	<0.00250		0.00096	0.0025
2-CHLOROTOLUENE	95-49-8	8260B	mg/l	NE	NE	NE	NE	NE	<0.00100		0.000106	0.001	<0.00100		0.000106	0.001	<0.00100		0.000106	0.001	<0.00100		0.000106	0.001	<0.00100		0.000106	0.001	<0.00100		0.000106	0.001
4-CHLOROTOLUENE	106-43-4	8260B	mg/l	NE	NE	NE	NE	NE	<0.00100		0.000114	0.001	<0.00100		0.000114	0.001	<0.00100		0.000114	0.001	<0.00100		0.000114	0.001	<0.00100		0.000114	0.001	<0.00100		0.000114	0.001
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	8260B	mg/l	0.0002	0.0000281	0.00034	NE	NE	<0.00500		0.000276	0.005	<0.00500		0.000276	0.005	<0.00500		0.000276	0.005	<0.00500		0.000276	0.005	<0.00500		0.000276	0.005	<0.00500		0.000276	0.005
1,2-DIBROMOETHANE	106-93-4	8260B	mg/l	0.00005	0.000176	0.000769	NE	NE	<0.00100		0.000126	0.001	<0.00100		0.000126	0.001	<0.00100		0.000126	0.001	<0.00100		0.000126	0.001	<0.00100		0.000126	0.001	<0.00100		0.000126	0.001
DIBROMOMETHANE	74-95-3	8260B	mg/l	NE	0.124	0.521	NE	NE	<0.00100		0.000122	0.001	<0.00100		0.000122	0.001	<0.00100		0.000122	0.001	<0.00100		0.000122	0.001	<0.00100		0.000122	0.001	<0.00100		0.000122	0.001
1,2-DICHLOROBENZENE	95-50-1	8260B	mg/l	0.6	2.66	11.2	NE	NE	<0.00100		0.000107	0.001	<0.00100		0.000107	0.001	<0.00100		0.000107	0.001	<0.00100		0.000107	0.001	<0.00100		0.000107	0.001	<0.00100		0.000107	0.001
1,3-DICHLOROBENZENE	541-73-1	8260B	mg/l	NE	NE	NE	NE	NE	<0.00100		0.00011	0.001	<0.00100		0.00011	0.001	<0.00100		0.00011	0.001	<0.00100		0.00011	0.001	<0.00100		0.00011	0.001	<0.00100		0.00011	0.001
1,4-DICHLOROBENZENE	106-46-7	8260B	mg/l	0.075	0.00259	0.0113	NE	NE	<0.00100		0.00012	0.001	<0.00100		0.00012	0.001	<0.00100		0.00012	0.001	<0.00100		0.00012	0.001	<0.00100		0.00012	0.001	<0.00100		0.00012	0.001
DICHLORODIFLUOROMETHANE	75-71-8	8260B	mg/l	NE	0.00744	0.0312	NE	NE	<0.00500		GW	0.005	<0.00500		0.000374	0.005	<0.00500		0.													

Table 5A - Volatile Organic Compounds in Soil Vapor, 2018
Schovaers Electronics 22 South Jeremy Street, Salt Lake City, Utah
Terracon Project No. 61247165

Lab Sample ID					L995391-03		L995391-04		L995391-01		L995391-02	
Client Sample ID					SE-VP-1		SE-VP-2		SE-VP-3		SE-VP-4	
Date Collected					05/18/2018		05/18/2018		05/18/2018		05/18/2018	
Analyte (Method TO-15)	CAS #	Units	EPA VISL: Residential ¹	EPA VISL: Commercial ²	Result	Q	Result	Q	Result	Q	Result	Q
ACETONE	67-64-1	ug/m3	NE	NE	312	E	24.3		233		35.7	
ALLYL CHLORIDE	107-05-1	ug/m3	15.6	68.1	<1.25		<1.25		<1.25		<1.25	
BENZENE	71-43-2	ug/m3	12	52.4	<1.28		<1.28		<1.28		<1.28	
BENZYL CHLORIDE	100-44-7	ug/m3	1.91	8.34	<2.08		<2.08		<2.08		<2.08	
BROMODICHLOROMETHANE	75-27-4	ug/m3	2.53	11	<2.68		<2.68		<2.68		<2.68	
BROMOFORM	75-25-2	ug/m3	85.1	372	<12.4		<12.4		<12.4		<12.4	
BROMOMETHANE	74-83-9	ug/m3	174	730	<1.55		<1.55		<1.55		<1.55	
1,3-BUTADIENE	106-99-0	ug/m3	3.12	13.6	<8.85		<8.85		<8.85		<8.85	
CARBON DISULFIDE	75-15-0	ug/m3	NE	NE	<1.24		<1.24		<1.24		<1.24	
CARBON TETRACHLORIDE	56-23-5	ug/m3	15.6	68.1	<2.52		<2.52		<2.52		<2.52	
CHLOROBENZENE	108-90-7	ug/m3	1740	7300	<1.85		<1.85		<1.85		<1.85	
CHLOROETHANE	75-00-3	ug/m3	139000	584000	<1.06		<1.06		<1.06		<1.06	
CHLOROFORM	67-66-3	ug/m3	4.07	17.8	<1.95		<1.95		<1.95		<1.95	
CHLOROMETHANE	74-87-3	ug/m3	3130	13100	<0.826		<0.826		<0.826		<0.826	
2-CHLOROTOLUENE	95-49-8	ug/m3	NE	NE	<2.06		<2.06		<2.06		<2.06	
CYCLOHEXANE	110-82-7	ug/m3	209000	876000	<1.38		<1.38		<1.38		<1.38	
CHLORODIBROMOMETHANE	124-48-1	ug/m3	NE	NE	<3.40		<3.40		<3.40		<3.40	
1,2-DIBROMOETHANE	106-93-4	ug/m3	0.156	0.681	<3.08		<3.08		<3.08		<3.08	
1,2-DICHLOROBENZENE	95-50-1	ug/m3	6950	29200	<2.40		<2.40		<2.40		<2.40	
1,3-DICHLOROBENZENE	541-73-1	ug/m3	NE	NE	<2.40		<2.40		<2.40		<2.40	
1,4-DICHLOROBENZENE	106-46-7	ug/m3	8.51	37.2	<2.40		<2.40		<2.40		<2.40	
1,2-DICHLOROETHANE	107-06-2	ug/m3	3.6	15.7	<1.62		<1.62		<1.62		<1.62	
1,1-DICHLOROETHANE	75-34-3	ug/m3	58.5	256	<1.60		<1.60		<1.60		<1.60	
1,1-DICHLOROETHENE	75-35-4	ug/m3	138	578	<1.59		<1.59		<1.59		<1.59	
CIS-1,2-DICHLOROETHENE	156-59-2	ug/m3	1390	5840	<1.59		<1.59		<1.59		<1.59	
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/m3	1390	5840	<1.59		<1.59		<1.59		<1.59	
1,2-DICHLOROPROPANE	78-87-5	ug/m3	25.3	110	<1.85		<1.85		<1.85		<1.85	
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/m3	NE	NE	<1.82		<1.82		<1.82		<1.82	
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/m3	NE	NE	<1.82		<1.82		<1.82		<1.82	
1,4-DIOXANE	123-91-1	ug/m3	18.7	81.8	<1.44		<1.44		6.34		<1.44	
ETHANOL	64-17-5	ug/m3	NE	NE	138		40		52.9		38.4	
ETHYLBENZENE	100-41-4	ug/m3	37.4	164	1.9		<1.73		11		<1.73	
4-ETHYLTOLUENE	622-96-8	ug/m3	NE	NE	4.97		3.86		14.6		4.44	
TRICHLOROFLUOROMETHANE	75-69-4	ug/m3	NE	NE	<2.25		<2.25		<2.25		<2.25	
DICHLORODIFLUOROMETHANE	75-71-8	ug/m3	3480	NE	<1.98		2		<1.98		1.98	
1,1,2-TRICHLOROTRIFLUOROETHANE	76-13-1	ug/m3	174000	730000	<3.07		<3.07		<3.07		<3.07	
1,2-DICHLOROTETRAFLUOROETHANE	76-14-2	ug/m3	NE	NE	<2.80		<2.80		<2.80		<2.80	
HEPTANE	142-82-5	ug/m3	13900	58400	1.99		1.71		1.79		<1.64	
HEXACHLORO-1,3-BUTADIENE	87-68-3	ug/m3	4.25	18.6	<13.5		<13.5		<13.5		<13.5	
N-HEXANE	110-54-3	ug/m3	24300	102000	<1.41		<1.41		<1.41		<1.41	
ISOPROPYLBENZENE	98-82-8	ug/m3	13900	NE	<1.97		<1.97		14.5		<1.97	
METHYLENE CHLORIDE	75-09-2	ug/m3	3380	40900	1.98		2.04		7.01		2.94	
METHYL BUTYL KETONE	591-78-6	ug/m3	1040	4380	<10.2		<10.2		11.2		<10.2	
2-BUTANONE (MEK)	78-93-3	ug/m3	174000	730000	43.4		<7.37		5190		20.8	
4-METHYL-2-PENTANONE (MIBK)	108-10-1	ug/m3	104000	438000	<10.2		<10.2		137		<10.2	
METHYL METHACRYLATE	80-62-6	ug/m3	24300	102000	<1.64		<1.64		<1.64		<1.64	
METHYL TERT-BUTYL ETHER	1634-04-4	ug/m3	360	NE	<1.44		<1.44		<1.44		<1.44	
NAPHTHALENE	91-20-3	ug/m3	2.75	12	<6.60		7.24		24.4		<6.60	
2-PROPANOL	67-63-0	ug/m3	6950	29200	205		55.4		49.3		36.5	
PROPENE	115-07-1	ug/m3	104000	438000	<1.38		<1.38		3.28		<1.38	
STYRENE	100-42-5	ug/m3	34800	NE	<1.70		<1.70		<1.70		<1.70	
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/m3	1.61	7.05	<2.75		<2.75		<2.75		<2.75	
TETRACHLOROETHENE	127-18-4	ug/m3	360	1570	<2.72		<2.72		<2.72		<2.72	
TETRAHYDROFURAN	109-99-9	ug/m3	69500	292000	5.51		4.04		11.7		5.82	
TOLUENE	108-88-3	ug/m3	174000	NE	2.71		2.07		15		2.73	
1,2,4-TRICHLOROBENZENE	120-82-1	ug/m3	69.5	292	<9.33		<9.33		<9.33		<9.33	
1,1,1-TRICHLOROETHANE	71-55-6	µg/m ³	174000	730000	6.59		<2.18		<2.18		3.55	
1,1,2-TRICHLOROETHANE	79-00-5	µg/m ³	5.85	25.6	<2.18		<2.18		<2.18		<2.18	
TRICHLOROETHENE	79-01-6	µg/m ³	15.9	99.7	498		17.1		3050		1070	
1,2,4-TRIMETHYLBENZENE	95-63-6	µg/m ³	2090	8760	6.83		5.43		59.6		6.62	
1,3,5-TRIMETHYLBENZENE	108-67-8	µg/m ³	2090	8760	2.57		<1.96		21.4		2.35	
2,2,4-TRIMETHYLPENTANE	540-84-1	µg/m ³	NE	NE	<1.87		<1.87		<1.87		<1.87	
VINYL CHLORIDE	75-01-4	µg/m ³	5.59	92.9	<1.02		<1.02		<1.02		<1.02	
VINYL BROMIDE	593-60-2	µg/m ³	6.24	27.3	<1.75		<1.75		<1.75		<1.75	
VINYL ACETATE	108-05-4	µg/m ³	6950	29200	<1.41		<1.41		<1.41		<1.41	
M&P-XYLENE	106-42-3	µg/m ³	6960	NE	8.83		6.84		96.3		7.68	
O-XYLENE	95-47-6	µg/m ³	3480	14600	3.3		2.58		27.9		2.9	
1,1-DIFLUOROETHANE	75-37-6	µg/m ³	1390000	5840000	<1.08		<1.08		2.44		2.12	

¹ Environmental Protection Agency Target Sub-Slab and Near-source Soil Gas Concentration (TSSNSGC) Residential Vapor Intrusion Screening Level (VISL) (November 2024; Target Hazard Quotient=1, Target Risk=10⁻⁶).

² Environmental Protection Agency Target Sub-Slab and Near-source Soil Gas Concentration (TSSNSGC) Commercial/Industrial Vapor Intrusion Screening Level (VISL) (November 2024; Target Hazard Quotient=1, Target Risk=10⁻⁶).

Bold values were reported above laboratory reporting limit. *Italicized* values indicate reporting limits above the Screening Levels.

CAS: Chemical Abstracts Service. µg/m³: micrograms per cubic meter. < : Not reported at or above the indicated analytical reporting limit.

Q: Qualifiers

E: The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration.

Table 5B - Volatile Organic Compounds in Soil Vapor, 2025
Schovaers Electronics, 22 South Jeremy Street, Salt Lake City, Utah
Terracon Project No. 61237186 Task 3.16

Lab Sample ID						E506010-01				E506010-02				E506010-03				E506010-04			
Client Sample ID						VP-1				VP-2				VP-3				VP-4			
Date Collected						5/21/2025				5/21/2025				5/21/2025				5/21/2025			
Analyte	CAS	Method	Units	TSSNSGC VISL Residential	TSSNSGC VISL Commercial	Result	Q	MDL	RDL	Result	Q	MDL	RDL	Result	Q	MDL	RDL	Result	Q	MDL	RDL
Dichlorodifluoromethane (F12)	75-71-8	TO-15	µg/m ³	3480	14600	<400		40	400	4.9	QL-1H	0.4	4.0	<100		10	100	5.1	QL-1H	0.4	4.0
Chloromethane	74-87-3	TO-15	µg/m ³	3130	13100	<83		17	83	0.2	J	0.2	0.8	<21		4.1	21	0.5	J	0.2	0.8
Dichlorotetrafluoroethane (F114)	76-14-2	TO-15	µg/m ³	NE	NE	<280		28	280	0.3	J	0.3	2.8	<71		7.1	71	0.3	J	0.3	2.8
Vinyl chloride	75-01-4	TO-15	µg/m ³	5.59	92.9	<52		13	52	<0.5		0.1	0.5	<13		3.2	13	<0.5		0.1	0.5
Bromomethane	74-83-9	TO-15	µg/m ³	174	730	<160		28	160	<1.6		0.3	1.6	<39		6.9	39	<1.6		0.3	1.6
Chloroethane	75-00-3	TO-15	µg/m ³	139000	584000	<160		64	160	<1.6		0.6	1.6	<40		16	40	<1.6		0.6	1.6
Trichlorofluoromethane (F11)	75-69-4	TO-15	µg/m ³	NE	NE	<230		23	230	2.8	QL-1H	0.2	2.3	<56		5.6	56	2.4	QL-1H	0.2	2.3
1,1-Dichloroethene	75-35-4	TO-15	µg/m ³	138	578	<160		20	160	<1.6		0.2	1.6	<40		5.0	40	<1.6		0.2	1.6
1,1,2-Trichlorotrifluoroethane (F113)	76-13-1	TO-15	µg/m ³	174000	730000	<310		31	310	1.0	J	0.3	3.1	<77		7.7	77	0.8	J	0.3	3.1
Methylene chloride (Dichloromethane)	75-09-2	TO-15	µg/m ³	3380	40900	<140		14	140	0.4	J	0.1	1.4	5.3	J	3.5	35	0.1	J	0.1	1.4
Carbon disulfide	75-15-0	TO-15	µg/m ³	24300	102000	<130		13	130	0.1	J	0.1	1.3	<32		3.2	32	2.6		0.1	1.3
trans-1,2-Dichloroethene	156-60-5	TO-15	µg/m ³	1390	5840	<160		24	160	<1.6		0.2	1.6	<40		6.0	40	<1.6		0.2	1.6
1,1-Dichloroethane	75-34-3	TO-15	µg/m ³	58.5	256	<160		16	160	<1.6		0.2	1.6	<41		4.1	41	<1.6		0.2	1.6
2-Butanone (MEK)	78-93-3	TO-15	µg/m ³	174000	730000	<240		54	240	27		0.5	2.4	<60		13	60	2.1	J	0.5	2.4
cis-1,2-Dichloroethene	156-59-2	TO-15	µg/m ³	1390	5840	<160		20	160	0.2	J	0.2	1.6	<40		5.0	40	<1.6		0.2	1.6
Chloroform	67-66-3	TO-15	µg/m ³	4.07	17.8	69	J	20	99	0.4	J	0.2	1.0	20	J	4.9	25	<1.0		0.2	1.0
1,1,1-Trichloroethane	71-55-6	TO-15	µg/m ³	174000	730000	33	J	22	220	0.9	J	0.2	2.2	26	J	5.5	55	3.1		0.2	2.2
1,2-Dichloroethane (EDC)	107-06-2	TO-15	µg/m ³	3.6	15.7	<160		21	160	<1.6		0.2	1.6	<41		5.1	41	<1.6		0.2	1.6
Benzene	71-43-2	TO-15	µg/m ³	12	52.4	<65		13	65	0.4	J	0.1	0.6	<16		3.2	16	0.4	J	0.1	0.6
Carbon tetrachloride	56-23-5	TO-15	µg/m ³	15.6	68.1	<130		26	130	1.0	J	0.3	1.3	<32		6.4	32	0.8	J	0.3	1.3
Trichloroethene	79-01-6	TO-15	µg/m ³	15.9	99.7	34000		33	220	110		0.3	2.2	13000		8.2	55	86		0.3	2.2
1,2-Dichloropropane	78-87-5	TO-15	µg/m ³	25.3	110	<190		37	190	<1.9		0.4	1.9	<47		9.4	47	<1.9		0.4	1.9
Bromodichloromethane	75-27-4	TO-15	µg/m ³	2.53	11	<270		27	270	<2.7		0.3	2.7	<68		6.8	68	<2.7		0.3	2.7
cis-1,3-Dichloropropene	10061-01-5	TO-15	µg/m ³	NE	NE	<180		18	180	<1.8		0.2	1.8	<46		4.6	46	<1.8		0.2	1.8
4-Methyl-2-pentanone (MIBK)	108-10-1	TO-15	µg/m ³	104000	438000	<330		33	330	29		0.3	3.3	<83		8.3	83	0.5	J	0.3	3.3
trans-1,3-Dichloropropene	10061-02-6	TO-15	µg/m ³	NE	NE	<180		23	180	<1.8		0.2	1.8	<46		5.8	46	<1.8		0.2	1.8
Toluene	108-88-3	TO-15	µg/m ³	174000	730000	<310		15	310	4.3		0.2	3.1	7.6	J	3.8	76	5.8		0.2	3.1
1,1,2-Trichloroethane	79-00-5	TO-15	µg/m ³	5.85	25.6	<220		22	220	<2.2		0.2	2.2	<55		5.5	55	<2.2		0.2	2.2
2-Hexanone (MBK)	591-78-6	TO-15	µg/m ³	1040	4380	<330		79	330	1.9	J	0.8	3.3	<83		20	83	<3.3		0.8	3.3
Dibromochloromethane	124-48-1	TO-15	µg/m ³	NE	NE	<350		35	350	<3.5		0.3	3.5	<86		8.6	86	<3.5		0.3	3.5
Tetrachloroethene	127-18-4	TO-15	µg/m ³	360	1570	<280		28	280	0.9	J	0.3	2.8	<69		6.9	69	0.8	J	0.3	2.8
1,2-Dibromoethane (EDB)	106-93-4	TO-15	µg/m ³	0.156	0.681	<310		31	310	<3.1		0.3	3.1	<78		7.8	78	<3.1		0.3	3.1
1,1,1,2-Tetrachloroethane	630-20-6	TO-15	µg/m ³	12.6	55.2	<280		35	280	<2.8		0.3	2.8	<70		8.7	70	<2.8		0.3	2.8
Chlorobenzene	108-90-7	TO-15	µg/m ³	1740	7300	<190		42	190	<1.9		0.4	1.9	<47		11	47	<1.9		0.4	1.9
Ethylbenzene	100-41-4	TO-15	µg/m ³	37.4	164	<180		18	180	0.7	J	0.2	1.8	<44		4.4	44	0.7	J	0.2	1.8
m,p-Xylene	179601-23-1	TO-15	µg/m ³	3480	14600	<180		22	180	12		0.2	1.8	<44		5.5	44	2.6		0.2	1.8
Styrene	100-42-5	TO-15	µg/m ³	34800	146000	<170		17	170	0.4	J	0.2	1.7	<43		4.3	43	0.4	J	0.2	1.7
o-Xylene	95-47-6	TO-15	µg/m ³	3480	14600	<180		18	180	4.7		0.2	1.8	<44		4.4	44	0.9	J	0.2	1.8
Bromoform	75-25-2	TO-15	µg/m ³	85.1	372	<420		42	420	<4.2		0.4	4.2	<100		10	100	<4.2		0.4	4.2
1,1,2,2-Tetrachloroethane	79-34-5	TO-15	µg/m ³	1.61	7.05	<280		28	280	<2.8		0.3	2.8	<70		7.0	70	<2.8		0.3	2.8
4-Ethyltoluene	622-96-8	TO-15	µg/m ³	NE	NE	<200		20	200	0.7	J	0.2	2.0	<50		5.0	50	<2.0		0.2	2.0
1,3,5-Trimethylbenzene	108-67-8	TO-15	µg/m ³	2090	8760	<200		20	200	2.2		0.2	2.0	<50		5.0	50	<2.0		0.2	2.0
1,2,4-Trimethylbenzene	95-63-6	TO-15	µg/m ³	2090	8760	<200		20	200	7.2		0.2	2.0	<50		5.0	50	0.9	J	0.2	2.0
1,3-Dichlorobenzene	541-73-1	TO-15	µg/m ³	NE	NE	<240		24	240	<2.4		0.2	2.4	<61		6.1	61	0.9	J	0.2	2.4
1,4-Dichlorobenzene	106-46-7	TO-15	µg/m ³	8.51	37.2	<240		24	240	<2.4		0.2	2.4	<61		6.1	61	<2.4		0.2	2.4
1,2-Dichlorobenzene	95-50-1	TO-15	µg/m ³	6950	29200	<240		24	240	<2.4		0.2	2.4	<61		6.1	61	<2.4		0.2	2.4
1,2,4-Trichlorobenzene	120-82-1	TO-15	µg/m ³	69.5	292	<750		30	750	<7.5		0.3	7.5	<190		7.5	190	<7.5		0.3	7.5
Hexachlorobutadiene	87-68-3	TO-15	µg/m ³	4.25	18.6	<1100		86	1100	<11		0.9	11	<270		21	270	<11		0.9	11

Qualifiers (Q):
J: The identification of the analyte is acceptable; the reported value is an estimate.
QL-1H: The LCS and/or LCSD recoveries fell above the established control specifications. Any result is qualified and should be considered biased high.
EPA VISL: Environmental Protection Agency Target Sub-Slab and Near-source Soil Gas Concentration (TSSNSGC) Vapor Intrusion Screening Level (VISL); November 2024.
NE: not established, <: Less than Reported Detection Limit (RDL), µg/m³: micrograms per cubic meter
Bold value exceeds Reported Detection Limit (RDL).
Blue italicized non-detect results (e.g., <0.0100) exceed one or more of the screening levels.
Color shaded value exceeds screening level.

Table 6 - Volatile Organic Compounds in Indoor Air, 2025
Schovaers Electronics, 22 South Jeremy Street, Salt Lake City, Utah
Terracon Project No. 61237316 Task 3.16

Lab Sample ID						E506010-05				E506010-06				E506010-07				E506010-08			
Client Sample ID						IA-1				IA-2				IA-3				IA-4			
Date Collected						5/22/2025				5/22/2025				5/22/2025				5/28/2025			
Analyte	CAS	Method	Units	VISL Residential	VISL Commercial	Result	Q	MDL	RDL	Result	Q	MDL	RDL	Result	Q	MDL	RDL	Result	Q	MDL	RDL
Dichlorodifluoromethane (F12)	75-71-8	TO-15	µg/m ³	104	438	3.0	QL-1H	0.10	1.0	1.9	QL-1H	0.10	1.0	2.3	QL-1H	0.10	1.0	3.2	QL-1H	0.10	1.0
Chloromethane	74-87-3	TO-15	µg/m ³	93.9	394	1.7		0.03	0.21	1.1		0.03	0.21	1.4		0.03	0.21	1.9		0.03	0.21
Dichlorotetrafluoroethane (F114)	76-14-2	TO-15	µg/m ³	NE	NE	0.14	J	0.07	0.71	0.14	J	0.07	0.71	0.21	J	0.07	0.71	0.21	J	0.07	0.71
Vinyl chloride	75-01-4	TO-15	µg/m ³	0.168	2.79	<0.13		0.03	0.13	<0.13		0.03	0.13	<0.13		0.03	0.13	<0.13		0.03	0.13
Bromomethane	74-83-9	TO-15	µg/m ³	5.21	21.9	<0.39		0.04	0.39	<0.39		0.04	0.39	<0.39		0.04	0.39	<0.39		0.04	0.39
Chloroethane	75-00-3	TO-15	µg/m ³	4170	17500	<0.27		0.13	0.27	<0.27		0.13	0.27	<0.27		0.13	0.27	<0.27		0.13	0.27
Trichlorofluoromethane (F11)	75-69-4	TO-15	µg/m ³	NE	NE	2.0	QL-1H	0.06	0.56	1.9	QL-1H	0.06	0.56	2.0	QL-1H	0.06	0.56	2.4	QL-1H	0.06	0.56
1,1-Dichloroethene	75-35-4	TO-15	µg/m ³	4.13	17.3	<0.40		0.04	0.40	<0.40		0.04	0.40	<0.40		0.04	0.40	<0.40		0.04	0.40
1,1,2-Trichlorotrifluoroethane (F113)	76-13-1	TO-15	µg/m ³	5210	21900	0.69	QL-1H, J	0.08	0.77	0.77	QL-1H	0.08	0.77	0.77	QL-1H	0.08	0.77	0.85	QL-1H	0.08	0.77
Methylene chloride (Dichloromethane)	75-09-2	TO-15	µg/m ³	101	1230	1.1		0.05	0.35	1.2		0.05	0.35	1.2		0.05	0.35	0.85		0.05	0.35
Carbon disulfide	75-15-0	TO-15	µg/m ³	730	3070	0.09	J	0.03	0.32	0.22	J	0.03	0.32	0.06	J	0.03	0.32	0.09	J	0.03	0.32
trans-1,2-Dichloroethene	156-60-5	TO-15	µg/m ³	41.7	175	0.04	J	0.04	0.40	0.04	J	0.04	0.40	0.04	J	0.04	0.40	0.04	J	0.04	0.40
1,1-Dichloroethane	75-34-3	TO-15	µg/m ³	1.75	7.67	<0.41		0.04	0.41	0.04	J	0.04	0.41	0.08	J	0.04	0.41	<0.41		0.04	0.41
2-Butanone (MEK)	78-93-3	TO-15	µg/m ³	5210	21900	2.0		0.12	0.60	2.3		0.12	0.60	2.3		0.12	0.60	2.7		0.12	0.60
cis-1,2-Dichloroethene	156-59-2	TO-15	µg/m ³	41.7	175	<0.40		0.04	0.40	<0.40		0.04	0.40	<0.40		0.04	0.40	<0.40		0.04	0.40
Chloroform	67-66-3	TO-15	µg/m ³	0.122	0.533	0.25		0.05	0.25	0.25		0.05	0.25	0.30		0.05	0.25	0.25		0.05	0.25
1,1,1-Trichloroethane	71-55-6	TO-15	µg/m ³	5210	21900	<0.55		0.06	0.55	0.06	J	0.06	0.55	<0.55		0.06	0.55	<0.55		0.06	0.55
1,2-Dichloroethane (EDC)	107-06-2	TO-15	µg/m ³	0.108	0.472	0.16	J	0.05	0.41	0.16	J	0.05	0.41	<0.41		0.05	0.41	0.16	J	0.05	0.41
Benzene	71-43-2	TO-15	µg/m ³	0.36	1.57	0.71		0.03	0.32	0.78		0.03	0.32	0.74		0.03	0.32	0.55		0.03	0.32
Carbon tetrachloride	56-23-5	TO-15	µg/m ³	0.468	2.04	0.83		0.06	0.64	0.83		0.06	0.64	0.77		0.06	0.64	0.83		0.06	0.64
Trichloroethene	79-01-6	TO-15	µg/m ³	0.478	2.99	5.9		0.08	0.55	4.9		0.08	0.55	2.7		0.08	0.55	2.7		0.08	0.55
1,2-Dichloropropane	78-87-5	TO-15	µg/m ³	0.759	3.31	<0.47		0.05	0.47	<0.47		0.05	0.47	<0.47		0.05	0.47	<0.47		0.05	0.47
Bromodichloromethane	75-27-4	TO-15	µg/m ³	0.0759	0.331	<0.68		0.07	0.68	<0.68		0.07	0.68	<0.68		0.07	0.68	<0.68		0.07	0.68
cis-1,3-Dichloropropene	10061-01-5	TO-15	µg/m ³	NE	NE	<0.46		0.05	0.46	<0.46		0.05	0.46	<0.46		0.05	0.46	<0.46		0.05	0.46
4-Methyl-2-pentanone (MIBK)	108-10-1	TO-15	µg/m ³	3130	13100	0.25	J	0.08	0.83	0.29	J	0.08	0.83	0.17	J	0.08	0.83	0.25	J	0.08	0.83
trans-1,3-Dichloropropene	10061-02-6	TO-15	µg/m ³	NE	NE	<0.46		0.05	0.46	<0.46		0.05	0.46	<0.46		0.05	0.46	<0.46		0.05	0.46
Toluene	108-88-3	TO-15	µg/m ³	5210	21900	3.1		0.08	0.76	7.1		0.08	0.76	3.2		0.08	0.76	2.3		0.08	0.76
1,1,2-Trichloroethane	79-00-5	TO-15	µg/m ³	0.175	0.767	<0.55		0.06	0.55	<0.55		0.06	0.55	<0.55		0.06	0.55	<0.55		0.06	0.55
2-Hexanone (MBK)	591-78-6	TO-15	µg/m ³	31.3	131	<0.83		0.17	0.83	<0.83		0.17	0.83	<0.83		0.17	0.83	<0.83		0.17	0.83
Dibromochloromethane	124-48-1	TO-15	µg/m ³	NE	NE	<1.7		0.09	1.7	<1.7		0.09	1.7	<1.7		0.09	1.7	<1.7		0.09	1.7
Tetrachloroethene	127-18-4	TO-15	µg/m ³	10.8	47.2	0.34	J	0.07	0.69	0.34	J	0.07	0.69	0.41	J	0.07	0.69	0.34	J	0.07	0.69
1,2-Dibromoethane (EDB)	106-93-4	TO-15	µg/m ³	0.00468	0.0204	<0.78		0.08	0.78	<0.78		0.08	0.78	<0.78		0.08	0.78	<0.78		0.08	0.78
1,1,1,2-Tetrachloroethane	630-20-6	TO-15	µg/m ³	0.379	1.66	<0.70		0.07	0.70	<0.70		0.07	0.70	<0.70		0.07	0.70	<0.70		0.07	0.70
Chlorobenzene	108-90-7	TO-15	µg/m ³	52.1	219	<0.47		0.05	0.47	<0.47		0.05	0.47	<0.47		0.05	0.47	<0.47		0.05	0.47
Ethylbenzene	100-41-4	TO-15	µg/m ³	1.12	4.91	0.40	J	0.04	0.44	0.53		0.04	0.44	0.40	J	0.04	0.44	0.26	J	0.04	0.44
m,p-Xylene	179601-23-1	TO-15	µg/m ³	104	438	2.5		0.04	0.44	3.3		0.04	0.44	2.0		0.04	0.44	1.4		0.04	0.44
Styrene	100-42-5	TO-15	µg/m ³	1040	4380	0.13	J	0.04	0.43	0.22	J	0.04	0.43	0.13	J	0.04	0.43	0.13	J	0.04	0.43
o-Xylene	95-47-6	TO-15	µg/m ³	104	438	1.0		0.04	0.44	1.3		0.04	0.44	0.75		0.04	0.44	0.57		0.04	0.44
Bromoform	75-25-2	TO-15	µg/m ³	2.55	11.1	<1.0		0.10	1.0	<1.0		0.10	1.0	<1.0		0.10	1.0	<1.0		0.10	1.0
1,1,1,2-Tetrachloroethane	79-34-5	TO-15	µg/m ³	0.0484	0.211	<0.70		0.07	0.70	<0.70		0.07	0.70	<0.70		0.07	0.70	<0.70		0.07	0.70
4-Ethyltoluene	622-96-8	TO-15	µg/m ³	NE	NE	0.20	J	0.05	0.50	0.25	J	0.05	0.50	0.20	J	0.05	0.50	0.15	J	0.05	0.50

Table 6 - Volatile Organic Compounds in Indoor Air, 2025
Schovaers Electronics, 22 South Jeremy Street, Salt Lake City, Utah
Terracon Project No. 61237316 Task 3.16

Lab Sample ID						E506010-05				E506010-06				E506010-07				E506010-08			
Client Sample ID						IA-1				IA-2				IA-3				IA-4			
Date Collected						5/22/2025				5/22/2025				5/22/2025				5/28/2025			
Analyte	CAS	Method	Units	VISL Residential	VISL Commercial	Result	Q	MDL	RDL	Result	Q	MDL	RDL	Result	Q	MDL	RDL	Result	Q	MDL	RDL
1,3,5-Trimethylbenzene	108-67-8	TO-15	µg/m ³	62.6	263	0.35	J	0.05	0.50	0.40	J	0.05	0.50	0.25	J	0.05	0.50	0.30	J	0.05	0.50
1,2,4-Trimethylbenzene	95-63-6	TO-15	µg/m ³	62.6	263	1.2		0.05	0.50	1.4		0.05	0.50	0.90		0.05	0.50	0.95		0.05	0.50
1,3-Dichlorobenzene	541-73-1	TO-15	µg/m ³	NE	NE	<0.61		0.06	0.61	<0.61		0.06	0.61	<0.61		0.06	0.61	<0.61		0.06	0.61
1,4-Dichlorobenzene	106-46-7	TO-15	µg/m ³	0.255	1.11	0.06	J	0.06	0.61	0.06	J	0.06	0.61	<0.61		0.06	0.61	0.06	J	0.06	0.61
1,2-Dichlorobenzene	95-50-1	TO-15	µg/m ³	209	876	<0.61		0.06	0.61	<0.61		0.06	0.61	<0.61		0.06	0.61	<0.61		0.06	0.61
1,2,4-Trichlorobenzene	120-82-1	TO-15	µg/m ³	2.09	8.76	<1.9		0.08	1.9	<1.9		0.08	1.9	<1.9		0.08	1.9	<1.9		0.08	1.9
Hexachlorobutadiene	87-68-3	TO-15	µg/m ³	0.128	0.557	<2.7		0.21	2.7	<2.7		0.21	2.7	<2.7		0.21	2.7	<2.7		0.21	2.7
Qualifiers (Q): J: The identification of the analyte is acceptable; the reported value is an estimate. QL-1H: The LCS and/or LCSD recoveries fell above the established control specifications. Any result is qualified and should be considered biased high. EPA VISL: Environmental Protection Agency Target Indoor Air Concentration (VISL); November 2024. NE: not established, <: Less than Reported Detection Limit (RDL), µg/m ³ : micrograms per cubic meter Bold value exceeds Reported Detection Limit (RDL). Blue italicized non-detect results (e.g., <0.0100) exceed one or more of the screening levels. Color shaded value exceeds screening level.																					

Appendix C

Quality Assurance Project Plan

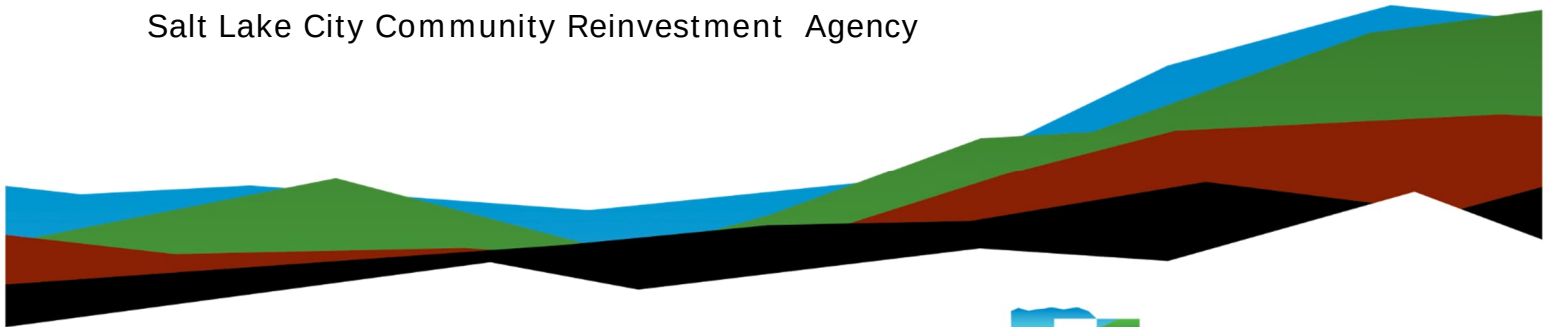
QUALITY ASSURANCE PROJECT PLAN

Salt Lake City Former Schovaers Cleanup Grant
EPA Cooperative Agreement No. 96884401

March 17, 2026 | Terracon Project No. 61247165 |
Revision 1



Prepared for:
Salt Lake City Community Reinvestment Agency



Nationwide
[Terracon.com](https://www.terracon.com)

- Facilities
- Environmental
- Geotechnical
- Materials

Group A Project Management

A1 Title and Approval Sheet

Project Title:

Quality Assurance Project Plan
Salt Lake City Former Schovaers Cleanup Grant
EPA Cooperative Agreement No. 96884401
Revision 1

Terracon Consultants Grant Manager



Signature

03/17/2026

Date

Benjamin Bowers

Printed Name

Terracon Consultants QA/QC Officer



Signature

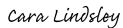
03/17/2026

Date

Andrew S. Turner, PG

Printed Name

Salt Lake City (Grantee) Approval



Signature

03/30/2026

Date

Cara Lindsley

Printed Name

U.S. EPA Project Manager/QA Officer Approval



Signature

03/30/2026

Date

Joann Jeplawy

Printed Name

U.S. EPA QA Delegated Approving Official



Signature

03/30/2026

Date

Joann Jeplawy

Printed Name

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Appendices

- Appendix A:** Pace Analytical, Chemtech-Ford, and H&P Quality Assurance Manuals
- Appendix B:** Standard Operating Procedures and Field Forms

A2.1 Acronym List

Term / Acronym	Description
ABCA	Analysis of Brownfields Cleanup Alternatives
DERR	Division of Environmental Response and Remediation
DQI	Data Quality Indicators
DQO	Data Quality Objectives
EDD	Electronic Data Deliverable
EPA	United States Environmental Protection Agency
HASP	Health and Safety Plan
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LIMS	Laboratory Information Management System
MCL	Maximum Contaminant Level
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
OSHA	Occupational Safety and Health Act
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity
ppm	parts per million (in mg/kg or mg/L)
PR	Percent Recovery
QA	Quality Assurance
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAP	Remedial Action Plan
RDL	Laboratory Reported Detection Limit (a.k.a. practicable quantification limit)
RSL	EPA's Regional Screening Levels
UDEQ	Utah Department of Environmental Quality
EPA	United States Environmental Protection Agency

A3 Distribution List

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A4 Project/Task Organization

This Quality Assurance Project Plan (QAPP) provides guidelines for the acquisition, analysis, and validation of data collected as part of the Salt Lake City Former Schovaers Cleanup Grant. The following is a brief description and identification of key personnel involved in the proposed Scope of Services as part of the Brownfields Assessment Grant project. An organizational chart indicating the roles of these individuals is included as [Figure 1](#).

Project Manager

The Project Manager is the central point of contact directing Brownfields Assessment Grant activities and problem resolution and is the primary point of contact with the Consultant Grant Manager regarding administrative and technical issues associated with this project. The Project Manager for this project is:

Austin Taylor
Project Manager
Salt Lake City Community Reinvestment Agency
451 South State Street Room 418
Salt Lake City, UT 84111-3102
(435) 705-3519
austin.taylor@slc.gov

Consultant Grant Manager

The Consultant Grant Manager will have responsibility for overseeing the activities associated with the remediation and monitoring activities. This person will be responsible for the preparation and maintenance of the QAPP, for distribution of the most current version of the QAPP to the individuals identified in A3, preparing and/or overseeing preparation of a Remedial Action Plan (RAP), and for overall management of the field operations. The Consultant Grant Manager will coordinate closely with the Consultant Quality Assurance/Quality Control (QA/QC) Officer and provide oversight during the field activities with routine visits to the jobsite(s). The Consultant Grant Manager will be the primary technical point of contact for communication with Salt Lake City. Additional responsibilities include scheduling, subcontractor procurement, cost accounting, reporting, identification of potential problems, and development of contingency plans to respond to the identified problems. The Consultant Grant Manager for this project is:

Benjamin B. Bowers
Consultant Grant Manager
Terracon Consultants, Inc.
6952 South High Tech Drive, Suite B
Midvale, UT 84047
(801) 746-5455
Ben.Bowers@terracon.com

Consultant QA/QC Officer

The Consultant QA/QC Officer for this project will function as an independent advisor to the Consultant Grant Manager and will oversee project activities, as necessary. This role will include providing surveillance level oversight, laboratory performance evaluation, and data quality validation with QA/QC reviews of all data included in final reports. In most cases, the Consultant QA/QC Officer will not take part in data collection activities. If the Consultant QA/QC Officer takes part in any such collection activities, another trained Terracon QA/QC Officer will conduct the review of QA/QC data evaluations presented in the final reports. The Consultant QA/QC Officer for this project is:

Andrew S. Turner, PG
Consultant QA/QC Officer
Terracon Consultants, Inc.
6952 South High Tech Drive, Suite B
Midvale, UT 84047
(385) 388-7028
Andrew.Turner@terracon.com

U.S. EPA Project Officer and QA Delegated Approving Official

The EPA Project Officer will review and approve the QAPP and revisions in terms of quality-assurance aspects, review and approve site eligibility determinations, provide technical assistance to the Grantee, review progress reports, and review draft and final reports when requested. The EPA Project Officer for this project is:

Joann Jeplawy
Brownfields Project Manager
U.S. EPA Region 8
Mail Code: 8LCR-BR
1595 Wynkoop Street
Denver, CO 80202-1129
(303) 312-6715
jeplawy.joann@epa.gov

UDEQ Project Manager

The UDEQ Project Manager will assist and support the EPA Project Officer with review of the QAPP, RAP, and other reports generated under the Salt Lake City Former Schovaers Cleanup Grant project. The UDEQ will remain a technical resource for the field activities and reporting throughout the course of the project. The UDEQ Project Manager for this project is:

Allison Stanley
Project Manager
Utah Department of Environmental Quality/
Division of Environmental Response and Remediation
P.O. Box 144840
Salt Lake City, UT 84114-4840
(385) 391-8134
allisonstanley@utah.gov

Environmental Laboratories: Pace Analytical, Chemtech-Ford Analytical Laboratories, and H&P Mobile Geochemistry, Inc. (H&P)

It is expected that the majority samples of environmental media that are collected during the field activities will be analyzed by Pace Analytical. Pace Analytical is an environmental analytical firm providing technical and support services to customers nationwide, with a diverse accreditation/certification program which represents over 48 separate state and national accreditations. Pace Analytical is responsible for providing reliable and high-quality analytical data, using the quality systems detailed in its Quality Assurance Manual ([Appendix A](#)). The Quality Assurance Director for Pace Analytical is responsible for managing the implementation, monitoring, and development of the laboratory's Quality Assurance Systems as well as overseeing laboratory safety, waste management, internal and external audits, and new method implementation. The Environmental Laboratory and Quality Assurance Director is:

Pace Analytical
Blake Judge
Laboratory Quality Assurance Director
12065 Lebanon Road
Mt. Juliet, Tennessee 37122
(615) 678-9577
Blake.Judge@Pacelabs.com

Due to laboratory availability, additional needed specialty analyses, requested expedited turnaround times, etc., environmental samples collected may also be analyzed by Chemtech-Ford Analytical Laboratories (Chemtech-Ford). Located in Sandy, Utah, Chemtech-Ford holds the required national licenses and accreditations to conduct the

required analytical work. A copy of their Quality Manual is included in [Appendix A](#). The Environmental Laboratory and Quality Assurance Manager is:

Chemtech-Ford Laboratories
Jenn Osborn
Laboratory Quality Manager
9632 South 500 West
Sandy, UT 84070
(801) 262-7299
josborn@chemtechford.com

Air samples (soil gas, indoor air, etc.) may be analyzed by H&P. Located in Carlsbad, California, H&P holds the required national licenses and accreditations to conduct the required air sample analytical work. A copy of their Quality Manual is included in [Appendix A](#). The Environmental Laboratory Director is:

H&P Mobile Geochemistry, Inc.
Kristin Beckley
Quality Assurance Officer
2470 Impala Drive
Carlsbad, CA
(760) 804-9678
kristin.beckley@handpimg.com

If additional laboratories are required or utilized to complete the needed analytical assessment, the Consultant QA/QC Officer will ensure those laboratories possess the required certifications prior to them being utilized and the EPA Project Officer will be notified prior to sending samples. A copy of their Quality Manual will be available for review as needed.

[A5 Problem Definition/Background](#)

A5.1 Purpose/Background

A Brownfield is a real property, the expansion, redevelopment, or reuse of which may be complicated by the real or potential presence of a hazardous substance, pollutant, or contaminant. Salt Lake City Corporation (the Grantee) is a recipient of an EPA cleanup grant to conduct remediation activities, vapor mitigation, assessment, monitoring, and public outreach activities for the former Schovaers Electronics site (site or former Schovaers site). This grant program will be used for metal and volatile organic compound (VOC) remediation, mitigation, and assessment at the former Schovaers site, located at 22 South

Jeremy Street in Salt Lake City, Utah. The Salt Lake City Community Reinvestment Agency (CRA) will implement this grant program.

The site is the former home of a circuit board manufacturer and includes 0.34 acres of land and one 6,000 square foot warehouse building, which was constructed in 1955. The site was used as an electroplating facility from 1977 to 2017 and was surrounded by other industrial facilities, including a decorative plating company, an autobody shop, a forge, and a chemical company.

The former Schovaers site is in the target area of the CRA's "North Temple Project Area." With its industrial nature and many derelict sites, the target area has struggled economically and environmentally for decades. It encompasses some of Salt Lake City's most socioeconomically underserved communities, with numerous properties affected by contaminants associated with hazardous substances, particulate matter, and petroleum. Once cleaned up and repurposed, the former Schovaers site will be a catalytic development that furthers the City's and community's goal of transforming the area into a walkable, mixed-use district. The site is adjacent to the Folsom Trail—a rails-to-trails project recently completed by Salt Lake City—which connects the Jordan River Parkway and North Temple Project Area to downtown Salt Lake City. This Cleanup Grant will allow the former Schovaers site to complement the new Folsom Trail with neighborhood-scale, trail-oriented commercial or light industrial space that is affordable to local businesses and nonprofit organizations.

The confirmation and monitoring activities will be conducted in accordance with the UDEQ Division of Environmental Response and Remediation (DERR) Voluntary Cleanup Program (VCP).

The specific remediation approaches, sampling locations, rationale, and applicable laboratory analyses are detailed in the Remedial Action Plan (RAP) (RAP Section 5.0). The RAP was developed to mitigate metal and/or VOC impacts at the site within soil, groundwater, and soil vapor. Remediation of the site will include the following actions: removal of the plating room sump, lateral sewer piping, a floor drain, and impacted soil inside the building; in-situ chemical reduction (ISCR) injections, based on groundwater monitoring data; soil vapor and groundwater monitoring; and testing and installation of a vapor intrusion management system (VIMS), as necessary based on vapor monitoring data. Remedial actions will address on-site soil, groundwater, and soil vapor that have been impacted by metals and/or VOCs from the former metal plating operations that were conducted at the site. Following the proposed mitigation, the site condition is anticipated to be acceptable for commercial or light industrial use. Approval of the RAP will be obtained from the CRA and the Utah Department of Environmental Quality Voluntary Cleanup Program prior to commencement of the field activities.

Regulatory information, including screening levels and cleanup objectives, are included in the Remedial Action Plan, Section 4.2.

A6 Project Task/Description and Schedule

The cleanup tasks include the following:

- VOC- and metal-impacted soils, a sump, sewer lateral segment, and a floor drain will be removed inside the building in and adjacent to the former plating shop area.
- Dissolved VOCs in groundwater will be treated by ISCR, based on groundwater monitoring data.
- Confirmation soil, groundwater, and soil vapor monitoring events will be conducted to assess the effectiveness of the remediation activities.
- A vapor mitigation system (VMS) will be installed below the building, as needed based on monitoring data and results of the ISCR event.

A baseline groundwater sampling event was conducted prior to implementation of remedial actions. The data will be used to assess existing groundwater conditions and the potential for off-site migration of trichloroethene (TCE). Confirmation soil sampling will be conducted to assess mitigation of metal and VOC impacts following the proposed excavation. Vapor sampling will be conducted to assess the requirements for design of the VIMS following ISCR injections and prior to final design and installation of the VIMS. The four existing sub-slab vapor pins will be utilized, and two indoor air samples will be collected for the same analyses. Following the completion of the soil and groundwater remedial action, four rounds of semi-annual groundwater monitoring will be conducted using the monitoring wells installed during site characterization. The groundwater samples will be collected following the SOPs detailed in the QAPP and will be analyzed for VOCs. The groundwater monitoring data will be used to assess the effectiveness of the groundwater treatment and monitor migration of impacts.

Further details of the cleanup tasks, work schedules, and resource and time constraints for the project tasks are included in the RAP.

A7 Quality Objectives and Criteria for Measurement Data

A7.1 Data Quality Objectives

Data Quality Objectives (DQOs) are quantitative and qualitative statements that specify the quality of data required to support the objectives of an investigation. DQOs are generated through the DQO Process, as shown in Guidance on Systematic Planning Using the Data Quality Objectives Process (QA/G-4) (EPA; February 2006).

A7.2 Measurement Performance Criteria

Table 1 provides measurement performance criteria, which are Data Quality Indicators (DQIs) expressed in terms of precision, bias, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS). The DQIs provide verifiable measurement criteria

to assess data quality. The following is a brief definition of the PARCCS parameters, including bias.

PARCCS Parameters	
Precision	The measure of agreement among repeated measurements of the same property under identical or substantially similar conditions, calculated as either the range or as the standard deviation. Precision may also be expressed as a percentage of the mean of the measurements, such as relative range or relative standard deviation (coefficient of variation).
Bias	The systematic or persistent distortion of a measurement process that causes errors in one direction. Use reference materials or analyze spiked matrix samples.
Accuracy	A measure of the overall agreement of a measurement to a known value; includes a combination of random error (precision) and systematic error (bias) components of both sampling and analytical operations.
Representativeness	A qualitative term that expresses “the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.” (ANSI/ASQC 1995)
Comparability	A qualitative term that expresses the measure of confidence that one data set can be compared to another and can be combined for the decision(s) to be made.
Completeness	A measure of the amount of valid data needed to be obtained from a measurement system.
Sensitivity	The capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest.

The Consultant QA/QC Officer will evaluate the PARCCS parameters in terms of the DQIs presented in [Table 1](#). Criteria to be used for accepting, rejecting, or qualifying data is further discussed in [Section D](#) of this QAPP.

Precision will be evaluated based on the relative percent difference (RPD) as a measure of reproducibility between LCS/LCSD pairs and MS/MSD pairs (analytical precision), and between field samples and field duplicate samples (field precision).

Bias and Accuracy will be evaluated through a review of the method blanks, equipment blanks, trip blanks, LCS/LCSD, and MS/MSD summaries provided by the laboratory. Method blank and Equipment Blank analyte concentrations are expected to be below the laboratory's Reported Detection Limits (RDLs), while the percent recoveries for LCS/LCSD and MS/MSD pairs are expected to be within the laboratory/method standards.

Representativeness will be ensured by using appropriate sampling locations, collection and preservation methods (including sample holding times), and analytical procedures according to the approved RAP.

Comparability will be ensured using standardized sampling procedures in accordance with the approved RAP and QAPP, use of standardized and approved laboratory analytical methods, and reporting the analytical results in appropriate and consistent units.

Completeness is the ratio of valid measurements to the number of planned measurements (valid measurements conducted by the laboratory from the collected field data divided by the planned measurements indicated in the RAP), expressed as a percentage, and the completeness goal is 90%.

Sensitivity must be such that the laboratory reporting limits are sufficiently low as to allow identification of analyzed constituent concentrations that are above applicable regulatory screening levels.

Soil, groundwater, indoor air, and soil vapor samples submitted for laboratory analyses will be considered definitive, consistent with EPA Superfund Data Categories (EPA; September 1993). Analytical results will be evaluated using the standards, screening levels, and cleanup objectives included in the RAP.

Certification and validation requirements apply to the laboratory. Regularly scheduled analyses of known duplicates, standards, and spiked samples are a routine aspect of data reduction, validation, and reporting procedures for the laboratory. The laboratory, which is associated with the National Environmental Laboratory Accreditation Program (NELAP), will verify the reliability and credibility of the analytical results. Analytical providers used will be NELAP certified unless no other option is available. Additionally, when possible, the laboratory reporting limits will be lower than the screening levels for each of the analytes analyzed. Exceptions will be noted. A copy of the Pace Analytical, Chemtech-Ford, and H&P

Quality Assurance Manuals (QAMs) are provided in [Appendix A](#). Information regarding the laboratory detection limits is provided in [Appendix A](#) and [Tables 3 through 5](#).

A8 Special Training Requirements

The Occupational Safety and Health Administration (OSHA) 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training, including an up to date 8-hour refresher course as required by OSHA, is required for field personnel. Initial 40-hour HAZWOPER “live” training is provided by reputable training providers in the local community, and annual refreshers are provided either by “live” training or via online courses approved by Terracon’s Corporate Safety and Health Manager. The Consultant Grant Manager will assess training/certification requirements for the field personnel prior to their entry to the site. Documentation (training certificates) of HAZWOPER and refresher training is maintained by Terracon’s Corporate Safety and Health Manager in employees’ confidential medical surveillance/environmental training files. In addition, Terracon’s environmental project managers (or designees) are responsible for conducting site-specific safety briefings prior to beginning hazardous waste site projects.

Terracon will prepare a site-specific Health and Safety Plan (HASP) prior to mobilizing to the site to identify specific hazards that may be encountered during the various field work phases. Terracon will also require on-site subcontractors (e.g., drillers, excavators, VMS installers) to provide documentation of current HAZWOPER certification prior to mobilization. Documentation of these certifications is maintained in Terracon databases at both the local and corporate levels.

A9 Documentation and Records

The remediation, VMS installation, confirmation soil sampling, and groundwater monitoring will be summarized in reports documenting the procedures and results, along with supporting maps, figures, and data summary tables. Appendices will include appended data for analyses, including laboratory QA/QC evaluation, chain of custody documentation, and field forms, where applicable. The reports will include discussion and general recommendations for additional identified conditions that must be considered in planning for future redevelopment, if applicable. These may include, for example, impacted environmental media and/or building-related conditions such as other hazardous materials that require further investigation, cleanup, or proper management as part of building renovation. The Analysis of Brownfields Cleanup Alternatives (ABCA) will be finalized following approval of this QAPP and the RAP.

Field personnel will maintain a field log to record pertinent activities associated with remediation and sampling activities. Photographic documentation will also be recorded, as will documentation of field problems and corrective measures taken. Additional field documents may include sketched maps, field forms, borehole logs, and chain-of-custody records.

Appropriate labels will be affixed to sample containers and completed by field personnel. The labels will identify sample numbers, dates and times collected, and requested analyses. Chain of custody records will be maintained for the samples from the time of collection through the time of submittal to the laboratory for analysis.

Electronic project documents (including but not limited to word processing files, spreadsheets, laboratory analytical reports, project photographs, and CAD/GIS files) will be stored for a minimum of five years in an electronic project folder on a local server hard drive in the Terracon office that is backed up automatically on a daily basis to a separate file server hard drive. In addition, analytical reports and chain-of-custody records will be maintained indefinitely on the analytical laboratory's LIMS (or similar) database and made available via the laboratory's secured online data access system.

Samples will be submitted to laboratories certified by the State of Utah and NELAP, using standard turnaround times unless alternate turnaround times are requested on chain-of-custody records for individual sample sets. It is anticipated that Pace Analytical will be used for most analyses; however, Chemtech-Ford and H&P may also be utilized for environmental sampling, where deemed necessary. If another laboratory performs analyses, it must meet the following criteria listed below, and submit QA/QC documentation to the EPA for approval as described above:

- demonstrated ability to achieve the required detection limits
- certified by the State of Utah and NELAP for the specific analyses
- ability to meet the project's analytical qc requirements, which typically includes a laboratory method blank, laboratory control sample, matrix spike and matrix spike duplicate, and narrative report of qc results and any corrective actions required
- follows an internal QA/QC Program
- data provided by the laboratory will be made available using similar methods (i.e., electronic deliverables)

Details of Pace Analytical's, Chemtech-Ford's, and H&P's QA/QC Programs are presented in [Appendix A](#).

The QAPP will be reviewed, recertified, or updated, as needed. The EPA will be notified once per year of updates to the QAPP following the initial publication.

Group B Measurement/Data Acquisition

B1 Sampling Process Design

Please refer to the site-specific RAP developed and submitted for review and approval by the appropriate Agencies prior to implementation and includes the following information:

- justification of design strategy and rationale for remediation, including soil excavation, sump and lateral removal, VMS installation, and groundwater treatment (area, depth, volume, specifications)
- justification of design strategy and rationale for sampling locations (location, volume, or time period to be represented by a sample)
- type and total number of sample times/matrix or test runs expected and needed
- discussion regarding procedures if sampling sites become inaccessible
- project activity schedules such as the remediation and sampling events, when samples should be sent to the laboratory, etc.
- sources of variability and how this variability will be reconciled

B2 Sampling Methods Requirements

Samples will be collected following applicable Terracon Standard Operating Procedures (SOPs) included in [Appendix B](#). The SOPs include lists of equipment needed for each SOP and were developed in general accordance with *Guidance for Preparing Standard Operating Procedures (SOPs) (QA/G-6)* (EPA, April 2007). The SOPs are revised, as needed. If problems develop in the field during implementation of an SOP, field personnel will contact the Consultant Grant Manager and Consultant QA/QC Officer for information on appropriate corrective action, and the problem and corrective action will be documented in the field log. No support facilities are expected to be needed at this time, except for equipment rental troubleshooting operations, if necessary.

B3 Sample Handling, Preservation and Custody Requirements

Samples will be identified, labeled, preserved, and handled following SOP 20, which includes chain of custody and documentation procedures. An example label and chain of custody form are included as attachments to SOP 20. In the case of soil samples, each sample will be labeled “S” followed by the boring sample number. Groundwater monitoring well samples will be labeled “MW” followed by the sample number. Stockpile soil samples will be labeled “SP” followed by the sample number. Sub-slab vapor samples will be labeled “VP” followed by the sample number. Indoor air samples will be labeled “IA” followed by the sample number. A copy of all SOPs can be found in [Appendix B](#).

Required sample containers, sample volumes, sample holding times, and sample preservation methods for a variety of analytical parameters including those that are likely to be used in the assessments are summarized in the individual laboratory's QAM, detailed in [Appendix A](#) of this QAPP and are outlined in [Table 6 – Analytical Method Summary](#) in this QAPP. The primary analytical parameters anticipated for the assessments include, but are not limited to, the following: VOCs (EPA Method 8260); RCRA Metals (EPA Method 6010/6020); and hexavalent chromium (EPA Methods 7196 and 7199).

Samples will be placed into the appropriate laboratory-provided container immediately after collection. The container will remain in the sight of the sampler or will be locked in a secure area until the samples are transported under chain of custody protocols for delivery to the laboratory. Samples will be prepared, packaged, and shipped in a manner to protect the samples and maintenance of an acceptable temperature.

The site-specific RAP will be developed and will provide details regarding the analytes being sampled, laboratory methods being utilized, QA/QC information, and additional analyte-specific information as appropriate.

B4 Analytical Methods Requirements

The analytical methods will follow standard EPA procedures as outlined in Test Methods for Evaluating Solid Wastes - Physical/Chemical Methods (SW-846), as updated. Please refer to SW-846 and the individual laboratory's QAM ([Appendix A](#)) for analytical SOPs and information regarding analytical equipment, instrumentation, performance criteria, corrective action procedures and documentation, sample disposal, and method validation information and procedures for nonstandard methods. Laboratory turnaround times needed will be specified on chain of custody records for each sample set but will typically be the standard laboratory turnaround time of 10 working days.

B5 Quality Control Requirements

B5.1 Definitive Data

To maintain high quality, reliable data is consistently collected, and that data is comparable to previous investigations, QA procedures will be followed throughout the investigation. Quality assurance procedures include using the data quality objectives, following SOPs, and collecting and analyzing field and laboratory QC samples.

The QC samples collected in the field will be preserved, handled, and transported in the same manner as the environmental samples. QC samples will include the following:

- field duplicates (when applicable) — Collected at a rate of 10%
- trip blanks (if applicable) — One per sampling event (only if VOC analyses conducted)
- matrix spikes and matrix spike duplicates (MS/MSDs) *

- laboratory method blanks*
- laboratory control samples and laboratory control sample duplicates (LCS/LCSDs)*

*Laboratory quality control samples (method blanks, MS/MSD, LCS/LCSD) will be analyzed at a frequency of no less than one per twenty samples or analytical batch. Quality control samples are briefly described below.

Field Duplicate Samples. To evaluate sampling and laboratory precision, field duplicate samples may be collected, as specified in the site-specific RAP. One sample set will be labeled with the correct sample identification, while the other will be labeled with a false or “blind” sample identification. If the detected analytes in the field sample and its duplicate are less than five times the laboratory RDL and the difference between the reported concentration in the sample and the reported concentration in the duplicate is less than or equal to the RDL value (for aqueous samples) or less than twice the RDL (for soil/solid samples), the samples will be considered within control. If the difference falls outside of this range, the data will be flagged and evaluated by the Consultant QA/QC Officer.

The relative percent difference (RPD) between detected analytes in the field sample and its duplicate are calculated when the reported concentrations for the sample and duplicate are greater than or equal to five times the RDL. The RPD is calculated to evaluate precision using the following equation.

$$RPD = \left(\frac{X_1 - X_2}{\left(\frac{X_1 + X_2}{2} \right)} \right) \times 100$$

Where X_1 and X_2 are the reported concentrations of the samples being evaluated.

The target RPD values for samples and their duplicates will be $\pm 25\%$ (for aqueous samples) and $\pm 50\%$ (for solid samples, due to greater sample heterogeneity). If samples exceed the target RPD values, the data will be flagged and evaluated by the Consultant QA/QC Officer to determine whether this affects the usability of the data.

Trip Blanks. Trip blanks will apply only when the field activity includes collection of samples to be analyzed for VOCs and will be used to evaluate whether external VOCs from sample container handling and analytical processes, independent of the field sampling processes, are contaminating the samples. Trip blanks will be prepared by the laboratory with analyte-free water prior to the sampling event, kept with the investigative samples throughout the sampling event, and returned to the laboratory with the other samples for analysis. One trip blank will typically be used and analyzed per VOC sample shipment when sample analyses include VOCs. Acceptance criteria will be analyte concentrations less than the RDLs. If above the RDLs, the data will be flagged and evaluated by the Consultant QA/QC Officer. The Consultant QA/QC Officer will review the shipping procedures to determine if contaminants could have been introduced by the shipping methodology. When necessary, the results will be discussed with the Agencies, laboratory personnel, and/or appropriate regulatory officials to determine if the data is acceptable or should be rejected.

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Samples. Samples for MS/MSD analyses will be selected by the consultant from field samples collected from the site being investigated whenever possible. The MS/MSD samples will be spiked in the laboratory with target analytes prior to extraction or analysis, according to the laboratory's SOPs, and then analyzed for the same compounds as the environmental samples. Each MS/MSD will be evaluated for Percent Recovery (PR). If the data meets the PR criteria, the MS/MSD will be evaluated for RPD according to the equation presented above

$$\text{Percent Recovery} = \frac{X_s - X_i}{SC} \times 100$$

Where X_s = concentration measured in spiked sample

X_i = concentration measured prior to spiking

SC = spike concentration

The PR acceptance criteria for MS/MSD samples will vary by sample medium, analyte, and analytical method, and may be either method defaults or laboratory derived. Laboratory RPD acceptance criteria also vary by sample medium, analyte, and analytical method, and are specified in the laboratory's QAM ([Appendix A](#)). Each laboratory report will include quality control summaries with PR results and comparison against PR acceptance criteria for each sample medium, analyte, and analytical method for that sample set. Additionally, specific control limits will be included in the individual data report packages. If data fails to meet the acceptance criteria, the Consultant QA/QC Officer will evaluate the data with the laboratory to determine potential causes of failure, such as matrix interference or sample heterogeneity. Data may be flagged or invalidated based on discussions with the laboratory.

Laboratory Method Blanks. Method blank samples will be prepared by the laboratory and analyzed with each analytical batch for each method. A method blank consists of laboratory-grade deionized water or solid that is processed through the analytical steps required by a method, including sample extraction, preparation, and analysis. Laboratory method blank samples are used to identify contamination originating in the laboratory, such as laboratory water, reagents, sample preparation steps, and instrument contamination. Method blank samples aid in distinguishing low-level field contamination from laboratory contamination. Method blank samples will be run with each batch of samples (20 or fewer samples per batch). If analytes are detected in the method blank, the laboratory will correct problems as per their SOPs. The Consultant QA/QC Officer will evaluate the data to determine whether a detection in the corresponding Method Blank affects the usability of the data.

Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicates (LCSDs). Laboratory control samples are used to evaluate laboratory accuracy in the absence of matrix interference. A laboratory control sample is composed of laboratory-grade deionized water or clean solid that is spiked with target analytes according to the laboratory's SOPs prior to extraction or analysis. The PR of the spiked compounds is calculated and compared to established QC limits using the following formula.

$$\text{Percent Recovery} = \frac{X_s}{SC} \times 100 \quad \text{Where } X_s = \text{concentration measured in spiked sample}$$

SC = spike concentration

Acceptance criteria for the LCS will vary by sample medium, analyte, and analytical method; may be either method defaults or laboratory-derived; and are compared against PR results in the laboratory quality control summaries provided as part of each laboratory report. If the LCS is out of control, the laboratory will correct problems in accordance with its standard operating procedures. If the data meets the PR criteria, the LCS/LCSD will be evaluated for RPD according to the RPD equation presented previously. The Consultant QA/QC Officer will evaluate the LCS/LCSD data to determine whether any issues or variations affect the usability of the data.

Holding Times. Holding times are used to evaluate the representativeness of the environmental samples. Holding time is the period following sample collection when a sample is considered representative of the environmental conditions. The holding time for each analysis will be compared to the method-specific holding times. Samples held beyond their holding time prior to analysis will be evaluated by the Consultant QA/QC Officer and the laboratory to determine whether the data can still be utilized to some capacity or must be rejected.

B5.2 Non-definitive data

Non-definitive data utilized to support decisions may include field soil screening measurements and observations, physical observations, and groundwater field parameter measurements. Non-definitive data will be collected following Terracon SOPs ([Appendix B](#)). The QC documentation for non-definitive data is not as rigorous as requirements for definitive data.

B6 Equipment Testing, Inspection, and Maintenance Requirements

Testing, inspection, and maintenance of sampling equipment and field instrumentation will be performed by Terracon field personnel prior to each day's field use and in accordance with the procedures and schedules in the manufacturers' specifications. A supply of appropriate spare parts and batteries will be maintained with each instrument in its transport case, along with instrument calibration supplies. Identified deficiencies will be documented in the field notes, along with any corrective actions (e.g., spare parts replacement and instrument re-testing) and effectiveness of corrective actions. Anticipated field instruments to be used at the site that require periodic maintenance may consist of the following:

- Photoionization Detector (PID)
- Manometer Gas Pressure Device

- 4-Gas Meter Detector
- Helium Gas Detector

Pace Analytical, Chemtech-Ford, and H&P conduct their own equipment testing, inspections, maintenance, and record keeping of the laboratory equipment as detailed in their QAMs provided in [Appendix A](#). Terracon owned equipment will be tested based on the manufacturer's specifications and criteria.

B7 Instrument/Equipment Calibration and Frequency

B7.1 Field Instruments

Field instruments will be calibrated daily or in accordance with manufacturers' specifications by Terracon field personnel, using National Institute of Standards and Technology (NIST) standards or equivalent. Calibration deficiencies, if any, will be documented in the field logbook along with their resolution (e.g., spare parts replacement and re-calibration). Anticipated field instruments to be used at the site may consist of the following:

- Photoionization Detector (PID)
- Manometer Gas Pressure Device
- 4-Gas Meter Detector
- Helium Gas Detector

Calibration documentation will consist of equipment supplier Terracon records, with hard and/or electronic copies.

B7.2 Laboratory Instruments

The listed laboratories and SOPs meet the State of Utah, The National Environmental Laboratory Accreditation Conference (NELAC) Institute, and EPA method protocols necessary to produce legally and defensible analytical data. Certification also applies to instrument calibration, reference material, standards traceability, data validation, and other aspects of each laboratory's QAM.

In the event of a negative audit finding or any other circumstance, which raises doubt concerning the laboratory's competence or compliance with required procedures, the laboratory ensures that those areas of concern are quickly investigated. A resolution of the situation is promptly sought and, where necessary, recalibration and retesting are conducted. Records of events and corrective actions taken by the laboratory to resolve issues and to prevent further occurrences are maintained. Additional information on laboratory corrective actions is described in each laboratory's QAM (Section 4.11 Pace Analytical and Chemtech-Ford and Section 9.6 H&P).

B8 Inspection/Acceptance Requirements for Supplies and Consumables

Sample containers and other dedicated consumables will meet EPA criteria for cleaning procedures required for low-level chemical analysis. Sample containers will be certified by the manufacturer, in accordance with pre-cleaning criteria established by EPA in “*Specifications and Guidelines for Obtaining Contaminant-Free Sample Containers*.” The certificates of cleanliness are maintained by the container suppliers and can be obtained upon request using the container batch and lot numbers. Sample containers and sample preservatives (where applicable) will be provided by the laboratory. The containers shall be pre-preserved, if possible, prior to the sampling event, if required. In addition, the laboratory will supply the laboratory-grade deionized water for the field and equipment blanks. The laboratory-grade deionized water may be prepared by the laboratory in-house, but the laboratory must have a routine procedure in place to analyze the water to ensure the deionized water’s quality. New disposable nitrile sampling gloves will be used during collection of samples and will be discarded after collection of each sample. New disposable water filters (if required), bailers, and/or tubing will be used to collect aqueous samples and will be discarded after use. New disposable tubing and connections and a dedicated flow controller will be used to collect each soil gas sample. Prior to use, the materials provided by the laboratory or other suppliers will be inspected visually for signs of tampering, contamination, or damage. No evidence of tampering, contamination, or damage will be acceptable. The field team leader will be responsible for the inspection. Reserves of field supplies and consumables are stored and maintained in Terracon’s secured storage warehouse and used as needed by field personnel for each day’s field activities, and the reserves of consumables are re-ordered/replenished as needed by Terracon staff.

B9 Data Acquisition of Non-direct Measurements

Additional data may be collected and used for site characterization following SOPs. The QA procedures will be followed throughout the investigation. External sources of existing data may also be used (for example, computer databases or regulatory files of previously investigated sites); such information will be used only for reference. This type of data will be considered non-definitive for the purpose of assessing selected sites, unless the data was collected following an Agency-approved RAP, evaluated following a QAPP that meets or exceeds the requirements provided in this QAPP, validated, and deemed definitive.

B10 Data Management

The results of the field activities will be compiled and detailed in reports. Please refer to [Section A9](#) for information pertaining to documentation that will be generated during the course of the project, and storage requirements for these records.

Data will be processed using commercially available word processing, spreadsheet, and/or database programs. During transcription of field measurements, each entry will be double-

checked immediately after each transcription from field logbooks and forms. Example forms for typical field data collection are included in [Appendix B](#). To minimize potential errors in laboratory data transcription, the use of electronic data deliverables (EDDs) will be maximized during data entry to summary tables and databases. The control mechanism to detect and correct possible errors in data transcription, reduction, reporting, and data entry to forms, reports, and databases will be the senior peer review of documents by the Consultant Project Manager and Consultant QA/QC Officer. Data will be stored electronically, both on a local server hard drive (subject to daily backup on a separate file server) and on the laboratory's LIMS database system and can be retrieved via the local server and via the laboratory's secured online data access system. Please refer to [Appendix A](#) (Laboratory's QAM) for information relating to procedures used and individuals responsible for laboratory data processing, transmittal, storage/archival, and hardware/software configurations.

Group C Assessment/Oversight

C1 Assessment Activities

The Consultant QA/QC Officer will conduct the assessment and oversight activities. There will be three primary activities conducted by the Consultant QA/QC Officer:

- **Surveillance Level Oversight:** The Consultant Project Manager will coordinate the investigation, with independent oversight by the Consultant QA/QC Officer. Both these individuals will have authority to stop work in the event of unsafe work conditions or deviation from SOPs. In the event of unsafe work conditions, field personnel and on-site contractors will also have authority to stop work and will contact the Consultant Project Manager for resolution. Deviations from the QAPP will be addressed immediately to ensure the quality of the data. Surveillance level oversight will be conducted throughout the duration of field activities.
- **Performance Evaluations:** The Consultant QA/QC Officer will verify that the laboratory certifications and methods are current and approved by the NELAP, prior to the initiation of field sampling.
- **Data Quality Validation Summary:** After the receipt of analytical data sets from the laboratory, the Consultant Project Manager will perform an initial review of the data, followed by a data validation review by the Consultant QA/QC Officer to determine whether DQOs were met and evaluate the overall usability of the data. The results of these data validation reviews will be communicated to the Consultant Project Manager, who will notify the laboratory if the need for corrective actions is identified. In this case, the laboratory will be required to perform and verify corrective actions taken, which will then be documented in an amended laboratory report identifying the corrective actions taken and resulting changes to the analytical results. In addition, the data validation reviews will form the basis for development of data validation summaries for inclusion with the final site investigation reports.

- Salt Lake City Corporation Review: Once the work has been completed, performance evaluations have been conducted, and the data has been validated, a report including this data will be submitted to Salt Lake City Corporation for review and further data assessment and validation.

C2 Reports to Management

Data validation summaries will be included as part of the final reports detailing the field activities. If laboratory corrective actions are required, the Consultant Project Manager will notify Salt Lake City Corporation, and final reports will include copies of the final approved laboratory reports. If field corrective actions are required, the problem and corrective action will be recorded in the field logbook and will also be documented in the final report. Copies of the final reports detailing the investigations will be sent to all parties listed in [Section A3 Distribution List](#).

Group D Data Validation and Usability

D1 Data Review

Following receipt of the laboratory analytical results and initial review by the Consultant Project Manager, the data will be forwarded to the Consultant QA/QC Officer for review which will include initial screening to evaluate whether any of the data is flagged or if laboratory control limits were not met. Upon acceptance of the data from the laboratory, the data will be validated. The data validation process evaluates whether the specific requirements for an intended use have been fulfilled and ensures that the results conform to the users' needs. Please see [Table 1 – Data Quality Indicators](#) and [Section D3](#) for further explanation of the data quality process.

D2 Validation and Verification Methods

The laboratory data will be subject to internal reduction and validation by the laboratory prior to external release of the data, as detailed in the laboratory's QAM in [Appendix A](#).

Following receipt of data released by the laboratory, additional data validation and verification will be conducted by the Consultant QA/QC Officer, using the criteria described in [Section B5.1](#) and [Table 2](#), and including review of chain of custody and laboratory log-in records. Data will be reviewed as it is received throughout the project. Each laboratory data set will be provided by the laboratory and will include the final analytical report with qualifiers where necessary; case narratives, chain-of-custody records; and results for method blanks, MS/MSD analyses with control limits; LCS/LCSD summary with control limits; reporting limits listed on all reports; and surrogate recoveries.

Laboratory QC issues will be addressed by communication between the Consultant QA/QC Officer and laboratory personnel. Problems identified in sample collection, handling, preservation, and documentation will be addressed with the Consultant Project Manager and field staff.

Deviations from the QA goals will be evaluated in terms of their effect on data usability based on compliance with the QA/QC Goals in Table 1. The degree of sample deviation beyond the acceptance limit will be evaluated for its potential effect on data usability, contribution to the quality of the reduced and analyzed data, and on decision-making for the project. The final reports provided to Salt Lake City Corporation will include a discussion of data usability due to deviations from the RAP or QA goals summarized by the Consultant QA/QC Officer.

D3 Reconciliation with User Requirements

Following the validation of field and laboratory data, the data and information will be reconciled with the project objectives to assess the overall success of sampling activities. Qualitative DQOs will be reviewed through a narrative discussion of the results to include limitations, if any, on data use due to uncertainties posed by any flagged data or elevated laboratory reporting limits. If such uncertainties result in significant hindrances to data usability, practical follow-up actions (for example, limited resampling) may be recommended, as warranted.

Data that does not meet the DQIs/DQOs will be assessed based on the site data for usability based on the site data. The data quality reviewer will include explanations regarding the usability of non-compliant data and/or invalid data to data users. Comments will be provided in the reports regarding whether the data uncertainties impact the overall conclusions of the reports.

Group E References

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QAPP Tables



Table 1 Data Quality Indicators (DQIs)

Parameter	QC Program	Evaluation Criteria	Summary of QA / QC Goals
Precision	<u>Laboratory Precision</u> LCS/LCSD Pairs MS/MSD Pairs <u>Field Precision</u> Field Duplicate Pairs	RPD ^a	<u>Laboratory Precision</u> LCS/LCSD RPDs and MS/MSD RPDs will be less than the laboratory-derived limits <u>Field Precision</u> Field Duplicate Pair RPDs will be less than ± 25% (aqueous samples) and ± 50% (solid samples) when detected concentrations are ≥ 5x the RDL. When detected concentrations are <5x the RDL and the difference between the reported concentrations is less than or equal to the RDL value (for aqueous samples) or less than twice the RDL (for soil/solid samples), the samples will be considered within control
Bias	LCS/LCSD	Percent Recovery ^b	LCS/LCSD percent recoveries will vary by sample medium, analyte, and method, and control limits may be either method defaults or laboratory derived.
	MS/MSD	Percent Recovery ^b	MS/MSD percent recoveries will vary by sample medium, analyte, and method, and control limits may be either method defaults or laboratory derived.
Accuracy ^c	Method Blanks	RDL	Less than RDL
	Equipment Blanks	RDL	Less than RDL
Representativeness	RAPs and SOPs	Qualitative determination of RAP and SOP adherence	Samples collected following site-specific RAP and SOPs
	Holding Times	Holding Times	All samples analyzed within holding times
	Field/Equipment/Trip Blanks	RDL	Less than RDL
Comparability	Units of Measure	Metric Units	100% of sample results reported in same units
	Analytical Methods	Approved Methods	100% of samples analyzed using approved methods
	Standardized Sampling	Qualitative determination of RAP and SOP adherence	Samples collected following site-specific RAP and SOPs
	QC Samples 10% Field Duplicates 10% Field Blanks (or as described in RAP) Lab QA	Verify Verify Verify	100% compliance 100% compliance 100% compliance
Completeness	Complete Sampling	Percent Valid Data	90% or more of the planned measurements are valid
Sensitivity	Sample analyses	RDL	100% of RDLs are less than Performance Standards

a: RPD (Relative Percent Difference) = $\frac{X_1 - X_2}{\left(\frac{X_1 + X_2}{2}\right)} \times 100$; where X₁ and X₂ are the reported concentrations of the samples being evaluated.

b: Percent Recovery = $\frac{X_s - X_i}{SC} \times 100$; where X_s = concentration measured in spiked sample, X_i = concentration measured prior to spiking, and SC = spike concentration.

c: Instrument calibration, reference material, standards traceability, and data validation will follow Pace Analytical's Standard Operating Procedures.

LCS/LCSD – Laboratory Control Sample/Laboratory Control Sample Duplicate

MS/MSD – Matrix Spike/Matrix Spike Duplicate

RDL – Laboratory Reported Detection Limit

RPD – Relative Percent Difference

RAP – Sampling and Analysis Plan

SOP – Standard Operating Procedure

Table 2
Data Validation and Verification Methods

Data Validation and Verification Requirements	Data Validation and Verification Methods
Samples were collected as per scheduled locations and frequency.	Comparison with RAP.
Sample collection and handling followed specific procedures (i.e., relevant SOPs and chain-of-custody procedures).	Review of field notes, sampling logs and COCs. Surveillance-level oversight of field procedures to maximize consistency in field.
Appropriate analytical methods were used, and internal laboratory calibration checks were performed according to the method-specified protocol.	Review of analytical methods and case narratives provided with laboratory reports. Maintain documentation of communications with laboratory regarding problems or corrective actions.
Required holding times and laboratory reporting limits were met.	Comparison with specified holding times and RDLs.
Recovery acceptance limits for field and laboratory QC samples (MS/MSD, LCS/LCSD, and method blanks) were met.	Comparison with specified acceptance limits. Comparison with Data Quality Indicators.
Appropriate steps were taken to maintain the accuracy of data reduction, including reducing data transfer errors in the preparation of summary data tables and maps.	Maintaining a permanent file of hard copies of laboratory analytical reports. Minimizing retyping of data. Double-checking values entered into databases, tables, and maps against laboratory reports.

TABLE 3
SCREENING LEVELS FOR CONTAMINANTS OF CONCERN - VOCs

CAS#	Parameter	EPA RSL Soil Residential	EPA RSL Soil Industrial	Utah DEQ-DERR ISL		Utah DEQ-DERR Tier 1		EPA MCL	EPA VISL Target Groundwater Concentration Residential	EPA VISL Target Groundwater Concentration Commercial	MDL (Soil)	MDL (Water)
				Soil	GW	Soil	GW					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)	(mg/kg)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/kg)	(ug/L)
67-64-1	Acetone	70,000	1,100,000	NE	NE	NE	NE	NE	NE	NE	0.01	11.3
107-13-1	Acrylonitrile	0.25	1.1	NE	NE	NE	NE	NE	0.01	0.032	0.00179	0.671
71-43-2	Benzene	1.2	5.1	0.2	0.005	0.9	0.3	0.005	0.00159	0.00693	0.00027	0.0941
108-86-1	Bromobenzene	290	1,800	NE	NE	NE	NE	NE	0.62	2.6	0.000284	0.118
75-27-4	Bromodichloromethane	0.29	1.3	NE	NE	NE	NE	0.08	0.000876	0.00382	0.000254	0.136
75-25-2	Bromoform	19	86	NE	NE	NE	NE	0.08	0.117	0.51	0.000424	0.129
74-83-9	Bromomethane	6.8	30	NE	NE	NE	NE	NE	0.0174	0.073	0.00134	0.605
104-51-8	n-Butylbenzene	3,900	58,000	NE	NE	NE	NE	NE	NE	NE	0.000258	0.157
135-98-8	sec-Butylbenzene	7,800	120,000	NE	NE	NE	NE	NE	NE	NE	0.000201	0.125
98-06-6	tert-Butylbenzene	7,800	120,000	NE	NE	NE	NE	NE	NE	NE	0.000206	0.127
56-23-5	Carbon tetrachloride	0.65	2.9	NE	NE	NE	NE	0.005	0.000415	0.00181	0.000328	0.128
108-90-7	Chlorobenzene	280	1,300	NE	NE	NE	NE	0.1	0	1.72	0.000212	0.116
124-48-1	Chlorodibromomethane	8.3	39	NE	NE	NE	NE	0.08	NE	NE	0.000373	0.14
75-00-3	Chloroethane	5,400	23,000	NE	NE	NE	NE	NE	23	96.5	0.000946	0.192
67-66-3	Chloroform	0.32	1.4	NE	NE	NE	NE	0.08	0.000814	0.00355	0.000229	0.111
74-87-3	Chloromethane	110	460	NE	NE	NE	NE	NE	0	1.09	0.000375	0.96
95-49-8	2-Chlorotoluene	1,600	23,000	NE	NE	NE	NE	NE	NE	NE	0.000301	0.106
106-43-4	4-Chlorotoluene	1,600	23,000	NE	NE	NE	NE	NE	NE	NE	0.00024	0.114
96-12-8	1,2-Dibromo-3-Chloropropane	0.0053	0.064	NE	NE	NE	NE	0.0002	0.0000281	0.00034	0.00105	0.000276
106-93-4	1,2-Dibromoethane	0.036	0.16	NE	NE	NE	NE	0.00005	0.000176	0.000769	0.000343	0.000126
74-95-3	Dibromomethane	24	99	NE	NE	NE	NE	NE	0	0.521	0.000382	0.000122
95-50-1	1,2-Dichlorobenzene	1,800	9,300	NE	NE	NE	NE	0.6	2.66	11.2	0.000305	0.000107
106-46-7	1,4-Dichlorobenzene	2.6	11	NE	NE	NE	NE	0.075	0.00259	0.0113	0.000226	0.12
75-71-8	Dichlorodifluoromethane	87	370	NE	NE	NE	NE	NE	0.00744	0.0312	0.000713	0.374
75-34-3	1,1-Dichloroethane	3.6	16	NE	NE	NE	NE	NE	0.00764	0.0334	0.000199	0.1
107-06-2	1,2-Dichloroethane	0.46	2	NE	NE	NE	NE	0.005	0.00224	0.00978	0.000265	0.0819
75-35-4	1,1-Dichloroethene	4.8	20	NE	NE	NE	NE	0.007	0.00387	0.0163	0.000606	0.188
156-59-2	cis-1,2-Dichloroethene	63	370	NE	NE	NE	NE	0.07	NE	NE	0.000235	0.126
156-60-5	trans-1,2-Dichloroethene	70	300	NE	NE	NE	NE	0.1	0.109	0.457	0.000264	0.149
78-87-5	1,2-Dichloropropane	2.5	11	NE	NE	NE	NE	0.005	0.00658	0.0287	0.000358	0.149
142-28-9	1,3-Dichloropropane	1,600	23,000	NE	NE	NE	NE	NE	NE	NE	0.000279	0.11
108-20-3	Di-isopropyl ether	2,200	9,400	NE	NE	NE	NE	NE	7	29.3	0.000248	0.105
100-41-4	Ethylbenzene	5.8	25	5	0.7	23	4	0.7	0.00349	0.0152	0.000297	0.137
87-68-3	Hexachloro-1,3-butadiene	1.2	5.3	NE	NE	NE	NE	NE	0.000303	0.00132	0.000342	0.337
98-82-8	Isopropylbenzene (Cumene)	1,900	9,900	NE	NE	NE	NE	NE	1	3.73	0.000243	0.105

TABLE 3
SCREENING LEVELS FOR CONTAMINANTS OF CONCERN - VOCs

CAS#	Parameter	EPA RSL Soil Residential	EPA RSL Soil Industrial	Utah DEQ-DERR ISL		Utah DEQ-DERR Tier 1		EPA MCL	EPA VISL Target Groundwater Concentration Residential	EPA VISL Target Groundwater Concentration Commercial	MDL (Soil)	MDL (Water)
				Soil	GW	Soil	GW					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)	(mg/kg)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/kg)	(ug/L)
78-93-3	2-Butanone (MEK)	27,000	190,000	NE	NE	NE	NE	NE	2,240	9,410	0.00468	0.119
75-09-2	Methylene Chloride	57	1,000	NE	NE	NE	NE	0.005	1	9.23	0.001	0.43
108-10-1	4-Methyl-2-pentanone (MIBK)	33,000	140,000	NE	NE	NE	NE	NE	555	2,330	0.00188	0.478
1634-04-4	Methyl tert-butyl ether	47	210	0.3	0.2	0.3	0.2	NE	0.45	1.97	0.000212	0.101
91-20-3	Naphthalene	2	8.6	51	0.7	51	0.7	NE	0.00459	0.0201	0.001	1.0
103-65-1	n-Propylbenzene	3,800	24,000	NE	NE	NE	NE	NE	2	10.2	0.000206	0.0993
100-42-5	Styrene	6,000	35,000	NE	NE	NE	NE	0.1	9	39	0.000234	0.118
630-20-6	1,1,1,2-Tetrachloroethane	2	8.8	NE	NE	NE	NE	NE	0.00	0.0162	0.000264	0.147
79-34-5	1,1,2,2-Tetrachloroethane	0.6	2.7	NE	NE	NE	NE	NE	0.00323	0.0141	0.000365	0.133
76-13-1	1,1,2-Trichlorotrifluoroethane	6,700	28,000	NE	NE	NE	NE	NE	0.242	1.02	0.000365	0.18
127-18-4	Tetrachloroethene	24	100	NE	NE	NE	NE	0.005	0.0149	0.0652	0.000276	0.3
108-88-3	Toluene	4,900	47,000	9	1	25	3	1	19	80.7	0.000434	0.278
87-61-6	1,2,3-Trichlorobenzene	63	930	NE	NE	NE	NE	NE	NE	NE	0.000306	0.23
120-82-1	1,2,4-Trichlorobenzene	24	110	NE	NE	NE	NE	0.07	0.0359	0.151	0.000388	0.481
71-55-6	1,1,1-Trichloroethane	8,100	36,000	NE	NE	NE	NE	0.2	7	31.1	0.000286	0.149
79-00-5	1,1,2-Trichloroethane	1.1	5	NE	NE	NE	NE	0.005	0.005	0.023	0.000277	0.158
79-01-6	Trichloroethene	0.94	6	NE	NE	NE	NE	0.005	0.00119	0.00743	0.000279	0.19
75-69-4	Trichlorofluoromethane	23,000	350,000	NE	NE	NE	NE	NE	NE	NE	0.000382	0.16
96-18-4	1,2,3-Trichloropropane	0.0051	0.11	NE	NE	NE	NE	NE	0.0223	0.0937	0.000741	0.237
95-63-6	1,2,4-Trimethylbenzene	300	1,800	NE	NE	NE	NE	NE	0.248	1.04	0.000211	0.104
526-73-8	1,2,3-Trimethylbenzene	340	2,000	NE	NE	NE	NE	NE	0	1.47	0.000287	0.322
108-67-8	1,3,5-Trimethylbenzene	270	1,500	NE	NE	NE	NE	NE	0	0.733	0.000266	0.104
75-01-4	Vinyl chloride	0.059	1.7	NE	NE	NE	NE	0.002	0.000147	0.00245	0.000291	0.234
1330-20-7	Xylenes, Total	580	2,500	142	10	142	10	10	0.000698	0.174	385	1,620

CAS – Chemical Abstracts Service, MDL - Laboratory Method Detection Limit, NE- not established

DEQ-DERR - Utah Department of Environmental Quality, Division of Environmental Response

EPA RSL – EPA Regional Screening Level

EPA MCL - EPA Maximum Contaminant Level, EPA VISL – Vapor Intrusion Screening Level Target Ground Water Conc. @ TCR = 1E-06 and THQ = 1

mg/kg – milligrams per kilogram, mg/L – milligrams per liter, µg/L - micrograms per liter

TABLE 4
SCREENING LEVELS FOR CONTAMINANTS OF CONCERN - METALS

Analyte	CAS No.	EPA RSL Residential Soil	EPA RSL Industrial Soil	EPA MCL	Method Detection Limits	
		(mg/kg)	(mg/kg)		Soil (mg/kg)	Water (mg/L)
Arsenic	7440-38-2	21.4 ¹		0.01	0.518	0.0044
Barium	7440-39-3	15,000	220,000	2	0.0852	0.000736
Cadmium	7440-43-9	7.1	100	0.005	0.0471	0.000479
Hexavalent Chromium	18540-29-9	0.95	20	0.1 ²	0.255	0.00015
Lead	7439-92-1	200	800	0.01	0.208	0.000299
Mercury	7439-97-6	7.1	30	0.002	0.018	0.0001
Selenium	7782-49-2	390	5,800	0.05	0.764	0.0074
Silver	7440-22-4	390	5,800	NE	0.127	0.00154

EPA RSL - United States Environmental Protection Agency Regional Screening Level

CAS – Chemical Abstracts Service, mg/kg – milligrams per kilogram, mg/L – milligrams per liter

MCL - Maximum Contaminant Level, NA - not applicable, NE - not established

1 - Calculated background threshold value, as detailed in Appendix F of the Remedial Action Plan.

2 - The MCL listed is the total chromium MCL. No MCL exists for hexavalent chromium.

TABLE 5
VAPOR INTRUSION SCREENING LEVELS (VISLs) FOR VOCs IN SOIL VAPOR AND INDOOR AIR

CAS No.	Parameter	EPA Residential VISL TSSNSGC	EPA Commercial VISL TSSNSGC	EPA Residential Indoor Air VISL	EPA Commercial Indoor Air VISL	MDL (ug/m ³)
		ug/m ³	ug/m ³	ug/m ³	ug/m ³	
71-55-6	1,1,1-Trichloroethane	174,000	730,000	5,210	21,900	2.2
79-34-5	1,1,2,2-Tetrachloroethane	1.61	7.05	0.0484	0.211	2.8
630-20-6	1,1,1,2-Tetrachloroethane	12.6	55.2	0.379	1.66	2.8
79-00-5	1,1,2-Trichloroethane	5.85	25.6	0.175	0.767	2.2
76-13-1	1,1,2-Trichlorotrifluoroethane (F113)	174,000	730,000	5,210	21,900	3.1
75-34-3	1,1-Dichloroethane	58.5	256	1.75	7.67	1.6
75-35-4	1,1-Dichloroethene	138	578	4.13	17.3	1.6
120-82-1	1,2,4-Trichlorobenzene	69.5	292	2.09	8.76	7.5
95-63-6	1,2,4-Trimethylbenzene	2,090	8,760	62.6	263	2
106-93-4	1,2-Dibromoethane (EDB)	0.156	0.681	0.00468	0.0204	3.1
95-50-1	1,2-Dichlorobenzene	6,950	29,200	209	876	2.4
107-06-2	1,2-Dichloroethane (EDC)	3.6	15.7	0.108	0.472	1.6
78-87-5	1,2-Dichloropropane	25.3	110	0.759	3.31	1.9
108-67-8	1,3,5-Trimethylbenzene	2,090	8,760	62.6	263	2
541-73-1	1,3-Dichlorobenzene	NE	NE	NE	NE	2.4
106-46-7	1,4-Dichlorobenzene	8.51	37.2	0.255	1.11	2.4
78-93-3	2-Butanone (MEK)	174,000	730,000	5,210	21,900	2.4
591-78-6	2-Hexanone (MBK)	1,040	4,380	31.3	131	3.3
622-96-8	4-Ethyltoluene	NE	NE	NE	NE	2
108-10-1	4-Methyl-2-pentanone (MIBK)	104,000	438,000	3,130	13,100	3.3
71-43-2	Benzene	12	52.4	0.36	1.57	0.6
75-27-4	Bromodichloromethane	2.53	11	0.0759	0.331	2.7
75-25-2	Bromoform	85.1	372	2.55	11.1	4.2
74-83-9	Bromomethane	174	730	5.21	21.9	1.6
75-15-0	Carbon disulfide	24,300	102,000	730	3,070	1.3
56-23-5	Carbon tetrachloride	15.6	68.1	0.468	2.04	1.3
108-90-7	Chlorobenzene	1,740	7,300	52.1	219	1.9
75-00-3	Chloroethane	139,000	584,000	4,170	17,500	1.1
67-66-3	Chloroform	4.07	17.8	0.122	0.533	1
74-87-3	Chloromethane	3,130	13,100	93.9	394	0.8
156-59-2	cis-1,2-Dichloroethene	1390	5840	41.7	175	1.6
10061-01-5	cis-1,3-Dichloropropene	NE	NE	NE	NE	1.8
124-48-1	Dibromochloromethane	NE	NE	NE	NE	3.5
75-71-8	Dichlorodifluoromethane (F12)	3,480	14,600	104	438	4
76-14-2	Dichlorotetrafluoroethane (F114)	NE	NE	NE	NE	2.8
100-41-4	Ethylbenzene	37.4	164	1.12	4.91	1.8
87-68-3	Hexachlorobutadiene	4.25	18.6	0.128	0.557	10.7
179601-23-1	m,p-Xylene	6,960	29,200	104	438	1.8
75-09-2	Methylene chloride (Dichloromethane)	3,380	40,900	101	1,230	1.4
95-47-6	o-Xylene	3,480	14,600	104	438	1.8
100-42-5	Styrene	34800	146,000	1,040	4,380	1.7
127-18-4	Tetrachloroethene	360	1570	10.8	47.2	2.8
108-88-3	Toluene	174,000	730,000	5,210	21,900	3.1
156-60-5	trans-1,2-Dichloroethene	1,390	5,840	41.7	175	1.6
10061-02-6	trans-1,3-Dichloropropene	NE	NE	NE	NE	1.8
79-01-6	Trichloroethene	15.9	99.7	0.478	2.99	2.2
75-69-4	Trichlorofluoromethane (F11)	NE	NE	NE	NE	2.3
75-01-4	Vinyl chloride	5.59	92.9	0.168	2.79	0.5

CAS - Chemical Abstract Service, (ug/m³) - micrograms per cubic meter, NE - Not Established

EPA Vapor Intrusion Screening Level (VISL) Target Sub-Slab and Near-source Soil Gas Concentration (TSSNSGC), assuming a target risk for carcinogens of 1.00E-06 and a target hazard quotient for non-carcinogens of 1

MDL - Method Detection Limit (per H&P Mobile Geochemistry, Inc.)

VOCs - Volatile Organic Compounds

TABLE 6
ANALYTICAL METHOD SUMMARY

Parameter	Matrix (Solid/Liquid/Soil Gas)	Analytical Method	Sample Container/ Preservative	Holding Time	Laboratory Method Detection Limit (MDL)
VOCs	Soil	SW-846 8260	4 oz glass, none, 4°C	14 days	0.01 to 0.0004 mg/kg
VOCs	Groundwater	SW-846 8260	3 x 40 ml vial glass, HCl, 4°C	14 days	0.01 to 0.000212 mg/L
Metals	Soil	SW-846 6000, 7000 Series	4 oz glass, none, 4°C	180 days ¹	0.0843 to 0.2 mg/kg
VOCs	Soil Vapor	TO-15	1 x Summa, none	30 days	0.587-6.32 ug/m ³
VOCs	Indoor Air	TO-15	1 x Summa, none	30 days	0.587-6.32 ug/m ³

HCl - hydrochloric acid, ml - milliliters, oz - ounces

MDL - Method Detection Limit

mg/kg - milligrams per kilogram, mg/L - milligrams per liter, ug/m³ - micrograms per cubic meter

VOCs - Volatile Organic Compounds

1 - Mercury has a 28-day holding time.

TABLE 7
SUMMARY OF SAMPLE LOCATIONS

Sample Location	Rationale	Sample Interval	Sample Matrix	Analytes
MW-1 through MW-5	Characterization of groundwater	Groundwater Interval	Groundwater	VOCs
S-1 through S-11 (Interior Excavation)	Confirmation that interior residual soil concentrations after removal of subsurface features are below EPA Industrial RSLs	Confirmation soil samples - various depths ¹	Soil	VOCs, Arsenic
SP-# (Stockpile Characterization)	Waste Characterization	Stockpiled soil from the excavations; one 5-point composite	Soil	ET Waste Profile
VP-# and IA-# (Vapor Pin and Indoor Air Samples)	Assess VOC concentrations in sub-slab vapor and indoor air prior to VIMS design	Soil gas below the floor slab and indoor ambient air	Soil Vapor and Ambient Air	VOCs

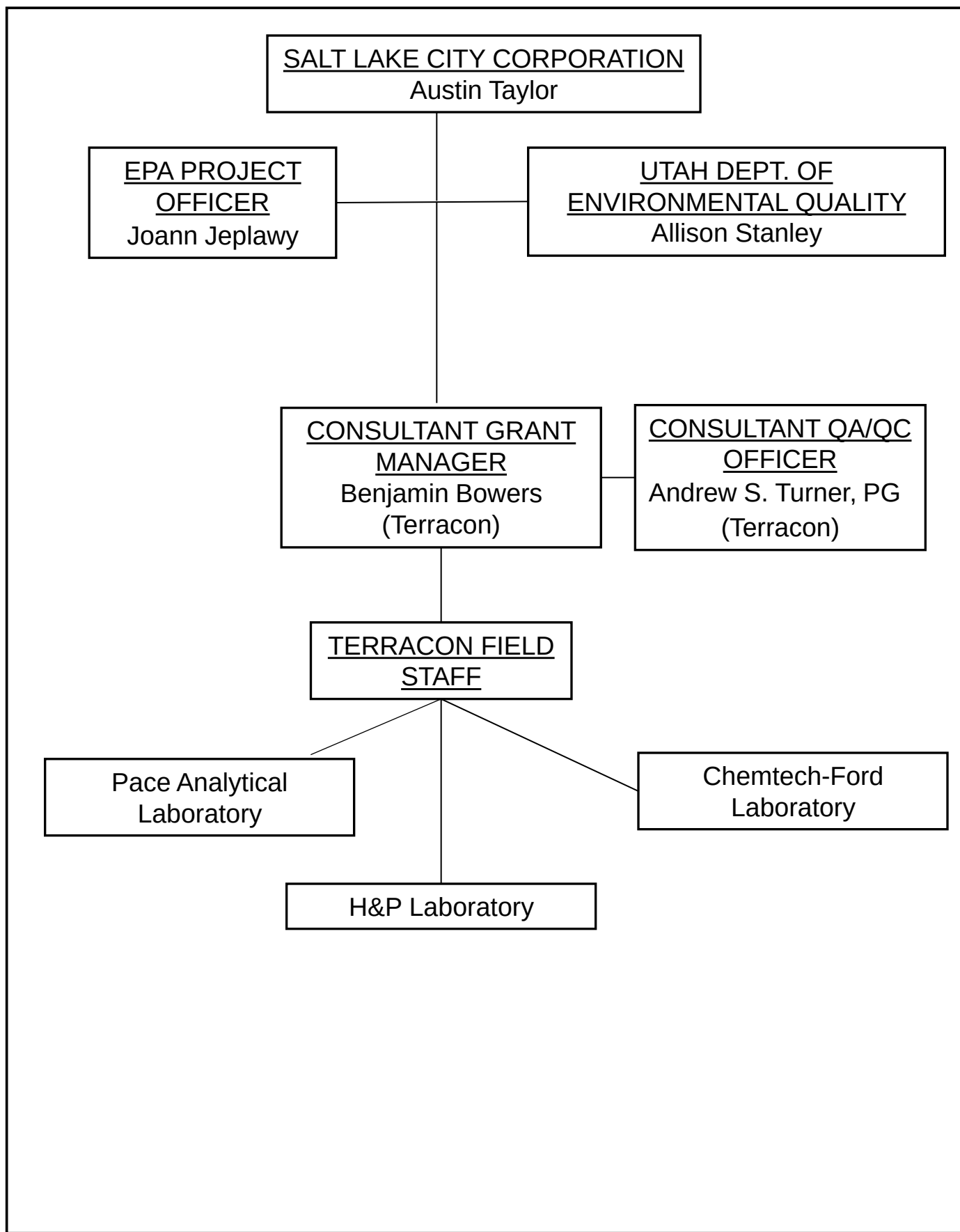
bgs - below ground surface

VOCs - Volatile Organic Compounds by EPA Method 8260 for groundwater and confirmation soil samples and by EPA Method TO-15 for air soil vapor samples.

Arsenic by EPA Method 6010, or similar.

1 - Soil sample collection locations will be at the walls and floors of final excavation widths and depths.

QAPP Figure



Project Manager BBB	Project No. 61247165	 6949 South High Tech Drive Midvale, Utah 84047 PH. (801) 545-8500 FAX. (801) 545-8600	PROJECT ORGANIZATION CHART	FIGURE
Drawn By: JH	Scale: NA		FORMER SCHOVAERS CLEANUP GRANT	1
Checked By: BBB	File Name: F1 Org Chart		Salt Lake City, Utah	
Approved By:. BBB	Date: 7/2024			

QAPP Appendix A
Pace Analytical, Chemtech-Ford,
and H&P Quality Assurance Manuals



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Laurence Hayden Approved on 9/1/2022 1:01:26 PM

Robert Johnson Approved on 8/15/2022 4:06:20 PM

Elizabeth Turner Approved on 9/1/2022 7:55:17 PM

Rebecca King Approved on 9/2/2022 8:32:34 AM

Title Page

Quality Manual

Pace Analytical Services, LLC

Prepared for:

ESC dba Pace® Analytical National Center for Testing and Innovation

12065 Lebanon Road

Mt. Juliet, TN 37122

Phone: 615-773-5858

Parent Company: Pace® Analytical Services, LLC

Signatory Attestation: I attest the application of my electronic signature on this title page affirms my management commitment and responsibility to uphold the requirements of the PAS Quality Management System (QMS) described in this Quality Manual (manual) at each location for which this manual is prepared.

Refer to the Quality Manual Signatory Page to view the job title and physical address for each signatory.

Quality Manual Approval Signatories

The following individuals represent the PAS corporate and local management team responsible for implementing the PAS Quality Management System (QMS) and upholding the requirements of this manual at the location(s) for which this manual was prepared, at the time this version of the manual was made effective, and that correlate with the electronic signatures shown on the title page of this manual.

If these persons(s) change positions, leave the company, or are on extended leave of absence, the approval of this manual automatically transfers to the person replacing the signatory or to the signatory's primary or alternate deputy until the manager is replaced and/or the manager returns to work. The individual replacing the signatory automatically accepts the responsibilities associated with the original signatory's attestation. Refer to Section 4.1.5.1.1 of this manual for the deputies assigned to key personnel job titles.

The manual is not revised and released under an updated version for the sole purpose of updating personnel change(s). Personnel information is updated when the next revision of the manual is released. See manual Sections 1.2.1 and 1.2.2 for more information about how this manual is maintained.

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1.0 PURPOSE AND SCOPE

1.1 Purpose

This quality manual (manual) outlines the quality management system (QMS) and management structure of Pace® Analytical Services, LLC. Pace® Analytical Services, LLC is referred to by brand name Pace® Analytical Services and by the acronyms PAS or ENV. The acronyms PAS and ENV are interchangeable.

The PAS QMS is also referred to as the quality program throughout this manual and other PAS documents. The phrases “quality management system” and “quality program” are synonymous and are referred to by the acronym QMS.

The QMS is the collection of policies and processes established by the senior leaders of PAS (top management) to ensure the service and products provided by PAS consistently meet relevant requirements and achieves the goal of Pace® to provide customers with high quality, cost-effective, analytical measurements, and services.

The QMS is also planned to establish conformance¹ and compliance with the current published versions of the following international and national quality system standards:

- ISO/IEC 17025: *General requirements for the competence of testing and calibration laboratories*
- NELAC/TNI Standard Volume 1: *Management and Technical Requirements for Laboratories Performing Environmental Analysis*

¹The statement of conformity to these Standards pertains only to testing and sampling activities carried out by the laboratory at its physical address, in temporary or mobile facilities, in-network, or by laboratory personnel at a customer's facility.

In addition to the international and national standards, the QMS is planned to achieve regulatory compliance with the various federal and state programs for which PAS locations provide compliance testing and/or holds certification or accreditation. Federal or state requirements that do not apply to all PAS locations, are provided in addendum to this manual or in other documents that supplement the manual. Customer-specific project and program requirements are not included in the manual in order to maintain client confidentiality.

- A list of accreditation and certifications held by each location associated with this manual is provided in Appendix A.
- A list of analytical testing capabilities offered by each location associated with this manual is provided in Appendix B.

1.2 Scope and Application

This manual applies to each location listed on the Title Page of this manual, including PAS laboratories, satellite laboratories, service centers, and supporting business functions.

For purposes of the PAS QMS:

- The term “location” used in this manual refers to laboratories and/or service centers.
- The term “laboratory” refers to any PAS location, however named by Pace® that provides testing, collects samples (sampling), or conducts field measurement services in a fixed building, mobile unit, or in-situ (field).

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- The phrase “service center” refers to any PAS location, however named by Pace® that does not perform any testing, sampling, or field measurements.
- The phrase “satellite laboratory” refers to a limited-service laboratory affiliated to a larger business unit or location. Some PAS business groups, such as accounting, may refer to a satellite laboratory as a “service center.” Irrespective of internal jargon or reference by any group, any PAS location that generates a test result for external use is a “laboratory” and must comply with the requirements specified in this manual for all analytical testing services.

PAS locations are defined by physical address. Laboratories are defined by physical address and certification/accreditation ID except mobile units which may be defined by the address of the location to which they are assigned, by VIN (vehicle identification number), or by certification/accreditation ID. Laboratories that provide sampling and field testing are defined by the physical address of the PAS location to which they are affiliated and that manages these activities.

1.2.1 Quality Manual Template

This manual was prepared using the PAS Quality Manual Template (template) created by the PAS Corporate Quality Director (CQD).

The template, known as document ID ENV-TMP-CORQ-0007, specifies the minimum requirements that every PAS location must abide by, regardless of scope of services or number of personnel, to maintain a quality program that achieves the objectives of the PAS Quality Policy (See Section 4.2.2).

The template is the mechanism used by top management to communicate to PAS personnel their commitment to continuously develop and improve the QMS for effectiveness, to meet customer expectations, and to comply with any statutory and regulatory requirements. Their signature of approval on this template is the mechanism used to document this responsibility.

“Top Management” is the phrase used by the TNI Standard to refer to the leaders of an organization that develop and/or release the PAS Quality Policy Statement and QMS under their authority

For PAS, these managers include the Chief Executive Officer (CEO) and Chief Compliance Officer (CCO) of Pace® and the President, CQD, Senior Vice President of Operations (Sr. VPO), and the Chief Technical Officer (CTO) of PAS.

The template and instructions for use of the template are released by corporate quality personnel to local quality managers responsible for each location (Local QM). The local QM uses the template to prepare the location manual by following the instructions provided to them. The local QM may not alter the font, structure, or content of the template, except where specified by instruction to do so. As previously stated, program specific requirements unique to each location are provided in addendum or in documents that supplement the manual.

The template is reviewed by corporate quality personnel annually and updated, if needed. More frequent review and revision may occur to manage change, to maintain conformance and compliance to relevant standards or to improve the QMS.

See standard operating procedure (SOP) ENV-SOP-CORQ-00015 *Document Management and Control* for more information

1.2.2 Quality Manual

The quality manual is created from template ENV-TMP-CORQ-0007 by local quality personnel, who are also responsible for maintenance and management of the document.

- PAS locations are not permitted to alter content of the template when preparing their manual, except where specified in the template. Control of content in the manual is necessary to ensure consistency of implementation of the PAS quality program across the network.
- If additions or changes to the manual are needed to maintain regulatory compliance or conformance to relevant standards and these changes cannot be covered by addendum to the manual, the need for change must be raised to the PAS Corporate Quality Director, who will decide how to resolve the need.

The manual is approved for release by the management team listed on the Quality Manual Approval Signatory Page. The manager's electronic signature on the Title Page of the manual affirms their commitment to implement and uphold the requirements, processes, and procedures of the PAS QMS at each location for which the manual was prepared.

The manual is reviewed annually and updated with each release of a new version of the template, and as needed to update appendices and addendum. More frequent review and revision may be necessary when there are significant changes to the capabilities, and resources of the laboratory during the calendar year

See SOP ENV-SOP-CORQ-00015 *Document Management and Control* for more information.

1.2.3 References to Supporting Documents

The template and the manual include references to other organization documents that support the QMS such as policies and standard operating procedures (SOPs).

These references may include the document's document control number (DC#) and the document title. This information is subject to change at the discretion of PAS. The manual and/or template are updated to reflect the editorial change during the manual's next scheduled review/revision cycle or the next time a version of the manual is released, whichever is sooner.

Each location maintains a current list of documents used by the location to support the QMS. This list, known as the "Master List", is readily available to personnel for their use and it provides a cross reference to the legacy document ID, where applicable. Parties external to PAS may contact the location of interest to obtain the most current version of the Master List for their use as needed.

2.0 REFERENCES

References used to prepare this manual include:

- "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act." Federal Register, 40 CFR Part 136, most current version.
- "Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods." SW-846.
- "Methods for Chemical Analysis of Water and Wastes," EPA 600-4-79-020, 1979 Revised 1983, U.S. EPA.

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- U.S. EPA Contract Laboratory Program Statement of Work for Organic Analysis, current version.
- U.S. EPA Contract Laboratory Program Statement of Work for Inorganic Analysis, current version.
- “Standard Methods for the Examination of Water and Wastewater.” Current Edition APHA-AWWA-WPCF.
- “Annual Book of ASTM Standards,” Section 4: Construction, Volume 04.04: Soil and Rock; Building Stones, American Society of Testing and Materials.
- “Annual Book of ASTM Standards,” Section 11: Water and Environmental Technology, American Society of Testing and Materials.
- “NIOSH Manual of Analytical Methods,” U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health, most current version.
- “Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water,” U.S. EPA, Environmental Monitoring and Support Laboratory – Cincinnati (Sep 1986).
- Quality Assurance of Chemical Measurements, Taylor, John K.; Lewis Publishers, Inc. 1987.
- Methods for Non-conventional Pesticides Chemicals Analysis of Industrial and Municipal Wastewater, Test Methods, EPA-440/1-83/079C.
- Environmental Measurements Laboratory (EML) Procedures Manual, HASL-300, US DOE, February 1992.
- Requirements for Quality Control of Analytical Data, HAZWRAP, DOE/HWP-65/R1, July 1990.
- Quality Assurance Manual for Industrial Hygiene Chemistry, AIHA, most current version.
- National Environmental Laboratory Accreditation Conference (NELAC) Standard- most current version.
- ISO/IEC 17025, General requirements for the competence of testing and calibration laboratories, 2nd Edition 2005-05-15; 3rd Edition 2017-11

The following are implemented by normative reference to ISO/IEC 17025:

- ISO/IEC Guide 99, *International vocabulary of metrology – Basic and general concepts and associated terms*
- ISO/IEC 17000, *Conformity assessment – Vocabulary and general principles*
- Department of Defense Quality Systems Manual (QSM), most current version.
- TNI (The NELAC Institute) Standard, 2009 and 2016 versions.
- UCMR Laboratory Approval Requirements and Information Document, most current version.
- US EPA Drinking Water Manual, most current version.

3.0 TERMS AND DEFINITIONS

Refer to Appendix C for terms, acronyms, and definitions used in this manual and in other documents used by PAS to support the QMS.

4.0 MANAGEMENT REQUIREMENTS

4.1 Organization

4.1.1 Legal Identity

Pace[®] Analytical Services, LLC (Pace[®] Analytical Services) is the responsible entity authorized by the State of Minnesota to do business as a limited liability company, under the parent company, PAS Parent, Inc.

4.1.1.1 Change of Ownership

If there is a change of ownership, if a location goes out of business, or if the entire organization ceases to exist, PAS management is responsible to notify regulatory authorities of the change within the timeframe required by each state agency for which the location is certified or accredited.

Requirements for records and other business information are addressed in the ownership transfer agreement or in accordance with appropriate regulatory requirements, whichever takes precedence.

4.1.2 Compliance Responsibility

PAS management has the responsibility and authority to establish and implement procedures and to maintain resources necessary to assure its activities are carried out in such a way to meet the federal and statutory requirements in addition to the requirements of the PAS QMS. Also See Section 1.1.

4.1.3 Scope of the Quality Management System

The QMS applies to work carried out at each location covered by this manual including permanent facilities, at sites away from its permanent facilities, or in associated temporary or mobile facilities.

The permanent and mobile facilities to which this manual applies are listed on the Title Page of this manual.

4.1.4 Organization History and Information

Founded in 1978, Pace[®] Analytical Services, LLC (PAS) is a privately held scientific services firm operating one of the largest full-service contract laboratory and service center networks in the United States.

The business purpose of PAS is to deliver the highest standard of testing and scientific services in the market. We offer the most advanced solutions in the industry, backed by transparent data, a highly trained team, and the service and support that comes from over four decades of experience.

4.1.4.1 Organization Structure

Each PAS location is led by a management team referred to as local management¹. Local management is responsible for making day-to-day decisions regarding the operations of the facility and implementing, and sustaining the requirements, policies, and procedures of the PAS quality program.

The roles that make up the local management team include a Vice President of Operations (VPO), a General Manager (GM) or Director of Laboratory Operations (DLO), a Quality Program Manager (QPM), and the Quality Manager (QM).

¹ The term “local management” does not mean “on-site” management. Some of the roles that make up the local management team, work off site or from a different PAS location. Refer to the Quality Manual Approval page at the beginning of this manual for the physical address of each manager that comprises the local management team.

The local management team is supported by department specific supervisors and in some PAS locations, a site supervisor or operations manager.

Local management and supervisors are supported by personnel from functional groups that support the division, such as HR, IT, Sales & Marketing, Finance, and EHS (Environmental Health & Safety).

Technical oversight for each location is provided by local personnel with support and guidance from the PAS Chief Technical Officer (CTO), PAS corporate quality personnel, and the Pace[®] compliance team. Locations that hold TNI accreditation, also have personnel appointed to serve as the “acting technical manager for TNI, however named” to perform the duties and responsibilities of this designation per the TNI Standard. See Section 4.1.5.2.1 for more information on this TNI requirement.

The reporting relationships and responsibilities of quality personnel are independent of operations in order to safeguard impartiality. See Section 4.1.5.2 for more information.

Refer to the organization charts provided in Appendix D to view the organization structure, reporting relationships, and the interrelationships between positions.

4.1.5 Management Requirements

4.1.5.1 Personnel

Each PAS location is staffed with administrative and/or technical personnel who perform and verify work under the supervision of their direct line supervisor.

All personnel are expected to perform their duties in accordance with the policies and processes outlined in this manual and in accordance with standard operating procedures (SOPs) and other quality system documents. PAS policies and procedures are designed for impartiality and integrity. When these procedures are fully implemented, personnel remain free from undue pressure and other influences that adversely impact the quality of their work or data.

4.1.5.1.1 Key Personnel

Key personnel are management positions that have the authority and responsibility to plan, direct, and control activities related to the QMS for the entire division (PAS Corporate), or for one or more PAS locations (Local).

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PAS Key Personnel Positions & Deputy Assignments by Role

Job Title	Acronym	Primary / Alternate Deputy
Chief Executive Officer	CEO	President
Chief Compliance Officer	CCO	CQD
President	NA	CEO / Sr. VPO
Corporate Quality Director	CQD	CCO
Quality Program Manager	QPM	CQD / Peer QPM
Chief Technical Officer	CTO	CQD / CCO
Sr. VP of Operations	Sr. VPO	President / VPO
Vice President of Operations	VPO	Sr. VPO / Peer VPO
Director of Lab Operations ¹	DLO	VPO / Peer GM or Sr. VPO
Health and Safety Director	NA	CCO
IT Director	NA	CTO
Quality Manager	QM	Direct QPM / Peer QPM
General Manager ¹	GM	VPO / Sr. VPO or Peer GM
Operations Manager ¹	OM	GM / DL or VPO
Technical Manager ¹	TM	CTO / Peer TM
TNI Approved TM ²	TNI TM	Another Qualified Employee

¹Position is not in place at all locations.

²The TNI TM is not a PAS position. See Section 4.1.5.2.1 for more information.

Some certification and accreditation programs require notification when there is a change in key personnel. Notification requirements and timeframes by agency, are tracked and upheld by the local QM, when these requirements apply.

4.1.5.2 Roles and Responsibilities

The qualifications, duties, and responsibilities for each position at Pace[®] are detailed in job descriptions maintained by the Pace[®] Human Resource personnel (HR).

The following sections provide a general overview of various management and supervisory roles and are presented in no particular order.

Chief Executive Officer (CEO): Provides leadership for overall operations; oversight of regulatory and compliance standards; development of growth strategies; and long-range capital and strategic planning for Pace[®].

Chief Compliance Officer (CCO): Has overall responsibility for statutory and regulatory compliance and the environmental health and safety programs (EHS) for Pace[®].

President: Provides leadership for overall operations; oversight of regulatory and compliance standards; development of growth strategies; and long-range capital and strategic planning for PAS.

Chief Technical Officer (CTO): Provides technical oversight and leadership to all PAS locations. Responsible for innovation and standardization of technical activities.

Corporate Director of Quality (CQD): Responsible for developing the PAS quality program and the policies and procedures that support the QMS. The CQD leads the

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quality team, establishing functions, responsibilities, duties, and organization structure for PAS.

Corporate Quality Program Manager (QPM): Responsible for helping local management implement, monitor, maintain and improve the PAS quality program for one or more locations in the network and for direct supervision of Quality Manager(s).

Director of Information Technology: Oversees and delivers the systems and processes of information technology used by PAS. These systems include Laboratory Information Management Systems (LIMS); data acquisition, reduction, and reporting software; virus-protection, communication tools, and ensuring the integrity, security of electronic data, and associated policies and procedures.

Sr. Vice President of Operations (Sr VPO): Provides leadership, direction, and insight necessary to achieve strategic initiatives. Develops and improves processes, structure, and allocation of resources for operations for all of PAS.

Vice-President of Operations (VPO): Provides leadership, guidance, and resources, including allocation of personnel, necessary to achieve the strategic goals of the organization and the PAS quality program to one or more PAS locations.

Director of Laboratory Operations (DLO): See description for General Manager.

General Manager (GM): The GM is responsible for overall administration and operation of one or more PAS locations and service centers. Although task duties associated with this responsibility may be delegated, the GM is responsible for ensuring all duties and activities of the locations they oversee comply with the PAS QMS, the PAS EHS program, and with any applicable statutory, regulatory requirements or program requirements.

Any GM of a NELAC/TNI Accredited laboratory is also responsible for the designation of technical personnel to serve as acting technical managers for TNI for the fields of accreditation held by the laboratory (See Section 4.1.5.2.1) and for notifying the accreditation body (AB) of any extended absence or reassignment of these designations.

Quality Manager (QM): The QM oversees and monitors the implementation, compliance, and improvement of the QMS and communicates gaps, deviations, and opportunities for improvement to local and corporate laboratory management. The QM is independent of the operation and analytical activities for which they provide oversight and has the authority to carry out the roles and responsibilities of their position without outside influence.

The QM:

- serves as the focal point for QA/QC protocol decisions and oversees review of QC data for trend analysis;
- evaluates data objectively and performs assessments without outside influence;

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- has documented training and experience in QA/QC procedures and the PAS quality system;
- has a general knowledge of the analytical methods offered by the laboratory;
- coordinates and conducts internal systems and technical audits;
- notifies laboratory management of deficiencies in the quality system;
- monitors corrective actions;
- provides support to technical personnel and may serve as the primary deputy for the acting TNI Technical Manager(s).

Manager-Client Services (CSM): This position is responsible for the training and supervision of project manager(s) and/or shipping, receiving and courier personnel. The primary responsibility of the CSM is to ensure projects are successfully managed to meet the expectations and needs of PAS customers.

Department Managers / Supervisors / Team Lead): These positions are responsible for administrative and operations management and implementation of the QMS in the work area he/she oversees. These responsibilities include but are not limited to: training and supervision of personnel, monitoring work activity to maintain compliance with this manual, SOPs, policies and other instructional documents that support the QMS; method development, validation and the establishment and implementation of SOPs to assure regulatory compliance and suitability for the intended purpose; monitoring QA/QC performance, proper handling and reporting of nonconforming work, purchasing of supplies and equipment adequate for use, maintaining instrumentation and equipment in proper working order and calibration, and general maintenance of administrative and technical processes and procedures established by the laboratory.

Operations Manager (OM): The OM is responsible for management of production and/or other duties assigned by the GM.

4.1.5.2.1 Approved Technical Manager (TNI Accreditation Only):

The requirements in this subsection apply to only to PAS locations that are NELAC/TNI accredited.

The TNI Standard specifies requirements for the qualification and duties of technical personnel. The TNI Standard lists these duties under the reference “technical manager(s), however named.”

At PAS, these duties closely correlate with the responsibilities and duties outlined in the PAS job descriptions for managers, supervisors, team leads, and/or scientist. However, these duties do not need to be associated with any specific job title and can be assigned to any one or more PAS employees that meets the qualifications specified in the TNI Standard.

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Refer to the applicable version of the TNI Standard to view the required qualifications for each discipline.

PAS locations that are TNI accredited must designate one or more employees to perform these duties and submit these qualifications to the TNI accreditation body (AB) for approval.

Employees approved by the TNI AB, to perform these duties retain their Pace[®] assigned job title.

When TNI Accreditation Bodies (AB) refer to these employees as ‘technical manager’ or ‘technical director’ on the official certificate or the scope of accreditation, this reference is referring to their approval to perform duties of the ‘technical manager, however named’ as specified in the TNI Standard and not to a PAS job title.

The duties of any approved technical manager for TNI, however named, can be completed in person or remotely. If an employee that is an approved technical manager for TNI is completely absent from work or on a leave of absence for more than 15 calendar days, the duties and responsibilities specified in the TNI Standard are temporarily reassigned to another employee that meets the qualifications for the technology or field of accreditation. If the employee’s absence exceeds 35 calendar days, the local QM must formally notify the TNI primary AB of the absence and the details of reassignment of duties in writing.

4.1.5.3 Conflict of Interest

A conflict of interest is a situation where a person has competing interests that may affect impartiality. It is the policy of Pace[®] to ensure business relationships, decisions and transactions do not place personal interest ahead of the organization, customers, colleagues, job responsibilities or the public we serve. Conflict of interest is avoided by making personnel aware of circumstances that conflict or appear to conflict with impartiality and/or designing process and procedures to include checks and balances to prevent conflict and ensure impartiality.

See the current version of policy COR-POL-0004 *Code of Ethics and Professional Conduct* for more information.

4.1.5.4 Confidentiality

PAS management is committed to preserving the confidentiality of Pace[®] customers and confidentiality of Pace[®] business information.

Client information obtained or created during work activities is considered confidential and is protected from intentional release to any person or entity other than the client or the client’s authorized representative, except when Pace[®] is required by law to release confidential information to another party, such as a regulatory agency or for litigation purposes. In which case, Pace[®] will notify the client

of the release of information and the information provided, unless notification is prohibited by law.

When Pace[®] obtains information about the customer from a source other than the customer, Pace[®] will keep the source of the information confidential unless disclosure is agreed upon by the source.

The terms of client confidentiality are included in PAS Standard Terms and Conditions (T&C). With the acceptance of the T&C and/or the implicit contract for analytical services that occurs when the client sends samples to PAS for testing, the client authorizes Pace[®] to release confidential information when required. Other procedures used by PAS to maintain confidentiality include:

- A Code of Ethics and Professional Conduct policy that covers this topic (COR-POL-0004):
- A Confidentiality Agreement which supervisory and sales personnel and other positions are required to sign at the time of employment and abide by the conditions of throughout employment;
- Record retention and disposal procedures that assure confidentiality is maintained;
- Physical access controls and encryption of electronic data; and

See policy COR-POL-0004 *Code of Ethics and Professional Conduct* for more information.

4.1.5.5 Communication

Communication is defined as the imparting or exchanging of news and information. Effective (good) communication occurs when the people included in the communication gets the point and understands it.

4.1.5.5.1 Workplace Communication

Effective communication in the workplace is necessary to assure work is performed correctly, efficiently, and in accordance with client specifications.

Instructions for how to conduct testing and other work activities are communicated to personnel via written policies, standard operating procedures, and other work instructions.

Information about PAS performance (positive and negative) and ideas for improvement are communicated to personnel using various communication channels such as face to face meetings, video conferencing, conference calls, email, memoranda, written reports, and posters.

4.1.5.5.2 External Communication

Communication with external parties such as customers, vendors, business partners, and regulatory agencies takes place every day.

PAS management is responsible for training personnel to communicate in professional and respectful ways to build strong relationships and to avoid misunderstanding.

4.2 Quality Management System

4.2.1 Quality Management System Objectives

The objectives of the PAS QMS are to provide clients with consistent, exemplary professional service, and objective work product that is of known and documented quality that meets their requirements for data usability and regulatory compliance.

Objective work product is analytical services, data, test results, and information that is not influenced by personal feeling or opinions. The quality of being objective is also known as ‘impartiality.’

4.2.1.1 Impartiality

PAS achieves and maintains impartiality by establishing an organizational structure that safeguards impartiality (See 4.1.4.1) and implementing and adhering to the policies and processes of the QMS outlined in this manual, which are based on industry accepted standards and methodologies.

PAS procedures for handling nonconforming work (See 4.9), corrective and preventive actions (See 4.11, 4.12) and management review (See 4.15) are the primary mechanisms used to identify risk to impartiality and to prompt actions necessary to eliminate or reduce the threat when risk to impartiality is suspected or confirmed.

4.2.1.2 Risk and Opportunity Assessment

Risks are variables that make achieving the goals and objectives of the QMS uncertain.

An opportunity is something that has potential positive consequences for the organization.

PAS personnel manage risks and opportunities on a daily basis by following policies, procedures and processes that support the QMS. Some ways in which the QMS is designed to identify, minimize, or eliminate risk on a daily basis include but are not limited to:

- Capability and capacity reviews of each analytical service request to assure the laboratory can meet the customer’s requirements;
- Maintenance of accreditation and certification for test methods in multiple states and programs to cover a broad range of jurisdiction for regulatory compliance;
- SOPs and other controlled instructional documents are provided to personnel to eliminate variability in the process. These documents include actions to counter risk factors inherent in the process and are reviewed on a regular basis for on-going suitability and relevancy;
- Participation in proficiency testing programs and auditing activities to verify on-going competency and comparability in performance;

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- Provision of on-the-job training and established protocol for quality control (QC) corrective action for nonconforming events;
- An established program for ethics, and data integrity;
- Tiered data review process;
- Culture of continuous improvement;
- Monitoring activities to assess daily and long-term performance; and
- Annual critical review of the effectiveness of the QMS.

PAS also promotes a continuous improvement culture based on the principles of lean manufacturing. These principles include 3P (Process, Productivity, Performance) and Kaizen. 3P is a platform used by PAS to share best practices and standardization across the network to achieve operational excellence. Kaizen is a team-based process used to implement tools and philosophies of lean to reduce waste and achieve flow with the purpose of improving both external and internal customer satisfaction. The PAS lean program and activities help to mitigate risk because they generate a collective understanding of vulnerabilities and utilize group-effort to develop and implement solutions at all levels.

Risk and opportunities may also be formally identified using specific risk and opportunity assessment methods such as SWOT Analysis (Strength, Weakness, Opportunity, Threats) and 3-Stage Impact/Probability Grids.

4.2.1.3 Communication of the Quality Management System

This manual is the primary mechanism used by PAS management to communicate the QMS to personnel.

To assure personnel understand and implement the quality program outlined in the manual:

- PAS personnel are required to sign a Read and Acknowledgement Statement to confirm the employee has:
 - 1) been informed of the manual by management,
 - 2) has access to the manual,
 - 3) has read the manual
 - 4) understands the content of the manual, and
 - 5) agrees to abide by the requirements, policies, and procedures therein.
- Personnel are informed that the manual provides the “what” of the QMS. The “how to” implementation of the QMS is provided in policy, SOPs, standard work instructions, and other instructional documents.
- This manual and supporting policies and procedures are made readily accessible to personnel in the area where the work activity is performed.

4.2.2 Quality Policy Statement

The quality policy of PAS is to provide customers with data of known and documented quality fit for their intended purpose. PAS achieves this policy by implementing the QMS defined in this manual, by following industry accepted protocol for analytical testing and quality assurance and quality control (QA/QC) activities, by conformance with published and industry accepted testing methodologies, and by compliance with international and national standards for the competency and/or accreditation of testing laboratories.

Intrinsic to this policy statement is each of the following principles:

- PAS will provide customers with reliable, consistent, and professional service. This is accomplished by making sure each PAS location has the resources necessary to maintain capability and capacity; that staff are trained and competent to perform the tasks they are assigned; that client-facing staff are trained and prepared to find solutions to problems and to assist customers with their needs for analytical services. Customer feedback, both positive and negative, is shared with personnel and used to identify opportunities for improvement.
- PAS maintains a quality program that complies with applicable state, federal, and industry standards for analytical testing and competency.
- PAS management provides training to personnel so that all personnel are familiar with the QMS outlined in this manual and that they understand that implementation of the QMS is achieved by adherence to the Pace[®] and PAS policies and procedures.
- PAS management continuously evaluates and improves the effectiveness of the QMS by responding to customer feedback, and other measures of performance, such as but not limited to the results of internal/external audits, proficiency testing, metrics, trend reports, and annual and periodic management reviews.

4.2.2.1 Ethics Policy / Data Integrity Program

Pace[®] has established a comprehensive ethics and data integrity program that is communicated to all Pace[®] employees so that they understand what is expected of them. The program is designed to promote a mindset of ethical behavior and professional conduct that is applied to all work activities.

The key elements of the Pace[®] Ethics / Data Integrity Program include:

- Ethics Policy (COR-POL-0004);
- Ethics Officer (Chief Compliance Officer);
- Standardized data integrity training course taken by all new employees on hire and a yearly refresher data integrity training course for all existing employees;
- Policy Acknowledgement Statements that all Pace[®] personnel, including contract and temporary, are required to sign at the time of employment and again during annual refresher training to document the employee's commitment and

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obligation to abide by the company's standards for ethics, data integrity and confidentiality;

- SOPs that provide instructions for how to carry out a test method or process to assure tasks are done correctly and consistently by each employee;
- On the Job Training;
- Data integrity monitoring activities which include, but are not limited to, primary, secondary and completeness data reviews, internal technical and system audits, data audits, data surveillance, and proficiency testing; and
- Confidential reporting process for alleged ethics and data integrity issues.

All PAS managers and supervisors are expected to provide a work environment where personnel feel safe and can report unethical or improper behavior in complete confidence without fear of retaliation. Retaliation against any employee that reports a concern is not tolerated.

Pace® has engaged Lighthouse Services, Inc. to provide personnel with an anonymous reporting process available to them 24 hours a day/7 days per week. The alert line may be used by any employee to report potential violations of the company's ethics and data integrity program. Reports are forwarded to the Pace® Ethics Compliance Officer to investigate and resolve the matter. Investigations concerning data integrity are kept confidential.

See COR-POL-0001 *Compliance Alertline* for more information.

Posters and flyers with the compliance alert line information must be prominently posted in each PAS location for personnel reference.

Compliance Alert Line Information:

English Speaking US & Canada	(844) 940-0003
Spanish Speaking North America	(800) 216-1288
Internet	www/lighthouse-services.com/pacelabs
Email	reports@lighthouse-services.com

4.2.3 Management Commitment: Quality Management System

Evidence of management's commitment for the development, maintenance, and on-going improvement of the QMS is provided by the application of their signature of approval to the template and/or manual. Their signature confirms they understand their responsibility to implement the QMS outlined in this manual, to communicate the quality program to personnel, and to uphold requirements of the program during work activities.

4.2.4 Management Commitment: Customer Service

Management communicates the importance of meeting customer and regulatory requirements to personnel by training personnel on the QMS outlined in this manual, implementing the QMS outlined in this manual, and upholding these requirements for all work activities.

4.2.5 Supporting Procedures

References to processes and procedures that support the QMS are included throughout this manual. The structure of the document management system is outlined in SOP ENV-SOP-CORQ-0015 *Document Management and Control* and summarized in the following subsections.

4.2.5.1 Quality Management System Document Structure

Documents associated with the QMS are classified into document types that identify the purpose of the document and establish how the document is managed and /or controlled.

Examples: Types of PAS Internally Created Documents

Document Type	Purpose
Quality Manual	Outlines the PAS QMS and structure and how it works for a system including policy, goals, objectives and detailed explanation of the system and the requirements for implementation of system. Includes roles and responsibilities, relationships, procedures, systems, and other information necessary to meet the objectives of the system described.
Policy	Provide requirements and rules for a process and is used to set course of actions and to guide and influence decisions. Policy describes the “what,” not the “how”.
Standard Operating Procedure	Provide written and consistent set of instructions or steps for execution of a routine process, method, or set of tasks performed. Assures that activities are performed properly in accordance with applicable requirements.
Standard Work Instruction	Provide step by step visual and/or written instruction to perform a specific task to improve competency, minimize variability, reduce work injury and strain, or to boost efficiency and quality of work (performance). SWI are associated with an SOP unless the task described is unrelated to generation of or contribution to environmental data or analytical results.
Template	Pre-formatted document that serves as a starting point for a new document.
Guide	Assists users in using a particular product; or a technical interpretation of a method or process by which PAS locations must abide.
Form	Used for a variety of purposes such as to provide a standardized format to record observations, to provide information to supplement an SOP.
Guidance	Non-binding advice used to explain internal policies, procedures, or practices.

Example: Types of External Documents used by PAS

Certificate	Lists parameters, methods, and matrices for which the location is certified/accredited to perform within the jurisdiction of the issuing regulatory agency or accreditation body.
Reference Document	Provide information, protocol, instructions, and/or requirements. Issued by the specifier. Examples include ISO/IEC, TNI, DoD and published referenced methods such as Standard Methods, ASTM, SW846, EPA, and federal and state regulatory bodies.
Project Document	Provides requirements necessary to meet individual client expectations for intended use of data. Examples include project quality assurance plans (QAPP), client-program technical specifications, contracts, and other agreements.

These document types are ranked to establish which documents takes precedence when there is an actual or perceived conflict between documents and to establish the hierarchal relationships between documents. The ranking system also provides information to document writers and reviewers to assure downline documents agree with documents of higher rank.

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PAS Document Hierarchy

Rank	Document
1	Corporate Manual
2	Corporate Policy
3	Corporate SOP
4	Corporate SWI, Templates, Guides, Forms, Guidance
5	Local Manual
6	Local SOP
7	Local SWI, Templates, Guide, Forms, Guidance

Information and requirements from project documents are not incorporated into PAS policy or SOPs in order to maintain client confidentiality. These documents are managed as external documents and any requirements for work specified is followed when work for the project is performed. Project Documents are reviewed and maintained as part of the contract/incoming work review process (See Section 4.4). If the project document is less stringent than the PAS QMS, policies, or SOPs, and/or is less stringent than applicable federal or state requirements, PAS locations are still required to meet the minimum requirements of the PAS QMS and any applicable statutory or federal requirements in addition to the requirements specified in the project document.

Reference documents are not ranked because all PAS created documents, processes and procedures must be consistent with the applicable reference document(s) in addition to higher-ranking PAS documents.

See SOP ENV-SOP-CORQ-0015 *Document Management and Control* for more information.

4.2.6 Roles and Responsibilities

The roles and responsibilities for technical management and the quality manager is provided in section 4.1.5.2.

4.2.7 Change Management

When significant changes to the PAS QMS are planned, these changes are managed by corporate quality personnel to assure that the integrity of the QMS is maintained.

4.3 Document Control

4.3.1 General

PAS procedures for document control are provided in SOP ENV-SOP-CORQ-0015 *Document Management and Control*.

PAS locations use electronic document management software (eDMS) to perform the document control procedures of the SOP. This system provides centralized access to all documents used by PAS locations across the network. All PAS locations are required to use the eDMS system established for PAS (presently Qualtrax) unless an exemption has been granted by the PAS Corporate Quality Director.

eDMS automates the process for unique document identification, version control, approval, access, and archival and restricts access to archived documents except to authorized users to prevent the use of obsolete documents.

The local QM maintains a master list of controlled documents used at each location. The master list minimally includes the document control number, document title, and current revision status and is made available to personnel for their reference.

See SOP ENV-SOP-CORQ-0015 *Document Management and Control* for more information.

4.3.2 Document Approval and Issue

Documents that support the QMS are reviewed by qualified personnel and approved by management prior to release for use.

Only the approved versions of documents are available to personnel for use unless use of a draft document is authorized by management.

The managers responsible for authorization of each document is situation specific.

See SOP ENV-SOP-CORQ-0015 *Document Management and Control* for more information.

4.3.3 Document Review and Change

Unless a more frequent review is required by regulatory, certification or accreditation program documents are reviewed at least every two years to ensure the documents remains current, appropriate, and relevant.

Documents are also informally reviewed every time the document is used. Personnel are expected to refer to and follow instructions in controlled documents when they conduct their work activities. Consequently, any concerns or problems with the document should be caught and brought to the attention of management on an on-going basis.

Documents are revised whenever necessary to ensure the document remains usable and correct. Older document versions and documents no longer needed are made obsolete and archived for historical purposes.

PAS does not allow hand-edits to documents. If an interim change is needed pending re-issue of the document, the interim change is communicated to those that use the document using a formal communication channel, such as change in progress form, email, or memorandum.

The document review, revision, and archival process is managed by quality personnel at the location from which the document was released using the procedures established in SOP ENV-SOP-CORQ-0015 *Document Management and Control*.

4.4 Analytical Service Request, Tender, and Contract Review

PAS management and/or client service personnel perform thorough reviews of requests and contracts for analytical services to verify the location(s) performing the work has the capability, capacity, and resources necessary to successfully meet the customer's needs. These review procedures are described in SOP ENV-SOP-MTJL-0009, *Contract Review*.

The procedures in this SOP(s) are established to ensure that:

- The PAS locations performing the work understand the purpose of data collection in order to ensure the test methods requested are appropriate for the intended use of the data and capable of meeting the client's data quality objectives;

- PAS locations and any external subcontractor(s) have the capability, capacity, and resources to meet the project requirements and expectations within the requested time frame for delivery of work product;
- Any concerns that arise from review are discussed and resolved with the client;
- Any discrepancies between the PAS QMS, statutory or regulatory requirements and the client request are resolved; and
- The results of review and any correspondence with the client related to this process and/or any changes made to the contract are recorded and retained for historical purposes.

Capability review confirms that the PAS locations contracted to perform the work and any internal or external subcontractors hold required certification/accreditation for the test method, matrix, and analyte and verifies the location can achieve the client's target compound list and data quality objectives (DQOs) for analytical sensitivity and reporting limits, QA/QC protocol, and hardcopy test report and electronic data deliverable (EDD) formats.

Capacity review verifies that the in-network locations and any potential subcontractors are able to manage the sample load and deliver work production within the delivery timeframe requested.

Resource review verifies that the location and any potential subcontractors have adequate qualified personnel with the skills and competency to perform the test methods and services requested and sufficient and proper equipment and instrumentation needed to perform the services requested.

4.5 Subcontracting (Internal and External)

The terms 'subcontract' and "subcontracting" refers to analytical work done by an organization external to Pace[®] (External Subcontracting) or by a Pace[®] location with an address different than the address listed on the cover page of the test report (Internal Subcontracting).

The PAS network offers comprehensive analytical capability and capacity to ensure Pace[®] can meet a diverse range of client needs for any type of project. If a PAS laboratory receives a request for analytical services and it cannot fulfill the project specifications, the location's client services team will collaborate with the client to place the work within the PAS network.

When it is not possible to place the work within network, the location will, with documented client approval, subcontract the work to a subcontractor that has the capabilities to meet the project specifications and can meet the same commitment agreed on between the location and the client.

Whenever work is subcontracted, the PAS location responsible for management of the project verifies each of these qualifications:

- The internal or external subcontractor has the proper accreditation/certifications required for the project and these are current; and
- The use of the internal or external subcontractor is approved by the client and/or regulatory agency when such approval is required by the customer. Record of customer approval is retained in the project record.

External subcontractors selected by Pace[®] must be pre-qualified by quality personnel to verify their QMS is similar to Pace[®] and complies with all relevant Standards such, as ISO/IEC 17025 and the TNI Standard(s) and/or federal and state regulatory requirements. The list of approved

subcontractors for each location is maintained by local quality personnel. Pre-qualification of a subcontractor does not eliminate the requirement for the PAS location placing work to verify the subcontractor has the certifications, capability, capacity, and resources to perform work on behalf of Pace[®] on a project-specific basis.

For all subcontracted work, the PAS location placing the work internally or externally is responsible to ensure project specifications are always communicated to and understood by the subcontractor.

4.6 Purchasing Services and Supplies

Vendors that provide services and supplies to PAS are qualified to meet the needs of Pace[®]. These needs include but are not limited to competitive pricing, capacity to fill purchase orders, quality of product, customer service, and business reputation and stability. Evidence of this qualification is the availability to purchase services and supplies from the vendor in the corporate purchasing system.

PAS locations may purchase goods and services from any supplier in the purchasing system.

The specifications (type, class, grade, tolerance, purity, etc.) of supplies, equipment, reagents, standard reference materials and other consumables used in the testing process are specified in SOPs. The SOP specifications are based on the governing requirements of the approved reference methods and any additional program driven regulatory specification, such as drinking water compliance.

All requisitions for materials and consumables are approved by local management who is responsible to ensure the services and supplies procured and received are fit for intended use.

4.7 Customer Service

Project details and management is managed by PAS client services personnel.

4.7.1 Commitment to Meet Customer Expectations

PAS personnel collaborate closely with our customers to ensure their needs are met and to establish their confidence in the capability of PAS to meet their needs for analytical services and expectations for service.

The project manager (PM) is the customer's primary point of contact for each analytical service request (work order). The PM gathers information from the customer to ensure the details of their request are understood. After samples are received, the PM monitors the progress of the project and alerts the customer of any delays or excursions that may adversely impact data usability. Supervisors are expected to keep the PM informed of project status and any delays or key issues, so that the PM can keep the client informed.

PAS encourages customers to visit our locations to learn more about the capabilities, observe performance and to meet personnel.

PAS customers expect confidentiality. Personnel will not divulge or release information to a third party without proper authorization unless the information is required for litigation purposes. See Section 4.1.5.4 of this manual and policy COR-POL-0004 *Code of Ethics and Professional Conduct* for more information on the policy for client confidentiality.

4.7.2 Customer Feedback

PAS actively seeks positive and negative feedback from customers through surveys and direct communication. Information from the client about their experience working with PAS and

their satisfaction with work product is used to enhance processes and practices and to improve decision making. Customer feedback is reviewed to identify risk and opportunity. Corrective, preventive, or continuous improvement actions are taken based on nature of and/or feedback trends.

Also see sections 4.9, 4.10, 4.11, 4.12, 4.14, and 4.15 for more information about how customer feedback is managed by PAS and used to enhance the QMS.

4.8 Complaints

A complaint is a formal expression of dissatisfaction with the performance of a service or product originating from a party external to Pace[®]. Complaints provide opportunities to improve processes and/or build stronger working relationships with clients.

The PAS complaint resolution process depends on the situation and the nature of the complaint.

Each complaint received is reviewed to determine if it is valid. If the complaint is valid, it is either addressed immediately by the person receiving the complaint or the nature of the complaint is further reviewed and investigated prior to resolution and follow up with the customer.

Complaints (and compliments) are recorded and reviewed during Annual Management Review (See Section 4.15).

4.9 Nonconforming Work

4.9.1 Definition of Nonconforming Work

Nonconforming work is work that does not conform to customer requirements, standard specifications, policies, and procedures, or that does not meet acceptance criteria.

The discovery of non-conforming work comes from various sources which include, but are not limited to:

- results of quality control samples and instrument calibrations;
- quality checks on consumables and materials;
- general observations of personnel;
- data review;
- proficiency testing;
- internal and external audits;
- complaints and feedback;
- management review and reports; and
- regulatory and certification and accreditation actions.

The way in which the laboratory or service center manages nonconforming work depends on the significance and impact (risk) of the issue. Some issues may simply require correction, others may require investigation, corrective action (See 4.11) and/or data recall (See 4.16). When the location releases data and test results associated with nonconforming QC and acceptance criteria, test results are qualified, or non-conformances are noted in the final analytical report to apprise the data user of the situation. (See 5.10)

Nonconforming work also includes unauthorized departure from policies, procedures, and test methods. Authorized departures are explained in the following subsections. Situations that do not conform to these conditions are considered unauthorized departure(s).

4.9.1.1 Authorized Departure from SOPs

Departures from an SOP may sometimes be necessary to correct for an error in an SOP or to resolve a complex problem. For example, to mitigate a complex matrix interference.

An authorized departure from a test method SOP is one that has been reviewed and approved by the department leader, however named, of the work area in which the test method is performed. The leader, when authorizing a departure from an SOP, accepts full responsibility to ensure the departure does not conflict with Pace[®] or PAS policy or procedure, does not affect statutory, regulatory or program compliance and does not adversely affect data integrity or usability.

Departure from administrative or process-oriented SOPs must be approved by the local QM.

Documentation of the reason for the SOP departures must be retained with management approval. Approved departures from test method SOPs should be noted in the final test report to advise the data user.

See SOP ENV-SOP-CORQ-0016 *SOP for SOPs and SWI*, for more information.

4.9.1.2 Authorized Departure from Test Methods (Method Modifications)

When test results are associated to a published reference test method, the location's test method SOP must be consistent with the test method. If the test method is mandated for use by a specific regulatory program such as drinking water, wastewater or a certification or accreditation program, such as TNI/NELAC, the SOP must comply with or include these requirements, or the resulting data and test results cannot be used for regulatory compliance purposes.

If the procedures in the SOP are modified from the test method, these modifications must be clearly identified in the SOP. The conditions under which the location may establish an SOP that is modified from these reference method or regulatory program and what is considered a modification are specified in ENV-SOP-CORQ-0011 *Method Validation and Instrument Verification*.

Client requests to deviate from the test method are managed as client requests to depart from the test method SOP since it is the SOP that the location follows when performing work.

4.9.1.3 Stop Work Authority

Stop Work Authority provides PAS personnel with capability to stop work when there is a perceived unsafe condition or behavior that may result in an unwanted event.

All personnel have the authority to request a stop work order when necessary to preserve data integrity or safety of workers.

The need for the stop work order and resolution of the problem must be confirmed by subject matter experts and resumption of work must be approved as follows:

- For stop work orders related to environmental health and safety (EHS) and/or waste management, the decision to stop work may be made by any employee. These decisions must often be made in real-time to protect the safety of the worker. The decision to correct the problem, how, and/or to resume work after stop work has been initiated may be made by the Chief Compliance Officer or the EHS Director, or the deputies assigned to these positions.
- Any employee may recommend a stop work order for concerns related to data integrity. The need to stop work must be reviewed and affirmed by quality personnel to confirm the concern is valid. The decision to uphold the stop work order must minimally include the local QM, the QPM, and the Corporate Quality Director. The President, the Sr. VPO, the VPO, the Chief Compliance Officer and Chief Technical Officer may also be included in the decision making and resolution process depending on the situation and/or needs for correction to ensure protocols for investigation are followed. Resumption of work after correction may be made by the Corporate Quality Director, or the Quality Program Manager assigned to the location for which the stop work order was issued or by the deputies assigned to these positions.

4.10 Continuous Improvement

The PAS QMS is designed to achieve continuous improvement through the implementation of the quality policy and objectives outlined in this manual. Information about laboratory and service center activities and performance is gained from sources such as customer feedback, audits, QC, trend analysis, business analytics, management reports, proficiency testing, and management systems review. This information is subsequently used during the corrective action (see section 4.11) and preventive action (see section 4.12) processes and during annual review of the management system (see section 4.15) to establish goals and objectives for improvement.

PAS also promotes a continuous improvement culture based on the principles of lean manufacturing. These principles include 3P (Process, Productivity, Performance) and Kaizen. 3P is a platform used by Pace to share best practices and standardization across the network to achieve operational excellence. Kaizen is a team-based process used to implement tools and philosophies of lean to reduce waste and achieve flow with the purpose of improving both external and internal customer satisfaction. All activities of 3P and Lean must conform with the requirements of this quality manual and supporting policies and procedures.

4.11 Corrective Action

Corrective action is a process used to eliminate the cause of a detected nonconformity. It is different from a correction. A correction is an action taken to fix an immediate problem but that does not resolve the underlying cause of why the problem occurred. The objective of corrective action is to find the underlying cause(s) of the problem and to put in place fixes to prevent the problem from happening again. The corrective action process, referred to as CAPA, is one of the most effective tools used by PAS to prevent nonconforming work, identify risk and opportunity, and improve service to our customers.

PAS has two general processes for corrective action, the application of which process is used depends on the type of nonconformity:

Quality control (QC) exceptions (nonconformance) that occur during routine testing is investigated through troubleshooting and required actions for correction is specified in policies and SOPs. When action is not taken, cannot be taken, or is not successful, test results associated with the nonconforming work are qualified in the final test report. Documentation of the nonconformance and corrective action taken is documented in the analytical record.

A 7-stage corrective action process is used when there is a recurring problem. These problems are identified through various activities such as but not limited to quality control trends, internal and external audits, management review, customer feedback, and general observation.

The 7 Stage CAPA Process for PAS includes:

- 1) Identification and Containment
- 2) Evaluation
- 3) Investigation
- 4) Cause Analysis
- 5) Action Plan
- 6) Implementation
- 7) Follow Up and Effectiveness Review

PAS procedures for corrective action, are specified in corporate SOP ENV-SOP-CORQ-0018 *Procedure for Corrective and Preventive Action*. Some key concepts and activities related to the PAS corrective action process is provided in the next three subsections.

4.11.1 Cause Analysis (AKA Root Cause Analysis)

Cause analysis is the process of investigation used to identify the underlying cause(s) of the problem. After causal factors are identified, ways to mitigate the causal factors are identified and action(s) most likely to eliminate these factors are taken.

PAS uses different methods to conduct cause analysis. The most common approach is 5-Why, 4M, Fishbone Diagrams, or brainstorming may be appropriate depending on the situation. The method used is case specific and is documented in the CAPA record.

4.11.2 Effectiveness Review

Monitoring corrective actions taken for effectiveness is an essential part of the corrective action process. Effectiveness means the actions taken were appropriate and sustainable. Appropriate means the action(s) taken prevented recurrence of the problem since the time corrective action was taken and sustainable means the actions taken are still in place.

The data from CAPA records are used by PAS to identify opportunities for preventive action or to gain lessons learned when actions taken were not adequate to solve the problem. See Section 4.12 (Preventive Action) and 4.15 (Management Review) for more information.

4.11.3 Additional Audits

When cause analysis and investigation of a problem casts doubt on compliance with PAS policies, procedures, or to regulatory requirements; a special audit of the area of activity may be performed as part of the corrective action process. These special audits are used to

determine the scope of the problem and to provide information for the CAPA process. Additional full-scale audits are done when a grave issue or risk to the business is identified.

4.12 Preventive Action

Preventive action(s) are actions taken to eliminate the cause of a potential nonconformity before it happens.

Some examples of preventative action include, but are not limited to:

- Routine instrument maintenance (Preventative maintenance)
- Addition of Staff and Equipment
- Professional Development Activities
- Implementation of New Technology

PAS looks for opportunities for preventive action from a variety of sources including employee idea's, customer feedback, business partners input, trend analysis, business analytics, management reviews, proficiency testing results, and risk-benefit analysis.

PAS management evaluates the success of preventive actions taken in any given year during annual management review. See Section 4.15 for more information.

4.12.1 Change Management

Preventive actions may sometimes result in significant changes to processes and procedures used by PAS locations. PAS management evaluates the risks and benefits of change and includes in its implementation of change process, actions to minimize or eliminate any risk. The types of changes for which risk are considered and managed include infrastructure change, change in analytical service offerings, certification or accreditation status, instrumentation, LIMS changes, and changes in key personnel.

4.13 Control of Records

A record is a piece of evidence about the past, especially an account of an act or occurrence kept in writing or another permanent form. PAS records document activities and provide evidence of conformity to the requirements established in the QMS. These records may be hardcopy or electronic on any form of media.

4.13.1 General Requirements

4.13.1.1 Procedure

PAS requirements for control of records are specified in corporate policy ENV-POL-CORQ-0013 *Record Management*.

The policy is established to assure quality and technical records are identified, retained, indexed, and filed to allow for retrieval during the entire retention timeframe. During storage, records are kept secure and protected from deterioration. At the end of the retention time, the records are disposed of properly in order to maintain client confidentiality and to protect the interests of the company.

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In general, records fall into three categories: quality, technical, and administrative.

Examples of each are provided in the following table:

Record Type	Includes Records of:
Quality	Document Types listed in SOP ENV-SOP-CORQ-0015 Audits: Internal and External Certificates and Scopes of Accreditation Corrective & Preventive Action Management Review Data Investigations Method Validation Instrument Verification Training Records
Technical	Raw Data Logbooks Certificates of Traceability Analytical Record Test Reports & Project Information Technical Training Records & Demonstration of Capability
Administrative	Personnel Records Finance/Business

4.13.1.2 Record Legibility and Storage

Records are designed to be legible and to clearly identify the information recorded. Manual entries are made in indelible ink; automated entries are in a typeface and of sufficient resolution to be read. The records identify personnel that performed the activity or entered the information. Records are archived and stored in a way that they are retrievable. Access to archived records is controlled and managed.

For records stored electronically, the capability to restore or retrieve the electronic record is maintained for the entire retention period. Hardcopy records are filed and stored in a suitable environment to protect from damage, deterioration, or loss. Hardcopy records may be scanned to PDF for retention. Scanned records must be checked against the hardcopy to verify the scan is complete and legible.

Administrative records are kept for a minimum of 5 years and technical and quality records are kept for 10 years unless otherwise specified by the client or regulatory program.

The date from which retention time is calculated depends on the record. In general, the retention time of technical records of original observation and measurement is calculated from the date the record is created. If the technical record is kept in a chronological logbook, the date of retention may be calculated from the date the logbook is archived. The retention time of test reports and project records, which are considered technical records, is calculated from the date the test report was issued. The retention time of quality records is usually calculated from the date the record is archived.

Refer to the record management policy and the location specific SOP for more information.

4.13.1.3 Security

PAS locations are secure facilities and access to records is restricted to authorized personnel.

4.13.1.4 Electronic Records

The data systems used to store electronic records is backed up in accordance with SOP ENV-SOP-MTJL-0058, *Information Technology Processes* and ENV-SOP-MTJL-0010, *Protection and Transfer of Laboratory Records*.. Access to archived records stored electronically is maintained by personnel responsible for management of the electronic system.

4.13.1.5 Electronic Signature Policy

Work done by PAS locations include activities that require the application of a signature. Some work product is in electronic format and signatures are applied electronically.

The Electronic Signatures in Global and National Commerce Act (E-Sign Act) clarifies that electronic signatures are legally valid and enforceable under United States law.

The PAS policy for use and application of electronic signatures is specified in corporate policy ENV-POL-CORQ-0014 *Electronic Signature Policy*.

All employees of PAS including temporary and contract personnel, must sign an Electronic Signature Agreement to acknowledge that they understand and accept that work activities performed by them may be authenticated with application of an electronic signature and that electronic signature has the same validity as a handwritten signature. Their signed agreement also confirms the individual has read and understands the policy and agrees to abide by the requirements for use of electronic signature stated in the policy.

4.13.2 Technical Records

In addition to the requirements specified in subsections 4.13.1.1 through 4.13.1.5, the requirements in the following subsections also apply to technical records.

4.13.2.1 Description

Technical records are the accumulation of data and information generated from the analytical process. These records may include forms, worksheets, workbooks, checklists, notes, raw data, calibration records, final test reports, and project record. The accumulated record needs to provide adequate detail to historically reconstruct the process and identify the personnel that performed the tasks associated with a test result.

4.13.2.2 Real Time Recordkeeping

Personnel are instructed and expected to always record observations, data, and calculations at the time they are made. PAS managers are responsible to assure that data entries, whether made electronically or on hardcopy, are identifiable to the task.

4.13.2.3 Error Correction

Errors in records must never be erased, deleted, or made illegible. Use of correction fluid, such as white-out is prohibited. In hardcopy records, the error is corrected by a single strike through the original entry and the new entry recorded alongside or footnoted to allow for readability. Corrections are initialed and dated by the person making the correction. If the correction is not self-explanatory, a reason for the correction is recorded.

For electronic records, equivalent measures of error correction or traceability of changes made is kept. For example, audit trails provide records of change.

Maintenance of proper practices for error correction is monitored through the tiered data review process described in Section 5.9.3. Records are reviewed throughout the data review process. Individuals performing these reviews flag errors that are not properly corrected and bring these to the attention of the department manager or supervisor of the work area in which the record was generated so that the problem may be addressed and corrected with the individual(s) that did not make the correction properly.

4.14 Audits

Quality personnel, or their designees, perform internal systems and technical audits to assess implementation of the QMS, compliance to this manual, policy, and procedures that make up the QMS. Since the processes in this manual are based on the requirements from relevant and applicable Standards for the operation and management of laboratories when operations are assessed against the PAS QMS, compliance with regulatory program requirements and accreditation/certification program requirements are also assessed.

PAS locations are also audited by external parties such as regulatory agencies, customers, consultants, and non-government assessment bodies (NGAB).

Information from internal and external audits is used by local and corporate management to address deficiencies and to identify opportunities to improve customer service and quality of work, including reliability and usability of data and test results.

Deficiencies, observations, and recommendations from audits are managed by the local QM using the CAPA process. See Section 4.11 for more information.

4.14.1 Internal Audit

The PAS internal audits are conducted to ensure practice matches what we say we do and what we say we do is compliant with the PAS QMS and relevant standards and requirements.

The internal audit program is managed by the local QM who prepares an audit plan at the beginning of each calendar year. The schedule is prepared to assure that all work areas are reviewed over the course of the year and test methods are audited every two years, unless a more frequent test method audit is required by program. Conformance to the schedule is monitored on a monthly basis.

PAS management is responsible to ensure the audit schedule is maintained. PAS supervisors are expected to cooperate with the quality personnel to provide them with complete access to the work area, personnel, and records needed to conduct the audit.

Internal audits may be performed by non-quality personnel when the auditor is approved by the local QM. Non-quality personnel may not audit their own work activities unless it can be demonstrated that an effective and objective audit will be conducted. The person conducting the audit should be trained, qualified, and familiar enough with the objectives and policies of the PAS QMS and knowledgeable with process and test method SOPs related to the activities audited. The auditors should be trained in auditing practices in order to perform a thorough and effective evaluation.

Test method audits include reviews of test reports to verify the product is consistent with customer/project requirements, the work was conducted in accordance with policy and SOPs, the SOP complies with the cited reference method, test results are accurate, and of known and documented quality and properly qualified, when necessary.

Special audits are performed as needed to follow up on a specific issue such as a client complaint, negative feedback, concerns of data integrity or ethics, or a problem identified through other audits. Special audits may be scheduled or unscheduled. Unscheduled internal audits are conducted whenever doubts are cast on compliance with regulatory requirements or its own policies and procedures. These unscheduled internal audits may be conducted at any time and may be performed without an announcement to the location or work area audited.

When observations and findings from any audit (internal or external) cast doubt on the validity of testing results, the location takes immediate action to investigate the problem and take corrective action. (Also see 4.11 and 4.16)

4.14.1.1 Corporate Compliance Audit

PAS locations may also be audited by corporate personnel at discretion. The purpose of the corporate compliance audit is to assess whether the location's practices, processes and procedures conform with the PAS QMS and to identify risk and opportunity.

4.15 Management Review

Local management conducts an annual business review of each location under their purview to assess performance and to establish goals, objectives, and action plans for the upcoming year.

The procedure used to conduct this review is specified in corporate SOP ENV-SOP-CORQ-0005 *Management Review*.

At a minimum, the following topics are reviewed and discussed during annual management review:

- Changes in internal and external issues relevant to the location;
- Fulfillment of objectives and initiatives;
- suitability of policies and procedures, including EHS and waste management;
- status of actions from previous performance reviews;
- The outcome of recent internal audits;
- Corrective and preventive actions;

- Assessments by external bodies;
- The results of interlaboratory comparisons or proficiency tests;
- Changes in the volume and type of the work;
- Customer and personnel feedback, including complaints;
- Effectiveness of improvements / preventive actions made since last review;
- Adequacy of resources;
- results of risk identification;
- Proficiency testing performance and other measures related to the assurance of validity of test results; other relevant factors, such as QC trends and training status.

The discussion and results of this review are documented in a report prepared by local management. This report includes a determination of the effectiveness of the management system and its processes, goals, and objectives for improvements in the coming year with timelines and responsibilities, and any other need for change.

Goals and action items from annual management systems review are shared with local employees and with corporate management to highlight focus areas for improvement in addition to areas in which the location has excelled.

4.16 Data Integrity

PAS procedures for the investigation and response to events that may affect data integrity are described in the corporate SOPs for data inquiries and data recall and corrective and preventive action, however named.

Customers whose data are affected by these events are notified in a timely manner, usually within 30 days after the impact of the problem is understood. Some accreditation programs also require notification to the accreditation body (AB) within a certain timeframe from date of discovery when the underlying cause of the issue impacts accreditation. PAS locations must follow any program or project specific client notification requirements for notification, when applicable.

5.0 TECHNICAL REQUIREMENTS

5.1 General

Multiple factors contribute to the correctness and reliability of the technical work performed by PAS. These factors fall under these broad categories:

- Human Performance
- Facility and Environmental Conditions
- Test Method Performance and Validation
- Measurement Traceability
- Handling of Samples

The impact of each of these factors varies based on the type of work performed. To minimize negative effects from each of these factors, PAS accounts for the contribution from each of these categories when developing test method and process (administrative) SOPs, evaluating personnel qualifications and competence, and in the selection of equipment and supplies used.

5.2 Personnel

5.2.1 Personnel Qualifications

The PAS program for personnel management is structured to ensure personnel are selected, qualified, and competent to perform the roles and responsibilities of their position based on education, experience, and training.

Qualifications, duties, responsibilities, and authorities of each position are specified in job descriptions maintained by corporate HR (See Section 5.2.4). These job descriptions provide the general basis for the selection of personnel for hire and are used by the location to communicate to personnel the duties, responsibilities, and authorities of their position. Qualification records may include but are not limited to diploma, transcripts, and curriculum vitae (CV).

The term “personnel” refers to individuals employed by PAS directly as full-time, part-time, or temporary, and individuals employed by PAS by contract, such as through an employment agency. The term “personnel” is used interchangeably with the term “employee” throughout this manual. For purposes of this manual, these terms are equivalent.

The personnel management program is structured to establish and maintain records for each of the following:

- Selection of personnel;
- Training of personnel;
- Supervision of personnel;
- Authorization of personnel; and
- Monitoring Competence of personnel.

5.2.1.1 Competence

Competence is the ability to apply a skill or series of skills to complete a task or series of tasks correctly within defined expectations.

Competence for technical personnel authorized by PAS to provide opinion and interpretation of data to customers also includes the demonstrated ability to:

- Apply knowledge, experience, and skills needed to safely and properly use equipment, instrumentation, and materials required to carry out testing and other work activities in accordance with manufacturer specifications and location SOPs;
- Understand and apply knowledge of general regulatory requirements necessary to achieve regulatory compliance in work product; and

- Understand the significance of departures and deviations from procedure that may occur during the analytical testing process and the capability and initiative to troubleshoot and correct the problem, document the situation and decision-making process, and to properly qualify the data and analytical results.

PAS requirements for the competence of personnel (education, qualification, work experience, technical skills, and responsibilities) are specified in job descriptions created by management and kept by human resources (HR). The job description provides the basis for the selection of personnel for each position.

An employee is considered competent when he/she has completed the required training specified in Section 5.2.2 and documentation of training is complete.

5.2.2 Training (Required)

Pace[®] training requirements are outlined in Pace[®] policies COR-POL-0023 *Mandatory Training Policy* and COR-POL-0004 *Code of Ethics and Professional Conduct*.

5.2.2.1 Required Training Requirements

The PAS training program includes these elements:

- Scheduling
- Execution
- Documentation and Tracking
- Evaluation of Effectiveness

Required training is scheduled by corporate training personnel, local quality personnel, and the employee's direct supervisor.

Training on required topics, processes and procedure is delivered using various methods that incorporate techniques that appeal to the main learning styles: visual, aural, linguistic, and kinesthetic. Techniques include, on-the-job, instructor-led, self-study, eLearning, and blended.

The employee's direct supervisor is responsible for oversight of completion of the employee's required training and for providing adequate time to the employee to complete training assignments. The supervisor and employee are responsible to make sure the employee's training status and training records for all required training is current, complete, and documentation of training is available.

Training status is tracked by the local QM, who provides the status to local management at least monthly or more frequently, as necessary, to ensure required training for personnel is complete and up to date.

The following subsections further describe the required PAS training program for new hire training and on-going training.

5.2.2.1.1 New Hire Required Training

New hire training requirements apply to new personnel and to existing employees starting in a new position or different work area.

Required new hire training includes training on each of the following:

- Ethics and Data Integrity (See 5.2.2.1.3)
- Quality Manual / Quality Management System (See 5.2.2.1.4)
- Safety Manual and any training requirements specified in the manual.
- Policies & SOPs relevant to their job tasks
- Technical personnel that prepare and test samples must also successfully complete an initial demonstration of capability (IDOC) for the test methods performed before independently testing customer samples. (See 5.2.2.1.5). Independent testing means without direct supervision of the work activity by the supervisor or a qualified trainer.

All required training must be documented and verified complete by the local QM before the employee is authorized to work independently on client samples. Until then, the employee's direct supervisor is responsible for all work produced by the new employee under their supervision.

5.2.2.1.2 On-Going Required Training

Personnel receive on-going training in each of the following topics:

- Ethics and Data Integrity (See 5.2.2.1.3)
- Quality Manual / Quality Management System (See 5.2.2.1.4)
- Safety
- Changes to Policies & SOPs, relevant to their job activities.
- New Policies & SOPS, relevant to their job activities.
- Technical personnel must also successfully complete on-going demonstration of capability (CDOC) for all test methods performed on an annual basis. (See 5.2.2.1.5)

All required training must be documented and verified complete by the local QM with training records readily accessible in accordance with the corporate policy for Record Management (ENV-POL-CORQ-0013).

5.2.2.1.3 Ethics and Data Integrity Training

Data integrity training is provided to all new personnel and refresher data integrity training is provided to all employees on an annual basis. Personnel are required to acknowledge they understand that any infractions of the PAS data integrity procedures will result in a detailed investigation that could lead to profound consequences

including immediate termination, debarment, or civil/criminal prosecution.

Completion of data integrity training is documented using the mechanism established by Pace[®] to provide evidence that the employee has participated in training on this topic and understand their obligations related to data integrity.

The following topics and activities are covered:

- Policy for honesty and full disclosure in all analytical reporting;
- Prohibited Practices;
- How and when to report data integrity issues;
- Record keeping. The training emphasizes the importance of proper written documentation on the part of the analyst with respect to those cases where analytical data may be useful, but are in one sense or another partially nonconforming;
- Training Program, including discussion regarding all data integrity procedures;
- Data integrity training documentation;
- In-depth procedures for data monitoring; and
- Specific examples of breaches of ethical behavior such as improper data manipulations, adjustments of instrument time clocks, and inappropriate changes in concentrations of standards.

All PAS personnel, including contract and temporary, are required to sign an “Attestation of Ethics and Confidentiality” at the time of hire and/or during annual refresher training or as specified in the ethics policy. This document clearly identifies inappropriate and questionable behavior. Violations of this document result in profound consequences, including prosecution and termination, if necessary.

Also see SOP-ENV-COR-POL-0004 *Code of Ethics and Professional Conduct* for more information.

5.2.2.1.4 Management System Documents Training

The Quality Manual policies, and SOPs are the documents used by regulatory bodies and Pace[®] customers to verify capability, competency, and compliance with their requirements and expectations.

In addition to on-the-job training, employees must have a signed Read and Acknowledgement Statement (R&A) on record for the quality manual, and the policies and SOPs relating to his/her job

responsibilities. This statement, whether signed by the employee electronically or by wet signature, confirms that the employee has received, read, and understands the content of the document, that the employee agrees to follow the document when carrying out their work tasks; and the employee understands that unauthorized change to procedures in an SOP is not allowed except in accordance with the SOP departure policy (See 4. 9.1).

See SOP ENV-CORQ-0016 *Standard Operating Procedures and Standard Work Instructions* for more information.

5.2.2.1.5 Demonstration of Capability (DOC) Requirements

An initial demonstration of capability (IDOC) must be completed and validated prior to authorization for the employee to work independently on client samples for the test method. After successful IDOC, the employee must demonstrate continued proficiency (CDOC) for the test method on an annual basis. If more than a year has passed since the employee last performed the method; then capability must be re-established with an IDOC.

Successful DOC is one where the DOC replicate data has been compiled, reviewed, and verified by the employee's supervisor and/or manager to be complete and to have met acceptance criteria and the DOC record has been validated by quality personnel for completeness and compliance, and placed in the employee's training file for accessibility and reference.

Demonstration of capability (DOC) procedures and requirements vary by technology.

For example, a DOC for chemistry test methods where spiking is appropriate, is based on the employee's capability to achieve acceptable precision and accuracy for each analyte reported by the laboratory for the test method using the laboratory's test method SOP.

DOC procedures and requirements must be specified in the laboratory's test method SOP or a stand-alone SOP. Refer to these SOPs for more information.

5.2.2.1.6 Effectiveness of Training

Effectiveness of individual employee training is measured by their demonstrated ability to comprehend the training material and apply knowledge and skills gained to their job task. Measurements include but are not limited to:

- Testing of the employee's knowledge of the QMS, policies, and technical and administrative procedures through various mechanisms, such as quizzes, observation, and interviews.

- Demonstrated ability to convey information correctly and factually in written and verbal communication to internal and external parties.
- Demonstrated ability to carry out tasks in accordance with SOPs and other work instructions.
- Demonstrated ability to make sound decisions based on guidance and information available.
- Demonstrated initiative to seek help or guidance when the employee is unsure of how to proceed.

5.2.2.2 Supplemental Learning

Supplemental learning objectives may be established for newly hired personnel to aid in their development of administrative and technical skills. These learning objectives and materials, referred to as Learning Plans (LP), are created and maintained by the PAS 3P program and managed by the employee's direct supervisor.

Pace[®] also offers a wide variety of supplemental learning courses that are made available to all employees for professional development. These learning materials, maintained by Pace[®] corporate training personnel, are accessed via the company's employee portal, PaceConnect. The learning may be self-initiated based on an employee's interest or may be assigned to the employee at the discretion of management as professional development as part of an employee's annual goals.

Supplemental learning courses and learning plan activities are not prerequisites for competency (Section 5.2.1.1) and are not considered part of the required PAS QMS training program.

5.2.3 Personnel Supervision

Every employee is assigned a direct supervisor, however named, who is responsible for their supervision.

General supervisory responsibilities may include but are not limited to:

- Hiring Employees
- Training Employees
- Performance Management
- Development, oversight, and execution of personnel training plans
- Monitoring personnel work product to assure the work is conducted in accordance with this quality manual, policies, SOPs, and other documents that support the QMS.

5.2.4 Job Descriptions

Job Descriptions that define the required education, qualifications, experience, skills, roles and responsibilities, and reporting relationships for each Pace[®] position are established by top management and kept by corporate HR. The job descriptions apply to employees who are

directly employed by Pace[®], part-time, temporary, technical, and administrative and by those that are under contract with Pace[®] through other means.

The job descriptions include the education, expertise, and experience required for the position and the responsibilities and duties, including any supervisory or managerial duties assigned to the position.

5.2.5 Authorization of Technical Personnel

Technical personnel are authorized by local quality personnel to perform the technical aspects of their position after quality personnel have verified that the employee meets the qualifications for the position, has successfully completed required training (Section 5.2.2.1), and the employee has completed initial demonstrated capability (Section 5.2.2.1.5). After initial authorization, technical personnel are expected to maintain a current and complete training record, demonstrate on-going capability at least annually for each test method performed, and produce reliable results through accurate analysis of certified reference materials, proficiency testing samples, and/or routine quality control samples in order to remain authorized to continue to perform their duties.

Records to support authorization including, education, experience, training, and other evaluations are kept by the location where the employee works.

5.3 Accommodations and Facilities

5.3.1 Facilities

PAS laboratories and service centers are designed to support the correct performance of procedures and to not adversely affect measurement integrity or safety. Access to PAS facilities is controlled by various measures, such as card access, locked doors, staffed main entry.

5.3.2 Environmental Conditions

Each location is equipped with energy sources, lighting, heating, and ventilation necessary to facilitate proper performance of calibrations and tests. The location ensures that housekeeping, electromagnetic interference, humidity, line voltage, temperature, sound, and vibration levels are appropriately controlled to ensure the integrity of specific measurement results and to prevent adverse effects on accuracy or increases in the uncertainty of each measurement.

Environmental conditions are monitored, controlled, and recorded as required by the relevant specifications, methods, and procedures. Operations are stopped if it is discovered that the environmental conditions would jeopardize the integrity of analytical results or other work product.

5.3.3 Separation of Incompatible Activities

The layout and infrastructure of each work area including air handling systems, power supplies, and gas supplies of each work area is specifically designed for the type of analytical activity performed. Effective separation between incompatible work activities is maintained. For example, sample storage, preparation, and chemical handling for volatile organic analysis (VOA) is kept separate from semi-volatile organic (SVOA).

Samples known or suspected to contain high concentration of analytes are separated from other samples to avoid the possibility for cross-contamination. If contamination is found, the source of contamination is investigated and resolved in accordance with applicable SOPs.

5.3.4 Security

Security is maintained by controlled access to the building and by surveillance of work areas by authorized personnel. Access is controlled to each area depending on the required personnel, the sensitivity of the operations performed, and potential safety concerns.

5.3.5 Good Housekeeping

PAS locations must maintain good housekeeping practices in work areas to maintain a standard of cleanliness necessary for analytical integrity and personnel health and safety.

5.4 Test Methods

5.4.1 General Requirements

The laboratory uses test methods and procedures that are appropriate for the scope of analytical services the laboratory offers.

Instructions on the use and operation of equipment and sample handling, preparation, and analysis of samples are provided in SOPs. The instructions in SOPs may be supplemented with other documents including, but not limited to, standard work instructions (SWI), manuals, guides, project documents and reference documents.

These documents are managed using the procedures described in SOP ENV-SOP-CORQ-0015 *Document Management and Control* and SOP ENV-SOP-CORQ-0016 *Standard Operating Procedures and Standard Work Instructions*.

5.4.2 Method Selection

The test methods and protocols used by the laboratory are selected to meet the needs of the customer, are appropriate for the items tested, for the intended use of the data, and to conform with applicable federal, statutory, or program requirements.

The test methods offered by PAS are industry accepted methods published by international, regional, or national standards. Each PAS laboratory bases its procedure on the latest approved edition of a method unless it is not appropriate or possible to do so, or unless regulatory requirements specify otherwise.

The laboratory confirms that it can perform the test method and achieve desired outcome before analyzing samples (see section 5.4.5). If there is a change in the published analytical method, then the confirmation is repeated.

When a customer does not specify the test method(s) to be used, the laboratory may suggest test methods that are appropriate for the intended use of the data and the type of samples to be tested. The laboratory will also inform customers when test methods requested are considered inappropriate for their purpose and/or out of date. This discourse takes place during review of analytical service requests (See Section 4.4).

5.4.3 PAS Developed Methods

A PAS developed method is a method developed from scratch (no published source method), a procedure that modifies the chemistry from the source method, or a procedure that exceeds the scope and application of the source method.

PAS developed methods must be validated prior to use (see section 5.4.5) and the procedure documented in a test method SOP.

The requirements for non-standard methods (Section 5.4.4) also apply to PAS developed methods.

5.4.4 Non-standard Methods

A non-standard method is a method that is not published or approved for use by conventional industry standards for the intended purpose of the data. Non-standard methods must be validated prior to use (see section 5.4.5) and the procedure developed and documented in a test method SOP.

At a minimum, the following information must be included in the procedure:

- Title / Identification of Method;
- Scope and Application;
- Description of the type of item to be analyzed;
- Parameters or quantities and ranges to be determined;
- Apparatus and equipment, including technical performance requirements;
- Reference standards and reference materials required;
- Environmental conditions required and any stabilization period needed; and
- Description of the procedure, including:
 - Affixing identification marks, handling, transporting, storing, and preparing of items;
 - Checks to be made before the work is started;
 - Verifying equipment function and, where required, calibrating and/or adjusting the equipment before each use;
 - Method of recording the observations and results;
 - Any safety measures to be observed;
 - Criteria and/or requirements for approval/rejection;
 - Data to be recorded and method of analysis and presentation; and
 - Uncertainty or procedure for estimating uncertainty.

Use of a non-standard method for testing must be agreed upon with the customer. The agreement, which is retained by the laboratory in the project record, must include the specifications of the client's requirements, the purpose of testing, and their authorization for use of the non-standard method.

5.4.5 Method Validation

5.4.5.1 Validation Description

Validation is the process of confirmation and the provision of objective evidence that the stated requirements for a specific method/procedure are fulfilled.

The laboratory's requirements and procedures for method validation are outlined in SOP ENV-SOP-CORQ-0011 *Method Validation and Instrument Verification*.

5.4.5.2 Validation Summary

All test methods offered by the laboratory are validated before use to confirm the procedure works and the data and results achieved meet the goals for the method and repeated when there are major changes to the laboratory procedure.

Results of validation are retained are kept in accordance with method validation SOP and the corporate policy ENV-CORQ-POL-0013 *Record Management*.

5.4.5.3 Validation of Customer Need

The validation process includes review of accuracy, precision, sensitivity, selectivity, linearity, repeatability, reproducibility, robustness, and cross-sensitivity of the procedure against general customer needs to ensure the laboratory's procedure will meet those needs.

The following subsections explain some concepts as they are applied to chemistry. The applications of these same concepts may differ for other technologies such as microbiology, radiochemistry, whole effluent toxicity (WET), and asbestos or other validation concepts may apply to these disciplines. Refer to the laboratory's test method SOPs for more information.

5.4.5.3.1 Accuracy

Accuracy is the degree to which the result of a measurement, calculation, or specification conforms to the correct value or a standard. When the result recovers within a range from the known value (control limit); the result generated using the laboratory's test method SOP is considered accurate.

5.4.5.3.2 Precision

Precision refers to the closeness of two or more measurements to each other. It is measured by calculating the relative percent difference (RPD) or relative standard deviation (RSD) from results of separate analysis of the same sample. Precision provides information about repeatability, reproducibility, and robustness of the laboratory's procedure.

5.4.5.3.3 Limits of Detection (LOD) (Chemistry)

The LOD is the minimum result which can be reliably discriminated from a blank with a predetermined confidence level. The LOD

establishes the limit of method sensitivity and is also known as the detection limit (DL) or the method detection limit (MDL).

Values below the LOD cannot be reliably measured and are not reported by the laboratory unless otherwise specified by regulatory program or test method.

The LOD is established during method validation and after major changes to the analytical system or procedure that affect sensitivity are made.

The laboratory's procedure for LOD determination is specified in SOP ENV-SOP-MTJL-0016, *Method Detection Limits (MDL), Limits of Detection (LOD) and Limits of Quantitation (LOQ)* and ENV-SOP-MTJL-0340, *Radiochemistry Method Performance Criteria*.

For chemistry methodology, the local SOP must comply with the current version of each of the following documents:

- EPA document EPA-821-R-16-006 *Definition and Procedure for the Determination of the Method Detection Limit*;
- 2016 TNI Standard V1M4; and
- TNI GUID-3-109-Rev. 0, *V1M4 2016 Standard Update Guidance on Detection and Quantitation*.

5.4.5.3.4 Limits of Quantitation (LOQ) and Reporting Limit (RL)

This section describes these concepts for chemistry. For non-chemistry technologies, such as microbiology, refer to laboratory SOPs.

The LOQ is the minimum level, concentration, or quantity of a target analyte that can be reported with a specified degree of confidence.

The LLOQ is the value of the lowest calibration standard included in the calibration curve. The LLOQ establishes the lower limit of quantitation; it is not the same concept as the LOQ, however, the LOQ and LLOQ may be the same value.

The LOQ and LLOQ represent quantitative sensitivity of the test method.

- The LOQ must always be equal to or greater than the LLOQ and the LLOQ must always be greater than the LOD.
- Any reported value (detect or non-detect) less than the LLOQ is a qualitative value.

The RL is the value to which the presence of a target analyte is reported as detected or not detected. The RL is project-defined

based on project data quality objectives (DQO). In the absence of project specific requirements, the RL is usually set to the LOQ or the LLOQ.

The laboratory's procedures for LOQ determination must be specified in the same SOP for LOD determination, (See Section 5.4.5.3.3) The LLOQ for each method must be specified in the test method SOP.

Linearity is a mathematical concept applied to calibration models that employ multiple points to establish a calibration range used for quantitative analysis. Linearity is measured differently based on the calibration model. In general, if linearity is demonstrated then the slope of the response of standards are sufficiently close to one another. The accuracy of the linear regression and non-linear curves is verified by checking percent error or relative standard error (RSE), which is the process of refitting calibration data back to the model to determine if the results are accurate. For linear curves that use average calibration or response factor, error is measured by relative standard difference (RSD).

Linearity also establishes the range of quantitation for the test method used which directly impacts the sensitivity of the test method and uncertainty in measurement results. As previously noted, the LLOQ establishes the lower limit of quantitation. Similarly, the upper range of linearity establishes the upper limit of quantitation. In general, results outside of this range are considered qualitative values. However, inorganic test methods sometimes allow for extension of the linear range above the upper limit of quantitation when accuracy at this value is verified.

Linearity can also be used to establish repeatability, reproducibility, and robustness of the laboratory's test method. When linearity is demonstrated using a specific calibration model during method validation, then use of this same calibration model to achieve linearity on a day-to-day basis confirms the laboratory's method is repeatable, reproducible, and robust.

5.4.5.3.5 Demonstration of Capability (DOC)

The DOC performed during method validation confirms that the procedure demonstrated acceptable precision and accuracy.

5.4.6 Measurement Uncertainty

The location provides an estimate of uncertainty in testing measurements with analytical results on request, or when required. For example, for radiochemistry uncertainty is always reported with the test result

For chemistry methodologies, the uncertainty of the test method is reflected in the control limits used to evaluate QC performance for the test method. (See 5.9.1.1.9). ISO/IEC states

that when a well-recognized test method specifies limits to the values of the major source of uncertainty of measurement and specifies the form of presentation of calculated results, the laboratory has satisfied the requirements on analytical uncertainty by following the test method and reporting instructions.

When measurement uncertainty cannot be satisfied through control limits, the location will provide a reasonable estimation of uncertainty. A reasonable estimation is based on knowledge of method performance and previous experience. When estimating the analytical uncertainty, all uncertainty components which are of importance in the given situation are considered.

5.4.7 Control of Data

PAS has policies and processes in place to assure that reported data is free from calculation and transcription errors, that quality control is reviewed and evaluated before data is reported, and to address manual calculation and integration.

5.4.7.1 Calculations, Data Transfer, Reduction and Review

Whenever possible, calculations, transfer of data, and data reduction are performed using validated software programs (See 5.4.7.2).

If manual calculations are performed, the results of these calculations are verified during the data review process outlined in section 5.9.3.

5.4.7.1.1 Manual Integration

The PAS policy and procedures for manual integration are provided in corporate SOP ENV-SOP-CORQ-0006 *Manual Integration*.

This SOP includes the conditions under which manual integration is allowed and the requirements for documentation.

Required documentation of manual integration includes:

- complete audit trail to permit reconstruction of before and after results;
- identification of the analyst that performed the integration and the reason the integration was performed; and
- identification of the individual(s) that reviewed the integration and verified the integration was done and documented in compliance with the SOP.

5.4.7.2 Use of Computers and Automated Acquisition

Whenever possible, PAS uses software and automation for the acquisition, processing, recording, reporting, storage, and/or retrieval of data.

Software applications developed by PAS are validated by corporate IT for adequacy before release for routine use. Commercial off the shelf software is considered sufficiently validated when the location follows the manufacturer or vendor's manual for set-up and use. Records of validation are kept by the corporate information technology (IT) group or by the group that performed the validation.

The PAS process for the protection of data stored in electronic systems includes:

- Individual usernames and passwords for Laboratory Information Management Systems (LIMS) and auxiliary systems used to store or process data.
- Employee Training in Computer Security Awareness
- Validation of spreadsheets used for calculations to verify formulas and logic yield correct results and protection of these cells to prevent unauthorized change.
- Operating system and file access safeguards
- Protection from Computer Viruses
- Regular system backup; and testing of retrieved data
- Verification the software application works as expected and is adequate for use and fulfills compliance requirements, such as the need to record date/time of data generation.
- Change control to assure requests for changes are reviewed and approved by management before the change is made.
- Communication channels to assure all staff are aware of changes made.
- Version Control and maintenance of historical records.

5.5 Equipment

5.5.1 Availability of Equipment

Each PAS location is furnished with all equipment and instrumentation necessary to correctly perform the tests offered in compliance with the specifications of the test method and to achieve the accuracy and sensitivity required.

When a regulation, program, or reference test method requires Class A glassware for quantitative measurements, only Class A glassware may be used. Plastic graduated cylinders, even if marketed by the vendor as comparable to Class A glassware, may not be used when Class A glassware is specified because ASTM's definition and tolerances for Class A glass cannot be applied to other materials.

5.5.2 Calibration

Equipment and instrumentation are checked prior to use to verify it performs within tolerance for its intended application.

5.5.2.1 Support Equipment

The location confirms support equipment is in proper working order, uniquely identified, and meets the specifications for use prior to placement in service. Periodic checks are performed to verify tolerance and accuracy are performed thereafter in accordance with a support equipment maintenance scheduled maintained by local quality personnel. Equipment that does not meet specifications is removed from

service until repaired or replaced. Records of repair and maintenance activities are maintained.

Procedures used to conduct and record these checks are outlined in SOP ENV-SOP-MTJL-0374, *Support Equipment*, ENV-SOP-MTJL-0047 *Lockout/Tagout* as well as ENV-SOP-MTJL-0056 *Instrument Transport*.

5.5.2.2 Analytical Instruments

Analytical instruments are checked prior to placement in service in accordance with SOP ENV-SOP-CORQ-0011 *Method Validation and Instrument Verification*. After the initial service date, the calibration of instruments and verification calibration is performed in accordance with local test method SOPs.

The calibration procedures in the test method SOPs comply with the requirements for acceptable calibration practices outlined in corporate policy ENV-POL-CORQ-0005 *Acceptable Calibration Practices*, the reference methods, and any applicable regulatory or program requirements.

5.5.3 Equipment Use and Operation

Equipment is operated and maintained by personnel that are trained on the test method SOP. Up-to-date instructions and procedures for the use and maintenance of analytical equipment are included in SOPs and/or supplemental documents such as standard work instructions (SWI) or instrument manuals which are made readily accessible in the work area to all laboratory personnel.

5.5.4 Equipment Identification

Each piece of equipment must be uniquely identified by serial number or any other unique ID system. The identifier is included in the equipment list maintained by the quality department and may not be reused or used interchangeably. New equipment and replacement equipment must be assigned a new unique ID.

5.5.5 Equipment Lists and Records

5.5.5.1 Equipment List

Each PAS location maintains a list of equipment that includes information about the equipment including a description, manufacturer, serial number, date placed in service, condition when received, identity, and the work area where the equipment is used. The date of purchase is tracked by the procurement record. The equipment list(s) for each location covered by this manual is provided in Appendix E.

5.5.5.2 Equipment Records

In addition to the equipment list, the location maintains records of equipment that include:

- Verification that equipment conforms with specifications.
- Calibration records including dates, results, acceptance criteria, and next calibration dates.

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- Maintenance plan and records
- Records of damage, malfunction, or repair

The laboratory follows an equipment maintenance program designed to optimize performance and to prevent instrument failure which is described in SOP ENV-SOP-MTJL-0373 *Instrument Maintenance*, ENV-SOP-MTJL-0374 *Support Equipment*, ENV-SOP-MTJL-0047 *Lockout/Tagout* as well as ENV-SOP-MTJL-0056 *Instrument Transport* and/or in individual test method SOPs.

The maintenance program includes routine maintenance activities which are performed as recommended by the manufacturer at the frequency recommended and non-routine maintenance, which is performed to resolve a specific problem such as degradation of peak resolution, shift in calibration relationship, loss of sensitivity, or repeat failure of instrument performance checks and quality control samples.

Maintenance is performed by PAS personnel or by outside service providers.

All maintenance activities performed by PAS personnel are recorded by the individual(s) that performed the activity at the time the maintenance was performed in an instrument maintenance log.

The maintenance record minimally includes the date of maintenance, the initials of the person(s) performing maintenance, a description of the activity performed, why (when the maintenance is non-routine), and the return to analytical control. When maintenance is performed by an external vendor, the service must be maintained and accessible for easy retrieval. The location must provide personnel with unrestricted access to instrument maintenance logs in order to promote good instrument maintenance and recordkeeping practices.

If an instrument must be moved, the location will use safe practices for handling and transport to minimize damage and contamination.

5.5.6 Out of Service Protocol

Equipment that has been subjected to overloading, mishandling, gives suspect results, has been shown to be defective, or is performing outside of specified limits is taken out of service and either removed from the work area or labeled to prevent accidental use until it has been repaired and verified to perform correctly.

When analytical equipment is taken out of service because it no longer meets tolerance specifications, the potential effect of the nonconformance may have had on previously reported analytical results should be evaluated. (See section 4.9).

5.5.7 Calibration Status

The location labels support equipment to indicate calibration status, whenever practicable or otherwise maintains the calibration status in a visible location in the work area. These procedures are described in SOP ENV-SOP-MTJL-0373 *Instrument Maintenance*, ENV-SOP-MTJL-0374 *Support Equipment*, ENV-SOP-MTJL-0047 *Lockout/Tagout* as well as ENV-SOP-MTJL-0056 *Instrument Transport*.

The calibration status of analytical instruments is documented in the analytical record. Analysts verify on-going acceptability of calibration status prior to use and with instrument performance check standards. These procedures are described in test method SOPs.

5.5.8 Returned Equipment Checks

When equipment or an instrument is sent out for service, the location using the equipment ensures that the function and calibration status of the equipment is checked and shown to be satisfactory before the equipment is returned to service.

5.5.9 Intermediate Equipment Checks

The location performs intermediate checks on equipment to verify the on-going calibration status. For example, most test methods require some form of continuing calibration verification check, and these procedures are included in the test method SOP. Periodic checks of support equipment are also performed; see ENV-SOP-MTJL-0373 *Instrument Maintenance*, ENV-SOP-MTJL-0374 *Support Equipment*, Env-SOP-MTJL-0047 *Lockout/Tagout* as well as ENV-SOP-MTJL-0056 *Instrument Transport* for more information.

5.5.10 Safeguarding Equipment Integrity

The location safeguards equipment integrity using a variety of mechanisms that include but are not limited to:

- Adherence to manufacturer's specification for instrument use so that settings do not exceed manufacturer's recommendation or stress the performance of the equipment.
- Established maintenance programs.
- Transparent maintenance records and unrestricted access to maintenance logs.
- Validation and approval of software before use.
- Audits to confirm instrument settings are consistent with SOPs.
- On-the-job training for safe and proper use of laboratory equipment.

5.6 Measurement Traceability

5.6.1 General

Measurement traceability refers to a property of a measurement result whereby the result can be related to a reference through an unbroken chain of calibration, each contributing to the measurement uncertainty. Traceability requires an established calibration hierarchy of equipment (instruments) used during testing including equipment used for subsidiary measurements. The location assures this equipment is calibrated prior to being put into service and that the reference standard and materials used for calibration are traceable to the international standard of units (SI) or national measurement standard.

When strict traceability to SI units cannot be made, the location establishes traceability with the use of reference standards and equipment obtained from competent suppliers that provide calibration certificates and/or certificates of analysis (COA).

5.6.2 Equipment Correction Factors

When correction factors are used to adjust results the PAS personnel will assure that results in computer software are also updated.

5.6.3 Specific Requirements

5.6.3.1 Requirements for Calibration Laboratories

The laboratory does not offer calibration services to customers; therefore, ISO/IEC and TNI requirements for calibration laboratories do not apply.

5.6.3.2 Requirements for Testing Laboratories

The laboratory has procedures in place to verify equipment is calibrated prior to being put into service (See 5.5.2) and ensures the reference standard and materials used for calibration are traceable to the international standard of units (SI) or national measurement standard. When strict traceability to SI units cannot be made, the laboratory establishes traceability with the use of reference standards and equipment obtained from competent suppliers that provide calibration certificates and/or certificates of analysis (COA).

5.6.4 Reference Standards and Reference Materials

5.6.4.1 Reference Standards

The laboratory uses reference standards of measurement to verify adequacy of working weights and thermometers. The working weights are the weight(s) used for daily balance calibration checks and the working thermometers are used for daily temperature measurements.

Working weights and thermometers must be periodically checked to verify on-going adequacy for use between calibrations performed by an external calibration laboratory using reference standards traceable to SI or a national standard and that are used solely for verification purposes.

For example:

- An acceptable reference standard to check working thermometers against include a NIST Certified Thermometer or a NIST Traceable Thermometer that is not used for any other purpose than to check the adequacy of the working thermometer.
- An acceptable reference standard for the working weights is a set of Class S weights that is not used for any other purpose than to verify the weights used daily.

The working weights must be checked against the reference standard annually and all weight sets must be recertified by an ISO accredited calibration body every 5 years. In this application, “annually” means within thirteen (13) months from the date of the last check.

Working thermometers must be checked against the reference thermometer prior to placement in service to establish a correction factor (CF)¹ and then re-checked

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annually (± 13 months from date of last check) or if battery operated, every three (3) months (± 100 days from date of last check).

Exceptions to the 3-month recheck for battery operated sensors are allowed when the sensor is embedded in a unit and the manufacturer/vendor has evidence to show that the accuracy of the sensor is not affected by battery life.

Liquid in Glass NIST Certified reference thermometers must be recertified by an ISO/IEC accredited calibration laboratory every 5 years. If the reference thermometer is NIST Traceable or is a digital NIST Certified thermometer, the reference thermometer must be recertified annually by an ISO/IEC 17025 accredited calibration laboratory or service provider that provides traceability to a national standard.

If criteria for the intermediate checks or recertification is not acceptable, the impact on previously reported results is evaluated using the process for evaluation of nonconforming work (See 4.9).

See SOP ENV-SOP-MTJL-0373 *Instrument Maintenance*, ENV-SOP-MTJL-0374, *Support Equipment*, Env-SOP-MTJL-0047 *Lockout/Tagout* as well as ENV-SOP-MTJL-0056 *Instrument Transport* for more information.

5.6.4.2 Reference Materials

The location purchases chemical reference materials (also known as stock standards) from vendors that are accredited to ISO 17034 or Guide 34. Purchased reference materials must be received with a Certificate of Analysis (COA) where available. If a reference material cannot be purchased with a COA, it must be verified by analysis and comparison to a certified reference material and/or there must be a demonstration of capability for characterization. COA are reviewed for adequacy and retained by the laboratory for future reference.

All prepared standards, reference materials, and reagents are verified to meet the requirements of the test method through routine analyses of quality control samples.

The laboratory procedure for traceability and use of these materials is provided in SOP ENV-SOP-MTJL-0041 *Standards Logger-Tree Operation*, ENV-SOP-MTJL-0023 *Storage of Consumables*, and ENV-SOP-MTJL-0042 *Standards Recertification*.

This SOP includes each of the following requirements:

- Procedures for documentation of receipt and tracking. The record of entry includes name of the material, the lot number, receipt date, and expiration date.
- Storage conditions and requirements. Reference materials must be stored separately from samples, extracts, and digestates.
- Requirements to assure that preparations of intermediate or working solutions are recorded and assigned a unique identification number for tracking. Records of preparation include the lot number of the stock standard(s) used, the type and

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lot number of the solvent, the formulation, date, expiration date, and the preparer's initials. The lot number of the working standards is recorded in the analytical record to provide traceability to the standard preparation record. The preparation record provides traceability to the COA, which is traceable to SI or the national measurement standard.

- A requirement that the expiration dates of prepared standards may not exceed the expiration date of the parent standard. Standards, reference materials, and reagents are not used after their expiration dates unless it is not possible to procure a new standard and the reliability of the expired material is verified and documented by the location using a procedure approved by corporate quality personnel. Otherwise, the expired material is promptly removed from the work area or clearly labeled as acceptable for qualitative/troubleshooting purposes only.
- The second source materials used for verification of instrument calibration are obtained from a different manufacturer or may be a different lot from the same manufacturer.
- Procedures to check reference materials for degradation and replacement of material if degradation or evaporation is suspected.
- Procedures for labeling. At a minimum, the container must identify the material, the ID of the material and the expiration date. Original containers should also be labeled with date opened.

5.6.4.3 Intermediate Checks

Checks to confirm the calibration status of reference standards and materials must be included in test method SOPs. These checks include use of second source standards and reference materials reserved only for the purpose of calibration checks.

5.6.4.4 Transport and Storage

The location handles and transports reference standards and materials in a manner that protects the integrity of the materials. Reference standard and material integrity is protected by separation from incompatible materials and/or minimizing exposure to degrading environments or materials. Standards and reference materials are stored separately from samples, extracts, and digestates. All standards are stored according to the manufacturer's recommended conditions. Temperatures colder than the manufacturer's recommendation are acceptable if it does not compromise the integrity of the material (e.g., remains in liquid state and does not freeze solid). In the event a standard is made from more than a single source with different storage conditions, the standard will be stored according to the conditions specified in the analytical method.

See the applicable analytical SOPs for specific reference material storage and transport protocols.

5.7 Sampling

Sampling refers to the field collection of samples and to subsamples taken by the laboratory for analysis from the field collected sample.

Subsampling procedures are included in each test method SOP or a stand-alone SOP to assure the aliquot used for testing is representative of the field collected sample.

The requirements in the following subsections apply when field sampling is performed by PAS.

5.7.1 Sampling Plans and SOPs

When PAS performs field collection of samples, sampling is carried out in accordance with a written sampling plan and sampling SOPs. These documents are made readily accessible at the sampling location. Sampling plans and SOPs are, whenever reasonable, based on appropriate governing methods and address the factors to be controlled to ensure the validity of the analytical results.

5.7.2 Customer Requested Deviations

When the customer requires deviations, additions, or exclusions from the documented sampling plan and/or procedure, the laboratory records the client's change request in detail with the sampling record, communicates the change to sampling personnel, and includes this information in the final test report.

5.7.3 Recordkeeping

PAS assures the sampling record includes the sampling procedure used, any deviations from the procedure, the date and time of sampling, the identification of the sampler, environmental conditions (if relevant), and the sampling location.

5.8 Sample Management & Handling

5.8.1 Procedures

The location's procedures for sample management and handling are outlined in SOP ENV-SOP-MTJL-0045 *Sample Dilution Policy*, ENV-SOP-MTJL-0060 *Sample Receiving*, ENV-SOP-MTJL-0061 *Sample Storage, Disposal and Sample Control Techniques*, ENV-SOP-MTJL-0064 *Sample Shipping*, and ENV-SOP-MTJL-0066 *Cold Storage Management*.

The procedures in these SOPs are established to maintain the safe handling and integrity of samples from transport, storage, to disposal and during all processing steps to maintain client confidentiality, and to protect the interests of PAS and its customers.

5.8.1.1 Chain of Custody

All samples received by the location must be accompanied with a Chain of Custody (COC) record. The COC provides information about the samples collected and submitted for testing and documents the possession of samples from time of collection to receipt by the location.

The COC record must minimally include the following information:

- Client name, address, phone number;

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- Project Reference;
- Client Sample Identification (Client ID);
- Date, Time, and Location of Sampling;
- Sampler's Name or Initials;
- Matrix;
- Type of container, and total number collected for each sample;
- Preservatives;
- Analyses Requested;
- Mode of collection;
- Any special instructions; and
- The date and time and signature of each sample transfer from time of collection to receipt in the location. When the signature field on CoC includes company. Personnel relinquishing and/or receiving samples are expected to record this information. When the COC is transported inside the cooler, independent couriers do not sign the COC and the shipping manifests and/or air bills are the records of possession during transport. The shipping manifest must be retained as part of the COC record and included in the test report when required (See Section 5.10.3).

A complete and legible COC is required. If the location observes that the COC is incomplete or illegible, the client is contacted for resolution. The COC must be filled out in indelible ink. Personnel correct errors by drawing a single line through the initial entry, so the entry is not obscured, entering the correct information, and initialing, and dating the change.

5.8.1.2 Legal Chain of Custody

Legal chain of custody is a chain of custody protocol used for evidentiary or legal purposes. The protocol is followed by the location when requested by customer or when mandated by a regulatory program.

Legal chain of custody (COC) protocol establishes an intact, continuous record of the physical possession*, storage, and disposal of "samples" which includes sample aliquots, and sample extracts/digestates/distillates.

Legal COC records account for all time periods associated with the samples and identifies all individuals who physically handled individual samples. Legal COC begins at the point established by legal authority, which is usually at the time the sample containers are provided by the location for sample collect or when sample collection begins.

*A sample is in someone's custody if:

- It is in one's physical possession;
- It is in one's view after being in one's physical possession;

- It has been in one's physical possession and then locked or sealed so that no one can tamper with it; and/or
- It is kept in a secure area, restricted to authorized personnel only.

Refer to SOP ENV-SOP-MTJL-0060 *Sample Receiving* for more information.

5.8.2 Unique Identification

Each sample is assigned a unique identification number (Lab ID) after the sample has been checked and accepted by PAS in accordance with the PAS sample acceptance policy (See 5.8.3). The Lab ID is affixed to the sample container using a durable label.

The unique identification of samples also applies to subsamples, and prepared samples.

The lab ID is linked to the field ID (client ID) in the receipt and log-in record. Both IDs are linked to the testing activities performed on the sample and the documentation records of the test.

Also see 5.8.4.

5.8.3 Sample Receipt Checks and Sample Acceptance Policy

The location checks the condition and integrity of samples on receipt and compares the labels on the sample containers to the COC record. Any problem or discrepancy is recorded. If the problem impacts the suitability of the sample for analysis or if the documentation is incomplete, the client is notified for resolution. Decisions and instructions from the client are maintained in the project record.

5.8.3.1 Sample Receipt Checks

The following checks are performed:

- Verification that the COC is complete and legible.
- Verification that each sample's container label includes the client sample ID, the date and time of collection and the preservative in indelible ink.
- The container type and preservative are appropriate for each test requested.
- Adequate volume is received for each test requested.
- Visual inspection for damage or evidence of tampering.
- Visual inspection for presence of headspace in VOA vials. (VOA = volatile organic analysis).
- Thermal Preservation: For chemical testing methods for which thermal preservation is required, temperature on receipt is typically considered acceptable if the measurement is above freezing but $<6^{\circ}\text{C}$ unless otherwise specified by federal, statutory, program or test method requirements. Refer to the location's SOP for sample receipt for specific thermal preservation requirements.

For samples that are hand-delivered to the location immediately after sample collection, there must be evidence that the chilling process began immediately

after sample collection and prior to delivery of the samples to the laboratory or service center, such as arrival of the samples on ice.

- Chemical Preservation
- Holding Time: Sample receiving personnel are trained to recognize tests where the holding time is 48 hours or less and to expedite the log-in of these samples. Except for tests with immediate holding times (15 minutes from time of collection or less), when samples are received out of hold, the location will notify the client and request instruction. If the decision is made to proceed with analysis, the final test report will include notation of this instruction.

5.8.3.2 Sample Acceptance Policy

PAS maintains a sample acceptance policy in accordance with regulatory guidelines to clearly establish the circumstances in which sample receipt is accepted or rejected.

When receipt does not meet criteria for any one of these conditions, the location must document the noncompliance, contact the customer, and either reject the samples or fully document any decisions to proceed with testing. In accordance with regulatory specifications, test results associated with receipt conditions that do not meet criteria are qualified in the final test report.

All samples received must meet each of the following criteria:

- Be listed on a complete and legible COC;
- Be received in properly labeled sample containers;
- Be received in appropriate containers that identify preservative;
- The COC must include the date and time of collection for each sample;
- The COC must include the test method requested for each sample;
- Be in appropriate sample containers with clear documentation of the preservatives used;
- Be received within holding time. Any samples received beyond the holding time will not be processed without prior customer approval;
- Have sufficient sample volume to proceed with the analytical testing. If insufficient sample volume is received, analysis will not proceed without customer approval; and
- Be received within appropriate temperature ranges unless program requirements or customer contractual obligations mandate otherwise.

Samples that are delivered to the location immediately after collection are considered acceptable if there is evidence that the chilling process has been started. For example, by the arrival of the samples on ice. If samples arrive that are not compliant with these temperature requirements, the customer will be notified. The analysis will NOT proceed unless otherwise directed by the

customer. If less than 72 hours remain in the hold time for the analysis, the analysis may be started while the customer is contacted to avoid missing the hold time. Data associated with any deviations from the above sample acceptance policy requirements will be appropriately qualified.

5.8.4 Sample Control and Tracking

The samples are controlled and tracked using the Laboratory Information Management System (LIMS). The LIMS stores information about the samples and project. The process of entering information into the LIMS is called log-in and these procedures are described in SOP ENV-SOP-MTJL-0060 **Sample Receiving**. After log-in, a label is generated and affixed to each sample container. Information on this label, such as the lab ID, links the sample container to the information in LIMS.

At a minimum, the following information is entered during log-in:

- Client Name and Contact Information;
- The laboratory ID linked to the client ID;
- Date and time of sample collection;
- Date and time of sample receipt;
- Matrix; and
- Tests Requested.

5.8.5 Sample Storage, Handling, and Disposal

The location procedures for sample storage, handling and disposal are detailed in SOPs

ENV-SOP-MTJL-0061 *Sample Storage, Disposal and Sample Control Technicians* and ENV-SOP-MTJL-0066 *Cold Storage Management* as well as test method SOPs.

5.8.5.1 Sample Storage

The samples are stored according to method and regulatory requirements as per test method SOPs. Samples are stored away from all standards, reagents, or other potential sources of contamination and stored in a manner that prevents cross contamination. Volatile samples are stored separately from other samples. All sample fractions, extracts, leachates, and other sample preparation products are stored in the same manner as actual samples or as specified by the analytical method.

Refrigerated storage areas are maintained at $\leq 6^{\circ}\text{C}$ (but not frozen) and freezer storage areas are maintained at $< -10^{\circ}\text{C}$, unless otherwise required per method or program. The temperature of each storage area is checked and documented at least once for each day of use. If the temperature falls outside the acceptable limits, then corrective actions are taken and appropriately documented.

The location is operated under controlled access protocols to ensure sample and data integrity. Visitors must register at the front desk and be properly escorted while on-site. Samples are taken to the appropriate storage location immediately after sample

receipt and log-in procedures are completed. All sample storage areas have limited access. Samples are removed from storage areas by designated personnel and returned to the storage areas as soon as possible after the required sample quantity has been taken.

5.8.5.2 Sample Retention and Disposal

The procedures used by the location for sample retention and disposal are detailed in SOP ENV-SOP-MTJL-0061 *Sample Storage, Disposal and Sample Control Techniques* and ENV-SOP-MTJL-0066 *Cold Storage Management*.

In general, unused sample volume and prepared samples such as extracts, digestates, distillates and leachates (samples) are retained by the location for the timeframe necessary to protect the interests of the location and the customer.

Samples may be stored at ambient temperature when all analyses are complete, the hold time is expired, the report has been delivered, and/or when allowed by the customer or program. Samples requiring storage beyond the minimum sample retention time due to special requests or contractual obligations may be stored at ambient temperature unless the location has a capacity, and their presence does not compromise the integrity of other samples.

After this period expires, non-hazardous samples are properly disposed of as non-hazardous waste. The preferred method for disposition of hazardous samples is to return the excess sample to the customer.

5.9 Assuring the Quality of Test Results

5.9.1 Quality Control (QC) Procedures

The location monitors the validity and reliability of test results using quality control (QC) samples that are prepared and analyzed concurrently with field samples in the same manner as field samples. QC results are always associated to and reported with the field samples they were prepared and analyzed with from the same preparation or analytical batch. See the glossary for definition of preparation and analytical batch.

The results of QC performed during the testing process are used by the location to assure the results of analysis are consistent, comparable, accurate, and/or precise within a specified limit. When the results are not within acceptance criteria or expectations for method performance, correction and corrective action(s) are taken. These actions may include retesting or reporting of data with qualification to alert the end user of the situation.

Other QC measures performed include the use of certified reference materials (see 5.6.4), participation in interlaboratory proficiency testing (see 5.9.1.2), verification that formulae used for reduction of data and calculation of results is accurate (see 5.9.3), on-going monitoring of environmental conditions that could impact test results (see 5.3.2), and evaluation and verification of method selectivity and sensitivity (see 5.4.5).

QC results are also used by the location to monitor performance statistical trends over time and to establish acceptance criteria when no method or regulatory criteria exist. (See 5.9.1.1.9)).

5.9.1.1 Essential QC

Although the general principles of QC for the testing process apply to all testing, the QC protocol used for each test depends on the type of test performed.

QC protocol used by the location to monitor the validity of the test are specified in test method SOPs. The SOP includes QC type, frequency, acceptance criteria, corrective actions, and procedures for reporting of nonconforming work.

These requirements in the SOP conform to the reference method and any applicable regulations or certification and accreditation program requirement for which results of the test are used. When a project requires more stringent QC protocol than specified in the SOP, project specification is followed. When the project requires less stringent QC protocol, the project specification may be followed as an authorized departure from the SOP when the project specifications meet the requirements in the mandated method and any regulatory compliance requirements for which the data will be used.

The following are examples of essential QC for chemistry. These concepts may not apply to other technologies and disciplines such as microbiology, radiochemistry, whole effluent toxicity, and/or asbestos. For essential QC for these disciplines, refer to test method SOPs.

5.9.1.1.1 Second Source Standard (ICV/QCS)

The second source standard is a standard obtained from a different vendor than the vendor of the standards used for calibration, or from a different lot from the same vendor, when only one vendor is available. It is a positive control used to verify the accuracy of instrument calibration relative to the purity of the standards used for calibration. This check may be referred to in published test methods and quality system standards as the initial calibration verification (ICV) or a quality control sample (QCS). The second source standard is analyzed immediately after the calibration and before analysis of any samples. When the ICV is not within acceptance criteria, a problem with the purity or preparation of the standards may be indicated. The source of the problem should be investigated and corrected prior to further use of the calibration/instrument for sample analysis.

5.9.1.1.2 Continuing Calibration Verification (CCV)

The CCV is used to determine if the analytical response has significantly changed since calibration. If the response of the CCV is within criteria, the calibration is considered valid. If not, there is a problem that requires further investigation and correction. Actions taken are technology and method specific.

5.9.1.1.3 Method Blank (MB) / Other Blanks

The MB is a negative control used to assess for contamination during the prep/analysis process. The MB consists of a clean matrix, similar

to the associated samples that is known to be free of analytes of interest. The MB, unless otherwise specified by the test method, is processed with, and carried through all preparation and analytical steps as the associated samples.

The criteria used to assess for contamination depends on the intended use of data. In general, detections in the MB above the RL or $\frac{1}{2}$ the RL indicate contamination. When contamination is evident, the source is investigated, and corrections are taken to reduce or eliminate it. Analytical results associated with MB that does not meet criteria are qualified in the final test report.

Other types of blanks that serve as negative controls in the process may include:

- Trip Blanks (VOA)
- Storage Blanks
- Equipment Blanks
- Field Blanks
- Calibration Blanks
- Cleanup Blanks
- Instrument Blanks

5.9.1.1.4 Laboratory Control Sample (LCS)

The LCS is a positive control used to measure the accuracy of process in a blank matrix. The LCS is spiked by the laboratory with a known amount of analyte. The spike is a standard solution that is pre-made or prepared from a certified reference standard. Like the MB, unless otherwise specified in the test method, the LCS is processed with and carried through all preparation and analytical steps as the associated samples.

When the percent recovery (%R) of the LCS is within the established control limit, sufficient accuracy has been achieved. If not, the source of the problem is investigated and corrected, and the procedure may be repeated. Analytical results associated with LCS that does not meet criteria are qualified in the final test report.

5.9.1.1.5 Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

The MS and MSD are replicates of a client sample that is spiked with known amount of target analyte. Matrix spikes measure the effect the sample matrix has on precision and accuracy of test results.

Matrix spike results mostly provide information on the effect of the matrix to the client whose sample was used and on samples of the same matrix from the same sampling site, during the same sampling event. Consequently, matrix spikes should be client designated. When there is not a client-specified MS for any sample in the batch,

the location randomly selects a sample from the batch; the sample selected at random is called a “batch” matrix spike.

The MS/MSD results for percent recovery and relative percent difference are checked against control limits. However, because the performance of matrix spikes is matrix-dependent and specific to the customer whose sample was used as the MS/MSD, the results of matrix spikes are not used for quality control on the batch.

5.9.1.1.6 Sample Duplicate (SD)

A sample duplicate is a second replicate of sample that is used to measure precision.

The relative percent difference between replicates are evaluated against the established acceptance criteria for relative percent difference (RPD) when this criterion is applicable. If RPD is not met, associated test results are reported with qualification.

5.9.1.1.7 Surrogates

Surrogates are compounds that mimic the chemistry of target analytes but are not expected to occur naturally in real world samples. Surrogates are added to each sample and matrix QC samples (MS, MSD, SD) at known concentration to measure the impact of the matrix on the accuracy of method performance. Surrogates are also added to the positive and negative control samples (MB, LCS) to evaluate performance in a clean matrix, and included in the calibration standards and calibration check standards.

The percent recovery of surrogates is evaluated against method-specified limits or statistically derived in-house limits. Project-specific limits and/or program-specific limits are used when required. Results with surrogate recovery out of limits in samples are reported with qualification. Samples with surrogate failures can also be re-extracted and/or re-analyzed to confirm that the out-of-control value was caused by the matrix of the sample and not by some other systematic error.

5.9.1.1.8 Internal Standards

Internal Standards are compounds not expected to occur naturally in field samples. They are added to every standard and sample at a known concentration prior to analysis for the purpose of adjusting the response factor used in quantifying target analytes. The location follows specific guidelines for the treatment of internal standard recoveries and further information can be found in the applicable test method SOP.

5.9.1.1.9 QC Acceptance Criteria and Control Limits

The QC acceptance criteria are specified in test method SOPs. The criteria in the SOP are based on the requirements in the published test method or regulatory program. When there are no established acceptance criteria, the location develops acceptance criteria in accordance with recognized industry standards.

Some methods and programs require the location to establish control limits for LCS, MS/MSD, and surrogate evaluation using historical data. PAS developed limits are referred to as “in-house” control limits. In-house control limits represent ± 3 Standard Deviations (99% confidence level) from the average recovery of at least 20 data points generated using the same preparation and analytical procedure in a similar matrix.

See SOP ENV-SOP-MTJL-0017 *Generation of Control Limits* for more information about the procedures used to establish in-house control limits.

5.9.1.2 Proficiency Testing (PT)

PAS locations participate in interlaboratory proficiency testing (PT) studies to measure performance of the test method and to identify or solve analytical problems. PT samples measure location performance through the analysis of unknown samples provided by an external source.

The frequency of PT participation is based on the certification and accreditation requirements held by the laboratory. The PT samples are obtained from accredited proficiency testing providers (PTP) and treated as field samples which means they are included in the location’s normal analytical processes and do not receive extraordinary attention due to their nature.

PAS locations do not share PT samples with other PAS locations, does not communicate with other PAS locations regarding current PT sample results during the duration of the study, and does not attempt to obtain the assigned value of any PT sample from the PT provider.

PT results scored unacceptable are investigated and correction action taken, when necessary.

Refer to corporate policy ENV-POL-CORQ-0002 *PT Policy* for more information.

5.9.2 QC Corrective Action

When the results of QC are not within acceptance criteria or expectations for method performance, correction and corrective action(s) are taken per the specifications in the test method SOP. These actions may include retesting or reporting of data with qualification to alert the end user of the situation.

5.9.3 Data Review

PAS locations use a tiered system for data review. The tiered process provides sequential checks to verify data transfer is complete; manual calculations, if performed, are correct, manual integrations are appropriate and documented, calibration and QC requirements are met, appropriate corrective action was taken when required, test results are properly qualified, process and test method SOPs were followed, project specific requirements were met, when applicable, and the test report is complete.

The sequential process includes three tiers referred to as primary review, secondary review, and administrative/completeness review.

Detailed procedures for the data review process are described in SOP ENV-SOP-MTJL-0038 *Data Review*. The general expectations for the tiered review process are described in the following sections:

5.9.3.1 Primary Review

Primary review is performed by the individual that performed the task. All PAS personnel are responsible for review of their work product to assure it is complete, accurate, documented, and consistent with policy and SOPs.

Checks performed during primary review include but are not limited to:

- Verification that data transfer and acquisition is complete
- Manual calculations, if performed, are documented and accurate
- Manual integrations, if performed, are documented, and comply with SOP ENV-SOP-CORQ-006 *Manual Integration*
- Calibration and QC criteria were met, and/or proper correction and corrective actions were taken, and data and test results associated with QC and criteria exceptions are properly qualified
- Work is consistent with SOPs and any other relevant instructional document such as SWI, program requirements, or project QAPP

5.9.3.2 Secondary Review

Secondary review is performed by a qualified peer or supervisor. Secondary review is a repeat of the checks performed during primary review by another person. In addition to the checks of primary review, secondary review includes chromatography review to check the accuracy of quantitative analyte identification.

5.9.3.3 Completeness Review

Completeness review is an administrative review performed prior to release of the test report to the customer. Completeness review verifies that the final test report is complete and meets project specification. This review also assures that information

necessary for the client's interpretation of results are explained in the case narrative or footnoted in the test report.

5.9.3.4 Data Audits

Test reports may be audited by local quality personnel to verify compliance with SOPs and to check for data integrity, technical accuracy, and compliance with the PAS QMS and any applicable federal, statutory, and program requirements. The reports chosen for the data audits are selected at random and these audits are not usually done prior to issuance of the test report to the customer.

If any problems with the data or test results are found during the data audit, the impact of the nonconforming work is evaluated using the process described in Section 4.9.

Also see Section 4.14 for internal audits.

5.9.4 Calibration Certificates

PAS does not perform calibration activities for its customers and calibration certificates are not offered or issued.

5.9.5 Opinions and Interpretations

The location provides objective data and information to its customers of sufficient detail for their interpretation and decision making. Objective data and information are based solely on fact and does not attempt to explain the meaning (interpret) or offer a view or judgement (opinion). Sometimes the customer may request the location provide opinion or interpretation to assist them with their decisions about the data.

When opinions and interpretations are included in the test report, the location will document the basis upon which the opinions and interpretations have been made and clearly identify this content as opinion or interpretation in the test report.

Examples of opinion and interpretation include but are not limited to:

- A viewpoint on how a nonconformance impacts the quality of the data or usability of results.
- Recommendations for how the customer should use the test results and information.
- Suggestions or guidance to the customer for improvement.

5.9.6 Subcontractor Reports

When analytical work has been subcontracted to an organization external to PAS, the test report from the subcontractor is included in its entirety as an amendment to the final test report.

Test results performed by multiple locations within the PAS network (internal subcontracting) may be merged into a single test report so long as the test report issued clearly identifies the location and address of each network location that performed testing, and which tests each PAS location performed. (See 5.10.2)

5.9.7 Electronic Transmission of Results

When test results and/or reports are submitted to the customer through electronic transmission, the procedures established in this manual for confidentiality and protection of data apply.

5.9.8 Format of Test Reports

The test formats offered by PAS are designed to accommodate each type of analytical test method performed and to minimize the possibility of misunderstanding or misuse of analytical results. The format of electronic data deliverables (EDD) follows the specifications for the EDD.

5.9.9 Amendments to Test Reports

Test reports that are revised or amended by the location after date of release of the original final test report to the customer are issued as a new test report that is clearly identified as an amendment or revision and that includes a reference to the originally issued final test report.

The customer is the organization doing business with PAS external to PAS.

Changes made to test results and data before the final test report is issued to the customer are not amendments or revisions, these are corrections to errors found during the location's data verification and review process.

The procedure for report amendments and revision are outlined in SOP ENV-SOP-MTJL-0014 *Data Handling and Reporting* and ENV-SOP-MTJL-0033 *Report Revision*.

5.10 Reporting

5.10.1 General Requirements

PAS offers a wide variety of test report formats to meet project needs of Pace[®] customers and that comply with federal and state regulatory programs.

The type and level of deliverable, including the electronic data deliverable (EDD) format are established between PAS and the customer during the contracting process. The report specifications include the test report format, protocol for the reporting limit (RL), conventions for the reporting of results less than the limit of quantitation (LOQ), and specification for the use of project or program specific data qualifiers. Information about review of analytical service requests is provided in Section 4.4.

5.10.2 Test Reports: Required Items

Regardless of deliverable or report requested, every test report issued by the location includes each of the following items:

- a) A Title
- b) The name and address of the location issuing the test report and for each location where testing was performed if different than address of the location issuing the report. When testing is done at multiple PAS locations, the report must clearly identify which PAS location performed each test method;

- c) Unique identification of the test report and on each page an identification number to link each page to the test report, and clear identification of the end of the report.
- d) The name and address of the customer
- e) Identification of test methods used
- f) Cross reference between client sample identification number (Sample ID) and the identification number for the sample (Lab ID) to provide unambiguous identification of samples.
- g) The date of receipt of samples, condition of samples on receipt, and identification of any instance where receipt of the samples did not meet sample acceptance criteria.
- h) Date and times of sample collection, receipt, preparation, and analysis.
- i) Test results and units of measurement, and qualification of results associated with QC criteria exceptions, and identification of reported results outside of the calibration range.
- j) All chains of custody (COC) including records of internal transfer between locations within PAS,
- k) Name, title, signature of the person(s) authorizing release of the test report and date of release.
- l) A statement that the results in the test report relate only to the items tested.
- m) Statement that the test report may not be reproduced except in full without written approval from PAS.

5.10.3 Test Reports: Supplemental Items

5.10.3.1 Supplemental Requirements

The following items are included in the test report when required or relevant:

- a) Shipping manifests / bill of lading as applicable when common couriers are utilized for shipment of samples,
- b) Explanation of departure from test method SOPs including, what the departure was and why it was necessary.
- c) Statistical methods used. (Required for Whole Effluent Toxicity)
- d) For solid samples, specification that results are reported on a dry weight or wet weight basis.
- e) Signed Affidavit, when required by client or regulatory agency.
- f) A statement of compliance / non-compliance with requirements or specifications (client, program, or standard) that includes identification of test results that did not meet acceptance criteria.
- g) When requested by the client, statement of estimated measurement uncertainty. In general, for environmental testing, estimated uncertainty of measurement is extrapolated from LCS control limits. Control limits incorporate the expected variation of the data derived from the laboratory's procedure. When the control limits are specified by the test method or regulatory program, the control limits

represent the expected variation of the test method and/or matrices for which the test method was designed.

- h) Opinions and Interpretations
- i) If a claim of accreditation/certification is included in the test report, identification of any test methods or analytes for which accreditation/certification is not held by the location if the accrediting body offers accreditation/certification for the test method/analyte. The fields of accreditation/certification vary between agencies, and it cannot be presumed that because accreditation/certification is not held that it is offered or required.
- j) Certification Information, including certificate number and issuing body.

For PAS locations accredited to ISO/IEC 17025:2017:

- Data included in the test report provided by a customer should be clearly identified. The test report should also include a statement that the test results apply only to the samples as received.

5.10.3.2 Test Reports: Sampling Information

The following items are included in the test report when samples are collected by PAS or when this information is necessary for the interpretation of test results:

- a) Date of Sampling.
- b) Unambiguous identification of material samples.
- c) Location of sampling including diagrams, sketches, or photographs.
- d) Reference to the sampling plan and procedures used.
- e) Details of environmental conditions at time of sample that may impact test results.
- f) Any standard or other specification for the sampling method or procedure, and deviations, additions to or exclusions from the specification concerned.

6.0 REVISION HISTORY

This Version (Version 2):

Section	Description of Change
Header / All	Added registered trademark after Pace as required by branding guidelines
Header	Updated the years associated with the copyright.
Signature Page	Removed Cover Page applied by MasterControl eDMS
Approval Signatory	Changed name of this page to "Management Personnel" and updated Job Titles.
All	Changed references to "laboratory" with PAS or location, where appropriate.
All	Replaced stand-alone acronym "ENV" with "PAS" except where "ENV" is embedded in document control numbers.
All	Corrected spelling, typographical, and format errors.
Various	Added language to clarify the examples in the manual are provided for chemistry, these examples may not apply in the same way to other disciplines such as radiochemistry, microbiology, asbestos, or whole effluent toxicity (WET).

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1.0	Corrected Parent Company Information.
1.2	Added definitions for “location,” “laboratory” and “service center” for QMS and compliance purposes.
1.2.1	Updated job titles to match current structure.
1.2.2	Revised language for clarity.
1.2.3	Removed specificity to allow for more options
4.1.4	Updated to describe current scope of organization
4.1.4.1	Updated to describe current organization structure
4.1.5.1.1	Updated to match new organization structure and job titles
4.1.5.2	Updated to match new organization structure and job titles
4.1.5.2.1	Updated to clarify qualifications and meaning of “absent”
4.1.5.3	Updated to clarify impartiality
4.1.5.4	Reorganized section for clarity
4.2.1.1	Added statement that the organization structure is designed to safeguard impartiality
4.2.2.1	Added requirement to post compliance alertline posters in work area.
4.2.1.3	Added requirement for policies and procedures to be available in work area (previously implied but not explicitly stated)
4.2.5.1	Clarified hierarchy and application of project documents
4.5	Updated requirements for internal and external subcontracting
4.8	Updated complaint handling requirements to clarify that only valid complaints are acted on with corrective action.
4.9.1.3	Added roles responsible for authorizing return to work after stop work order.
4.11	Main and subsections updated for clarity
4.14	Main and subsections updated for clarity
5.2.2 Subsections	Content reorganized and language related to documentation of training and authorization of personnel revised to clarify expectations. Requirements of DOCs modified to clarify procedure described in manual pertains to chemistry methodology; other approaches to DOC acceptable for other disciplines such as microbiology, radiochemistry, asbestos, whole effluent toxicity.
5.4.5.3.3	Added reference documents for which the local SOP for LOD must comply with.
5.5	Added language to clarify existing requirements.
5.6.4	Clarified requirements for reference standards for working weights and thermometers and defined meaning of terms “annual” and “quarterly.” Included examples of acceptable reference standards for adequacy checks.
5.8.1	Added recommendation for Pace® personnel to add “Pace®” next to their signature on the CoC when receiving samples since the CoC form has signature/company, implying the company affiliation must be added.
5.10.3.1	Included ISO/IEC 17025:2017 to add disclaimer to test reports (applies to laboratories accredited to ISO/IEC 17025:2017 only).
Addendum	Added AIHA, Radiological and Calculation addendums

This document supersedes the following documents:

Document Number	Title	Version
ENV-MAN-MTJL-0001	Quality Manual	02

ENV-MAN-MTJL-0001 v03_Quality Manual
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7.0 APPENDICES

7.1 Appendix A: Certification / Accreditation Listing

Disclaimer: The certifications / accreditation lists provided in this Appendix are those that were held by the PAS location on the effective date of this manual. This information is subject to change without notice and must not be considered valid proof of certification or accreditation status. This manual is not updated with each change made. Current certificates are accessible via the eDMS Portal for PAS employees. External parties should contact the location for the most current information.

7.1.1 PAS-Mt. Juliet

Authority	ID	Authority	ID
Alabama	40660	North Carolina	Env375
Alaska	UST-080	North Dakota	R-140
Arizona	AZ0612	Ohio EPA/VAP	CL0069
Arkansas	88-0469	Oklahoma	9915
California	2932	Oregon	TN200002
Colorado	None	Pennsylvania	68-02979
Connecticut	PH-0197	Rhode Island	221
Florida	E87487	South Carolina	84004
Georgia DW	923	South Dakota	Pending
Georgia	None	Tennessee DW	2006
Idaho	TN00003	Tennessee DW Micro	2006
Illinois	200008	Texas-Env.	T 104704245-07-TX
Indiana	C-TN-01	Texas-Mold	LAB0152
Iowa	364	Utah	TN000032019-9
Kansas	E-10277	Vermont	VT2006
Kentucky DW	90010	Virginia VELAP	460132
Kentucky UST	16	Washington	C1915
Kentucky WW	90010	West Virginia	233
Louisiana	Agency ID 30792	West Virginia Crypto	9966 M
Louisiana DW	LA150002	Wisconsin	998093910
Maine	TN0002	Wyoming	A2LA
Maryland	324	A2LA	1461.01
Massachusetts	M-TN003	AIHA-LAP	100789
Michigan	9958	DOD	1461.01
Minnesota	047-999-395	EPA	TN00003
Mississippi	None	EPA Region 8	
Missouri	340	USDA	S-67674
Montana	CERT0086		
Nebraska	NA		
Nevada	TN-03-2002-34		
New Hampshire	2975		
New Jersey-NELAP	TN002		
New Mexico	None		
New York	11742		
North Carolina Aquatic Tox.	41		
North Carolina DW	DW21704		

7.2 Appendix B: Capability Listing

The capabilities listed in this Appendix were held by the location referenced on the effective date of this manual. This information is subject to change without notice. External parties should contact the location for the most current information.

Table Legend:

- Air = Air
- DW = Drinking Water
- NPW = Non-Potable Water
- SCM = Solid and Chemical Materials
- Waste = Non-Aqueous Phase Liquid (NAPL), Oil
- Tissue = Biota and Tissue

7.2.1 PAS-Mt. Juliet

Parameter	Method	Matrices							
		Air	DW	NPW	SCM	Waste	Tissue		
1,1,1,2-Tetrachloroethane	EPA 5030				X				
1,1,1,2-Tetrachloroethane	EPA 624.1			X					
1,1,1,2-Tetrachloroethane	EPA 8260B			X	X				
1,1,1,2-Tetrachloroethane	EPA 8260C			X	X				
1,1,1,2-Tetrachloroethane	EPA 8260D			X	X				
1,1,1,2-Tetrachloroethane	SM 6200 B-2011			X					
1,1,1,2-Tetrachloroethane	EPA 524.2		X						
1,1,1-Trichloroethane	EPA 624.1			X					
1,1,1-Trichloroethane	EPA 8260B			X	X				
1,1,1-Trichloroethane	EPA 8260C			X	X				
1,1,1-Trichloroethane	EPA 8260D			X	X				
1,1,1-Trichloroethane	EPA TO-15	X							
1,1,1-Trichloroethane	EPA TO-15 GC/MS SIM	X							
1,1,1-Trichloroethane	SM 6200 B-2011			X					
1,1,1-Trichloroethane	EPA 524.2		X						
1,1,2,2-Tetrachloroethane	EPA 624.1			X					
1,1,2,2-Tetrachloroethane	EPA 8260B			X	X				
1,1,2,2-Tetrachloroethane	EPA 8260C			X	X				
1,1,2,2-Tetrachloroethane	EPA 8260D			X	X				
1,1,2,2-Tetrachloroethane	EPA TO-15	X							

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1,1,2,2-Tetrachloroethane	EPA TO-15 GC/MS SIM	X							
1,1,2,2-Tetrachloroethane	SM 6200 B-2011			X					
1,1,2,2-Tetrachloroethane	EPA 524.2		X						
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	EPA 624.1			X					
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	EPA 8260B			X	X				
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	EPA 8260C			X	X				
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	EPA 8260D			X	X				
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	EPA TO-15	X							
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	SM 6200 B-2011			X					
1,1,2-Trichloroethane	EPA 624.1			X					
1,1,2-Trichloroethane	EPA 8260B			X	X				
1,1,2-Trichloroethane	EPA 8260C			X	X				
1,1,2-Trichloroethane	EPA 8260D			X	X				
1,1,2-Trichloroethane	EPA TO-15	X							
1,1,2-Trichloroethane	EPA TO-15 GC/MS SIM	X							
1,1,2-Trichloroethane	SM 6200 B-2011			X					
1,1,2-Trichloroethane	EPA 524.2		X						
1,1'-Biphenyl (BZ-0) (Biphenyl)	EPA 8270C			X	X				
1,1'-Biphenyl (BZ-0) (Biphenyl)	EPA 8270D			X					
1,1-Dichloroethane	EPA 624.1			X					
1,1-Dichloroethane	EPA 8260B			X	X				
1,1-Dichloroethane	EPA 8260C			X	X				
1,1-Dichloroethane	EPA 8260D			X	X				
1,1-Dichloroethane	EPA TO-15	X							
1,1-Dichloroethane	EPA TO-15 GC/MS SIM	X							
1,1-Dichloroethane	SM 6200 B-2011			X					
1,1-Dichloroethane	EPA 524.2		X						
1,1-Dichloroethene	EPA 524.2		X						
1,1-Dichloroethylene	EPA 624.1			X					
1,1-Dichloroethylene	EPA 8260B			X	X				
1,1-Dichloroethylene	EPA 8260C			X	X				
1,1-Dichloroethylene	EPA 8260D			X	X				

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1,1-Dichloroethylene	EPA TO-15	X							
1,1-Dichloroethylene	EPA TO-15 GC/MS SIM	X							
1,1-Dichloroethylene	SM 6200 B-2011			X					
1,1-Dichloropropene	EPA 524.2		X						
1,1-Dichloropropene	EPA 624 (extended)			X					
1,1-Dichloropropene	EPA 624.1			X					
1,1-Dichloropropene	EPA 8260B			X	X				
1,1-Dichloropropene	EPA 8260C			X	X				
1,1-Dichloropropene	EPA 8260D			X	X				
1,1-Dichloropropene	SM 6200 B-2011			X					
1,1-dimethylethyl ester (tert-Butyl Formate)	EPA 8260B			X	X				
1,1-dimethylethyl ester (tert-Butyl Formate)	EPA 8260C			X					
1,1-dimethylethyl ester (tert-Butyl Formate)	EPA 8260D			X					
1,2,3,4-Tetrachlorobenzene	EPA 8270C			X	X				
1,2,3,4-Tetrachlorobenzene	EPA 8270D			X	X				
1,2,3,4-Tetrachlorobenzene	EPA 8270E			X	X				
1,2,3,5-Tetrachlorobenzene	EPA 625.1			X					
1,2,3,5-Tetrachlorobenzene	EPA 8270C			X	X				
1,2,3,5-Tetrachlorobenzene	EPA 8270D			X	X				
1,2,3,5-Tetrachlorobenzene	EPA 8270E			X	X				
1,2,3-Trichlorobenzene	EPA 524.2		X						
1,2,3-Trichlorobenzene	EPA 624 (extended)			X					
1,2,3-Trichlorobenzene	EPA 624.1			X					
1,2,3-Trichlorobenzene	EPA 8260B			X	X				
1,2,3-Trichlorobenzene	EPA 8260C			X	X				
1,2,3-Trichlorobenzene	EPA 8260D			X	X				
1,2,3-Trichlorobenzene	SM 6200 B-2011			X					
1,2,3-Trichloropropane	EPA 504.1		X						
1,2,3-Trichloropropane	EPA 624.1			X					
1,2,3-Trichloropropane	EPA 8260B			X	X				
1,2,3-Trichloropropane	EPA 8260C			X	X				
1,2,3-Trichloropropane	EPA 8260D			X	X				

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1,2,3-Trichloropropane	SM 6200 B-2011			X					
1,2,3-Trichloropropane	EPA 524.2		X						
1,2,3-Trimethylbenzene	EPA 624.1			X					
1,2,3-Trimethylbenzene	EPA 8260B			X	X				
1,2,3-Trimethylbenzene	EPA 8260C			X	X				
1,2,3-Trimethylbenzene	EPA 8260D			X	X				
1,2,3-Trimethylbenzene	EPA TO-15	X							
1,2,4,5-Tetrachlorobenzene	EPA 625.1			X					
1,2,4,5-Tetrachlorobenzene	EPA 8270C			X	X				
1,2,4,5-Tetrachlorobenzene	EPA 8270D			X	X				
1,2,4,5-Tetrachlorobenzene	EPA 8270E			X	X				
1,2,4-Trichlorobenzene	EPA 624.1			X					
1,2,4-Trichlorobenzene	EPA 625.1			X					
1,2,4-Trichlorobenzene	EPA 8260B			X	X				
1,2,4-Trichlorobenzene	EPA 8260C			X	X				
1,2,4-Trichlorobenzene	EPA 8260D			X	X				
1,2,4-Trichlorobenzene	EPA 8270C			X	X				
1,2,4-Trichlorobenzene	EPA 8270D			X	X				
1,2,4-Trichlorobenzene	EPA 8270E			X	X				
1,2,4-Trichlorobenzene	EPA TO-15	X							
1,2,4-Trichlorobenzene	SM 6200 B-2011			X					
1,2,4-Trichlorobenzene	EPA 524.2		X						
1,2,4-Trimethylbenzene	EPA 624.1			X					
1,2,4-Trimethylbenzene	EPA 8260B			X	X				
1,2,4-Trimethylbenzene	EPA 8260C			X	X				
1,2,4-Trimethylbenzene	EPA 8260D			X	X				
1,2,4-Trimethylbenzene	EPA TO-15	X							
1,2,4-Trimethylbenzene	SM 6200 B-2011			X					
1,2,4-Trimethylbenzene	EPA 524.2		X						
1,2-Dibromo-3-chloropropane	EPA 504.1		X						
1,2-Dibromo-3-chloropropane	EPA 524.2		X						
1,2-Dibromo-3-chloropropane (DBCP)	EPA 624.1			X					

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1,2-Dibromo-3-chloropropane (DBCP)	EPA 8011			X	X				
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260B			X	X				
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260C			X	X				
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260D			X	X				
1,2-Dibromo-3-chloropropane (DBCP)	SM 6200 B-2011			X					
1,2-Dibromoethane	EPA 504.1		X						
1,2-Dibromoethane	EPA 524.2		X						
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 624.1			X					
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8011			X	X				
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260B			X	X				
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260C			X	X				
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260D			X	X				
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA TO-15	X							
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA TO-15 GC/MS SIM	X							
1,2-Dibromoethane (EDB, Ethylene dibromide)	SM 6200 B-2011			X					
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)	EPA TO-15	X							
1,2-Dichlorobenzene	EPA 624.1			X					
1,2-Dichlorobenzene	EPA 625.1			X					
1,2-Dichlorobenzene	EPA 8260B			X	X				
1,2-Dichlorobenzene	EPA 8260C			X	X				
1,2-Dichlorobenzene	EPA 8260D			X	X				
1,2-Dichlorobenzene	EPA 8270C			X	X				
1,2-Dichlorobenzene	EPA 8270D			X	X				
1,2-Dichlorobenzene	EPA 8270E			X	X				
1,2-Dichlorobenzene	EPA TO-15	X							
1,2-Dichlorobenzene	SM 6200 B-2011			X					
1,2-Dichlorobenzene	EPA 524.2		X						
1,2-Dichloroethane	EPA 524.2		X						
1,2-Dichloroethane (Ethylene dichloride)	EPA 624.1			X					
1,2-Dichloroethane (Ethylene dichloride)	EPA 8260B			X	X				
1,2-Dichloroethane (Ethylene dichloride)	EPA 8260C			X	X				
1,2-Dichloroethane (Ethylene dichloride)	EPA 8260D			X	X				

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1,2-Dichloroethane (Ethylene dichloride)	EPA TO-15	X							
1,2-Dichloroethane (Ethylene dichloride)	EPA TO-15 GC/MS SIM	X							
1,2-Dichloroethane (Ethylene dichloride)	SM 6200 B-2011			X					
1,2-Dichloropropane	EPA 624.1			X					
1,2-Dichloropropane	EPA 8260B			X	X				
1,2-Dichloropropane	EPA 8260C			X	X				
1,2-Dichloropropane	EPA 8260D			X	X				
1,2-Dichloropropane	EPA TO-15	X							
1,2-Dichloropropane	EPA TO-15 GC/MS SIM	X							
1,2-Dichloropropane	SM 6200 B-2011			X					
1,2-Dichloropropane	EPA 524.2		X						
1,2-Diphenylhydrazine	EPA 625.1			X					
1,2-Diphenylhydrazine	EPA 8270C			X	X				
1,2-Diphenylhydrazine	EPA 8270D			X	X				
1,2-Diphenylhydrazine	EPA 8270E			X	X				
1,3,5-Trimethylbenzene	EPA 524.2		X						
1,3,5-Trimethylbenzene	EPA 624.1			X					
1,3,5-Trimethylbenzene	EPA 8260B			X	X				
1,3,5-Trimethylbenzene	EPA 8260C			X	X				
1,3,5-Trimethylbenzene	EPA 8260D			X	X				
1,3,5-Trimethylbenzene	EPA TO-15	X							
1,3,5-Trimethylbenzene	SM 6200 B-2011			X					
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 625.1			X					
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270C			X	X				
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270D			X	X				
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270E			X	X				
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330			X	X				
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330A			X	X				
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330B			X	X				
1,3-Butadiene	EPA 624.1			X					
1,3-Butadiene	EPA 8260B			X					
1,3-Butadiene	EPA 8260C			X					

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1,3-Butadiene	EPA 8260D			X					
1,3-Butadiene	EPA TO-15	X							
1,3-Dichlorobenzene	EPA 624.1			X					
1,3-Dichlorobenzene	EPA 625.1			X					
1,3-Dichlorobenzene	EPA 8260B			X	X				
1,3-Dichlorobenzene	EPA 8260C			X	X				
1,3-Dichlorobenzene	EPA 8260D			X	X				
1,3-Dichlorobenzene	EPA 8270C			X	X				
1,3-Dichlorobenzene	EPA 8270D			X	X				
1,3-Dichlorobenzene	EPA 8270E			X	X				
1,3-Dichlorobenzene	EPA TO-15	X							
1,3-Dichlorobenzene	SM 6200 B-2011			X					
1,3-Dichlorobenzene	EPA 524.2		X						
1,3-Dichloropropane	EPA 624 (extended)			X					
1,3-Dichloropropane	EPA 624.1			X					
1,3-Dichloropropane	EPA 8260B			X	X				
1,3-Dichloropropane	EPA 8260C			X	X				
1,3-Dichloropropane	EPA 8260D			X	X				
1,3-Dichloropropane	SM 6200 B-2011			X					
1,3-Dichloropropane	EPA 524.2		X						
1,3-Dichloropropene	EPA 624 (extended)			X					
1,3-Dinitrobenzene (1,3-DNB)	EPA 625.1			X					
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270C			X	X				
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270D			X	X				
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270E			X	X				
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330			X	X				
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330A			X	X				
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330B			X	X				
1,3-Hexachlorobutadiene	EPA 8260B			X					
1,3-Hexachlorobutadiene	EPA 8260C			X					
1,3-Hexachlorobutadiene	EPA 8260D			X					
1,3-Hexachlorobutadiene	EPA 8270D			X					

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1,3-Hexachlorobutadiene	EPA 8270E			X					
1,3-Hexachlorobutadiene	EPA TO-15	X							
1,4-Dichlorobenzene	EPA 624.1			X					
1,4-Dichlorobenzene	EPA 625.1			X					
1,4-Dichlorobenzene	EPA 8260B			X	X				
1,4-Dichlorobenzene	EPA 8260C			X	X				
1,4-Dichlorobenzene	EPA 8260D			X	X				
1,4-Dichlorobenzene	EPA 8270C			X	X				
1,4-Dichlorobenzene	EPA 8270D			X	X				
1,4-Dichlorobenzene	EPA 8270E			X	X				
1,4-Dichlorobenzene	EPA TO-15	X							
1,4-Dichlorobenzene	EPA TO-15 GC/MS SIM	X							
1,4-Dichlorobenzene	SM 6200 B-2011			X					
1,4-Dichlorobenzene	EPA 524.2		X						
1,4-Dinitrobenzene	EPA 625.1			X					
1,4-Dinitrobenzene	EPA 8270C			X	X				
1,4-Dinitrobenzene	EPA 8270D			X	X				
1,4-Dinitrobenzene	EPA 8270E			X	X				
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 624.1			X					
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 625.1 SIM			X					
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260B			X	X				
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260B SIM			X	X				
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260C			X	X				
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260C SIM			X	X				
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260D			X	X				
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260D SIM			X	X				
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8270C			X					
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8270C SIM			X					
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8270D			X					
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8270D SIM			X					
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8270E			X					
1,4-Dioxane (1,4-Diethyleneoxide)	EPA TO-15	X							

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1,4-Dioxane (1,4-Diethyleneoxide)	SM 6200 B-2011			X					
1,4-Naphthoquinone	EPA 625.1			X					
1,4-Naphthoquinone	EPA 8270C			X	X				
1,4-Naphthoquinone	EPA 8270D			X	X				
1,4-Naphthoquinone	EPA 8270E			X	X				
1,4-Phenylenediamine	EPA 625.1			X					
1,4-Phenylenediamine	EPA 8270C			X	X				
1,4-Phenylenediamine	EPA 8270D			X	X				
1,4-Phenylenediamine	EPA 8270E			X	X				
1-Chloronaphthalene	EPA 625.1			X					
1-Chloronaphthalene	EPA 8270C			X	X				
1-Chloronaphthalene	EPA 8270D			X	X				
1-Chloronaphthalene	EPA 8270E			X	X				
1-Methylnaphthalene	EPA 610 (HPLC)			X					
1-Methylnaphthalene	EPA 625.1 SIM			X					
1-Methylnaphthalene	EPA 8260B			X	X				
1-Methylnaphthalene	EPA 8260C			X	X				
1-Methylnaphthalene	EPA 8260D				X				
1-Methylnaphthalene	EPA 8270C			X	X				
1-Methylnaphthalene	EPA 8270C SIM			X	X				
1-Methylnaphthalene	EPA 8270D			X	X				
1-Methylnaphthalene	EPA 8270D SIM			X	X				
1-Methylnaphthalene	EPA 8270E			X	X				
1-Methylnaphthalene	EPA 8270E SIM			X	X				
1-Methylnaphthalene	EPA 8310			X	X				
1-Methylnaphthalene	SM 6200 B-2011			X					
1-Naphthylamine	EPA 625.1			X					
1-Naphthylamine	EPA 8270C			X	X				
1-Naphthylamine	EPA 8270D			X	X				
1-Naphthylamine	EPA 8270E			X	X				
2,2,4-Trimethylpentane (Isooctane)	EPA 624.1			X					
2,2,4-Trimethylpentane (Isooctane)	EPA 8260B			X	X				

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2,2,4-Trimethylpentane (Isooctane)	EPA 8260C			X	X				
2,2,4-Trimethylpentane (Isooctane)	EPA 8260D			X	X				
2,2,4-Trimethylpentane (Isooctane)	EPA TO-15	X							
2,2,4-Trimethylpentane (Isooctane)	SM 6200 B-2011			X					
2,2-Dichloropropane	EPA 524.2		X						
2,2-Dichloropropane	EPA 624 (extended)			X					
2,2-Dichloropropane	EPA 624.1			X					
2,2-Dichloropropane	EPA 8260B			X	X				
2,2-Dichloropropane	EPA 8260C			X	X				
2,2-Dichloropropane	EPA 8260D			X	X				
2,2-Dichloropropane	SM 6200 B-2011			X					
2,2'-Oxybis(1-chloropropane), bis(2-Chloro-1-	EPA 625.1			X					
2,2'-Oxybis(1-chloropropane), bis(2-Chloro-1-	EPA 8270C			X	X				
2,2'-Oxybis(1-chloropropane), bis(2-Chloro-1-	EPA 8270D			X	X				
2,2'-Oxybis(1-chloropropane), bis(2-Chloro-1-	EPA 8270E			X	X				
2,3,4,6-Tetrachlorophenol	EPA 625.1			X					
2,3,4,6-Tetrachlorophenol	EPA 8270C			X	X				
2,3,4,6-Tetrachlorophenol	EPA 8270D			X	X				
2,3,4,6-Tetrachlorophenol	EPA 8270E			X	X				
2,3-Dichloroaniline	EPA 625.1			X					
2,4,5-T	EPA 8151A			X	X				
2,4,5-T	SM 6640 B-2001			X					
2,4,5-T	SM 6640 B-2006			X					
2,4,5-Trichlorophenol	EPA 625.1			X					
2,4,5-Trichlorophenol	EPA 8270C			X	X				
2,4,5-Trichlorophenol	EPA 8270D			X	X				
2,4,5-Trichlorophenol	EPA 8270E			X	X				
2,4,6-Trichlorophenol	EPA 625.1			X					
2,4,6-Trichlorophenol	EPA 8270C			X	X				
2,4,6-Trichlorophenol	EPA 8270D			X	X				
2,4,6-Trichlorophenol	EPA 8270E			X	X				
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330			X	X				

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2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330A			X	X				
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330B			X	X				
2,4-D	EPA 8151A			X	X				
2,4-D	SM 6640 B-2001			X					
2,4-D	SM 6640 B-2006			X					
2,4-DB	EPA 8151A			X	X				
2,4-Dichlorophenol	EPA 625.1			X					
2,4-Dichlorophenol	EPA 8270C			X	X				
2,4-Dichlorophenol	EPA 8270D			X	X				
2,4-Dichlorophenol	EPA 8270E			X	X				
2,4-Dimethylphenol	EPA 625.1			X					
2,4-Dimethylphenol	EPA 8270C			X	X				
2,4-Dimethylphenol	EPA 8270D			X	X				
2,4-Dimethylphenol	EPA 8270E			X	X				
2,4-Dinitrophenol	EPA 625.1			X					
2,4-Dinitrophenol	EPA 8270C			X	X				
2,4-Dinitrophenol	EPA 8270D			X	X				
2,4-Dinitrophenol	EPA 8270E			X	X				
2,4-Dinitrotoluene (2,4-DNT)	EPA 625.1			X					
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270C			X	X				
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270D			X	X				
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270E			X	X				
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330			X	X				
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330A			X	X				
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330B			X	X				
2,6-Dichlorophenol	EPA 625.1			X					
2,6-Dichlorophenol	EPA 8270C			X	X				
2,6-Dichlorophenol	EPA 8270D			X	X				
2,6-Dichlorophenol	EPA 8270E			X	X				
2,6-Dinitrotoluene (2,6-DNT)	EPA 625.1			X					
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270C			X	X				
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270D			X	X				

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2,6-Dinitrotoluene (2,6-DNT)	EPA 8270E			X	X				
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330			X	X				
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330A			X	X				
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330B			X	X				
2,6-Toluenediisocyanate	EPA 8270C			X					
2,6-Toluenediisocyanate	EPA 8270D			X					
2,6-Toluenediisocyanate	EPA 8270E			X					
2-Acetylaminofluorene	EPA 625.1			X					
2-Acetylaminofluorene	EPA 8270C			X	X				
2-Acetylaminofluorene	EPA 8270D			X	X				
2-Acetylaminofluorene	EPA 8270E			X	X				
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330			X	X				
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330A			X	X				
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330B			X	X				
2-Butanone (Methyl ethyl ketone, MEK)	EPA 624.1			X					
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260B			X	X				
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260C			X	X				
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260D			X	X				
2-Butanone (Methyl ethyl ketone, MEK)	EPA TO-15	X							
2-Butanone (Methyl ethyl ketone, MEK)	SM 6200 B-2011			X					
2-Chloroethyl vinyl ether	EPA 624.1			X					
2-Chloroethyl vinyl ether	EPA 8260B			X	X				
2-Chloroethyl vinyl ether	EPA 8260C			X	X				
2-Chloroethyl vinyl ether	EPA 8260D			X	X				
2-Chloroethyl vinyl ether	SM 6200 B-2011			X					
2-Chloronaphthalene	EPA 625.1			X					
2-Chloronaphthalene	EPA 8270C			X	X				
2-Chloronaphthalene	EPA 8270C SIM				X				
2-Chloronaphthalene	EPA 8270D			X	X				
2-Chloronaphthalene	EPA 8270D SIM				X				
2-Chloronaphthalene	EPA 8270E			X	X				
2-Chloronaphthalene	EPA 8270E SIM				X				

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2-Chlorophenol	EPA 625.1			X					
2-Chlorophenol	EPA 8270C			X	X				
2-Chlorophenol	EPA 8270D			X	X				
2-Chlorophenol	EPA 8270E			X	X				
2-Chlorotoluene	EPA 524.2		X						
2-Chlorotoluene	EPA 624 (extended)			X					
2-Chlorotoluene	EPA 624.1			X					
2-Chlorotoluene	EPA 8260B			X	X				
2-Chlorotoluene	EPA 8260C			X	X				
2-Chlorotoluene	EPA 8260D			X	X				
2-Chlorotoluene	EPA TO-15	X							
2-Chlorotoluene	SM 6200 B-2011			X					
2-Hexanone	EPA 524.2		X						
2-Hexanone	EPA 624.1			X					
2-Hexanone	EPA 8260B			X	X				
2-Hexanone	EPA 8260C			X	X				
2-Hexanone	EPA 8260D			X	X				
2-Hexanone	EPA TO-15	X							
2-Hexanone	SM 6200 B-2011			X					
2-methyl-2-butanol (tert-Amyl alcohol)	EPA 624.1			X					
2-methyl-2-butanol (tert-Amyl alcohol)	EPA 8260B			X	X				
2-methyl-2-butanol (tert-Amyl alcohol)	EPA 8260C			X	X				
2-methyl-2-butanol (tert-Amyl alcohol)	EPA 8260D			X	X				
2-methyl-2-butanol (tert-Amyl alcohol)	SM 6200 B-2011			X					
2-Methyl-2-pentanol	EPA 8260B			X	X				
2-Methyl-2-pentanol	EPA 8260C			X	X				
2-Methyl-2-pentanol	EPA 8260D				X				
2-methyl-2-pentanol (ethyl tert-butyl alcohol)	EPA 8260B			X	X				
2-methyl-2-pentanol (ethyl tert-butyl alcohol)	EPA 8260D			X					
2-methyl-2-pentanol (ethyl tert-butyl alcohol)	SM 6200 B-2011			X					
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	EPA 625.1			X					
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	EPA 8270C			X	X				

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2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	EPA 8270D			X	X				
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	EPA 8270E			X	X				
2-Methylaniline (o-Toluidine)	EPA 625.1			X					
2-Methylaniline (o-Toluidine)	EPA 8270C			X	X				
2-Methylaniline (o-Toluidine)	EPA 8270D			X	X				
2-Methylaniline (o-Toluidine)	EPA 8270E			X	X				
2-Methylnaphthalene	EPA 610 (HPLC)			X					
2-Methylnaphthalene	EPA 625.1			X					
2-Methylnaphthalene	EPA 625.1 SIM			X					
2-Methylnaphthalene	EPA 8260B			X	X				
2-Methylnaphthalene	EPA 8260C			X	X				
2-Methylnaphthalene	EPA 8260D			X	X				
2-Methylnaphthalene	EPA 8270C			X	X				
2-Methylnaphthalene	EPA 8270C SIM			X	X				
2-Methylnaphthalene	EPA 8270D			X	X				
2-Methylnaphthalene	EPA 8270D SIM			X	X				
2-Methylnaphthalene	EPA 8270E			X	X				
2-Methylnaphthalene	EPA 8270E SIM			X	X				
2-Methylnaphthalene	EPA 8310			X	X				
2-Methylnaphthalene	EPA TO-15	X							
2-Methylnaphthalene	MADEP EPH			X	X				
2-Methylnaphthalene	SM 6200 B-2011			X					
2-Methylphenol (o-Cresol)	EPA 625.1			X					
2-Methylphenol (o-Cresol)	EPA 8270C			X	X				
2-Methylphenol (o-Cresol)	EPA 8270D			X	X				
2-Methylphenol (o-Cresol)	EPA 8270E			X	X				
2-Naphthylamine	EPA 625.1			X					
2-Naphthylamine	EPA 8270C			X	X				
2-Naphthylamine	EPA 8270D			X	X				
2-Naphthylamine	EPA 8270E			X	X				
2-Nitroaniline	EPA 625.1			X					
2-Nitroaniline	EPA 8270C			X	X				

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2-Nitroaniline	EPA 8270D			X	X				
2-Nitroaniline	EPA 8270E			X	X				
2-Nitrodiphenylamine	EPA 8270C			X	X				
2-Nitrodiphenylamine	EPA 8270D			X	X				
2-Nitrodiphenylamine	EPA 8270E			X	X				
2-Nitroguanidine (Nitroguanidine)	EPA 8330A (extended)			X	X				
2-Nitroguanidine (Nitroguanidine)	EPA 8330B (extended)			X	X				
2-Nitrophenol	EPA 625.1			X					
2-Nitrophenol	EPA 8270C			X	X				
2-Nitrophenol	EPA 8270D			X	X				
2-Nitrophenol	EPA 8270E			X	X				
2-Nitropropane	EPA 624.1			X					
2-Nitropropane	EPA 8260B			X	X				
2-Nitropropane	EPA 8260C			X	X				
2-Nitropropane	EPA 8260D			X	X				
2-Nitropropane	SM 6200 B-2011			X					
2-Nitrotoluene	EPA 8330			X	X				
2-Nitrotoluene	EPA 8330A			X	X				
2-Nitrotoluene	EPA 8330B			X	X				
2-Picoline (2-Methylpyridine)	EPA 625.1			X					
2-Picoline (2-Methylpyridine)	EPA 8270C			X	X				
2-Picoline (2-Methylpyridine)	EPA 8270D			X	X				
2-Picoline (2-Methylpyridine)	EPA 8270E			X	X				
2-Sec-butyl-4,6-dinitrophenol (DNBP, Dinoseb)	EPA 8151A			X					
3,3'-Dichlorobenzidine	EPA 625.1			X					
3,3'-Dichlorobenzidine	EPA 8270C			X	X				
3,3'-Dichlorobenzidine	EPA 8270D			X	X				
3,3'-Dichlorobenzidine	EPA 8270E			X	X				
3,3-dimethyl-1-butanol	EPA 624.1			X					
3,3-dimethyl-1-butanol	EPA 8260B			X	X				
3,3-dimethyl-1-butanol	EPA 8260C			X	X				
3,3-dimethyl-1-butanol	EPA 8260D			X	X				

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3,3-dimethyl-1-butanol	SM 6200 B-2011			X					
3,3'-Dimethylbenzidine	EPA 625.1			X					
3,3'-Dimethylbenzidine	EPA 8270C			X	X				
3,3'-Dimethylbenzidine	EPA 8270D			X	X				
3,3'-Dimethylbenzidine	EPA 8270E			X	X				
3+4 Methylphenol	EPA 625.1			X					
3+4 Methylphenol	EPA 8270C			X	X				
3+4 Methylphenol	EPA 8270D			X	X				
3+4 Methylphenol	EPA 8270E				X				
3-Methylcholanthrene	EPA 625.1			X					
3-Methylcholanthrene	EPA 8270C			X	X				
3-Methylcholanthrene	EPA 8270D			X	X				
3-Methylcholanthrene	EPA 8270E			X	X				
3-Methylphenol (m-Cresol)	EPA 625.1			X					
3-Nitroaniline	EPA 625.1			X					
3-Nitroaniline	EPA 8270C			X	X				
3-Nitroaniline	EPA 8270D			X	X				
3-Nitroaniline	EPA 8270E			X	X				
3-Nitrotoluene	EPA 8330			X	X				
3-Nitrotoluene	EPA 8330A			X	X				
3-Nitrotoluene	EPA 8330B			X	X				
4,4'-DDD	EPA 608.3			X					
4,4'-DDD	EPA 8081A			X	X				
4,4'-DDD	EPA 8081B			X	X				
4,4'-DDE	EPA 608.3			X					
4,4'-DDE	EPA 8081A			X	X				
4,4'-DDE	EPA 8081B			X	X				
4,4'-DDT	EPA 608.3			X					
4,4'-DDT	EPA 8081A			X	X				
4,4'-DDT	EPA 8081B			X	X				
4,4'-Methylenebis(2-chloroaniline)	EPA 8270C			X	X				
4,4'-Methylenebis(2-chloroaniline)	EPA 8270D			X	X				

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4,4'-Methylenebis(2-chloroaniline)	EPA 8270E				X				
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330			X	X				
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330A			X	X				
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330B			X	X				
4-Aminobiphenyl	EPA 625.1			X					
4-Aminobiphenyl	EPA 8270C			X	X				
4-Aminobiphenyl	EPA 8270D			X	X				
4-Aminobiphenyl	EPA 8270E			X	X				
4-Bromophenyl phenyl ether	EPA 625.1			X					
4-Bromophenyl phenyl ether	EPA 625.1 SIM			X					
4-Bromophenyl phenyl ether	EPA 8270C			X	X				
4-Bromophenyl phenyl ether	EPA 8270D			X	X				
4-Bromophenyl phenyl ether	EPA 8270E			X	X				
4-Chloro-3-methylphenol	EPA 625.1			X					
4-Chloro-3-methylphenol	EPA 8270C			X	X				
4-Chloro-3-methylphenol	EPA 8270D			X	X				
4-Chloro-3-methylphenol	EPA 8270E			X	X				
4-Chloroaniline	EPA 625.1			X					
4-Chloroaniline	EPA 8270C			X	X				
4-Chloroaniline	EPA 8270D			X	X				
4-Chloroaniline	EPA 8270E			X	X				
4-Chlorophenyl phenylether	EPA 625.1			X					
4-Chlorophenyl phenylether	EPA 8270C			X	X				
4-Chlorophenyl phenylether	EPA 8270D			X	X				
4-Chlorophenyl phenylether	EPA 8270E			X	X				
4-Chlorotoluene	EPA 524.2		X						
4-Chlorotoluene	EPA 624 (extended)			X					
4-Chlorotoluene	EPA 624.1			X					
4-Chlorotoluene	EPA 8260B			X	X				
4-Chlorotoluene	EPA 8260C			X	X				
4-Chlorotoluene	EPA 8260D			X	X				
4-Chlorotoluene	SM 6200 B-2011			X					

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4-Dimethyl aminoazobenzene	EPA 8270C				X				
4-Dimethyl aminoazobenzene	EPA 8270D				X				
4-Dimethyl aminoazobenzene	EPA 8270E				X				
4-Ethyltoluene	EPA 8260B			X					
4-Ethyltoluene	EPA TO-15	X							
4-Isopropyltoluene	EPA 524.2		X						
4-Isopropyltoluene (p-Cymene)	EPA 624 (extended)			X					
4-Isopropyltoluene (p-Cymene)	EPA 624.1			X					
4-Isopropyltoluene (p-Cymene)	EPA 8260B			X	X				
4-Isopropyltoluene (p-Cymene)	EPA 8260C			X	X				
4-Isopropyltoluene (p-Cymene)	EPA 8260D			X	X				
4-Isopropyltoluene (p-Cymene)	SM 6200 B-2011			X					
4-Methyl-2-pentanone (MIBK)	EPA 624.1			X					
4-Methyl-2-pentanone (MIBK)	EPA 8260B			X	X				
4-Methyl-2-pentanone (MIBK)	EPA 8260C			X	X				
4-Methyl-2-pentanone (MIBK)	EPA 8260D			X	X				
4-Methyl-2-pentanone (MIBK)	EPA TO-15	X							
4-Methyl-2-pentanone (MIBK)	SM 6200 B-2011			X					
4-Methylphenol (p-Cresol)	EPA 625.1			X					
4-Methylphenol (p-Cresol)	EPA 8270C			X	X				
4-Methylphenol (p-Cresol)	EPA 8270D			X	X				
4-Methylphenol (p-Cresol)	EPA 8270E			X	X				
4-Nitroaniline	EPA 625.1			X					
4-Nitroaniline	EPA 8270C			X	X				
4-Nitroaniline	EPA 8270D			X	X				
4-Nitroaniline	EPA 8270E			X	X				
4-Nitrophenol	EPA 625.1			X					
4-Nitrophenol	EPA 8270C			X	X				
4-Nitrophenol	EPA 8270D			X	X				
4-Nitrophenol	EPA 8270E			X	X				
4-Nitroquinoline 1-oxide	EPA 625.1			X					
4-Nitroquinoline 1-oxide	EPA 8270C			X	X				

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4-Nitroquinoline 1-oxide	EPA 8270D			X	X				
4-Nitroquinoline 1-oxide	EPA 8270E			X	X				
4-Nitrotoluene	EPA 8330			X	X				
4-Nitrotoluene	EPA 8330A			X	X				
4-Nitrotoluene	EPA 8330B			X	X				
5-Nitro-o-toluidine	EPA 625.1			X					
5-Nitro-o-toluidine	EPA 8270C			X	X				
5-Nitro-o-toluidine	EPA 8270D			X	X				
5-Nitro-o-toluidine	EPA 8270E			X	X				
7,12-Dimethylbenz(a)anthracene	EPA 625.1			X					
7,12-Dimethylbenz(a)anthracene	EPA 8270C			X	X				
7,12-Dimethylbenz(a)anthracene	EPA 8270D			X	X				
7,12-Dimethylbenz(a)anthracene	EPA 8270E			X	X				
7h-Dibenzo(c,g) carbazole	EPA 8270C			X	X				
7h-Dibenzo(c,g) carbazole	EPA 8270D			X	X				
7h-Dibenzo(c,g) carbazole	EPA 8270E			X	X				
96-hour LC50	EPA 2000			X					
a-a-Dimethylphenethylamine	EPA 625.1			X					
a-a-Dimethylphenethylamine	EPA 8270C			X	X				
a-a-Dimethylphenethylamine	EPA 8270D			X	X				
a-a-Dimethylphenethylamine	EPA 8270E			X	X				
Acenaphthene	EPA 610 (HPLC)			X					
Acenaphthene	EPA 625.1			X					
Acenaphthene	EPA 625.1 SIM			X					
Acenaphthene	EPA 8270C			X	X				
Acenaphthene	EPA 8270C SIM			X	X				
Acenaphthene	EPA 8270D			X	X				
Acenaphthene	EPA 8270D SIM			X	X				
Acenaphthene	EPA 8270E			X	X				
Acenaphthene	EPA 8270E SIM			X	X				
Acenaphthene	EPA 8310			X	X				
Acenaphthene	MADEP EPH			X	X				

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Acenaphthylene	EPA 610 (HPLC)			X					
Acenaphthylene	EPA 625.1			X					
Acenaphthylene	EPA 625.1 SIM			X					
Acenaphthylene	EPA 8270C			X	X				
Acenaphthylene	EPA 8270C SIM			X	X				
Acenaphthylene	EPA 8270D			X	X				
Acenaphthylene	EPA 8270D SIM			X	X				
Acenaphthylene	EPA 8270E			X	X				
Acenaphthylene	EPA 8270E SIM			X	X				
Acenaphthylene	EPA 8310			X	X				
Acenaphthylene	MADEP EPH			X	X				
Acetaldehyde	EPA TO-15	X							
Acetone	EPA 624.1			X					
Acetone	EPA 8260B			X	X				
Acetone	EPA 8260C			X	X				
Acetone	EPA 8260D			X	X				
Acetone	EPA TO-15	X							
Acetone	SM 6200 B-2011			X					
Acetone	EPA 524.2		X						
Acetonitrile	EPA 624.1			X					
Acetonitrile	EPA 8260B			X	X				
Acetonitrile	EPA 8260C			X	X				
Acetonitrile	EPA 8260D			X	X				
Acetonitrile	EPA TO-15	X							
Acetonitrile	SM 6200 B-2011			X					
Acetophenone	EPA 625.1			X					
Acetophenone	EPA 8270C			X	X				
Acetophenone	EPA 8270D			X	X				
Acetophenone	EPA 8270E			X	X				
Acetylene	EPA RSK-175 (GC/FID)	X		X					
Acid Digestion of Aqueous samples and Extracts for Total	EPA 3010A			X					
Acid Digestion of Oils for Metals Analysis or ICP	EPA 3031				X				

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Acid Digestion of Sediments, Sludges, and soils	EPA 3050B				X				
Acid Digestion of waters for Total Recoverable or Dissolved	EPA 3005A			X					
Acidity, as CaCO ₃	SM 2310 B-2011			X					
Acrolein (Propenal)	EPA 624.1			X					
Acrolein (Propenal)	EPA 8260B			X	X				
Acrolein (Propenal)	EPA 8260C			X	X				
Acrolein (Propenal)	EPA 8260D			X	X				
Acrolein (Propenal)	EPA TO-15	X							
Acrolein (Propenal)	SM 6200 B-2011			X					
Acrylonitrile	EPA 624.1			X					
Acrylonitrile	EPA 8260B			X	X				
Acrylonitrile	EPA 8260C			X	X				
Acrylonitrile	EPA 8260D			X	X				
Acrylonitrile	EPA TO-15	X							
Acrylonitrile	SM 6200 B-2011			X					
Acute toxicity	EPA 2002 Ceriodaphnia dubia			X					
Alachlor	EPA 507		X	X					
Aldrin	EPA 608.3			X					
Aldrin	EPA 8081A			X	X				
Aldrin	EPA 8081B			X	X				
Alkalinity as CaCO ₃	EPA 310.2			X					
Alkalinity as CaCO ₃	SM 2320 B-2011		X	X					
Allyl chloride (3-Chloropropene)	EPA 624.1			X					
Allyl chloride (3-Chloropropene)	EPA 8260B			X	X				
Allyl chloride (3-Chloropropene)	EPA 8260C			X	X				
Allyl chloride (3-Chloropropene)	EPA 8260D			X	X				
Allyl chloride (3-Chloropropene)	EPA TO-15	X							
Allyl chloride (3-Chloropropene)	SM 6200 B-2011			X					
Alpha Emitting Radium Isotopes	EPA 9315			X	X				
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 608.3			X					
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081A			X	X				
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081B			X	X				

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alpha-Chlordane	EPA 608.3			X					
alpha-Chlordane	EPA 8081A			X	X				
alpha-Chlordane	EPA 8081B			X	X				
alpha-Terpineol	EPA 625.1			X					
alpha-Terpineol	EPA 8270C			X	X				
alpha-Terpineol	EPA 8270D			X	X				
alpha-Terpineol	EPA 8270E				X				
Alumina Clean-Up	EPA 3610B				X				
Alumina Clean-Up	EPA 3611B				X				
Aluminum	EPA 200.7		X	X					
Aluminum	EPA 200.8		X	X					
Aluminum	EPA 6010B			X	X				
Aluminum	EPA 6010C			X	X				
Aluminum	EPA 6010D			X	X				
Aluminum	EPA 6020			X	X				
Aluminum	EPA 6020A			X	X				
Aluminum	EPA 6020B			X	X				
Amenable cyanide	EPA 9010B				X				
Amenable cyanide	EPA 9010C			X	X				
Amenable cyanide	EPA 9012B			X	X				
Amenable cyanide	EPA 9014			X	X				
Amenable cyanide	SM 4500-CN ⁻ B-2011			X					
Amenable cyanide	SM 4500-CN ⁻ G-2011			X					
Americium-241	EPA 907 Modified (ENV-SOP-MTJL-	X		X	X		X		
Ammonia	SM 4500-NH3 B-2011			X					
Ammonia as N	EPA 350.1		X	X	X				
Ammonia as N	SM 4500-NH3 B-2011			X					
Ammonia as N	SM 4500-NH3 G-2011			X					
Aniline	EPA 625.1			X					
Aniline	EPA 8270C			X	X				
Aniline	EPA 8270D			X	X				
Aniline	EPA 8270E			X	X				

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Anthracene	EPA 610 (HPLC)			X					
Anthracene	EPA 625.1			X					
Anthracene	EPA 625.1 SIM			X					
Anthracene	EPA 8270C			X	X				
Anthracene	EPA 8270C SIM			X	X				
Anthracene	EPA 8270D			X	X				
Anthracene	EPA 8270D SIM			X	X				
Anthracene	EPA 8270E			X	X				
Anthracene	EPA 8270E SIM			X	X				
Anthracene	EPA 8310			X	X				
Anthracene	MADEP EPH			X	X				
Antimony	EPA 200.7		X	X					
Antimony	EPA 200.8		X	X					
Antimony	EPA 6010B			X	X				
Antimony	EPA 6010C			X	X				
Antimony	EPA 6010D			X	X				
Antimony	EPA 6020			X	X				
Antimony	EPA 6020A			X	X				
Antimony	EPA 6020B			X	X				
Aramite	EPA 625.1			X					
Aramite	EPA 8270C			X	X				
Aramite	EPA 8270D			X	X				
Aramite	EPA 8270E			X	X				
Aroclor-1016 (PCB-1016)	EPA 600/4-81-045			X					
Aroclor-1016 (PCB-1016)	EPA 608.3			X					
Aroclor-1016 (PCB-1016)	EPA 8082			X	X				
Aroclor-1016 (PCB-1016)	EPA 8082A			X	X				
Aroclor-1016 (PCB-1016) in Oil	EPA 8082A				X				
Aroclor-1221 (PCB-1221)	EPA 600/4-81-045			X					
Aroclor-1221 (PCB-1221)	EPA 608.3			X					
Aroclor-1221 (PCB-1221)	EPA 8082			X	X				
Aroclor-1221 (PCB-1221)	EPA 8082A			X	X				

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Aroclor-1221 (PCB-1221) in Oil	EPA 8082A				X				
Aroclor-1232 (PCB-1232)	EPA 600/4-81-045			X					
Aroclor-1232 (PCB-1232)	EPA 608.3			X					
Aroclor-1232 (PCB-1232)	EPA 8082			X	X				
Aroclor-1232 (PCB-1232)	EPA 8082A			X	X				
Aroclor-1232 (PCB-1232) in Oil	EPA 8082A				X				
Aroclor-1242 (PCB-1242)	EPA 600/4-81-045			X					
Aroclor-1242 (PCB-1242)	EPA 608.3			X					
Aroclor-1242 (PCB-1242)	EPA 8082			X	X				
Aroclor-1242 (PCB-1242)	EPA 8082A			X	X				
Aroclor-1242 (PCB-1242) in Oil	EPA 8082A				X				
Aroclor-1248 (PCB-1248)	EPA 600/4-81-045			X					
Aroclor-1248 (PCB-1248)	EPA 608.3			X					
Aroclor-1248 (PCB-1248)	EPA 8082			X	X				
Aroclor-1248 (PCB-1248)	EPA 8082A			X	X				
Aroclor-1248 (PCB-1248) in Oil	EPA 8082A				X				
Aroclor-1254 (PCB-1254)	EPA 600/4-81-045			X					
Aroclor-1254 (PCB-1254)	EPA 608.3			X					
Aroclor-1254 (PCB-1254)	EPA 8082			X	X				
Aroclor-1254 (PCB-1254)	EPA 8082A			X	X				
Aroclor-1254 (PCB-1254) in Oil	EPA 8082A				X				
Aroclor-1260 (PCB-1260)	EPA 600/4-81-045			X					
Aroclor-1260 (PCB-1260)	EPA 608.3			X					
Aroclor-1260 (PCB-1260)	EPA 8082			X	X				
Aroclor-1260 (PCB-1260)	EPA 8082A			X	X				
Aroclor-1260 (PCB-1260) in Oil	EPA 8082A				X				
Aroclor-1262 (PCB-1262)	EPA 600/4-81-045			X					
Aroclor-1262 (PCB-1262)	EPA 8082			X	X				
Aroclor-1262 (PCB-1262)	EPA 8082A			X	X				
Aroclor-1262 (PCB-1262) in Oil	EPA 8082A				X				
Aroclor-1268 (PCB-1268)	EPA 600/4-81-045			X					
Aroclor-1268 (PCB-1268)	EPA 8082			X	X				

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Aroclor-1268 (PCB-1268)	EPA 8082A			X	X				
Aroclor-1268 (PCB-1268) in Oil	EPA 8082A				X				
Arsenic	EPA 200.7		X	X					
Arsenic	EPA 200.8		X	X					
Arsenic	EPA 6010B			X	X				
Arsenic	EPA 6010C			X	X				
Arsenic	EPA 6010D			X	X				
Arsenic	EPA 6020			X	X				
Arsenic	EPA 6020A			X	X				
Arsenic	EPA 6020B			X	X				
Atrazine	EPA 507		X	X					
Atrazine	EPA 625.1			X					
Atrazine	EPA 8141A			X					
Atrazine	EPA 8141B			X					
Atrazine	EPA 8270C			X	X				
Atrazine	EPA 8270D			X	X				
Atrazine	EPA 8270E			X	X				
Azinphos-methyl (Guthion)	EPA 1657			X					
Azinphos-methyl (Guthion)	EPA 8141A			X	X				
Azinphos-methyl (Guthion)	EPA 8141B			X	X				
Barium	EPA 200.7		X	X					
Barium	EPA 200.8		X	X					
Barium	EPA 6010B			X	X				
Barium	EPA 6010C			X	X				
Barium	EPA 6010D			X	X				
Barium	EPA 6020			X	X				
Barium	EPA 6020A			X	X				
Barium	EPA 6020B			X	X				
Barium-133	DOE 4.5.2.3				X				
Barium-133	EPA 901.1		X						
Barium-133	HASL 300 Ga-01-R				X				
Benzal chloride	EPA 8270C			X	X				

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Benzal chloride	EPA 8270D			X	X				
Benzal chloride	EPA 8270E			X	X				
Benzaldehyde	EPA 625.1			X					
Benzaldehyde	EPA 8270C			X	X				
Benzaldehyde	EPA 8270D			X	X				
Benzaldehyde	EPA 8270E			X	X				
Benzene	EPA 602			X					
Benzene	EPA 624.1			X					
Benzene	EPA 8021B			X	X				
Benzene	EPA 8260B			X	X				
Benzene	EPA 8260C			X	X				
Benzene	EPA 8260D			X	X				
Benzene	EPA TO-15	X							
Benzene	EPA TO-15 GC/MS SIM	X							
Benzene	IDNR OA-1			X	X				
Benzene	LUFT GCMS			X	X				
Benzene	MADEP VPH			X	X				
Benzene	OK DEQ GRO			X	X				
Benzene	SM 6200 B-2011			X					
Benzene	EPA 524.2		X						
Benzenethiol	EPA 625.1			X					
Benzenethiol	EPA 8270C			X	X				
Benzenethiol	EPA 8270D			X	X				
Benzenethiol	EPA 8270E				X				
Benzidine	EPA 625.1			X					
Benzidine	EPA 8270C			X	X				
Benzidine	EPA 8270D			X	X				
Benzidine	EPA 8270E			X	X				
Benzo(a)anthracene	EPA 610 (HPLC)			X					
Benzo(a)anthracene	EPA 625.1			X					
Benzo(a)anthracene	EPA 625.1 SIM			X					
Benzo(a)anthracene	EPA 8270C			X	X				

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Benzo(a)anthracene	EPA 8270C SIM			X	X				
Benzo(a)anthracene	EPA 8270D			X	X				
Benzo(a)anthracene	EPA 8270D SIM			X	X				
Benzo(a)anthracene	EPA 8270E			X	X				
Benzo(a)anthracene	EPA 8270E SIM			X	X				
Benzo(a)anthracene	EPA 8310			X	X				
Benzo(a)anthracene	MADEP EPH			X	X				
Benzo(a)pyrene	EPA 610 (HPLC)			X					
Benzo(a)pyrene	EPA 625.1			X					
Benzo(a)pyrene	EPA 625.1 SIM			X					
Benzo(a)pyrene	EPA 8270C			X	X				
Benzo(a)pyrene	EPA 8270C SIM			X	X				
Benzo(a)pyrene	EPA 8270D			X	X				
Benzo(a)pyrene	EPA 8270D SIM			X	X				
Benzo(a)pyrene	EPA 8270E			X	X				
Benzo(a)pyrene	EPA 8270E SIM			X	X				
Benzo(a)pyrene	EPA 8310			X	X				
Benzo(a)pyrene	MADEP EPH			X	X				
Benzo(b)fluoranthene	EPA 610 (HPLC)			X					
Benzo(b)fluoranthene	EPA 625.1			X					
Benzo(b)fluoranthene	EPA 625.1 SIM			X					
Benzo(b)fluoranthene	EPA 8270C			X	X				
Benzo(b)fluoranthene	EPA 8270C SIM			X	X				
Benzo(b)fluoranthene	EPA 8270D			X	X				
Benzo(b)fluoranthene	EPA 8270D SIM			X	X				
Benzo(b)fluoranthene	EPA 8270E			X	X				
Benzo(b)fluoranthene	EPA 8270E SIM			X	X				
Benzo(b)fluoranthene	EPA 8310			X	X				
Benzo(b)fluoranthene	MADEP EPH			X	X				
Benzo(c)pyrene	EPA 8270D SIM			X	X				
Benzo(c)pyrene	EPA 8270E SIM			X	X				
Benzo(g,h,i)perylene	EPA 610 (HPLC)			X					

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Benzo(g,h,i)perylene	EPA 625.1			X					
Benzo(g,h,i)perylene	EPA 625.1 SIM			X					
Benzo(g,h,i)perylene	EPA 8270C			X	X				
Benzo(g,h,i)perylene	EPA 8270C SIM			X	X				
Benzo(g,h,i)perylene	EPA 8270D			X	X				
Benzo(g,h,i)perylene	EPA 8270D SIM			X	X				
Benzo(g,h,i)perylene	EPA 8270E			X	X				
Benzo(g,h,i)perylene	EPA 8270E SIM			X	X				
Benzo(g,h,i)perylene	EPA 8310			X	X				
Benzo(g,h,i)perylene	MADEP EPH			X	X				
Benzo(j)fluoranthene	EPA 8270C			X	X				
Benzo(j)fluoranthene	EPA 8270D			X	X				
Benzo(j)fluoranthene	EPA 8270E			X	X				
Benzo(k)fluoranthene	EPA 610 (HPLC)			X					
Benzo(k)fluoranthene	EPA 625.1			X					
Benzo(k)fluoranthene	EPA 625.1 SIM			X					
Benzo(k)fluoranthene	EPA 8270C			X	X				
Benzo(k)fluoranthene	EPA 8270C SIM			X	X				
Benzo(k)fluoranthene	EPA 8270D			X	X				
Benzo(k)fluoranthene	EPA 8270D SIM			X	X				
Benzo(k)fluoranthene	EPA 8270E			X	X				
Benzo(k)fluoranthene	EPA 8270E SIM			X	X				
Benzo(k)fluoranthene	EPA 8310			X	X				
Benzo(k)fluoranthene	MADEP EPH			X	X				
Benzoic acid	EPA 625.1			X					
Benzoic acid	EPA 8270C			X	X				
Benzoic acid	EPA 8270D			X	X				
Benzoic acid	EPA 8270E			X	X				
Benzotrichloride	EPA 8270C			X	X				
Benzotrichloride	EPA 8270D			X	X				
Benzotrichloride	EPA 8270E			X	X				
Benzyl alcohol	EPA 625.1			X					

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Benzyl alcohol	EPA 8270C			X	X				
Benzyl alcohol	EPA 8270D			X	X				
Benzyl alcohol	EPA 8270E			X	X				
Benzyl chloride	EPA 8270C			X	X				
Benzyl chloride	EPA 8270D			X	X				
Benzyl chloride	EPA 8270E			X	X				
Benzyl chloride	EPA TO-15	X							
Beryllium	EPA 200.7		X	X					
Beryllium	EPA 200.8		X	X					
Beryllium	EPA 6010B			X	X				
Beryllium	EPA 6010C			X	X				
Beryllium	EPA 6010D			X	X				
Beryllium	EPA 6020			X	X				
Beryllium	EPA 6020A			X	X				
Beryllium	EPA 6020B			X	X				
beta-BHC (beta-Hexachlorocyclohexane)	EPA 608.3			X					
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081A			X	X				
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081B			X	X				
Biochemical oxygen demand	SM 5210 B-2011			X					
Biphenyl (1,1'-Biphenyl)	EPA 625.1			X					
Biphenyl (1,1'-Biphenyl)	EPA 8270C			X	X				
Biphenyl (1,1'-Biphenyl)	EPA 8270D			X	X				
Biphenyl (1,1'-Biphenyl)	EPA 8270E			X	X				
bis(2-Chloroethoxy)methane	EPA 625.1			X					
bis(2-Chloroethoxy)methane	EPA 8270C			X	X				
bis(2-Chloroethoxy)methane	EPA 8270D			X	X				
bis(2-Chloroethoxy)methane	EPA 8270E			X	X				
bis(2-Chloroethyl) ether	EPA 625.1			X					
bis(2-Chloroethyl) ether	EPA 8270C			X	X				
bis(2-Chloroethyl) ether	EPA 8270D			X	X				
bis(2-Chloroethyl) ether	EPA 8270E			X	X				
Bis(2-Chloroisopropyl) ether	EPA 625.1			X					

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Bis(2-Chloroisopropyl) ether	EPA 8270E			X	X				
Bis(2-Chloroisopropyl) ether (2,2-oxybis(1-chloropropane))	EPA 8270C			X	X				
Bis(2-Chloroisopropyl) ether (2,2-oxybis(1-chloropropane))	EPA 8270D			X	X				
bis(2-Ethylhexyl)adipate	EPA 625.1			X					
bis(2-Ethylhexyl)adipate	EPA 625.1 SIM			X					
Bolstar (Sulprofos)	EPA 1657			X					
Bolstar (Sulprofos)	EPA 8141A			X	X				
Bolstar (Sulprofos)	EPA 8141B			X	X				
Boron	EPA 200.7		X	X					
Boron	EPA 200.8			X					
Boron	EPA 6010B			X	X				
Boron	EPA 6010C			X	X				
Boron	EPA 6010D			X	X				
Boron	EPA 6020			X	X				
Boron	EPA 6020A			X	X				
Boron	EPA 6020B			X	X				
Bromide	EPA 300.0		X	X	X				
Bromide	EPA 9056			X	X				
Bromide	EPA 9056A			X	X				
Bromide	SM 4110 B-2011		X	X					
Bromoacetic acid	EPA 552.2		X						
Bromobenzene	EPA 524.2		X						
Bromobenzene	EPA 624 (extended)			X					
Bromobenzene	EPA 624.1			X					
Bromobenzene	EPA 8260B			X	X				
Bromobenzene	EPA 8260C			X	X				
Bromobenzene	EPA 8260D			X	X				
Bromobenzene	SM 6200 B-2011			X					
Bromochloromethane	EPA 524.2		X						
Bromochloromethane	EPA 624.1			X					
Bromochloromethane	EPA 8260B			X	X				
Bromochloromethane	EPA 8260C			X	X				

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Bromochloromethane	EPA 8260D			X	X				
Bromochloromethane	SM 6200 B-2011			X					
Bromodichloromethane	EPA 624.1			X					
Bromodichloromethane	EPA 8260B			X	X				
Bromodichloromethane	EPA 8260C			X	X				
Bromodichloromethane	EPA 8260D			X	X				
Bromodichloromethane	EPA TO-15	X							
Bromodichloromethane	SM 6200 B-2011			X					
Bromoethane (Ethyl Bromide)	EPA 624.1			X					
Bromoethane (Ethyl Bromide)	EPA TO-15	X							
Bromoform	EPA 624.1			X					
Bromoform	EPA 8260B			X	X				
Bromoform	EPA 8260C			X	X				
Bromoform	EPA 8260D			X	X				
Bromoform	EPA TO-15	X							
Bromoform	SM 6200 B-2011			X					
Bromoform	EPA 524.2		X						
Butachlor	EPA 507		X	X					
Butyl benzyl phthalate	EPA 625.1			X					
Butyl benzyl phthalate	EPA 8270C			X	X				
Butyl benzyl phthalate	EPA 8270D			X	X				
Butyl benzyl phthalate	EPA 8270E			X	X				
Cadmium	EPA 200.7		X	X					
Cadmium	EPA 200.8		X	X					
Cadmium	EPA 6010B			X	X				
Cadmium	EPA 6010C			X	X				
Cadmium	EPA 6010D			X	X				
Cadmium	EPA 6020			X	X				
Cadmium	EPA 6020A			X	X				
Cadmium	EPA 6020B			X	X				
Calcium	EPA 200.7		X	X					
Calcium	EPA 200.8			X					

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Calcium	EPA 6010B			X	X				
Calcium	EPA 6010C			X	X				
Calcium	EPA 6010D			X	X				
Calcium	EPA 6020			X	X				
Calcium	EPA 6020A			X	X				
Calcium	EPA 6020B			X	X				
Calcium hardness as CaCO ₃	EPA 200.7			X					
Calcium hardness as CaCO ₃	EPA 200.8			X					
Calcium hardness as CaCO ₃	EPA 6010B			X					
Calcium hardness as CaCO ₃	EPA 6010C			X	X				
Calcium hardness as CaCO ₃	EPA 6010D			X					
Calcium hardness as CaCO ₃	SM 2340 B-2011			X					
California Waste Extraction Test	CCR Chapter 11, Article 5 Appendix II				X				
Caprolactam	EPA 625.1			X					
Caprolactam	EPA 8270C			X	X				
Caprolactam	EPA 8270D			X	X				
Caprolactam	EPA 8270E			X	X				
Carbazole	EPA 625.1			X					
Carbazole	EPA 8270C			X	X				
Carbazole	EPA 8270D			X	X				
Carbazole	EPA 8270E			X	X				
Carbon dioxide	ASTM D1946-90	X							
Carbon dioxide	SM 4500-CO ₂ D-2011		X	X					
Carbon disulfide	EPA 624.1			X					
Carbon disulfide	EPA 8260B			X	X				
Carbon disulfide	EPA 8260C			X	X				
Carbon disulfide	EPA 8260D			X	X				
Carbon disulfide	EPA TO-15	X							
Carbon disulfide	SM 6200 B-2011			X					
Carbon disulfide	EPA 524.2		X						
Carbon monoxide	ASTM D1946-90	X							
Carbon tetrachloride	EPA 624.1			X					

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Carbon tetrachloride	EPA 8260B			X	X				
Carbon tetrachloride	EPA 8260C			X	X				
Carbon tetrachloride	EPA 8260D			X	X				
Carbon tetrachloride	EPA TO-15	X							
Carbon tetrachloride	EPA TO-15 GC/MS SIM	X							
Carbon tetrachloride	SM 6200 B-2011			X					
Carbon tetrachloride	EPA 524.2		X						
Carbon-14	EPA EERF Method C-01	X		X	X		X		
Carbonaceous BOD, CBOD	SM 5210 B-2011			X					
Carbophenothion	EPA 8141A			X					
Carbophenothion	EPA 8141B			X					
Ceriodaphnia dubia	EPA 1002			X					
Ceriodaphnia dubia	EPA 2002 Ceriodaphnia dubia			X					
Ceriodaphnia dubia	EPA 2002.0			X					
Cesium-134	DOE 4.5.2.3				X				
Cesium-134	EPA 901.1		X	X					
Cesium-134	HASL 300 Ga-01-R				X				
Cesium-137	DOE 4.5.2.3				X				
Cesium-137	EPA 901.1		X	X					
Cesium-137	HASL 300 Ga-01-R				X				
Chemical oxygen demand	EPA 410.4			X					
Chemical oxygen demand	SM 5220 D-2011			X					
Chlorate	EPA 300.0			X					
Chlordane (tech.)	EPA 608.3			X					
Chlordane (tech.)	EPA 8081A			X	X				
Chlordane (tech.)	EPA 8081B			X	X				
Chloride	EPA 300.0		X	X	X				
Chloride	EPA 9056			X	X				
Chloride	EPA 9056A			X	X				
Chloride	SM 4110 B-2011		X	X					
Chlorine	EPA 9076				X				
Chlorine	SM 4500-Cl G-2011		X	X					

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Chloroacetic acid	EPA 552.2		X						
Chlorobenzene	EPA 624.1			X					
Chlorobenzene	EPA 8260B			X	X				
Chlorobenzene	EPA 8260C			X	X				
Chlorobenzene	EPA 8260D			X	X				
Chlorobenzene	EPA TO-15	X							
Chlorobenzene	SM 6200 B-2011			X					
Chlorobenzene	EPA 524.2		X						
Chlorobenzilate	EPA 625.1			X					
Chlorobenzilate	EPA 8270C			X	X				
Chlorobenzilate	EPA 8270D			X	X				
Chlorobenzilate	EPA 8270E			X	X				
Chlorodibromomethane	EPA 524.2		X						
Chlorodibromomethane (dibromochloromethane)	EPA 624.1			X					
Chlorodibromomethane (dibromochloromethane)	EPA 8260B			X	X				
Chlorodibromomethane (dibromochloromethane)	EPA 8260C			X	X				
Chlorodibromomethane (dibromochloromethane)	EPA 8260D			X	X				
Chlorodibromomethane (dibromochloromethane)	EPA TO-15	X							
Chlorodibromomethane (dibromochloromethane)	SM 6200 B-2011			X					
Chloroethane	EPA 524.2		X						
Chloroethane (Ethyl chloride)	EPA 624.1			X					
Chloroethane (Ethyl chloride)	EPA 8260B			X	X				
Chloroethane (Ethyl chloride)	EPA 8260C			X	X				
Chloroethane (Ethyl chloride)	EPA 8260D			X	X				
Chloroethane (Ethyl chloride)	EPA TO-15	X							
Chloroethane (Ethyl chloride)	EPA TO-15 GC/MS SIM	X							
Chloroethane (Ethyl chloride)	SM 6200 B-2011			X					
Chloroform	EPA 624.1			X					
Chloroform	EPA 8260B			X	X				
Chloroform	EPA 8260C			X	X				
Chloroform	EPA 8260D			X	X				
Chloroform	EPA TO-15	X							

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Chloroform	EPA TO-15 GC/MS SIM	X							
Chloroform	SM 6200 B-2011			X					
Chloroform	EPA 524.2		X						
Chloromethane	EPA 524.2		X						
Chloroprene (2-Chloro-1,3-butadiene)	EPA 624.1			X					
Chloroprene (2-Chloro-1,3-butadiene)	EPA 8260B			X	X				
Chloroprene (2-Chloro-1,3-butadiene)	EPA 8260C			X	X				
Chloroprene (2-Chloro-1,3-butadiene)	EPA 8260D			X	X				
Chloroprene (2-Chloro-1,3-butadiene)	SM 6200 B-2011			X					
Chlorpyrifos	EPA 1657			X					
Chlorpyrifos	EPA 8141A			X	X				
Chlorpyrifos	EPA 8141B			X	X				
Chromium	EPA 200.7		X	X					
Chromium	EPA 200.8		X	X					
Chromium	EPA 6010B			X	X				
Chromium	EPA 6010C			X	X				
Chromium	EPA 6010D			X	X				
Chromium	EPA 6020			X	X				
Chromium	EPA 6020A			X	X				
Chromium	EPA 6020B			X	X				
Chromium VI	EPA 218.6		X	X					
Chromium VI	EPA 3060A				X				
Chromium VI	EPA 7196A			X	X				
Chromium VI	EPA 7199			X	X				
Chromium VI	SM 3500-Cr B-2011		X	X					
Chromium VI	SM 3500-Cr C-2011		X	X					
Chromium VI Digestion	EPA 3060A				X				
Chrysene	EPA 610 (HPLC)			X					
Chrysene	EPA 625.1			X					
Chrysene	EPA 625.1 SIM			X					
Chrysene	EPA 8270C			X	X				
Chrysene	EPA 8270C SIM			X	X				

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Chrysene	EPA 8270D			X	X				
Chrysene	EPA 8270D SIM			X	X				
Chrysene	EPA 8270E			X	X				
Chrysene	EPA 8270E SIM			X	X				
Chrysene	EPA 8310			X	X				
Chrysene	MADEP EPH			X	X				
cis-1,2-Dichloroethene	EPA 524.2		X						
cis-1,2-Dichloroethylene	EPA 624.1			X					
cis-1,2-Dichloroethylene	EPA 8260B			X	X				
cis-1,2-Dichloroethylene	EPA 8260C			X	X				
cis-1,2-Dichloroethylene	EPA 8260D			X	X				
cis-1,2-Dichloroethylene	EPA TO-15	X							
cis-1,2-Dichloroethylene	EPA TO-15 GC/MS SIM	X							
cis-1,2-Dichloroethylene	SM 6200 B-2011			X					
cis-1,3-Dichloropropene	EPA 524.2		X						
cis-1,3-Dichloropropene	EPA 624.1			X					
cis-1,3-Dichloropropene	EPA 8260B			X	X				
cis-1,3-Dichloropropene	EPA 8260C			X	X				
cis-1,3-Dichloropropene	EPA 8260D			X	X				
cis-1,3-Dichloropropene	EPA TO-15	X							
cis-1,3-Dichloropropene	EPA TO-15 GC/MS SIM	X							
cis-1,3-Dichloropropene	SM 6200 B-2011			X					
cis-1,4-Dichloro-2-butene	EPA 624.1			X					
cis-1,4-Dichloro-2-butene	EPA 8260B			X	X				
cis-1,4-Dichloro-2-butene	EPA 8260C			X	X				
cis-1,4-Dichloro-2-butene	EPA 8260D			X	X				
cis-1,4-Dichloro-2-butene	SM 6200 B-2011			X					
cis-Diallate	EPA 8270C			X					
cis-Isosafrole	EPA 8270C			X					
Closed-System Purge-and-Trap and Extraction for Volatile	EPA 5035A				X				
Cobalt	EPA 200.7		X	X					
Cobalt	EPA 200.8			X					

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Cobalt	EPA 6010B			X	X				
Cobalt	EPA 6010C			X	X				
Cobalt	EPA 6010D			X	X				
Cobalt	EPA 6020			X	X				
Cobalt	EPA 6020A			X	X				
Cobalt	EPA 6020B			X	X				
Cobalt-60	DOE 4.5.2.3				X				
Cobalt-60	EPA 901.1		X	X					
Cobalt-60	HASL 300 Ga-01-R				X				
Color	SM 2120 B-2011		X	X					
Conductivity	EPA 120.1		X	X					
Conductivity	EPA 9050A			X	X				
Conductivity	SM 2510 B-2011		X	X					
Copper	EPA 200.7		X	X					
Copper	EPA 200.8		X	X					
Copper	EPA 6010B			X	X				
Copper	EPA 6010C			X	X				
Copper	EPA 6010D			X	X				
Copper	EPA 6020			X	X				
Copper	EPA 6020A			X	X				
Copper	EPA 6020B			X	X				
Corrosivity (langlier index)	SM 2320 B-2011		X	X					
Corrosivity (pH)	EPA 9040B			X					
Corrosivity (pH)	EPA 9040C			X					
Corrosivity (pH)	EPA 9045D				X				
Coumaphos	EPA 1657			X					
Coumaphos	EPA 8141A			X	X				
Coumaphos	EPA 8141B			X	X				
Cyanazine	EPA 8141A			X	X				
Cyanazine	EPA 8141B			X	X				
Cyanide	EPA 335.4		X	X					
Cyanide	EPA 9010B			X	X				

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Cyanide	EPA 9010C			X	X				
Cyanide	EPA 9012A			X					
Cyanide	EPA 9012B			X	X				
Cyanide	EPA 9013				X				
Cyanide	EPA 9013A				X				
Cyanide	EPA 9014			X	X				
Cyanide	SM 4500-CN ⁻ B-2011		X	X					
Cyanide	SM 4500-CN ⁻ C-2011		X	X					
Cyanide	SM 4500-CN ⁻ E-2011		X	X					
Cyanide	SM 4500-CN ⁻ G-2011		X						
Cyclohexane	EPA 624.1			X					
Cyclohexane	EPA 8260B			X	X				
Cyclohexane	EPA 8260C			X	X				
Cyclohexane	EPA 8260D			X	X				
Cyclohexane	EPA TO-15	X							
Cyclohexane	SM 6200 B-2011			X					
Cyclohexanone	EPA 624.1			X					
Cyclohexanone	EPA 8260B			X	X				
Cyclohexanone	EPA 8260C			X	X				
Cyclohexanone	EPA 8260D			X	X				
Cyclohexanone	SM 6200 B-2011			X					
Dalapon	EPA 8151A			X	X				
Dalapon	SM 6640 B-2001			X					
delta-BHC	EPA 608.3			X					
delta-BHC	EPA 8081A			X	X				
delta-BHC	EPA 8081B			X	X				
Demeton	EPA 1657			X					
Demeton	EPA 8141A			X	X				
Demeton	EPA 8141B			X	X				
Demeton-o	EPA 8141A			X	X				
Demeton-o	EPA 8141B			X	X				
Demeton-s	EPA 8141A			X	X				

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Demeton-s	EPA 8141B			X	X				
Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate,	EPA 625.1			X					
Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate,	EPA 8270C			X	X				
Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate,	EPA 8270D			X	X				
Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate,	EPA 8270E			X	X				
Diallate	EPA 625.1			X					
Diallate	EPA 8270C			X	X				
Diallate	EPA 8270D			X	X				
Diallate	EPA 8270E			X	X				
Diazinon	EPA 1657			X					
Diazinon	EPA 8141A			X	X				
Diazinon	EPA 8141B			X	X				
Dibenz(a, h) acridine	EPA 625.1			X					
Dibenz(a, h) acridine	EPA 8270C			X	X				
Dibenz(a, h) acridine	EPA 8270D			X	X				
Dibenz(a, h) acridine	EPA 8270E			X	X				
Dibenz(a, j)acridine	EPA 625.1			X					
Dibenz(a, j)acridine	EPA 8270C			X	X				
Dibenz(a, j)acridine	EPA 8270D			X	X				
Dibenz(a, j)acridine	EPA 8270E			X	X				
Dibenz(a,h)anthracene	EPA 610 (HPLC)			X					
Dibenz(a,h)anthracene	EPA 625.1			X					
Dibenz(a,h)anthracene	EPA 625.1 SIM			X					
Dibenz(a,h)anthracene	EPA 8270C			X	X				
Dibenz(a,h)anthracene	EPA 8270C SIM			X	X				
Dibenz(a,h)anthracene	EPA 8270D			X	X				
Dibenz(a,h)anthracene	EPA 8270D SIM			X	X				
Dibenz(a,h)anthracene	EPA 8270E			X	X				
Dibenz(a,h)anthracene	EPA 8270E SIM			X	X				
Dibenz(a,h)anthracene	EPA 8310			X	X				
Dibenz(a,h)anthracene	MADEP EPH			X	X				
Dibenzo(a,e)pyrene	EPA 8270C			X	X				

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Dibenzo(a,e)pyrene	EPA 8270D			X	X				
Dibenzo(a,e)pyrene	EPA 8270E			X	X				
Dibenzo(a,h) pyrene	EPA 8270C			X	X				
Dibenzo(a,h) pyrene	EPA 8270D			X	X				
Dibenzo(a,h) pyrene	EPA 8270E			X	X				
Dibenzo(a,i) pyrene	EPA 8270C			X	X				
Dibenzo(a,i) pyrene	EPA 8270D			X	X				
Dibenzo(a,i) pyrene	EPA 8270E			X	X				
Dibenzofuran	EPA 625.1			X					
Dibenzofuran	EPA 8270C			X	X				
Dibenzofuran	EPA 8270D			X	X				
Dibenzofuran	EPA 8270E			X	X				
Dibromoacetic acid	EPA 552.2		X						
Dibromomethane	EPA 524.2		X						
Dibromomethane (Methylene bromide)	EPA 624.1			X					
Dibromomethane (Methylene bromide)	EPA 8260B			X	X				
Dibromomethane (Methylene bromide)	EPA 8260C			X	X				
Dibromomethane (Methylene bromide)	EPA 8260D			X	X				
Dibromomethane (Methylene bromide)	SM 6200 B-2011			X					
Dicamba	EPA 8151A			X	X				
Dicamba	SM 6640 B-2001			X					
Dichlorobromomethane	EPA 524.2		X						
Dichlorodifluoromethane	EPA 524.2		X						
Dichlorodifluoromethane (Freon-12)	EPA 624.1			X					
Dichlorodifluoromethane (Freon-12)	EPA 8260B			X	X				
Dichlorodifluoromethane (Freon-12)	EPA 8260C			X	X				
Dichlorodifluoromethane (Freon-12)	EPA 8260D			X	X				
Dichlorodifluoromethane (Freon-12)	EPA TO-15	X							
Dichlorodifluoromethane (Freon-12)	SM 6200 B-2011			X					
Dichloroacetic acid	EPA 552.2		X						
Dichloroprop (Dichlorprop)	EPA 8151A			X	X				
Dichlorovos (DDVP, Dichlorvos)	EPA 1657			X					

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Dichlorovos (DDVP, Dichlorvos)	EPA 8141A			X	X				
Dichlorovos (DDVP, Dichlorvos)	EPA 8141B			X	X				
Dichlorvos	EPA 507			X					
Dicyclopentadiene	EPA 8260B			X					
Dicyclopentadiene	EPA 8260C			X					
Dicyclopentadiene	EPA 8260D			X					
Dicyclopentadiene	EPA TO-15	X							
Dieldrin	EPA 608.3			X					
Dieldrin	EPA 8081A			X	X				
Dieldrin	EPA 8081B			X	X				
Diesel range organics (DRO)	CA LUFT GCMS				X				
Diesel range organics (DRO)	EPA 8015B			X	X				
Diesel range organics (DRO)	EPA 8015C			X	X				
Diesel range organics (DRO)	EPA 8015D			X	X				
Diesel range organics (DRO)	EPA 8270C			X	X				
Diesel range organics (DRO)	EPA 8270D			X	X				
Diesel range organics (DRO)	EPA 8270E				X				
Diesel range organics (DRO)	IDNR OA-2			X	X				
Diesel range organics (DRO)	LUFT GC			X	X				
Diesel range organics (DRO)	LUFT GCMS			X					
Diesel range organics (DRO)	MADEP EPH				X				
Diesel range organics (DRO)	MO-DRO			X	X				
Diesel range organics (DRO)	NWTPH-Dx			X	X				
Diesel range organics (DRO)	OA-2			X					
Diesel range organics (DRO)	OK DEQ DRO			X	X				
Diesel range organics (DRO)	OK DEQ GRO				X				
Diesel range organics (DRO)	WI(95) DRO			X	X				
Diethyl ether	EPA 624.1			X					
Diethyl ether	EPA 8260B			X	X				
Diethyl ether	EPA 8260C			X	X				
Diethyl ether	EPA 8260D			X	X				
Diethyl ether	SM 6200 B-2011			X					

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Diethyl phthalate	EPA 625.1			X					
Diethyl phthalate	EPA 8270C			X	X				
Diethyl phthalate	EPA 8270D			X	X				
Diethyl phthalate	EPA 8270E			X	X				
Di-isopropylether (DIPE) (Isopropyl ether)	EPA 624.1			X					
Di-isopropylether (DIPE) (Isopropyl ether)	EPA 8260B			X	X				
Di-isopropylether (DIPE) (Isopropyl ether)	EPA 8260C			X	X				
Di-isopropylether (DIPE) (Isopropyl ether)	EPA 8260D			X	X				
Di-isopropylether (DIPE) (Isopropyl ether)	SM 6200 B-2011			X					
Dimethoate	EPA 1657			X					
Dimethoate	EPA 625.1			X					
Dimethoate	EPA 8141A			X	X				
Dimethoate	EPA 8141B			X	X				
Dimethoate	EPA 8270C			X	X				
Dimethoate	EPA 8270D			X	X				
Dimethoate	EPA 8270E			X	X				
Dimethyl phthalate	EPA 625.1			X					
Dimethyl phthalate	EPA 8270C			X	X				
Dimethyl phthalate	EPA 8270D			X	X				
Dimethyl phthalate	EPA 8270E			X	X				
Di-n-butyl phthalate	EPA 625.1			X					
Di-n-butyl phthalate	EPA 8270C			X	X				
Di-n-butyl phthalate	EPA 8270D			X	X				
Di-n-butyl phthalate	EPA 8270E			X	X				
Di-n-octyl phthalate	EPA 625.1			X					
Di-n-octyl phthalate	EPA 8270C			X	X				
Di-n-octyl phthalate	EPA 8270D			X	X				
Di-n-octyl phthalate	EPA 8270E			X	X				
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 625.1			X					
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151A			X	X				
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270C			X	X				
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270D			X	X				

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Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270E			X	X				
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	SM 6640 B-2001			X					
Diphenyl ether (Diphenyl Oxide)	EPA 625.1			X					
Diphenyl ether (Diphenyl Oxide)	EPA 8270C			X	X				
Diphenyl ether (Diphenyl Oxide)	EPA 8270D			X	X				
Diphenyl ether (Diphenyl Oxide)	EPA 8270E			X	X				
Diphenyl ketone (Benzophenone)	EPA 8270C			X					
Diphenyl ketone (Benzophenone)	EPA 8270D			X					
Diphenyl ketone (Benzophenone)	EPA 8270E			X					
Diphenylamine	EPA 625.1			X					
Diphenylamine	EPA 8270C			X	X				
Diphenylamine	EPA 8270D			X	X				
Diphenylamine	EPA 8270E			X	X				
Dissolved Carbon	SM 5310 B-2011			X					
Dissolved organic carbon (DOC)	EPA 9060			X					
Dissolved organic carbon (DOC)	EPA 9060A			X					
Dissolved organic carbon (DOC)	SM 5310 B-2011			X					
Dissolved organic carbon (DOC)	SM 5310 C-2011		X						
Disulfoton	EPA 1657			X					
Disulfoton	EPA 8141A			X	X				
Disulfoton	EPA 8141B			X	X				
Disulfoton	EPA 8270C			X	X				
Disulfoton	EPA 8270D			X	X				
Disulfoton	EPA 8270E			X	X				
Endosulfan I	EPA 608.3			X					
Endosulfan I	EPA 8081A			X	X				
Endosulfan I	EPA 8081B			X	X				
Endosulfan II	EPA 608.3			X					
Endosulfan II	EPA 8081A			X	X				
Endosulfan II	EPA 8081B			X	X				
Endosulfan sulfate	EPA 608.3			X					
Endosulfan sulfate	EPA 8081A			X	X				

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Endosulfan sulfate	EPA 8081B			X	X				
Endrin	EPA 608.3			X					
Endrin	EPA 8081A			X	X				
Endrin	EPA 8081B			X	X				
Endrin aldehyde	EPA 608.3			X					
Endrin aldehyde	EPA 8081A			X	X				
Endrin aldehyde	EPA 8081B			X	X				
Endrin ketone	EPA 608.3			X					
Endrin ketone	EPA 8081A			X	X				
Endrin ketone	EPA 8081B			X	X				
Enterococci	ASTM D6503-99			X					
Enterococci	Enterolert®			X					
EPH Aliphatic >C10-C12	MADEP EPH			X	X				
EPH Aliphatic >C12-C16	MADEP EPH			X	X				
EPH Aliphatic >C16-C35	MADEP EPH			X	X				
EPH Aliphatic C19-C36	MADEP EPH			X	X				
EPH Aliphatic C9-C18	MADEP EPH			X	X				
EPH Aromatic >C10-C12	MADEP EPH			X	X				
EPH Aromatic >C12-C16	MADEP EPH			X	X				
EPH Aromatic >C16-C21	MADEP EPH			X	X				
EPH Aromatic >C21-C35	MADEP EPH			X	X				
EPH Aromatic C11-C22	MADEP EPH			X	X				
EPH Aromatic C11-C22 Unadjusted	MADEP EPH			X	X				
EPN	EPA 1657			X					
EPN	EPA 8141A			X	X				
EPN	EPA 8141B			X	X				
Escherichia coli	SM 9223 B-2004		X	X					
Ethane	EPA RSK-175 (GC/FID)	X		X					
Ethanol	EPA 624.1			X					
Ethanol	EPA 8015			X					
Ethanol	EPA 8015B			X	X				
Ethanol	EPA 8015C			X	X				

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Ethanol	EPA 8015D			X	X				
Ethanol	EPA 8260B			X	X				
Ethanol	EPA 8260C			X	X				
Ethanol	EPA 8260D			X	X				
Ethanol	EPA TO-15	X							
Ethanol	SM 6200 B-2011			X					
Ethene	EPA RSK-175 (GC/FID)	X		X					
Ethion	EPA 8141A			X					
Ethion	EPA 8141B			X					
Ethoprop	EPA 1657			X					
Ethoprop	EPA 507			X					
Ethoprop	EPA 8141A			X	X				
Ethoprop	EPA 8141B			X	X				
Ethyl acetate	EPA 624.1			X					
Ethyl acetate	EPA 8260B			X	X				
Ethyl acetate	EPA 8260C			X	X				
Ethyl acetate	EPA 8260D			X	X				
Ethyl acetate	EPA TO-15	X							
Ethyl acetate	SM 6200 B-2011			X					
Ethyl methacrylate	EPA 624.1			X					
Ethyl methacrylate	EPA 8260B			X	X				
Ethyl methacrylate	EPA 8260C			X	X				
Ethyl methacrylate	EPA 8260D			X	X				
Ethyl methacrylate	SM 6200 B-2011			X					
Ethyl methanesulfonate	EPA 625.1			X					
Ethyl methanesulfonate	EPA 8270C			X	X				
Ethyl methanesulfonate	EPA 8270D			X	X				
Ethyl methanesulfonate	EPA 8270E			X	X				
Ethylbenzene	CA LUFT GCMS			X	X				
Ethylbenzene	EPA 524.2		X						
Ethylbenzene	EPA 602			X					
Ethylbenzene	EPA 624.1			X					

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Ethylbenzene	EPA 8021B			X	X				
Ethylbenzene	EPA 8260B			X	X				
Ethylbenzene	EPA 8260C			X	X				
Ethylbenzene	EPA 8260D			X	X				
Ethylbenzene	EPA TO-15	X							
Ethylbenzene	EPA TO-15 GC/MS SIM	X							
Ethylbenzene	IDNR OA-1			X	X				
Ethylbenzene	MADEP VPH			X	X				
Ethylbenzene	OK DEQ GRO			X	X				
Ethylbenzene	SM 6200 B-2011			X					
Ethylene glycol	EPA 8015B			X	X				
Ethylene glycol	EPA 8015C			X	X				
Ethylene glycol	EPA 8015D			X	X				
Ethyl-t-butyl ether (ETBE) (2-Ethoxy-2-methylpropane)	EPA 624.1			X					
Ethyl-t-butyl ether (ETBE) (2-Ethoxy-2-methylpropane)	EPA 8260B			X	X				
Ethyl-t-butyl ether (ETBE) (2-Ethoxy-2-methylpropane)	EPA 8260C			X	X				
Ethyl-t-butyl ether (ETBE) (2-Ethoxy-2-methylpropane)	EPA 8260D			X	X				
Ethyl-t-butyl ether (ETBE) (2-Ethoxy-2-methylpropane)	SM 6200 B-2011			X					
Extractable organics halides (EOX)	EPA 9023				X				
Extractable Petroleum Hydrocarbons (EPH)	CT ETPH			X					
Extractable Petroleum Hydrocarbons (EPH)	IDNR OA-2			X	X				
Extractable Petroleum Hydrocarbons (EPH)	MADEP EPH			X	X				
Extractable Petroleum Hydrocarbons (EPH)	NJDEP EPH 10/08			X					
Extractable Petroleum Hydrocarbons (EPH)	TN EPH			X	X				
Extractable Total Petroleum Hydrocarbons	NJDEP EPH 10/08				X				
Famphur	EPA 625.1			X					
Famphur	EPA 8141A			X					
Famphur	EPA 8141B			X					
Famphur	EPA 8270C			X	X				
Famphur	EPA 8270D			X	X				
Famphur	EPA 8270E			X	X				
Fecal coliforms	EPA 1681			X	X				

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Fecal coliforms	SM 9223 B-2004			X					
Fensulfothion	EPA 1657			X					
Fensulfothion	EPA 8141A			X	X				
Fensulfothion	EPA 8141B			X	X				
Fenthion	EPA 1657			X					
Fenthion	EPA 8141A			X	X				
Fenthion	EPA 8141B			X	X				
Flash Point	ASTM D93			X	X				
Flash Point	ASTM D93-07			X	X				
Florisil Clean-up	EPA 3620			X					
Florisil Clean-up	EPA 3620C				X				
Fluoranthene	EPA 610 (HPLC)			X					
Fluoranthene	EPA 625.1			X					
Fluoranthene	EPA 625.1 SIM			X					
Fluoranthene	EPA 8270C			X	X				
Fluoranthene	EPA 8270C SIM			X	X				
Fluoranthene	EPA 8270D			X	X				
Fluoranthene	EPA 8270D SIM			X	X				
Fluoranthene	EPA 8270E			X	X				
Fluoranthene	EPA 8270E SIM			X	X				
Fluoranthene	EPA 8310			X	X				
Fluoranthene	MADEP EPH			X	X				
Fluorene	EPA 610 (HPLC)			X					
Fluorene	EPA 625.1			X					
Fluorene	EPA 625.1 SIM			X					
Fluorene	EPA 8270C			X	X				
Fluorene	EPA 8270C SIM			X	X				
Fluorene	EPA 8270D			X	X				
Fluorene	EPA 8270D SIM			X	X				
Fluorene	EPA 8270E			X	X				
Fluorene	EPA 8270E SIM			X	X				
Fluorene	EPA 8310			X	X				

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Fluorene	MADEP EPH			X	X				
Fluoride	EPA 300.0		X	X	X				
Fluoride	EPA 9056			X	X				
Fluoride	EPA 9056A			X	X				
Fluoride	SM 4110 B-2011		X	X					
Fluoride	SM 4500-F ⁻ B-2011			X					
Fluoride	SM 4500-F ⁻ C-2011			X					
Fractional Organic Carbon (FOC)	ASTM D2974				X				
Free cyanide	EPA 9014			X					
Free liquid	EPA 9095A				X				
Free liquid	EPA 9095B			X	X				
Gamma Emitters	DOE 4.5.2.3			X	X				
Gamma Emitters	EPA 901.1		X	X	X				
Gamma Emitters	HASL 300 Ga-01-R	X		X	X		X		
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 608.3			X					
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081A			X	X				
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081B			X	X				
gamma-Chlordane	EPA 608.3			X					
gamma-Chlordane	EPA 8081A			X	X				
gamma-Chlordane	EPA 8081B			X	X				
Gasoline range organics (GRO)	CA LUFT GCMS				X				
Gasoline range organics (GRO)	EPA 8015B			X	X				
Gasoline range organics (GRO)	EPA 8015C			X	X				
Gasoline range organics (GRO)	EPA 8015D			X	X				
Gasoline range organics (GRO)	EPA 8260B			X	X				
Gasoline range organics (GRO)	EPA 8260C			X	X				
Gasoline range organics (GRO)	EPA 8260D			X	X				
Gasoline range organics (GRO)	EPA TO-15	X							
Gasoline range organics (GRO)	IDNR OA-1			X	X				
Gasoline range organics (GRO)	LUFT GC			X	X				
Gasoline range organics (GRO)	LUFT GCMS			X					
Gasoline range organics (GRO)	MADEP VPH				X				

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Gasoline range organics (GRO)	MO-GRO			X					
Gasoline range organics (GRO)	NWTPH-Gx			X	X				
Gasoline range organics (GRO)	OK DEQ GRO			X	X				
Gasoline range organics (GRO)	TN GRO			X					
Gasoline range organics (GRO)	WI(95) GRO			X	X				
Gross alpha-beta	EPA 900			X					
Gross alpha-beta	EPA 9310	X		X					
Gross-alpha	EPA 900			X					
Gross-alpha	EPA 900.0 (GPC)		X	X	X				
Gross-alpha	EPA 9310	X		X	X				
Gross-alpha Radium	EPA 900.1			X					
Gross-beta	EPA 900			X					
Gross-beta	EPA 900.0 (GPC)		X	X	X				
Gross-beta	EPA 9310	X		X	X				
Guanidine Nitrate	EPA 9056			X	X				
Guanidine Nitrate	EPA 9056A			X	X				
Hardness	EPA 130.1		X	X					
Hardness	SM 2340 B-2011		X	X					
Hardness (calc.)	EPA 200.7		X	X					
Hardness (calc.)	EPA 200.8			X					
Hardness (calc.)	SM 2340 B-2011		X	X					
Helium	ASTM D1946-90	X							
Heptachlor	EPA 608.3			X					
Heptachlor	EPA 8081A			X	X				
Heptachlor	EPA 8081B			X	X				
Heptachlor epoxide	EPA 608.3			X					
Heptachlor epoxide	EPA 8081A			X	X				
Heptachlor epoxide	EPA 8081B			X	X				
Heterotrophic plate count	SM 9215 B 2000 (PCA)		X	X					
Hexachlorobenzene	EPA 608.3			X					
Hexachlorobenzene	EPA 625.1			X					
Hexachlorobenzene	EPA 625.1 SIM			X					

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Hexachlorobenzene	EPA 8081A			X	X				
Hexachlorobenzene	EPA 8081B			X	X				
Hexachlorobenzene	EPA 8270C			X	X				
Hexachlorobenzene	EPA 8270C SIM			X	X				
Hexachlorobenzene	EPA 8270D			X	X				
Hexachlorobenzene	EPA 8270D SIM			X	X				
Hexachlorobenzene	EPA 8270E			X	X				
Hexachlorobenzene	EPA 8270E SIM				X				
Hexachlorobutadiene	EPA 624.1			X					
Hexachlorobutadiene	EPA 625.1			X					
Hexachlorobutadiene	EPA 8260B			X	X				
Hexachlorobutadiene	EPA 8260C			X	X				
Hexachlorobutadiene	EPA 8260D			X	X				
Hexachlorobutadiene	EPA 8270C			X	X				
Hexachlorobutadiene	EPA 8270D			X	X				
Hexachlorobutadiene	EPA 8270E			X	X				
Hexachlorobutadiene	EPA TO-15	X							
Hexachlorobutadiene	SM 6200 B-2011			X					
Hexachlorobutadiene	EPA 524.2		X						
Hexachlorocyclopentadiene	EPA 625.1			X					
Hexachlorocyclopentadiene	EPA 8270C			X	X				
Hexachlorocyclopentadiene	EPA 8270D			X	X				
Hexachlorocyclopentadiene	EPA 8270E			X	X				
Hexachloroethane	EPA 624.1			X					
Hexachloroethane	EPA 625.1			X					
Hexachloroethane	EPA 8260B			X	X				
Hexachloroethane	EPA 8260C			X	X				
Hexachloroethane	EPA 8260D			X	X				
Hexachloroethane	EPA 8270C			X	X				
Hexachloroethane	EPA 8270D			X	X				
Hexachloroethane	EPA 8270E			X	X				
Hexachloroethane	SM 6200 B-2011			X					

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Hexachlorophene	EPA 625.1			X					
Hexachlorophene	EPA 8270C			X	X				
Hexachlorophene	EPA 8270D			X	X				
Hexachlorophene	EPA 8270E			X	X				
Hexachloropropene	EPA 625.1			X					
Hexachloropropene	EPA 8270C			X	X				
Hexachloropropene	EPA 8270D			X	X				
Hexachloropropene	EPA 8270E			X	X				
Hydroquinone	EPA 625.1			X					
Hydroquinone	EPA 8270C			X					
Hydroquinone	EPA 8270D			X					
IC25 (ON) Growth	EPA 1000.0 - Fathead minnow, 7-day			X					
IC25 Reproduction	EPA 1002.0 - Ceriodaphnia dubia,			X					
IC25 Survival	EPA 1000.0 - Fathead minnow, 7-day			X					
IC25 Survival	EPA 1002.0 - Ceriodaphnia dubia,			X					
Ignitability	EPA 1010			X	X				
Ignitability	EPA 1010A			X	X				
Indene	EPA 625.1			X					
Indene	EPA 8270C			X	X				
Indene	EPA 8270D			X	X				
Indene	EPA 8270E			X	X				
Indeno(1,2,3-cd)pyrene	EPA 610 (HPLC)			X					
Indeno(1,2,3-cd)pyrene	EPA 625.1			X					
Indeno(1,2,3-cd)pyrene	EPA 625.1 SIM			X					
Indeno(1,2,3-cd)pyrene	EPA 8270C			X	X				
Indeno(1,2,3-cd)pyrene	EPA 8270C SIM			X	X				
Indeno(1,2,3-cd)pyrene	EPA 8270D			X	X				
Indeno(1,2,3-cd)pyrene	EPA 8270D SIM			X	X				
Indeno(1,2,3-cd)pyrene	EPA 8270E			X	X				
Indeno(1,2,3-cd)pyrene	EPA 8270E SIM			X	X				
Indeno(1,2,3-cd)pyrene	EPA 8310			X	X				
Indeno(1,2,3-cd)pyrene	MADEP EPH			X	X				

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Inorganic Carbon	SM 5310 B-2011			X					
Iodomethane (Methyl iodide)	EPA 624 (extended)			X					
Iodomethane (Methyl iodide)	EPA 624.1			X					
Iodomethane (Methyl iodide)	EPA 8260B			X	X				
Iodomethane (Methyl iodide)	EPA 8260C			X	X				
Iodomethane (Methyl iodide)	EPA 8260D			X	X				
Iodomethane (Methyl iodide)	EPA TO-15	X							
Iodomethane (Methyl iodide)	SM 6200 B-2011			X					
Iron	EPA 200.7		X	X					
Iron	EPA 200.8			X					
Iron	EPA 6010B			X	X				
Iron	EPA 6010C			X	X				
Iron	EPA 6010D			X	X				
Iron	EPA 6020			X	X				
Iron	EPA 6020A			X	X				
Iron	EPA 6020B			X	X				
Iron-(II) (Ferrous Iron)	SM 3500-Fe B-2011			X					
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 624.1			X					
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260B			X	X				
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260C			X	X				
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260D			X	X				
Isobutyl alcohol (2-Methyl-1-propanol)	SM 6200 B-2011			X					
Isodrin	EPA 625.1			X					
Isodrin	EPA 8270C			X	X				
Isodrin	EPA 8270D			X	X				
Isodrin	EPA 8270E			X	X				
Isophorone	EPA 625.1			X					
Isophorone	EPA 8270C			X	X				
Isophorone	EPA 8270D			X	X				
Isophorone	EPA 8270E			X	X				
Isopropyl alcohol (2-Propanol, Isopropanol)	EPA 624.1			X					
Isopropyl alcohol (2-Propanol, Isopropanol)	EPA 8260B			X	X				

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Isopropyl alcohol (2-Propanol, Isopropanol)	EPA 8260C			X	X				
Isopropyl alcohol (2-Propanol, Isopropanol)	EPA 8260D			X	X				
Isopropyl alcohol (2-Propanol, Isopropanol)	EPA TO-15	X							
Isopropyl alcohol (2-Propanol, Isopropanol)	SM 6200 B-2011			X					
Isopropylbenzene	EPA 524.2		X						
Isopropylbenzene (Cumene)	EPA 624 (extended)			X					
Isopropylbenzene (Cumene)	EPA 624.1			X					
Isopropylbenzene (Cumene)	EPA 8260B			X	X				
Isopropylbenzene (Cumene)	EPA 8260C			X	X				
Isopropylbenzene (Cumene)	EPA 8260D			X	X				
Isopropylbenzene (Cumene)	EPA TO-15	X							
Isopropylbenzene (Cumene)	SM 6200 B-2011			X					
Isosafrole	EPA 8270C			X	X				
Isosafrole	EPA 8270D			X	X				
Isosafrole	EPA 8270E			X	X				
Isotopic uranium	ASTM D3972-09 Modified (ENV-SOP-			X					
Isotopic uranium	ASTM D3972-97			X					
Kepone	EPA 625.1			X					
Kepone	EPA 8270C			X	X				
Kepone	EPA 8270D			X	X				
Kepone	EPA 8270E			X	X				
Kjeldahl nitrogen - total	EPA 351.2			X					
Kjeldahl nitrogen - total	SM 4500-NH3 B-2011			X					
Kjeldahl nitrogen - total	SM 4500-NH3 C-2011			X					
Kjeldahl nitrogen - total	SM 4500-Norg B-2011			X					
Kjeldahl nitrogen - total	SM 4500-Norg C-2011			X					
Kjeldahl nitrogen - total	SM 4500-Norg D-2011			X	X				
LC50 Survival	EPA 2000.0 - Fathead minnow, 48-hr Acute,			X					
LC50 Survival	EPA 2002 Ceriodaphnia dubia			X					
Lead	EPA 200.7		X	X					
Lead	EPA 200.8		X	X					
Lead	EPA 6010B			X	X				

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Lead	EPA 6010C			X	X				
Lead	EPA 6010D			X	X				
Lead	EPA 6020			X	X				
Lead	EPA 6020A			X	X				
Lead	EPA 6020B			X	X				
Lead-210	DOE 4.5.2.3			X					
Lead-210	Eichrom OTW01			X					
Lead-210	EICHROM PBS01-12	X		X	X		X		
Lead-210	HASL 300 Ga-01-R			X					
Legionella	Legiolert		X	X					
Lithium	EPA 200.7		X	X					
Lithium	EPA 6010B			X	X				
Lithium	EPA 6010C			X	X				
Lithium	EPA 6010D			X	X				
Lithium	EPA 6020			X					
Lithium	EPA 6020A			X					
Lithium	EPA 6020B			X					
LOEC Survival	EPA 2000			X					
m+p-xylene	EPA 602			X					
m+p-xylene	EPA 8021B			X	X				
m+p-xylene	EPA 8260B			X	X				
m+p-xylene	EPA 8260C			X	X				
m+p-xylene	EPA 8260D				X				
m+p-xylene	EPA TO-15	X							
m+p-xylene	IDNR OA-1				X				
m+p-xylene	MADEP VPH			X	X				
m+p-xylene	SM 6200 B-2011			X					
Magnesium	EPA 200.7		X	X					
Magnesium	EPA 200.8			X					
Magnesium	EPA 6010B			X	X				
Magnesium	EPA 6010C			X	X				
Magnesium	EPA 6010D			X	X				

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Magnesium	EPA 6020			X	X				
Magnesium	EPA 6020A			X	X				
Magnesium	EPA 6020B			X	X				
Malathion	EPA 1657			X					
Malathion	EPA 8141A			X	X				
Malathion	EPA 8141B			X	X				
Manganese	EPA 200.7		X	X					
Manganese	EPA 200.8		X	X					
Manganese	EPA 6010B			X	X				
Manganese	EPA 6010C			X	X				
Manganese	EPA 6010D			X	X				
Manganese	EPA 6020			X	X				
Manganese	EPA 6020A			X	X				
Manganese	EPA 6020B			X	X				
MCPA	EPA 8151A			X	X				
MCPP	EPA 8151A			X	X				
Mercury	EPA 245.1		X	X					
Mercury	EPA 7470A			X					
Mercury	EPA 7471A				X				
Mercury	EPA 7471B				X				
Merphos	EPA 1657			X					
Merphos	EPA 507			X					
Merphos	EPA 8141A			X	X				
Merphos	EPA 8141B			X	X				
Methacrylonitrile	EPA 624.1			X					
Methacrylonitrile	EPA 8260B			X	X				
Methacrylonitrile	EPA 8260C			X	X				
Methacrylonitrile	EPA 8260D			X	X				
Methacrylonitrile	SM 6200 B-2011			X					
Methane	ASTM D1946-90	X							
Methane	EPA RSK-175 (GC/FID)	X		X					
Methanol	EPA 8015			X					

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Methanol	EPA 8015B			X	X				
Methanol	EPA 8015C			X	X				
Methanol	EPA 8015D			X	X				
Methanol	EPA 8260B			X					
Methanol	EPA 8260C			X					
Methanol	EPA TO-15	X							
Methanol	SM 6200 B-2011			X					
Methapyrilene	EPA 625.1			X					
Methapyrilene	EPA 8270C			X	X				
Methapyrilene	EPA 8270D			X	X				
Methapyrilene	EPA 8270E			X	X				
Methoxychlor	EPA 608.3			X					
Methoxychlor	EPA 8081A			X	X				
Methoxychlor	EPA 8081B			X	X				
Methyl acetate	EPA 624.1			X					
Methyl acetate	EPA 8260B			X	X				
Methyl acetate	EPA 8260C			X	X				
Methyl acetate	EPA 8260D			X	X				
Methyl acetate	SM 6200 B-2011			X					
Methyl acrylate	EPA 624.1			X					
Methyl acrylate	EPA 8260B			X	X				
Methyl acrylate	EPA 8260C			X	X				
Methyl acrylate	EPA 8260D			X	X				
Methyl acrylate	SM 6200 B-2011			X					
Methyl bromide (Bromomethane)	EPA 624.1			X					
Methyl bromide (Bromomethane)	EPA 8260B			X	X				
Methyl bromide (Bromomethane)	EPA 8260C			X	X				
Methyl bromide (Bromomethane)	EPA 8260D			X	X				
Methyl bromide (Bromomethane)	EPA TO-15	X							
Methyl bromide (Bromomethane)	SM 6200 B-2011			X					
Methyl chloride (Chloromethane)	EPA 624.1			X					
Methyl chloride (Chloromethane)	EPA 8260B			X	X				

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Methyl chloride (Chloromethane)	EPA 8260C			X	X				
Methyl chloride (Chloromethane)	EPA 8260D			X	X				
Methyl chloride (Chloromethane)	EPA TO-15	X							
Methyl chloride (Chloromethane)	EPA TO-15 GC/MS SIM	X							
Methyl chloride (Chloromethane)	SM 6200 B-2011			X					
Methyl ethyl ketone	EPA 524.2		X						
Methyl iodide	EPA 524.2		X						
Methyl isobutyl ketone	EPA 524.2		X						
Methyl methacrylate	EPA 624.1			X					
Methyl methacrylate	EPA 8260B			X	X				
Methyl methacrylate	EPA 8260C			X	X				
Methyl methacrylate	EPA 8260D			X	X				
Methyl methacrylate	EPA TO-15	X							
Methyl methacrylate	SM 6200 B-2011			X					
Methyl methanesulfonate	EPA 625.1			X					
Methyl methanesulfonate	EPA 8270C			X	X				
Methyl methanesulfonate	EPA 8270D			X	X				
Methyl methanesulfonate	EPA 8270E			X	X				
Methyl parathion (Parathion, methyl)	EPA 1657			X					
Methyl parathion (Parathion, methyl)	EPA 625.1			X					
Methyl parathion (Parathion, methyl)	EPA 8141A			X	X				
Methyl parathion (Parathion, methyl)	EPA 8141B			X	X				
Methyl parathion (Parathion, methyl)	EPA 8270C			X	X				
Methyl parathion (Parathion, methyl)	EPA 8270D			X	X				
Methyl parathion (Parathion, methyl)	EPA 8270E			X	X				
Methyl tert-butyl ether	EPA 524.2		X						
Methyl tert-butyl ether (MTBE)	EPA 602			X					
Methyl tert-butyl ether (MTBE)	EPA 624.1			X					
Methyl tert-butyl ether (MTBE)	EPA 8021B			X	X				
Methyl tert-butyl ether (MTBE)	EPA 8260B			X	X				
Methyl tert-butyl ether (MTBE)	EPA 8260C			X	X				
Methyl tert-butyl ether (MTBE)	EPA 8260D			X	X				

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Methyl tert-butyl ether (MTBE)	EPA TO-15	X							
Methyl tert-butyl ether (MTBE)	IDNR OA-1			X	X				
Methyl tert-butyl ether (MTBE)	LUFT GCMS			X	X				
Methyl tert-butyl ether (MTBE)	MADEP VPH			X	X				
Methyl tert-butyl ether (MTBE)	OK DEQ GRO			X	X				
Methyl tert-butyl ether (MTBE)	SM 6200 B-2011			X					
Methyl-2,4,6-trinitrophenylnitramine (tetryl)	EPA 8330			X	X				
Methyl-2,4,6-trinitrophenylnitramine (tetryl)	EPA 8330A			X	X				
Methyl-2,4,6-trinitrophenylnitramine (tetryl)	EPA 8330B			X	X				
Methylcyclohexane	EPA 624.1			X					
Methylcyclohexane	EPA 8260B			X	X				
Methylcyclohexane	EPA 8260C			X	X				
Methylcyclohexane	EPA 8260D			X	X				
Methylcyclohexane	EPA TO-15	X							
Methylcyclohexane	SM 6200 B-2011			X					
Methylene bromide	EPA 524.2		X						
Methylene chloride	EPA 524.2		X						
Methylene chloride (Dichloromethane)	EPA 624.1			X					
Methylene chloride (Dichloromethane)	EPA 8260B			X	X				
Methylene chloride (Dichloromethane)	EPA 8260C			X	X				
Methylene chloride (Dichloromethane)	EPA 8260D			X	X				
Methylene chloride (Dichloromethane)	EPA TO-15	X							
Methylene chloride (Dichloromethane)	SM 6200 B-2011			X					
Metolachlor	EPA 507		X	X					
Metribuzin	EPA 507		X	X					
Mevinphos	EPA 1657			X					
Mevinphos	EPA 507			X					
Mevinphos	EPA 8141A			X	X				
Mevinphos	EPA 8141B			X	X				
Microextraction of Organics in Water	EPA 3511			X	X				
Microwave Assisted Acid Digestion of Aqueous Samples	EPA 3015A			X					
Microwave Assisted Acid Digestion of Sediments,	EPA 3051				X				

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Microwave Assisted Acid Digestion of Sediments,	EPA 3051A				X				
Microwave Assisted Acid Digestion of Sediments,	EPA 3052				X				
Microwave Extraction	EPA 3546				X				
Mirex	EPA 8270C			X					
Mirex	EPA 8270D			X					
Molybdenum	EPA 200.7		X	X					
Molybdenum	EPA 200.8		X	X					
Molybdenum	EPA 6010B			X	X				
Molybdenum	EPA 6010C			X	X				
Molybdenum	EPA 6010D			X	X				
Molybdenum	EPA 6020			X	X				
Molybdenum	EPA 6020A			X	X				
Molybdenum	EPA 6020B			X	X				
m-Xylene	EPA 624.1			X					
m-Xylene	EPA 8021B			X	X				
m-Xylene	EPA 8260B			X	X				
m-Xylene	EPA 8260C			X	X				
m-Xylene	EPA 8260D			X	X				
m-Xylene	EPA TO-15	X							
m-Xylene	EPA 524.2		X						
Naled	EPA 1657			X					
Naled	EPA 8141A			X	X				
Naled	EPA 8141B			X	X				
Naphthalene	EPA 610 (HPLC)			X					
Naphthalene	EPA 624.1			X					
Naphthalene	EPA 625.1			X					
Naphthalene	EPA 625.1 SIM			X					
Naphthalene	EPA 8021B			X					
Naphthalene	EPA 8260B			X	X				
Naphthalene	EPA 8260C			X	X				
Naphthalene	EPA 8260D			X	X				
Naphthalene	EPA 8270C			X	X				

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Naphthalene	EPA 8270C SIM			X	X				
Naphthalene	EPA 8270D			X	X				
Naphthalene	EPA 8270D SIM			X	X				
Naphthalene	EPA 8270E			X	X				
Naphthalene	EPA 8270E SIM			X	X				
Naphthalene	EPA 8310			X	X				
Naphthalene	EPA TO-15	X							
Naphthalene	MADEP EPH			X	X				
Naphthalene	MADEP VPH			X	X				
Naphthalene	OK DEQ GRO			X	X				
Naphthalene	SM 6200 B-2011			X					
Naphthalene	EPA 524.2		X						
n-Butane	EPA TO-15	X							
n-Butyl alcohol (1-Butanol, n-Butanol)	EPA 624.1			X					
n-Butyl alcohol (1-Butanol, n-Butanol)	EPA 8260B			X	X				
n-Butyl alcohol (1-Butanol, n-Butanol)	EPA 8260C			X	X				
n-Butyl alcohol (1-Butanol, n-Butanol)	EPA 8260D			X	X				
n-Butyl alcohol (1-Butanol, n-Butanol)	SM 6200 B-2011			X					
n-Butylbenzene	EPA 524.2		X						
n-Butylbenzene	EPA 624 (extended)			X					
n-Butylbenzene	EPA 624.1			X					
n-Butylbenzene	EPA 8260B			X	X				
n-Butylbenzene	EPA 8260C			X	X				
n-Butylbenzene	EPA 8260D			X	X				
n-Butylbenzene	EPA TO-15	X							
n-Butylbenzene	SM 6200 B-2011			X					
n-Decane	EPA 625.1			X					
n-Decane	EPA 8270C			X	X				
n-Decane	EPA 8270D			X	X				
n-Decane	EPA 8270E			X	X				
Neptunium-237	EPA 907 Modified (ENV-SOP-MTJL-	X		X	X		X		
n-Heptane	EPA 624.1			X					

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n-Heptane	EPA 8260B			X					
n-Heptane	EPA 8260C			X					
n-Heptane	EPA 8260D			X					
n-Heptane	EPA TO-15	X							
n-Hexane	EPA 624.1			X					
n-Hexane	EPA 8260B			X	X				
n-Hexane	EPA 8260C			X	X				
n-Hexane	EPA 8260D			X	X				
n-Hexane	EPA TO-15	X							
n-Hexane	SM 6200 B-2011			X					
n-Hexane Extractable Material (O&G)	EPA 1664A (HEM)			X	X				
n-Hexane Extractable Material (O&G)	EPA 1664A (SGT-HEM)			X					
n-Hexane Extractable Material (O&G)	EPA 1664B			X					
n-Hexane Extractable Material (O&G)	EPA 9070A			X					
n-Hexane Extractable Material (O&G)	EPA 9071A				X				
n-Hexane Extractable Material (O&G)	EPA 9071B				X				
Nickel	EPA 200.7		X	X					
Nickel	EPA 200.8		X	X					
Nickel	EPA 6010B			X	X				
Nickel	EPA 6010C			X	X				
Nickel	EPA 6010D			X	X				
Nickel	EPA 6020			X	X				
Nickel	EPA 6020A			X	X				
Nickel	EPA 6020B			X	X				
Nitrate as N	EPA 300.0		X	X	X				
Nitrate as N	EPA 353.2		X						
Nitrate as N	EPA 9056			X	X				
Nitrate as N	EPA 9056A			X	X				
Nitrate as N	SM 4110 B-2011		X	X					
Nitrate as N	SM 4500-NO ₃ ⁻ F-2011		X	X					
Nitrate-Nitrite	EPA 300.0		X	X	X				
Nitrate-Nitrite	EPA 353.2		X	X					

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Nitrate-Nitrite	EPA 9056			X	X				
Nitrate-Nitrite	EPA 9056A			X	X				
Nitrate-Nitrite	SM 4110 B-2011		X	X					
Nitrate-Nitrite	SM 4500-NO ₃ ⁻ F-2011		X	X					
Nitrite as N	EPA 300.0		X	X	X				
Nitrite as N	EPA 353.2		X						
Nitrite as N	EPA 9056			X	X				
Nitrite as N	EPA 9056A			X	X				
Nitrite as N	SM 4110 B-2011		X	X					
Nitrite as N	SM 4500-NO ₃ ⁻ F-2011		X						
Nitrobenzene	EPA 625.1			X					
Nitrobenzene	EPA 8270C			X	X				
Nitrobenzene	EPA 8270D			X	X				
Nitrobenzene	EPA 8270E			X	X				
Nitrobenzene	EPA 8330			X	X				
Nitrobenzene	EPA 8330A			X	X				
Nitrobenzene	EPA 8330B			X	X				
Nitrocellulose	EPA 353.2 Modified			X	X				
Nitrocellulose	US Army #ADA067081			X	X				
Nitroglycerin	EPA 8330			X	X				
Nitroglycerin	EPA 8330A			X	X				
Nitroglycerin	EPA 8330B			X	X				
Nitroguanidine	EPA 8330			X	X				
Nitroguanidine	EPA 8330A			X	X				
Nitroguanidine	EPA 8330B			X	X				
n-Nitrosodiethylamine	EPA 625.1			X					
n-Nitrosodiethylamine	EPA 8270C			X	X				
n-Nitrosodiethylamine	EPA 8270D			X	X				
n-Nitrosodiethylamine	EPA 8270E			X	X				
n-Nitrosodimethylamine	EPA 625.1			X					
n-Nitrosodimethylamine	EPA 625.1 SIM			X					
n-Nitrosodimethylamine	EPA 8270C			X	X				

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n-Nitrosodimethylamine	EPA 8270C SIM			X	X				
n-Nitrosodimethylamine	EPA 8270D			X	X				
n-Nitrosodimethylamine	EPA 8270D SIM			X	X				
n-Nitrosodimethylamine	EPA 8270E			X	X				
n-Nitrosodimethylamine	EPA 8270E SIM				X				
n-Nitroso-di-n-butylamine	EPA 625.1			X					
n-Nitroso-di-n-butylamine	EPA 8260B			X					
n-Nitroso-di-n-butylamine	EPA 8260C			X					
n-Nitroso-di-n-butylamine	EPA 8260D			X					
n-Nitroso-di-n-butylamine	EPA 8270C			X	X				
n-Nitroso-di-n-butylamine	EPA 8270D			X	X				
n-Nitroso-di-n-butylamine	EPA 8270E			X	X				
n-Nitrosodi-n-propylamine	EPA 625.1			X					
n-Nitrosodi-n-propylamine	EPA 8270C			X	X				
n-Nitrosodi-n-propylamine	EPA 8270D			X	X				
n-Nitrosodi-n-propylamine	EPA 8270E			X	X				
n-Nitrosodiphenylamine	EPA 625.1			X					
n-Nitrosodiphenylamine	EPA 8270C			X	X				
n-Nitrosodiphenylamine	EPA 8270D			X	X				
n-Nitrosodiphenylamine	EPA 8270E			X	X				
n-Nitrosomethylethylamine	EPA 625.1			X					
n-Nitrosomethylethylamine	EPA 8270C			X	X				
n-Nitrosomethylethylamine	EPA 8270D			X	X				
n-Nitrosomethylethylamine	EPA 8270E			X	X				
n-Nitrosomorpholine	EPA 625.1			X					
n-Nitrosomorpholine	EPA 8270C			X	X				
n-Nitrosomorpholine	EPA 8270D			X	X				
n-Nitrosomorpholine	EPA 8270E			X	X				
n-Nitrosopiperidine	EPA 625.1			X					
n-Nitrosopiperidine	EPA 8270C			X	X				
n-Nitrosopiperidine	EPA 8270D			X	X				
n-Nitrosopiperidine	EPA 8270E			X	X				

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n-Nitrosopyrrolidine	EPA 625.1			X					
n-Nitrosopyrrolidine	EPA 8270C			X	X				
n-Nitrosopyrrolidine	EPA 8270D			X	X				
n-Nitrosopyrrolidine	EPA 8270E			X	X				
n-Nonane	EPA TO-15	X							
n-Octadecane	EPA 625.1			X					
n-Octadecane	EPA 8270C			X	X				
n-Octadecane	EPA 8270D			X	X				
n-Octadecane	EPA 8270E			X	X				
n-Octane	EPA 8260B			X	X				
n-Octane	EPA 8260C			X	X				
n-Octane	EPA 8260D			X	X				
n-Octane	SM 6200 B-2011			X					
NOEC (ON) Growth	EPA 1000.0 - Fathead minnow, 7-day			X					
NOEC Reproduction	EPA 1002.0 - Ceriodaphnia dubia,			X					
NOEC Survival	EPA 1000.0 - Fathead minnow, 7-day			X					
NOEC Survival	EPA 1002.0 - Ceriodaphnia dubia,			X					
NOEC Survival	EPA 2002 Ceriodaphnia dubia			X					
non-Polar Extractable Material (TPH)	EPA 1664A (HEM)			X					
n-Pentane	EPA TO-15	X							
n-Propane	EPA RSK-175 (GC/FID)			X					
n-Propylbenzene	EPA 524.2		X						
n-Propylbenzene	EPA 624 (extended)			X					
n-Propylbenzene	EPA 624.1			X					
n-Propylbenzene	EPA 8260B			X	X				
n-Propylbenzene	EPA 8260C			X	X				
n-Propylbenzene	EPA 8260D			X	X				
n-Propylbenzene	EPA TO-15	X							
n-Propylbenzene	SM 6200 B-2011			X					
o,o,o-Triethyl phosphorothioate	EPA 625.1			X					
o,o,o-Triethyl phosphorothioate	EPA 8270C			X	X				
o,o,o-Triethyl phosphorothioate	EPA 8270D			X	X				

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o,o,o-Triethyl phosphorothioate	EPA 8270E			X	X				
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330			X	X				
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330A			X	X				
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330B			X	X				
Odor	SM 2150 B		X	X					
Oil & Grease	EPA 1664A (HEM)			X	X				
Oil & Grease	EPA 1664B			X	X				
Oil & Grease	EPA 1664B (SGT-HEM)			X					
Oil & Grease	EPA 9070A			X					
Oil & Grease	EPA 9071B				X				
Oil-Range Organics (ORO)	EPA 8015B			X	X				
Oil-Range Organics (ORO)	EPA 8015C			X	X				
Oil-Range Organics (ORO)	EPA 8015D			X	X				
Organic nitrogen	EPA 350.1			X					
Organic nitrogen	EPA 351.1			X					
Organic nitrogen	EPA 351.2			X					
Organic nitrogen	EPA 351.2 minus EPA 350.1			X					
Organic nitrogen	EPA 351.3			X					
Organic nitrogen	EPA 351.4			X					
Organic nitrogen	SM 4500-Norg D-2011 minus SM 4500-			X					
Organic nitrogen	TKN minus AMMONIA			X					
Orthophosphate	EPA 9056A				X				
Orthophosphate as P	EPA 300.0				X				
Orthophosphate as P	EPA 365.2		X	X					
Orthophosphate as P	EPA 9056				X				
Orthophosphate as P	EPA 9056A				X				
Orthophosphate as P	SM 4500-P E-2011		X	X					
Oxidation Reduction Potential	SM 2580 B		X						
Oxygen	ASTM D1946-90	X							
Oxygen, dissolved	SM 4500-O C-2011			X					
Oxygen, dissolved	SM 4500-O G-2011			X					
o-Xylene	EPA 602			X					

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o-Xylene	EPA 624.1			X					
o-Xylene	EPA 8021B			X	X				
o-Xylene	EPA 8260B			X	X				
o-Xylene	EPA 8260C			X	X				
o-Xylene	EPA 8260D			X	X				
o-Xylene	EPA TO-15	X							
o-Xylene	IDNR OA-1				X				
o-Xylene	MADEP VPH			X	X				
o-Xylene	OK DEQ GRO				X				
o-Xylene	SM 6200 B-2011			X					
o-Xylene	EPA 524.2		X						
Parathion, ethyl	EPA 1657			X					
Parathion, ethyl	EPA 625.1			X					
Parathion, ethyl	EPA 8141A			X	X				
Parathion, ethyl	EPA 8141B			X	X				
Parathion, ethyl	EPA 8270C			X	X				
Parathion, ethyl	EPA 8270D			X	X				
Parathion, ethyl	EPA 8270E			X	X				
p-Dimethylaminoazobenzene	EPA 625.1			X					
p-Dimethylaminoazobenzene	EPA 8270C			X	X				
p-Dimethylaminoazobenzene	EPA 8270D			X	X				
p-Dimethylaminoazobenzene	EPA 8270E			X	X				
Pentachlorobenzene	EPA 625.1			X					
Pentachlorobenzene	EPA 8270C			X	X				
Pentachlorobenzene	EPA 8270D			X	X				
Pentachlorobenzene	EPA 8270E			X	X				
Pentachloroethane	EPA 624.1			X					
Pentachloroethane	EPA 625 (extended)			X					
Pentachloroethane	EPA 625.1			X					
Pentachloroethane	EPA 8260B			X	X				
Pentachloroethane	EPA 8260C			X	X				
Pentachloroethane	EPA 8260D			X	X				

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Pentachloroethane	EPA 8270C			X	X				
Pentachloroethane	EPA 8270D			X	X				
Pentachloroethane	EPA 8270E			X	X				
Pentachloroethane	SM 6200 B-2011			X					
Pentachloronitrobenzene	EPA 625.1			X					
Pentachloronitrobenzene	EPA 8270C			X	X				
Pentachloronitrobenzene	EPA 8270D			X	X				
Pentachloronitrobenzene	EPA 8270E			X	X				
Pentachlorophenol	EPA 625.1			X					
Pentachlorophenol	EPA 8151A			X	X				
Pentachlorophenol	EPA 8270C			X	X				
Pentachlorophenol	EPA 8270D			X	X				
Pentachlorophenol	EPA 8270E			X	X				
Pentaerythritoltetranitrate	EPA 8330			X	X				
Pentaerythritoltetranitrate	EPA 8330A			X	X				
Pentaerythritoltetranitrate	EPA 8330B			X	X				
Percent ash	ASTM D482				X				
Perchlorate	EPA 314.0		X	X	X				
Petroleum Organics	CT ETPH				X				
Petroleum Organics	FL PRO				X				
Petroleum Organics	LUFT GC				X				
Petroleum Organics	NWTPH-HCID			X	X				
Petroleum Organics	Texas 1006			X	X				
Petroleum Volatile Organic Compounds (PVOC)	WI(95) GRO			X	X				
pH	EPA 150.1		X	X					
pH	EPA 9040B			X	X				
pH	EPA 9040C			X	X				
pH	EPA 9045C			X	X				
pH	EPA 9045D			X	X				
pH	SM 4500-H+ B-2011		X	X					
Phenacetin	EPA 625.1			X					
Phenacetin	EPA 8270C			X	X				

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Phenacetin	EPA 8270D			X	X				
Phenacetin	EPA 8270E			X	X				
Phenanthrene	EPA 610 (HPLC)			X					
Phenanthrene	EPA 625.1			X					
Phenanthrene	EPA 625.1 SIM			X					
Phenanthrene	EPA 8270C			X	X				
Phenanthrene	EPA 8270C SIM			X	X				
Phenanthrene	EPA 8270D			X	X				
Phenanthrene	EPA 8270D SIM			X	X				
Phenanthrene	EPA 8270E			X	X				
Phenanthrene	EPA 8270E SIM			X	X				
Phenanthrene	EPA 8310			X	X				
Phenanthrene	MADEP EPH			X	X				
Phenol	EPA 420.4			X					
Phenol	EPA 625.1			X					
Phenol	EPA 8270C			X	X				
Phenol	EPA 8270D			X	X				
Phenol	EPA 8270E			X	X				
Phenols	EPA 420.1		X						
Phenols	EPA 420.4		X						
Phenols	SM 3500 D-2005		X						
Phorate	EPA 1657			X					
Phorate	EPA 625.1			X					
Phorate	EPA 8141A			X	X				
Phorate	EPA 8141B			X	X				
Phorate	EPA 8270C			X	X				
Phorate	EPA 8270D			X	X				
Phorate	EPA 8270E			X	X				
Phosmet (Imidan)	EPA 8141A			X					
Phosmet (Imidan)	EPA 8141B			X					
Phosphorus	EPA 200.7		X	X					
Phosphorus	EPA 6010B			X					

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Phosphorus	EPA 6010C			X	X				
Phosphorus	EPA 6010D			X					
Photon Emitters	DOE 4.5.2.3				X				
Photon Emitters	EPA 901.1			X					
Photon Emitters	HASL 300 Ga-01-R				X				
Phthalic anhydride	EPA 625.1			X					
Phthalic anhydride	EPA 8270C			X	X				
Phthalic anhydride	EPA 8270D			X	X				
Phthalic anhydride	EPA 8270E				X				
Pimephales promelas	EPA 1000			X					
Pimephales promelas	EPA 2000			X					
Plutonium-238	EPA 907 Modified (ENV-SOP-MTJL-	X		X	X		X		
Plutonium-239/240	EPA 907 Modified (ENV-SOP-MTJL-	X		X	X		X		
Plutonium-241	EPA 907 Modified (ENV-SOP-MTJL-	X		X	X		X		
Polonium-210	DOE EML Po-02-RC			X					
Polonium-210	HASL 300 Po-02-RC	X		X	X		X		
Potassium	EPA 200.7		X	X					
Potassium	EPA 200.8			X					
Potassium	EPA 6010B			X	X				
Potassium	EPA 6010C			X	X				
Potassium	EPA 6010D			X	X				
Potassium	EPA 6020			X	X				
Potassium	EPA 6020A			X	X				
Potassium	EPA 6020B			X	X				
Preparation/Extraction	EPA 200.2			X					
Pronamide (Kerb)	EPA 625.1			X					
Pronamide (Kerb)	EPA 8270C			X	X				
Pronamide (Kerb)	EPA 8270D			X	X				
Pronamide (Kerb)	EPA 8270E			X	X				
Propane	EPA RSK-175 (GC/FID)	X		X					
Propionitrile (Ethyl cyanide)	EPA 624.1			X					
Propionitrile (Ethyl cyanide)	EPA 8260B			X	X				

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Propionitrile (Ethyl cyanide)	EPA 8260C			X	X				
Propionitrile (Ethyl cyanide)	EPA 8260D			X	X				
Propionitrile (Ethyl cyanide)	SM 6200 B-2011			X					
Propylene	EPA TO-15	X							
Propylene Glycol	EPA 8015B			X	X				
Propylene Glycol	EPA 8015C			X					
Propylene Glycol	EPA 8015C (extended)			X	X				
Propylene Glycol	EPA 8015D			X	X				
Purge and trap for aqueous phase samples	EPA 5030			X					
Purge and trap for aqueous phase samples	EPA 5030A			X					
Purge and trap for aqueous phase samples	EPA 5030B			X					
Purge and trap for aqueous phase samples	EPA 5030C			X					
p-Xylene	EPA 624.1			X					
p-Xylene	EPA 8021B			X	X				
p-Xylene	EPA 8260B			X	X				
p-Xylene	EPA 8260C			X	X				
p-Xylene	EPA 8260D			X	X				
p-Xylene	EPA TO-15	X							
Pyrene	EPA 610 (HPLC)			X					
Pyrene	EPA 625.1			X					
Pyrene	EPA 625.1 SIM			X					
Pyrene	EPA 8270C			X	X				
Pyrene	EPA 8270C SIM			X	X				
Pyrene	EPA 8270D			X	X				
Pyrene	EPA 8270D SIM			X	X				
Pyrene	EPA 8270E			X	X				
Pyrene	EPA 8270E SIM			X	X				
Pyrene	EPA 8310			X	X				
Pyrene	MADEP EPH			X	X				
Pyridine	EPA 625.1			X					
Pyridine	EPA 8270C			X	X				
Pyridine	EPA 8270D			X	X				

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Pyridine	EPA 8270E			X	X				
Quinoline	EPA 625.1			X					
Quinoline	EPA 8270C			X	X				
Quinoline	EPA 8270D			X	X				
Quinoline	EPA 8270E			X	X				
Radium-226	EPA 903.0		X						
Radium-226	EPA 903.1			X	X				
Radium-226	EPA 9315			X					
Radium-226	HASL 300 Ra-04-RC				X				
Radium-226	SM 7500 Ra B Modified	X		X	X		X		
Radium-226	SM 7500-Ra B		X	X					
Radium-226	SM 7500-Ra B (GPC)			X	X				
Radium-228	EPA 904			X					
Radium-228	EPA 904.0		X	X	X				
Radium-228	EPA 9320			X	X				
Radon	SM 7500-Rn B		X	X					
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330			X	X				
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330A			X	X				
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330B			X	X				
Reactive Cyanide	EPA 9010C				X				
Reactive Cyanide	EPA 9014			X					
Reactive sulfide	EPA 9034			X	X				
Residue-filterable (TDS)	SM 2540 C-2011			X					
Residue-nonfilterable (TSS)	SM 2540 D-2011			X					
Residue-nonfilterable (TSS)	USGS I-3765-85			X					
Residue-settleable	SM 2540 F-2011			X					
Residue-total	SM 2540 B-2011			X					
Residue-volatile	EPA 160.4			X					
Residue-volatile	SM 2540 E-2011			X					
Ronnel	EPA 1657			X					
Ronnel	EPA 8141A			X	X				
Ronnel	EPA 8141B			X	X				

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Safrole	EPA 625.1			X					
Safrole	EPA 8270C			X	X				
Safrole	EPA 8270D			X	X				
Safrole	EPA 8270E			X	X				
Salinity	SM 2520 B-2011			X					
sec-Butylbenzene	EPA 524.2		X						
sec-Butylbenzene	EPA 624 (extended)			X					
sec-Butylbenzene	EPA 624.1			X					
sec-Butylbenzene	EPA 8260B			X	X				
sec-Butylbenzene	EPA 8260C			X	X				
sec-Butylbenzene	EPA 8260D			X	X				
sec-Butylbenzene	EPA TO-15	X							
sec-Butylbenzene	SM 6200 B-2011			X					
Selenium	EPA 200.7		X	X					
Selenium	EPA 200.8		X	X					
Selenium	EPA 6010B			X	X				
Selenium	EPA 6010C			X	X				
Selenium	EPA 6010D			X	X				
Selenium	EPA 6020			X	X				
Selenium	EPA 6020A			X	X				
Selenium	EPA 6020B			X	X				
Separatory Funnel Liquid-liquid extraction	EPA 3510C			X					
Silica as SiO2	EPA 200.7		X	X					
Silica as SiO2	EPA 6010B			X					
Silica as SiO2	EPA 6010C			X					
Silica as SiO2	EPA 6010D			X					
Silica Gel Clean-up	EPA 3630C			X	X				
Silica Gel Treated n-hexane Extractable Material (SGT-	EPA 1664A (HEM)			X	X				
Silica Gel Treated n-hexane Extractable Material (SGT-	EPA 1664B				X				
Silica Gel Treated n-hexane Extractable Material (SGT-	EPA 9071B				X				
Silica-dissolved	EPA 200.7			X					
Silicon	EPA 200.7			X					

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Silicon	EPA 6010B			X					
Silicon	EPA 6010C			X					
Silicon	EPA 6010D			X					
Silver	EPA 200.7		X	X					
Silver	EPA 200.8		X	X					
Silver	EPA 6010B			X	X				
Silver	EPA 6010C			X	X				
Silver	EPA 6010D			X	X				
Silver	EPA 6020			X	X				
Silver	EPA 6020A			X	X				
Silver	EPA 6020B			X	X				
Silvex (2,4,5-TP)	EPA 8151A			X	X				
Silvex (2,4,5-TP)	SM 6640 B-2001			X					
Silvex (2,4,5-TP)	SM 6640 B-2006			X					
Simazine	EPA 507		X	X					
Simazine	EPA 8141B			X					
Sodium	EPA 200.7		X	X					
Sodium	EPA 200.8			X					
Sodium	EPA 6010B			X	X				
Sodium	EPA 6010C			X	X				
Sodium	EPA 6010D			X	X				
Sodium	EPA 6020			X	X				
Sodium	EPA 6020A			X	X				
Sodium	EPA 6020B			X	X				
Solid-Phase Extraction (SPE)	EPA 3535A			X					
Soxhlet Extraction	EPA 3540C				X				
Specific Gravity (Relative Density)	SM 2710 F-2011			X					
Specific Gravity of Sludge	SM 2710 F-2011				X				
Stirophos	EPA 1657			X					
Stirophos	EPA 8141A			X	X				
Stirophos	EPA 8141B			X	X				
Strontium	EPA 200.7		X	X					

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Strontium	EPA 200.8			X					
Strontium	EPA 6010B			X	X				
Strontium	EPA 6010C			X	X				
Strontium	EPA 6010D			X	X				
Strontium	EPA 6020			X	X				
Strontium	EPA 6020A			X	X				
Strontium	EPA 6020B			X	X				
Strontium-89	DOE EML Sr-01-RC				X				
Strontium-89	EPA 905.0			X	X				
Strontium-89	HASL 300 Sr-01-RC (GPC)				X				
Strontium-89, 90	EPA 905		X	X					
Strontium-90	DOE EML Sr-02-RC				X				
Strontium-90	EPA 905		X	X					
Strontium-90	EPA 905.0			X	X				
Strontium-90	HASL 300 Sr-02-RC (GPC)				X				
Styrene	EPA 624.1			X					
Styrene	EPA 8260B			X	X				
Styrene	EPA 8260C			X	X				
Styrene	EPA 8260D			X	X				
Styrene	EPA TO-15	X							
Styrene	SM 6200 B-2011			X					
Styrene	EPA 524.2		X						
Sulfate	EPA 300.0		X	X	X				
Sulfate	EPA 9056			X	X				
Sulfate	EPA 9056A			X	X				
Sulfate	SM 4110 B-2011		X	X					
Sulfide	EPA 9030A				X				
Sulfide	EPA 9030B			X	X				
Sulfide	EPA 9034			X	X				
Sulfide	SM 4500-S2 ⁻ D-2011			X					
Sulfite-SO3	SM 4500-SO3 ⁻ B-2011			X					
Sulfotep	EPA 1657			X					

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Sulfotep	EPA 625.1			X					
Sulfotep	EPA 8141A			X	X				
Sulfotep	EPA 8141B			X	X				
Sulfotep	EPA 8270C			X	X				
Sulfotep	EPA 8270D			X	X				
Sulfotep	EPA 8270E			X	X				
Sulfur	EPA 6010B			X					
Sulfur	EPA 6010C			X					
Sulfur	EPA 6010D			X					
Sulfur Clean-Up	EPA 3660B			X	X				
Sulfuric acid/permanganate clean-up	EPA 3665A			X	X				
Surfactants - MBAS	SM 5540 C-2011		X	X					
Synthetic Precipitation Leaching Procedure	EPA 1312			X	X				
T-amylmethylether (TAME)	EPA 624.1			X					
T-amylmethylether (TAME)	EPA 8260B			X	X				
T-amylmethylether (TAME)	EPA 8260C			X	X				
T-amylmethylether (TAME)	EPA 8260D			X	X				
T-amylmethylether (TAME)	SM 6200 B-2011			X					
Technetium-99	DOE EML Tc-02-RC	X		X	X		X		
Temperature, deg. C	SM 2550 B-2000		X	X					
Terbufos	EPA 8141A			X					
Terbufos	EPA 8141B			X	X				
tert-Amyl-ethyl ether (TAEE)	EPA 8260B (extended)			X	X				
tert-Amyl-ethyl ether (TAEE)	EPA 8260C			X	X				
tert-Amyl-ethyl ether (TAEE)	EPA 8260D				X				
tert-Amyl-ethyl ether (TAEE)	EPA TO-15	X							
tert-Amyl-ethyl ether (TAEE)	SM 6200 B-2011			X					
tert-Butyl alcohol	EPA 602			X					
tert-Butyl alcohol	EPA 624.1			X					
tert-Butyl alcohol	EPA 8260B			X	X				
tert-Butyl alcohol	EPA 8260C			X	X				
tert-Butyl alcohol	EPA 8260D			X	X				

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tert-Butyl alcohol	EPA TO-15	X							
tert-Butyl alcohol	SM 6200 B-2011			X					
tert-Butyl formate	EPA 624.1			X					
tert-Butyl formate	EPA 8260B			X	X				
tert-Butyl formate	EPA 8260C			X	X				
tert-Butyl formate	EPA 8260D				X				
tert-Butyl formate	SM 6200 B-2011			X					
tert-Butylbenzene	EPA 524.2		X						
tert-Butylbenzene	EPA 624 (extended)			X					
tert-Butylbenzene	EPA 624.1			X					
tert-Butylbenzene	EPA 8260B			X	X				
tert-Butylbenzene	EPA 8260C			X	X				
tert-Butylbenzene	EPA 8260D			X	X				
tert-Butylbenzene	EPA TO-15	X							
tert-Butylbenzene	SM 6200 B-2011			X					
Tetrachloroethene	EPA 524.2		X						
Tetrachloroethylene (Perchloroethylene)	EPA 624.1			X					
Tetrachloroethylene (Perchloroethylene)	EPA 8260B			X	X				
Tetrachloroethylene (Perchloroethylene)	EPA 8260C			X	X				
Tetrachloroethylene (Perchloroethylene)	EPA 8260D			X	X				
Tetrachloroethylene (Perchloroethylene)	EPA TO-15	X							
Tetrachloroethylene (Perchloroethylene)	EPA TO-15 GC/MS SIM	X							
Tetrachloroethylene (Perchloroethylene)	SM 6200 B-2011			X					
Tetrachlorovinphos	EPA 8141B			X					
Tetraethyl pyrophosphate (TEPP)	EPA 1657			X					
Tetraethyl pyrophosphate (TEPP)	EPA 8141A			X	X				
Tetraethyl pyrophosphate (TEPP)	EPA 8141B			X	X				
Tetrahydrofuran	EPA 524.2		X						
Tetrahydrofuran (THF)	EPA 624.1			X					
Tetrahydrofuran (THF)	EPA 8260B			X	X				
Tetrahydrofuran (THF)	EPA 8260C			X	X				
Tetrahydrofuran (THF)	EPA 8260D			X	X				

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Tetrahydrofuran (THF)	EPA TO-15	X							
Tetrahydrofuran (THF)	SM 6200 B-2011			X					
Thallium	EPA 200.7		X	X					
Thallium	EPA 200.8		X	X					
Thallium	EPA 6010B			X	X				
Thallium	EPA 6010C			X	X				
Thallium	EPA 6010D			X	X				
Thallium	EPA 6020			X	X				
Thallium	EPA 6020A			X	X				
Thallium	EPA 6020B			X	X				
Thionazin (Zinophos)	EPA 625.1			X					
Thionazin (Zinophos)	EPA 8270C			X	X				
Thionazin (Zinophos)	EPA 8270D			X	X				
Thionazin (Zinophos)	EPA 8270E			X	X				
Thorium	EPA 200.8			X					
Thorium	EPA 6020			X	X				
Thorium	EPA 6020A			X	X				
Thorium	EPA 6020B			X	X				
Thorium-228	LANL ER200 Modified	X		X	X		X		
Thorium-230	LANL ER200 Modified	X		X	X		X		
Thorium-232	LANL ER200 Modified	X		X	X		X		
Tin	EPA 200.7		X	X					
Tin	EPA 200.8		X	X					
Tin	EPA 6010B			X	X				
Tin	EPA 6010C			X	X				
Tin	EPA 6010D			X	X				
Tin	EPA 6020			X	X				
Tin	EPA 6020A			X	X				
Tin	EPA 6020B			X	X				
Titanium	EPA 200.7		X	X					
Titanium	EPA 200.8			X					
Titanium	EPA 6010B			X	X				

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Titanium	EPA 6010C			X	X				
Titanium	EPA 6010D			X	X				
Titanium	EPA 6020			X	X				
Titanium	EPA 6020A			X	X				
Titanium	EPA 6020B			X	X				
Tokuthion (Prothiophos)	EPA 1657			X					
Tokuthion (Prothiophos)	EPA 8141A			X	X				
Tokuthion (Prothiophos)	EPA 8141B			X	X				
Toluene	EPA 602			X					
Toluene	EPA 624.1			X					
Toluene	EPA 8021B			X	X				
Toluene	EPA 8260B			X	X				
Toluene	EPA 8260C			X	X				
Toluene	EPA 8260D			X	X				
Toluene	EPA TO-15	X							
Toluene	IDNR OA-1			X	X				
Toluene	LUFT GCMS			X	X				
Toluene	MADEP VPH			X	X				
Toluene	OK DEQ GRO			X	X				
Toluene	SM 6200 B-2011			X					
Toluene	EPA 524.2		X						
Total coliforms	SM 9223 B-2004		X	X					
Total Cyanide	EPA 335.4			X					
Total Cyanide	EPA 9010B			X					
Total Cyanide	EPA 9010C			X	X				
Total Cyanide	EPA 9012A			X	X				
Total Cyanide	EPA 9012B			X	X				
Total Cyanide	EPA 9014			X	X				
Total Cyanide	SM 4500-CN ⁻ B-2011			X					
Total Cyanide	SM 4500-CN ⁻ C-2011			X					
Total Cyanide	SM 4500-CN ⁻ E-2011			X					
Total Dissolved Solids	SM 2540 C-2011		X						

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Total Haloacetic Acids	EPA 552.2		X						
Total hardness as CaCO3	EPA 130.1			X					
Total hardness as CaCO3	EPA 200.7			X					
Total hardness as CaCO3	EPA 200.8			X					
Total hardness as CaCO3	EPA 6010B			X					
Total hardness as CaCO3	EPA 6010C			X	X				
Total hardness as CaCO3	EPA 6010D			X					
Total hardness as CaCO3	SM 2340 B-2011			X					
Total hardness as CaCO3	SM 2340 C-2011			X					
Total Nitrate+Nitrite	EPA 300.0			X					
Total Organic Carbon	ASTM F1647-02A				X				
Total Organic Carbon	EPA 9060			X					
Total Organic Carbon	EPA 9060A			X					
Total Organic Carbon	SM 5310 B-2011		X	X					
Total Organic Carbon	SM 5310 C-2011		X						
Total Organic Carbon	USDA LOI				X				
Total Organic Carbon	Walkley-Black Method				X				
Total Organic Halides (TOX)	EPA 9020B			X					
Total Organic Halides (TOX)	EPA 9076				X				
Total Organic Halides (TOX)	SM 5320 B-2010			X					
Total Petroleum Hydrocarbons (>C12-C28)	TNRCC 1005			X	X				
Total Petroleum Hydrocarbons (>C28-C35)	TNRCC 1005			X	X				
Total Petroleum Hydrocarbons (Aviation Gasoline Range)	EPA 8015B			X	X				
Total Petroleum Hydrocarbons (Aviation Gasoline Range)	EPA 8015C			X	X				
Total Petroleum Hydrocarbons (Aviation Gasoline Range)	EPA 8015D			X	X				
Total Petroleum Hydrocarbons (C6-C12)	TNRCC 1005			X	X				
Total Petroleum Hydrocarbons (C6-C35)	TNRCC 1005			X	X				
Total Petroleum Hydrocarbons (C8-C40)	EPA 8015B			X	X				
Total Petroleum Hydrocarbons (C8-C40)	EPA 8015C			X	X				
Total Petroleum Hydrocarbons (C8-C40)	EPA 8015D			X	X				
Total Petroleum Hydrocarbons (Gasoline Range)	TN GRO				X				
Total Petroleum Hydrocarbons (Jet Fuel Range)	EPA 8015B			X	X				

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Total Petroleum Hydrocarbons (Jet Fuel Range)	EPA 8015C			X	X				
Total Petroleum Hydrocarbons (Jet Fuel Range)	EPA 8015D			X	X				
Total Petroleum Hydrocarbons (Oil Range)	EPA 8015B			X	X				
Total Petroleum Hydrocarbons (Oil Range)	EPA 8015C			X	X				
Total Petroleum Hydrocarbons (Oil Range)	EPA 8015D			X	X				
Total Petroleum Hydrocarbons (TPH)	EPA 8015B			X	X				
Total Petroleum Hydrocarbons (TPH)	EPA 8015C			X	X				
Total Petroleum Hydrocarbons (TPH)	EPA 8015D			X	X				
Total Petroleum Hydrocarbons (TPH)	FL PRO			X					
Total Petroleum Hydrocarbons (TPH)	TNRCC 1005			X	X				
Total Phenolics	EPA 420.1			X	X				
Total Phenolics	EPA 420.2				X				
Total Phenolics	EPA 420.4			X					
Total Phenolics	EPA 9066			X	X				
Total Phenolics	SM 5530 D			X					
Total Phosphorus	EPA 365.1			X					
Total Phosphorus	EPA 365.4			X	X				
Total Phosphorus	EPA 6010B				X				
Total Phosphorus	EPA 6010C				X				
Total Phosphorus	EPA 6010D				X				
Total Phosphorus	SM 4500-P B 5-2011			X					
Total Phosphorus	SM 4500-P H-2011			X					
Total Purgeable Hydrocarbons (C5-C12)	MADEP VPH			X	X				
Total radium	EPA 903.0 (GPC)		X	X					
Total radium	EPA 9315			X	X				
Total radium	SM 7500-Ra B (GPC)			X					
Total radium	SM 7500-Ra B (GPC)-2001			X					
Total residual chlorine	SM 4500-Cl G-2011			X					
Total Suspended Solids	SM 2540 D-2011		X						
Total Trihalomethanes	EPA 524.2		X						
Total, Fixed, and Volatile Residue	SM 2540 G			X	X				
Total, Fixed, and Volatile Residue	SM 2540 G-2011			X					

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Toxaphene (Chlorinated camphene)	EPA 608.3			X					
Toxaphene (Chlorinated camphene)	EPA 8081A			X	X				
Toxaphene (Chlorinated camphene)	EPA 8081B			X	X				
Toxicity Characteristic Leaching Procedure (TCLP)	EPA 1311			X	X				
trans-1,2-Dichloroethene	EPA 524.2		X						
trans-1,2-Dichloroethylene	EPA 624.1			X					
trans-1,2-Dichloroethylene	EPA 8260B			X	X				
trans-1,2-Dichloroethylene	EPA 8260C			X	X				
trans-1,2-Dichloroethylene	EPA 8260D			X	X				
trans-1,2-Dichloroethylene	EPA TO-15	X							
trans-1,2-Dichloroethylene	SM 6200 B-2011			X					
trans-1,3-Dichloropropene	EPA TO-15	X							
trans-1,3-Dichloropropene	EPA 524.2		X						
trans-1,3-Dichloropropylene	EPA 624.1			X					
trans-1,3-Dichloropropylene	EPA 8260B			X	X				
trans-1,3-Dichloropropylene	EPA 8260C			X	X				
trans-1,3-Dichloropropylene	EPA 8260D			X	X				
trans-1,3-Dichloropropylene	EPA TO-15	X							
trans-1,3-Dichloropropylene	EPA TO-15 GC/MS SIM	X							
trans-1,3-Dichloropropylene	SM 6200 B-2011			X					
trans-1,4-Dichloro-2-butene	EPA 624.1			X					
trans-1,4-Dichloro-2-butene	EPA 8260B			X	X				
trans-1,4-Dichloro-2-butene	EPA 8260C			X	X				
trans-1,4-Dichloro-2-butene	EPA 8260D			X	X				
trans-1,4-Dichloro-2-butene	SM 6200 B-2011			X					
trans-Diallyl	EPA 8270C			X					
trans-Isosafrole	EPA 8270C			X					
Trichloroacetic acid	EPA 552.2		X						
Trichloroethene	EPA 524.2		X						
Trichloroethene (Trichloroethylene)	EPA 624.1			X					
Trichloroethene (Trichloroethylene)	EPA 8260B			X	X				
Trichloroethene (Trichloroethylene)	EPA 8260C			X	X				

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Trichloroethene (Trichloroethylene)	EPA 8260D			X	X				
Trichloroethene (Trichloroethylene)	EPA TO-15	X							
Trichloroethene (Trichloroethylene)	SM 6200 B-2011			X					
Trichlorofluoromethane	EPA 524.2		X						
Trichlorofluoromethane (Fluorotrichloromethane, Freon	EPA 624.1			X					
Trichlorofluoromethane (Fluorotrichloromethane, Freon	EPA 8260B			X	X				
Trichlorofluoromethane (Fluorotrichloromethane, Freon	EPA 8260C			X	X				
Trichlorofluoromethane (Fluorotrichloromethane, Freon	EPA 8260D			X	X				
Trichlorofluoromethane (Fluorotrichloromethane, Freon	EPA TO-15	X							
Trichlorofluoromethane (Fluorotrichloromethane, Freon	SM 6200 B-2011			X					
Trichloronate	EPA 1657			X					
Trichloronate	EPA 8141A			X	X				
Trichloronate	EPA 8141B			X	X				
Triclosan	EPA 8270C			X					
Triclosan	EPA 8270D			X					
Triclosan	EPA 8270E			X					
tris-(2,3-Dibromopropyl) phosphate (tris-BP)	EPA 8270C			X	X				
tris-(2,3-Dibromopropyl) phosphate (tris-BP)	EPA 8270D			X	X				
tris-(2,3-Dibromopropyl) phosphate (tris-BP)	EPA 8270E				X				
Tritium	EPA 906		X	X					
Tritium	EPA 906 (Modified)				X				
Tritium	EPA 906.0			X					
Turbidity	EPA 180.1		X	X					
Turbidity	SM 2130 B-2011		X	X					
Ultrasonic Extraction	EPA 3550B				X				
Ultrasonic Extraction	EPA 3550C				X				
Uranium	ASTM D5174-02		X	X					
Uranium	ASTM D5174-07 Modified (ENV-SOP-	X			X		X		
Uranium	ASTM D5174-97		X	X					
Uranium	DOE EML U-02-RC				X				
Uranium	EPA 200.8		X	X					
Uranium	EPA 6020			X	X				

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Uranium	EPA 6020A			X	X				
Uranium	EPA 6020B			X	X				
Uranium	HASL 300 U-02-RC				X				
Uranium-234	ASTM D3972-09 Modified (ENV-SOP-	X			X		X		
Uranium-234	DOE EML U-02-RC				X				
Uranium-234	HASL 300 U-02-RC				X				
Uranium-235	ASTM D3972-09 Modified (ENV-SOP-	X			X		X		
Uranium-235	DOE EML U-02-RC				X				
Uranium-235	HASL 300 U-02-RC				X				
Uranium-238	ASTM D3972-09 Modified (ENV-SOP-	X			X		X		
Uranium-238	DOE EML U-02-RC				X				
Uranium-238	HASL 300 U-02-RC				X				
UV254	SM 5910 B-2011		X						
Vanadium	EPA 200.7		X	X					
Vanadium	EPA 200.8		X	X					
Vanadium	EPA 6010B			X	X				
Vanadium	EPA 6010C			X	X				
Vanadium	EPA 6010D			X	X				
Vanadium	EPA 6020			X	X				
Vanadium	EPA 6020A			X	X				
Vanadium	EPA 6020B			X	X				
Vinyl acetate	EPA 624.1			X					
Vinyl acetate	EPA 8260B			X	X				
Vinyl acetate	EPA 8260C			X	X				
Vinyl acetate	EPA 8260D			X	X				
Vinyl acetate	EPA TO-15	X							
Vinyl acetate	SM 6200 B-2011			X					
Vinyl bromide (Bromoethane)	EPA 624.1			X					
Vinyl bromide (Bromoethane)	EPA 8260			X					
Vinyl bromide (Bromoethane)	EPA 8260B			X	X				
Vinyl bromide (Bromoethane)	EPA 8260C			X	X				
Vinyl bromide (Bromoethane)	EPA 8260D			X	X				

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Vinyl bromide (Bromoethane)	EPA TO-15	X							
Vinyl bromide (Bromoethane)	SM 6200 B-2011			X					
Vinyl chloride	EPA 624.1			X					
Vinyl chloride	EPA 8260B			X	X				
Vinyl chloride	EPA 8260C			X	X				
Vinyl chloride	EPA 8260D			X	X				
Vinyl chloride	EPA TO-15	X							
Vinyl chloride	EPA TO-15 GC/MS SIM	X							
Vinyl chloride	SM 6200 B-2011			X					
Vinyl chloride	EPA 524.2		X						
Volatile Petroleum Hydrocarbons (VPH)	MADEP VPH (modified)			X					
Volatile suspended solids	SM 2540 E-2011			X					
VPH Aliphatic >C6-C8	MADEP VPH			X	X				
VPH Aliphatic >C8-C10	MADEP VPH			X	X				
VPH Aliphatic C5-C8	MADEP VPH			X	X				
VPH Aliphatic C5-C8 Unadjusted	MADEP VPH			X	X				
VPH Aliphatic C9-C12	MADEP VPH			X	X				
VPH Aliphatic C9-C12 Unadjusted	MADEP VPH			X	X				
VPH Aromatic >C8-C10	MADEP VPH			X	X				
VPH Aromatic C9-C10	MADEP EPH			X					
VPH Aromatic C9-C10	MADEP VPH			X	X				
Waste Dilution	EPA 3580A			X	X				
Waste Dilution	EPA 3585				X				
Weak Acid Dissociable Cyanide	SM 4500-CN I			X					
Xylene (mixed isomers, total)	EPA 524.2		X						
Xylene (total)	EPA 602			X					
Xylene (total)	EPA 624.1			X					
Xylene (total)	EPA 8021B			X	X				
Xylene (total)	EPA 8260B			X	X				
Xylene (total)	EPA 8260C			X	X				
Xylene (total)	EPA 8260D			X	X				
Xylene (total)	EPA TO-15	X							

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Xylene (total)	IDNR OA-1			X	X				
Xylene (total)	LUFT GCMS			X	X				
Xylene (total)	MADEP VPH				X				
Xylene (total)	OK DEQ GRO			X	X				
Xylene (total)	SM 6200 B-2011			X					
Zinc	EPA 200.7		X	X					
Zinc	EPA 200.8		X	X					
Zinc	EPA 6010B			X	X				
Zinc	EPA 6010C			X	X				
Zinc	EPA 6010D			X	X				
Zinc	EPA 6020			X	X				
Zinc	EPA 6020A			X	X				
Zinc	EPA 6020B			X	X				
Zinc-65	DOE 4.5.2.3				X				
Zinc-65	EPA 901.1			X					
Zinc-65	HASL 300 Ga-01-R				X				

¹ = Laboratory does not hold TNI Accreditation for this test method.

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7.3 Appendix C: Glossary

This glossary provides common terms and definitions used by PAS. **It is not intended to be a complete list of all terms and definitions used.** The definitions have been compiled mostly from the TNI Standard and DoD QSM. Although this information has been reproduced with care, errors cannot be entirely excluded. Definitions for the same term also vary between sources. When the meaning of a term used in a PAS document is different from this glossary or when the glossary does not include the term, the term and definition is included or defined in context in the laboratory document.

Term	Definition
3P Program	The continuous improvement program used by PAS that focuses on Process, Productivity, and Performance.
Absence	Inability to perform assigned duties due to lack of physical presence and connectivity.
Acceptance Criteria	TNI- Specified limits placed on characteristics of an item, process, or service defined in requirement documents.
Accreditation	TNI- The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. DoD- Refers to accreditation in accordance with the DoD ELAP.
Accreditation Body (AB)	TNI- The organization having responsibility and accountability for environmental laboratory accreditation, and which grants accreditation under this program. DoD- Entities recognized in accordance with the DoD-ELAP that are required to operate in accordance with ISO/IEC 17011, <i>Conformity assessment: General requirements for accreditation bodies accrediting conformity assessment bodies</i> . The AB must be a signatory, in good standing, to the International Laboratory Accreditation Cooperation (ILAC) mutual recognition arrangement (MRA) that verifies, by evaluation and peer assessment, that its signatory members are in full compliance with ISO/IEC 17011 and that its accredited laboratories comply with ISO/IEC 17025.
Accuracy	TNI- 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 that are due to sampling and analytical operations; a data quality indicator.
Activity, Absolute	TNI- Rate of nuclear decay occurring in a body of material, equal to the number of nuclear disintegrations per unit time. NOTE: Activity (absolute) may be expressed in becquerels (Bq), curies (Ci), or disintegrations per minute (dpm), and multiples or submultiples of these units.
Activity, Areic	TNI- Quotient of the activity of a body of material and its associated area.
Activity, Massic	TNI- Quotient of the activity of a body of material and its mass; also called specific activity.
Activity, Volumic	TNI- Quotient of the activity of a body of material and its volume; also called activity concentration. NOTE: In this module [TNI Volume 1, Module 6], unless otherwise stated, references to activity shall include absolute activity, areic activity, massic activity, and volumic activity.
Activity Reference Date	TNI- The date (and time, as appropriate to the half-life of the radionuclide) to which a reported activity result is calculated. NOTE: The sample collection date is most frequently used as the Activity Reference Date for environmental measurements, but different programs may specify other points in time for correction of results for decay and ingrowth.
Aliquot	DoD- A discrete, measured, representative portion of a sample taken for analysis.
American Society for Testing and Materials (ASTM)	An international standards organization that develops and publishes voluntary consensus standards for a wide range of materials, products, systems, and services.
Analysis	DoD- A combination of sample preparation and instrument determination.
Analysis Code (Acode)	All the set parameters of a test, such as Analytes, Method, Detection Limits and Price.
Analysis Sequence	A compilation of all samples, standards and quality control samples run during a specific amount of time on a particular instrument in the order they are analyzed.
Analyst	TNI- 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.

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Analyte	TNI- A substance, organism, physical parameter, property, or chemical constituent(s) for which an environmental sample is being analyzed. DoD- The specific chemicals or components for which a sample is analyzed; it may be a group of chemicals that belong to the same chemical family and are analyzed together.
Analytical Method	DoD- A formal process that identifies and quantifies the chemical components of interest (target analytes) in a sample.
Analytical Uncertainty	TNI- A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis.
Aliquot	DoD- A discrete, measured, representative portion of a sample taken for analysis.
Annual (or Annually)	Defined by PAS as every 12 months $\pm$ 30 days.
Assessment	TNI- The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its system to defined criteria (to the standards and requirements of laboratory accreditation). DoD- An all-inclusive term used to denote any of the following: audit, performance evaluation, peer review, inspection, or surveillance conducted on-site.
Atomic Absorption Spectrometer	Instrument used to measure concentration in metals samples.
Atomization	A process in which a sample is converted to free atoms.
Audit	TNI- A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives.
Batch	TNI- Environmental samples that 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 quality systems 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 or the timeframe specified by the regulatory program. 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 quality system matrices and can exceed 20 samples.
Batch, Radiation Measurements (RMB)	TNI- An RMB is composed of 1 to 20 environmental samples that are counted directly without preliminary physical or chemical processing that affects the outcome of the test (e.g., non-destructive gamma spectrometry, alpha/beta counting of air filters, or swipes on gas proportional detectors). The samples in an RMB share similar physical and chemical parameter, and analytical configurations (e.g., analytes, geometry, calibration, and background corrections). The maximum time between the start of processing of the first and last in an RMB is 14 calendar days.
Bias	TNI- The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value).
Blank	TNI and DoD- 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 (See Method Blank). DoD- Blank samples are negative control samples, which typically include field blank samples (e.g., trip blank, equipment (rinsate) blank, and temperature blank) and laboratory blank samples (e.g., method blank, reagent blank, instrument blank, calibration blank, and storage blank).
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.
BNA (Base Neutral Acid compounds)	A list of semi-volatile compounds typically analyzed by mass spectrometry methods. Named for the way they can be extracted out of environmental samples in an acidic, basic, or neutral environment.
BOD (Biochemical Oxygen Demand)	Chemical procedure for determining how fast biological organisms use up oxygen in a body of water.

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Calibration	TNI- A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. 1) In calibration of support equipment, the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI); 2) In calibration according to test methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.
Calibration Curve	TNI- The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response.
Calibration Method	A defined technical procedure for performing a calibration.
Calibration Range	DoD- The range of values (concentrations) between the lowest and highest calibration standards of a multi-level calibration curve. For metals analysis with a single-point calibration, the low-level calibration check standard and the high standard establish the linear calibration range, which lies within the linear dynamic range.
Calibration Standard	TNI- A substance or reference material used for calibration.
Certified Reference Material (CRM)	TNI- Reference material accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute.
Chain of Custody	An unbroken trail of accountability that verifies the physical security of samples, data, and records.
Chain of Custody Form (COC)	TNI- 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 type of containers; the mode of collection, the collector, time of collection; preservation; and requested analyses.
Chemical Oxygen Demand (COD)	A test commonly used to indirectly measure the amount of organic compounds in water.
Client (referred to by ISO as Customer)	Any individual or organization for whom items or services are furnished or work performed in response to defined requirements and expectations.
Code of Federal Regulations (CFR)	A codification of the general and permanent rules published in the Federal Register by agencies of the federal government.
Comparability	An assessment of the confidence with which one data set can be compared to another. Comparable data are produced through the use of standardized procedures and techniques.
Completeness	The percent of valid data obtained from a measurement system compared to the amount of valid data expected under normal conditions. The equation for completeness is: $\% \text{ Completeness} = (\text{Valid Data Points} / \text{Expected Data Points}) * 100$
Confirmation	TNI- 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. DoD- Includes verification of the identity and quantity of the analyte being measured by another means (e.g., by another determinative method, technology, or column). Additional cleanup procedures alone are not considered confirmation techniques.
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.
Congener	A member of a class of related chemical compounds (e.g., PCBs, PCDDs).
Consensus Standard	DoD- A standard established by a group representing a cross-section of a particular industry or trade, or a part thereof.
Continuing Calibration Blank (CCB)	A blank sample used to monitor the cleanliness of an analytical system at a frequency determined by the analytical method.
Continuing Calibration Check Compounds (CCC)	Compounds listed in mass spectrometry methods that are used to evaluate an instrument calibration from the standpoint of the integrity of the system. High variability would suggest leaks or active sites on the instrument column.
Continuing Calibration Verification	DoD- The verification of the initial calibration. Required prior to sample analysis and at periodic intervals. Continuing calibration verification applies to both external and internal standard calibration techniques, as well as to linear and non-linear calibration models.
Continuing Calibration Verification (CCV) Standard	Also referred to as a Calibration Verification Standard (CVS) in some methods, it is a standard used to verify the initial calibration of compounds in an analytical method. CCVs are analyzed at a frequency determined by the analytical method.

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Continuous Emission Monitor (CEM)	A flue gas analyzer designed for fixed use in checking for environmental pollutants.
Continuous Improvement Plan (CIP)	The delineation of tasks for a given laboratory department or committee to achieve the goals of that department.
Contract Laboratory Program (CLP)	A national network of EPA personnel, commercial labs, and support contractors whose fundamental mission is to provide data of known and documented quality.
Contract Required Detection Limit (CRDL)	Detection limit that is required for EPA Contract Laboratory Program (CLP) contracts.
Contract Required Quantitation Limit (CRQL)	Quantitation limit (reporting limit) that is required for EPA Contract Laboratory Program (CLP) contracts.
Control Chart	A graphic representation of a series of test results, together with limits within which results are expected when the system is in a state of statistical control (see definition for Control Limit)
Control Limit	A range within which specified measurement results must fall to verify that the analytical system is in control. Control limit exceedances may require corrective action or require investigation and flagging of non-conforming data.
Correction	DoD- Action taken to eliminate a detected non-conformity.
Corrective Action	DoD- The action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation in order to prevent recurrence. A root cause analysis may not be necessary in all cases.
Corrective and Preventative Action (CAPA)	The primary management tools for bringing improvements to the quality system, to the management of the quality system's collective processes, and to the products or services delivered which are an output of established systems and processes.
Critical Value	TNI- Value to which a measurement result is compared to make a detection decision (also known as critical level or decision level). NOTE: The Critical Value is designed to give a specified low probability α of false detection in an analyte-free sample, which implies that a result that exceeds the Critical Value, gives high confidence ($1 - \alpha$) that the radionuclide is actually present in the material analyzed. For radiometric methods, α is often set at 0.05.
Customer	DoD- Any individual or organization for which products or services are furnished or work performed in response to defined requirements and expectations.
Data Integrity	TNI- The condition that exists when data are sound, correct, and complete, and accurately reflect activities and requirements.
Data Quality Objective (DQO)	Systematic strategic planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use or end user.
Data Reduction	TNI- The process of transforming the number of data items by arithmetic or statistical calculation, standard curves, and concentration factors, and collating them into a more usable form.
Definitive Data	DoD- Analytical data of known quantity and quality. The levels of data quality on precision and bias meet the requirements for the decision to be made. Data that is suitable for final decision-making.
Demonstration of Capability (DOC)	TNI- A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. DoD- A procedure to establish the ability of the analyst to generate analytical results by a specific method that meet measurement quality objectives (e.g., for precision and bias).
Department of Defense (DoD)	An executive branch department of the federal government of the United States charged with coordinating and supervising all agencies and functions of the government concerned directly with national security.
Detection Limit (DL)	DoD- The smallest analyte concentration that can be demonstrated to be different than zero or a blank concentration with 99% confidence. At the DL, the false positive rate (Type 1 error) is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific analyte in a specific matrix with a specific method with 99% confidence.
Detection Limit (DL) for Safe Drinking Water Act (SDWA) Compliance	TNI- Laboratories that analyze drinking-water samples for SDWA compliance monitoring must use methods that provide sufficient detection capability to meet the detection limit requirements established in 40 CFR 141. The SDWA DL for radioactivity is defined in 40 CFR Part 141.25.c as the radionuclide concentration, which can be counted with a precision of plus or minus 100% at the 95% confidence level (1.96σ where σ is the standard deviation of the net counting rate of the sample).
Deuterated Monitoring Compounds (DMCs)	DoD- SIM specific surrogates as specified for GC/MS SIM analysis.

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Diesel Range Organics (DRO)	A range of compounds that denote all the characteristic compounds that make up diesel fuel (range can be state or program specific).
Digestion	DoD- A process in which a sample is treated (usually in conjunction with heat and acid) to convert the target analytes in the sample to a more easily measured form.
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.
Documents	DoD- Written components of the laboratory management system (e.g., policies, procedures, and instructions).
Dry Weight	The weight after drying in an oven at a specified temperature.
Duplicate (also known as Replicate or Laboratory Duplicate)	The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results of duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation, or storage internal to the laboratory.
Electron Capture Detector (ECD)	Device used in GC methods to detect compounds that absorb electrons (e.g., PCB compounds).
Electronic Data Deliverable (EDD)	A summary of environmental data (usually in spreadsheet form) which clients request for ease of data review and comparison to historical results.
Eluent	A solvent used to carry the components of a mixture through a stationary phase.
Elute	To extract, specifically, to remove (absorbed material) from an absorbent by means of a solvent.
Elution	A process in which solutes are washed through a stationary phase by movement of a mobile phase.
Environmental Data	DoD- Any measurements or information that describe environmental processes, locations, or conditions; ecological or health effects and consequences; or the performance of environmental technology.
Environmental Monitoring	The process of measuring or collecting environmental data.
Environmental Protection Agency (EPA)	An agency of the federal government of the United States which was created for the purpose of protecting human health and the environment by writing and enforcing regulations based on laws passed by Congress.
Environmental Sample	A representative sample of any material (aqueous, non-aqueous, or multimedia) collected from any source for which determination of composition or contamination is requested or required. Environmental samples can generally be classified as follows: • Non-Potable Water (Includes surface water, ground water, effluents, water treatment chemicals, and TCLP leachates or other extracts) • Drinking Water - Delivered (treated or untreated) water designated as potable water • Water/Wastewater - Raw source waters for public drinking water supplies, ground waters, municipal influents/effluents, and industrial influents/effluents • Sludge - Municipal sludges and industrial sludges. • Soil - Predominately inorganic matter ranging in classification from sands to clays. • Waste - Aqueous and non-aqueous liquid wastes, chemical solids, and industrial liquid and solid wastes
Equipment Blank	A sample of analyte-free media used to rinse common sampling equipment to check effectiveness of decontamination procedures.
Extracted Internal Standard Analyte	Isotopically labeled analogs of analytes of interest added to all standards, blanks and samples analyzed. Added to samples and batch QC samples prior to the first step of sample extraction and to standards and instrument blanks prior to analysis. Used for isotope dilution methods.
Facility	A distinct location within the company that has unique certifications, personnel, and waste disposal identifications.
False Negative	DoD- A result that fails to identify (detect) an analyte or reporting an analyte to be present at or below a level of interest when the analyte is actually above the level of interest.
False Positive	DoD- A result that erroneously identifies (detects) an analyte or reporting an analyte to be present above a level of interest when the analyte is actually present at or below the level of interest.
Field Blank	A blank sample prepared in the field by filling a clean container with reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken.
Field Measurement	Determination of physical, biological, or radiological properties, or chemical constituents that are measured on-site, close in time and sPAS to the matrices being sampled/measured, following accepted test methods. This testing is performed in the field outside of a fixed-laboratory or outside of an enclosed structure that meets the requirements of a mobile laboratory.

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Field of Accreditation	TNI- Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.
Field of Proficiency Testing (FoPT)	TNI- Matrix, technology/method, analyte combinations for which the composition, spike concentration ranges and acceptance criteria have been established by the PTPEC.
Finding	TNI- An assessment conclusion referenced to a laboratory accreditation standard and supported by objective evidence that identifies a deviation from a laboratory accreditation standard requirement. DoD- An assessment conclusion that identifies a condition having a significant effect on an item or activity. An assessment finding may be positive, negative, or neutral and is normally accompanied by specific examples of the observed condition. The finding must be linked to a specific requirement (e.g., this standard, ISO requirements, analytical methods, contract specifications, or laboratory management systems requirements).
Flame Atomic Absorption Spectrometer (FAA)	Instrumentation used to measure the concentration of metals in an environmental sample based on the fact that ground state metals absorb light at different wavelengths. Metals in a solution are converted to the atomic state by use of a flame.
Flame Ionization Detector (FID)	A type of gas detector used in GC analysis where samples are passed through a flame which ionizes the sample so that various ions can be measured.
Gas Chromatography (GC)	Instrumentation which utilizes a mobile carrier gas to deliver an environmental sample across a stationary phase with the intent to separate compounds out and measure their retention times.
Gas Chromatograph/Mass Spectrometry (GC/MS)	In conjunction with a GC, this instrumentation utilizes a mass spectrometer which measures fragments of compounds and determines their identity by their fragmentation patterns (mass spectra).
Gasoline Range Organics (GRO)	A range of compounds that denote all the characteristic compounds that make up gasoline (range can be state or program specific).
Graphite Furnace Atomic Absorption Spectrometry (GFAA)	Instrumentation used to measure the concentration of metals in an environmental sample based on the absorption of light at different wavelengths that are characteristic of different analytes.
High Pressure Liquid Chromatography (HPLC)	Instrumentation used to separate, identify, and quantitate compounds based on retention times which are dependent on interactions between a mobile phase and a stationary phase.
Holding Time	TNI- The maximum time that can elapse between two specified activities. 40 CFR Part 136- The maximum time that samples may be held prior to preparation and/or analysis as defined by the method and still be considered valid or not compromised. For sample prep purposes, hold times are calculated using the time of the start of the preparation procedure. DoD- The maximum time that may elapse from the time of sampling to the time of preparation or analysis, or from preparation to analysis, as appropriate.
Homogeneity	The degree to which a property or substance is uniformly distributed throughout a sample.
Homologue	One in a series of organic compounds in which each successive member has one more chemical group in its molecule than the next preceding member. For instance, methanol, ethanol, propanol, butanol, etc., form a homologous series.
Improper Actions	DoD- Intentional or unintentional deviations from contract-specified or method-specified analytical practices that have not been authorized by the customer (e.g., DoD or DOE).
Incremental Sampling Method (ISM)	Soil preparation for large volume (1 kg or greater) samples.
In-Depth Data Monitoring	TNI- When used in the context of data integrity activities, a review and evaluation of documentation related to all aspects of the data generation process that includes items such as preparation, equipment, software, calculations, and quality controls. Such monitoring shall determine if the laboratory uses appropriate data handling, data use and data reduction activities to support the laboratory's data integrity policies and procedures.
Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)	Analytical technique used for the detection of trace metals which uses plasma to produce excited atoms that emit radiation of characteristic wavelengths.
Inductively Coupled Plasma- Mass Spectrometry (ICP/MS)	An ICP that is used in conjunction with a mass spectrometer so that the instrument is not only capable of detecting trace amounts of metals and non-metals but is also capable of monitoring isotopic speciation for the ions of choice.
Infrared Spectrometer (IR)	An instrument that uses infrared light to identify compounds of interest.

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Initial Calibration (ICAL)	The process of analyzing standards, prepared at specified concentrations, to define the quantitative response relationship of the instrument to the analytes of interest. Initial calibration is performed whenever the results of a calibration verification standard do not conform to the requirements of the method in use or at a frequency specified in the method.
Initial Calibration Blank (ICB)	A blank sample used to monitor the cleanliness of an analytical system at a frequency determined by the analytical method. This blank is specifically run in conjunction with the Initial Calibration Verification (ICV) where applicable.
Initial Calibration Verification (ICV)	DoD- Verifies the initial calibration with a standard obtained or prepared from a source independent of the source of the initial calibration standards to avoid potential bias of the initial calibration.
Injection Internal Standard Analyte	Isotopically labeled analogs of analytes of interest (or similar in physiochemical properties to the target analytes but with a distinct response) to be quantitated. Added to all blanks, standards, samples, and batch QC after extraction and prior to analysis.
Instrument Blank	A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination.
Instrument Detection Limits (IDLs)	Limits determined by analyzing a series of reagent blank analyses to obtain a calculated concentration. IDLs are determined by calculating the average of the standard deviations of three runs on three non-consecutive days from the analysis of a reagent blank solution with seven consecutive measurements per day.
Interference, spectral	Occurs when particulate matter from the atomization scatters incident radiation from the source or when the absorption or emission from an interfering species either overlaps or is so close to the analyte wavelength that resolution becomes impossible.
Interference, chemical	Results from the various chemical processes that occur during atomization and later the absorption characteristics of the analyte.
Internal Standard	TNI and DoD- 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.
International Organization for Standardization (ISO)	An international standard-setting body composed of representatives from various national standards organizations.
Intermediate Standard Solution	Reference solutions prepared by dilution of the stock solutions with an appropriate solvent.
International System of Units (SI)	The coherent system of units adopted and recommended by the General Conference on Weights and Measures.
Ion Chromatography (IC)	Instrumentation or process that allows the separation of ions and molecules based on the charge properties of the molecules.
Isomer	One of two or more compounds, radicals, or ions that contain the same number of atoms of the same element but differ in structural arrangement and properties. For example, hexane (C ₆ H ₁₄) could be n-hexane, 2-methylpentane, 3-methylpentane, 2,3-dimethylbutane, 2,2-dimethylbutane.
Laboratory	A body that calibrates and/or performs testing.
Laboratory Control Sample (LCS)	TNI- (also known as laboratory fortified blank (LFB), 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 and taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a reference method. It is generally used to establish intra-laboratory or analyst-specific precision and bias or to evaluate the performance of all or a portion of the measurement system.
Laboratory Duplicate	Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently.
Laboratory Information Management System (LIMS)	DoD- The entirety of an electronic data system (including hardware and software) that collects, analyzes, stores, and archives electronic records and documents.
Learning Management System (LMS)	A web-based database used by the laboratories to track and document training activities. The system is administered by the corporate training department and each laboratory's learn centers are maintained by a local administrator.
Legal Chain-of-Custody Protocols	TNI- Procedures employed to record the possession of samples from the time of sampling through the retention time specified by the client or program. These procedures are performed at the special request of the client and include the use of a Chain-of-Custody (COC) Form that documents the collection, transport, and receipt of compliance samples by the laboratory. In addition, these protocols document all handling of the samples within the laboratory.

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Limit(s) of Detection (LOD)	TNI- The minimum result, which can be reliably discriminated from a blank with predetermined confidence level. DoD- 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 LOD, the false negative rate (Type II error) is 1%. A LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method at 99% confidence.
Limit(s) of Quantitation (LOQ)	TNI- The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. DoD- The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.
Linear Dynamic Range	DoD- Concentration range where the instrument provides a linear response.
Liquid chromatography/tandem mass spectrometry (LC/MS/MS)	Instrumentation that combines the physical separation techniques of liquid chromatography with the mass analysis capabilities of mass spectrometry.
Lot	TNI- A definite amount of material produced during a single manufacturing cycle and intended to have uniform character and quality.
Management	Those individuals directly responsible and accountable for planning, implementing, and assessing work.
Management System	System to establish policy and objectives and to achieve those objectives.
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.
Matrix	TNI- The substrate of a test sample.
Matrix Duplicate	TNI- A replicate matrix prepared in the laboratory and analyzed to obtain a measure of precision.
Matrix Spike (MS) (spiked sample or fortified sample)	TNI- A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result 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.
Matrix Spike Duplicate (MSD) (spiked sample or fortified sample duplicate)	TNI- A replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.
Measurement Performance Criteria (MPC)	DoD- Criteria that may be general (such as completion of all tests) or specific (such as QC method acceptance limits) that are used by a project to judge whether a laboratory can perform a specified activity to the defined criteria.
Measurement Quality Objective (MQO)	TNI- The analytical data requirements of the data quality objectives are project- or program-specific and can be quantitative or qualitative. MQOs are measurement performance criteria or objectives of the analytical process. Examples of quantitative MQOs include statements of required analyte detectability and the uncertainty of the analytical protocol at a specified radionuclide activity, such as the action level. Examples of qualitative MQOs include statements of the required specificity of the analytical protocol, e.g., the ability to analyze for the radionuclide of interest given the presence of interferences.
Measurement System	TNI- A method, as implemented at a particular laboratory, and which includes the equipment used to perform the test and the operator(s). DoD- A test method, as implemented at a particular laboratory, and which includes the equipment used to perform the sample preparation and test and the operator(s).
Measurement Uncertainty	DoD- An estimate of the error in a measurement often stated as a range of values that contain the true value within a certain confidence level. The uncertainty generally includes many components which may be evaluated from experimental standard deviations based on repeated observations or by standard deviations evaluated from assumed probability distributions based on experience or other information. For DoD/DOE, a laboratory's Analytical Uncertainty (such as use of LCS control limits) can be reported as the minimum uncertainty.
Method	TNI- A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.

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Method Blank	TNI- 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.
Method Detection Limit (MDL)	TNI- One way to establish a Detection Limit; defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.
Method of Standard Additions	A set of procedures adding one or more increments of a standard solution to sample aliquots of the same size in order to overcome inherent matrix effects. The procedures encompass the extrapolation back to obtain the sample concentration.
Minimum Detectable Activity (MDA)	TNI- Estimate of the smallest true activity that ensures a specified high confidence, $1 - \beta$, of detection above the Critical Value, and a low probability β of false negatives below the Critical Value. For radiometric methods, β is often set at 0.05. NOTE 1: The MDS is a measure of the detection capability of a measurement process and as such, it is an a priori concept. It may be used in the selection of methods to meet specified MQOs. Laboratories may also calculate a “sample specific” MDA, which indicates how well the measurement process is performing under varying real-world measurement conditions, when sample-specific characteristics (e.g., interferences) may affect the detection capability. However, the MDA must never be used instead of the Critical Value as a detection threshold. NOTE 2: For the purpose of this Standard, the terms MDA and minimum detectable concentration (MDC) are equivalent.
Minimum Reporting Limit (MRL)	the lowest concentration of standard used for calibration – Drinking Water Manual
MintMiner	Commercial software program used to scan large amounts of chromatographic data to monitor for errors or data integrity issues.
Mobile Laboratory	TNI- A portable enclosed structure with necessary and appropriate accommodation and environmental conditions for a laboratory, within which testing is performed by analysts. Examples include but are not limited to trailers, vans, and skid-mounted structures configured to house testing equipment and personnel.
National Environmental Laboratory Accreditation Conference (NELAC)	See definition of The NELAC Institute (TNI).
National Institute of Occupational Safety and Health (NIOSH)	National institute charged with the provision of training, consultation, and information in the area of occupational safety and health.
National Institute of Standards and Technology (NIST)	TNI- A federal agency of the US Department of Commerce’s Technology Administration that is designed as the United States national metrology institute (or NMI).
National Pollutant Discharge Elimination System (NPDES)	A permit program that controls water pollution by regulating point sources that discharge pollutants into U.S. waters.
Negative Control	Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.
Nitrogen Phosphorus Detector (NPD)	A detector used in GC analyses that utilizes thermal energy to ionize an analyte. With this detector, nitrogen and phosphorus can be selectively detected with a higher sensitivity than carbon.
Nonconformance	An indication or judgment that a product or service has not met the requirement of the relevant specifications, contract, or regulation; also, the state of failing to meet the requirements.
Not Detected (ND)	The result reported for a compound when the detected amount of that compound is less than the method reporting limit.
Operator Aid	DoD- A technical posting (such as poster, operating manual, or notepad) that assists workers in performing routine tasks. All operator aids must be controlled documents (i.e., a part of the laboratory management system).
Performance Based Measurement System (PBMS)	An analytical system 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.
Physical Parameter	TNI- A measurement of a physical characteristic or property of a sample as distinguished from the concentrations of chemical and biological components.

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Photo-ionization Detector (PID)	An ion detector which uses high-energy photons, typically in the ultraviolet range, to break molecules into positively charged ions.
Polychlorinated Biphenyls (PCB)	A class of organic compounds that were used as coolants and insulating fluids for transformers and capacitors. The production of these compounds was banned in the 1970's due to their high toxicity.
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.
Post-Digestion Spike	A sample prepared for metals analyses that has analytes spike added to determine if matrix effects may be a factor in the results.
Power of Hydrogen (pH)	The measure of acidity or alkalinity of a solution.
Practical Quantitation Limit (PQL)	Another term for a method reporting limit. The lowest reportable concentration of a compound based on parameters set up in an analytical method and the laboratory's ability to reproduce those conditions.
Precision	TNI- 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.
Preservation	TNI and DoD- Any conditions under which a sample must be kept in order to maintain chemical, physical, and/or biological integrity prior to analysis.
Primary Accreditation Body (Primary AB)	TNI- The accreditation body responsible for assessing a laboratory's total quality system, on-site assessment, and PT performance tracking for fields of accreditation.
Procedure	TNI- A specified way to carry out an activity or process. Procedures can be documented or not.
Proficiency Testing (PT)	TNI- A means to evaluate a laboratory's performance under controlled conditions relative to a given set of criteria, through analysis of unknown samples provided by an external source.
Proficiency Testing Program (PT Program)	TNI- 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.
Proficiency Testing Provider (PT Provider)	TNI- A person or organization accredited by a TNI-approved Proficiency Testing Provider Accreditor to operate a TNI-compliant PT Program.
Proficiency Testing Provider Accreditor (PTPA)	TNI- An organization that is approved by TNI to accredit and monitor the performance of proficiency testing providers.
Proficiency Testing Reporting Limit (PTRL)	TNI- A statistically derived value that represents the lowest acceptable concentration for an analyte in a PT sample, if the analyte is spiked into the PT sample. The PTRLs are specified in the TNI FoPT tables.
Proficiency Testing Sample (PT)	TNI- A sample, the composition of which is unknown to the laboratory, and is provided to test whether the laboratory can produce analytical results within the specified acceptance criteria.
Proficiency Testing (PT) Study	TNI- a) Scheduled PT Study: A single complete sequence of circulation and scoring of PT samples to all participants in a PT program. The study must have the same pre-defined opening and closing dates for all participants; b) Supplemental PT Study: A PT sample that may be from a lot previously released by a PT Provider that meets the requirements for supplemental PT samples given in Volume 3 of this Standard [TNI] but that does not have a pre-determined opening date and closing date.
Proficiency Testing Study Closing Date	TNI- a) Scheduled PT Study: The calendar date by which all participating laboratories must submit analytical results for a PT sample to a PT Provider; b) Supplemental PT Study: The calendar date a laboratory submits the results for a PT sample to the PT Provider.
Proficiency Testing Study Opening Date	TNI- a) Scheduled PT Study: The calendar date that a PT sample is first made available to all participants of the study by a PT Provider; b) Supplemental PT Study: The calendar date the PT Provider ships the sample to a laboratory.
Protocol	TNI- A detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) that must be strictly followed.
Qualitative Analysis	DoD- Analysis designed to identify the components of a substance or mixture.
Quality Assurance (QA)	TNI- An integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.
Quality Assurance Manual (QAM)	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.
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.

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Quality Control (QC)	TNI- The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against “out of control” conditions and ensuring that the results are of acceptable quality.
Quality Control Sample (QCS)	TNI- A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control.
Quality Manual	TNI- 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.
Quality System	TNI and DoD- 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 quality assurance and quality control activities.
Quality System Matrix	TNI and DoD- These matrix definitions shall be used for purposes of batch and quality control requirements and may be different from a field of accreditation matrix: • Air and Emissions: 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 • Aqueous: Any aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine. Includes surface water, groundwater effluents, and TCLP or other extracts. • Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin. • Chemical Waste: A product or by-product of an industrial process that results in a matrix not previously defined. • Drinking Water: Any aqueous sample that has been designated a potable or potentially potable water source. • Non-aqueous liquid: Any organic liquid with <15% settleable solids • Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other saltwater source such as the Great Salt Lake. • Solids: Includes soils, sediments, sludges, and other matrices with >15% settleable solids.
Quantitation Range	DoD- The range of values (concentrations) in a calibration curve between the LOQ and the highest successively analyzed initial calibration standard used to relate instrument response to analyte concentration. The quantitation range (adjusted for initial sample volume/weight, concentration/dilution, and final volume) lies within the calibration range.
Quantitative Analysis	DoD- Analysis designed to determine the amounts or proportions of the components of a substance.
Random Error	The EPA has established that there is a 5% probability that the results obtained for any one analyte will exceed the control limits established for the test due to random error. As the number of compounds measured increases in a given sample, the probability for statistical error also increases.
Raw Data	TNI- The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records.
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.
Reagent Grade	Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents that conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.
Records	DoD- The output of implementing and following management system documents (e.g., test data in electronic or hand-written forms, files, and logbooks).

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Reference Material	TNI- Material or substance one or more of whose property values are sufficiently homogenized and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.
Reference Method	TNI- A published method issued by an organization generally recognized as competent to do so. (When the ISO language refers to a “standard method,” that term is equivalent to “reference method”). When a laboratory is required to analyze by a specified method due to a regulatory requirement, the analyte/method combination is recognized as a reference method. If there is no regulatory requirement for the analyte/method combination, the analyte/method combination is recognized as a reference method if it can be analyzed by another reference method of the same matrix and technology.
Reference Standard	TNI- Standard used for the calibration of working measurement standards in a given organization or at a given location.
Relative Percent Difference (RPD)	A measure of precision defined as the difference between two measurements divided by the average concentration of the two measurements.
Reporting Limit (RL)	The level at which method, permit, regulatory and customer-specific objectives are met. The reporting limit may never be lower than the Limit of Detection (i.e., statistically determined MDL). Reporting limits are corrected for sample amounts, including the dry weight of solids, unless otherwise specified. There must be a sufficient buffer between the Reporting Limit and the MDL. DoD- A customer-specified lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.
Reporting Limit Verification Standard (RLVS)	A standard analyzed at the reporting limit for an analysis to verify the laboratory’s ability to report to that level.
Representativeness	A quality element related to the ability to collect a sample reflecting the characteristics of the part of the environment to be assessed. Sample representativeness is dependent on the sampling techniques specified in the project work plan.
Requirement	Denotes a mandatory specification; often designated by the term “shall.”
Retention Time	The time between sample injection and the appearance of a solute peak at the detector.
Revocation	TNI- The total or partial withdrawal of a laboratory’s accreditation by an accreditation body.
Sample	Portion of material collected for analysis, identified by a single, unique alphanumeric code. A sample may consist of portions in multiple containers, if a single sample is submitted for multiple or repetitive analysis.
Sample Condition Upon Receipt Form (SCURF)	Form used by sample receiving personnel to document the condition of sample containers upon receipt to the laboratory (used in conjunction with a COC).
Sample Delivery Group (SDG)	A unit within a single project that is used to identify a group of samples for delivery. An SDG is a group of 20 or fewer field samples within a project, received over a period of up to 14 calendar days. Data from all samples in an SDG are reported concurrently.
Sample Receipt Form (SRF)	Letter sent to the client upon login to show the tests requested and pricing.
Sample Tracking	Procedures employed to record the possession of the samples from the time of sampling until analysis, reporting and archiving. These procedures include the use of a chain-of-custody form that documents the collection, transport, and receipt of compliance samples to the laboratory. In addition, access to the laboratory is limited and controlled to protect the integrity of the samples.
Sampling	TNI- Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.
Selected Ion Monitoring (SIM)	A mode of analysis in mass spectrometry where the detector is set to scan over a very small mass range, typically one mass unit. The narrower the range, the more sensitive the detector. DoD- Using GC/MS, characteristic ions specific to target compounds are detected and used to quantify in applications where the normal full scan mass spectrometry results in excessive noise.
Selectivity	TNI- The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system.
Sensitivity	TNI- The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest.
Serial Dilution	The stepwise dilution of a substance in a solution.
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 as long as the requirement is fulfilled.

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Should	Denotes a guideline or recommendation whenever noncompliance with the specification is permissible.
Signal-to-Noise Ratio (S/N)	DoD- A measure of signal strength relative to background noise. The average strength of the noise of most measurements is constant and independent of the magnitude of the signal. Thus, as the quantity being measured (producing the signal) decreases in magnitude, S/N decreases and the effect of the noise on the relative error of a measurement increases.
Source Water	TNI- When sampled for drinking water compliance, untreated water from streams, rivers, lakes, or underground aquifers, which is used to supply private and public drinking water supplies.
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.
Standard (Document)	TNI- The document describing the elements of a laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies.
Standard (Chemical)	Standard samples are comprised of a known amount of standard reference material in the matrix undergoing analysis. A standard reference material is a certified reference material produced by US NIST and characterized for absolute content, independent of analytical test method.
Standard Blank (or Reagent Blank)	A calibration standard consisting of the same solvent/reagent matrix used to prepare the calibration standards without the analytes. It is used to construct the calibration curve by establishing instrument background.
Standard Method	A test method issued by an organization generally recognized as competent to do so.
Standard Operating Procedure (SOP)	TNI- A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or repetitive tasks.
Standard Reference Material (SRM)	A certified reference material produced by the US NIST or other equivalent organization and characterized for absolute content, independent of analytical method.
Statement of Qualifications (SOQ)	A document that lists information about a company, typically the qualifications of that company to compete on a bid for services.
Stock Standard	A concentrated reference solution containing one or more analytes prepared in the laboratory using an assayed reference compound or purchased from a reputable commercial source.
Storage Blank	DoD- A sample of analyte-free media prepared by the laboratory and retained in the sample storage area of the laboratory. A storage blank is used to record contamination attributable to sample storage at the laboratory.
Supervisor	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 technical employees have the required balance of education, training, and experience to perform the required analyses.
Surrogate	DoD- A substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them for quality control purposes.
Suspension	TNI- The temporary removal of a laboratory's accreditation for a defined period of time, which shall not exceed 6 months or the period of accreditation, whichever is longer, in order to allow the laboratory time to correct deficiencies or area of non-conformance with the Standard.
Systems Audit	An on-site inspection or assessment of a laboratory's quality system.
Target Analytes	DoD- Analytes or chemicals of primary concern identified by the customer on a project-specific basis.
Technical Director	Individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory.
Technology	TNI- A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.
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.
Test Method	DoD- A definitive procedure that determines one or more characteristics of a given substance or product.
Test Methods for Evaluating Solid Waste, Physical/ Chemical (SW-846)	EPA Waste's official compendium of analytical and sampling methods that have been evaluated and approved for use in complying with RCRA regulations.

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Test Source	TNI- A radioactive source that is tested, such as a sample, calibration standard, or performance check source. A Test Source may also be free of radioactivity, such as a Test Source counted to determine the subtraction background, or a short-term background check.
The NELAC Institute (INI)	A non-profit organization whose mission is to foster the generation of environmental data of known and documented quality through an open, inclusive, and transparent process that is responsive to the needs of the community. Previously known as NELAC (National Environmental Laboratory Accreditation Conference).
Total Petroleum Hydrocarbons (TPH)	A term used to denote a large family of several hundred chemical compounds that originate from crude oil. Compounds may include gasoline components, jet fuel, volatile organics, etc.
Toxicity Characteristic Leaching Procedure (TCLP)	A solid sample extraction method for chemical analysis employed as an analytical method to simulate leaching of compounds through a landfill.
Traceability	TNI- The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical conditions or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project.
Training Document	A training resource that provides detailed instructions to execute a specific method or job function.
Trip Blank	This blank sample is used to detect sample contamination from the container and preservative during transport and storage of the sample. A cleaned sample container is filled with laboratory reagent water and the blank is stored, shipped, and analyzed with its associated samples.
Tuning	A check and/or adjustment of instrument performance for mass spectrometry as required by the method.
Ultraviolet Spectrophotometer (UV)	Instrument routinely used in quantitative determination of solutions of transition metal ions and highly conjugated organic compounds.
Uncertainty, Counting	TNI- The component of Measurement Uncertainty attributable to the random nature of radioactive decay and radiation counting (often estimated as the square root of observed counts (MARLAP). Older references sometimes refer to this parameter as Error, Counting Error, or Count Error (c.f., Total Uncertainty).
Uncertainty, Expanded	TNI- The product of the Standard Uncertainty and a coverage factor, k, which is chosen to produce an interval about the result that has a high probability of containing the value of the measurand (c.f., Standard Uncertainty). NOTE: Radiochemical results are generally reported in association with the Total Uncertainty. Either if these estimates of uncertainty can be reported as the Standard Uncertainty (one-sigma) or as an Expanded Uncertainty (k-sigma, where $k > 1$).
Uncertainty, Measurement	TNI- Parameter associated with the result of a measurement that characterizes the dispersion of the values that could reasonably be attributed to the measurand.
Uncertainty, Standard	TNI- An estimate of the Measurement Uncertainty expressed as a standard deviation (c.f., Expanded Uncertainty).
Uncertainty, Total	TNI- An estimate of the Measurement Uncertainty that accounts for contributions from all significant sources of uncertainty associated with the analytical preparation and measurement of a sample. Such estimates are also commonly referred to as Combined Standard Uncertainty or Total Propagated Uncertainty, and in some older references as the Total Propagated Error, among other similar items (c.f., Counting Uncertainty).
Unethical actions	DoD- Deliberate falsification of analytical or quality control results where failed method or contractual requirements are made to appear acceptable.
United States Department of Agriculture (USDA)	A department of the federal government that provides leadership on food, agriculture, natural resources, rural development, nutrition, and related issues based on public policy, the best available science, and effective management.
United States Geological Survey (USGS)	Program of the federal government that develops new methods and tools to supply timely, relevant, and useful information about the Earth and its processes.
Unregulated Contaminant Monitoring Rule (UCMR)	EPA program to monitor unregulated contaminants in drinking water.
Validation	DoD- The confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

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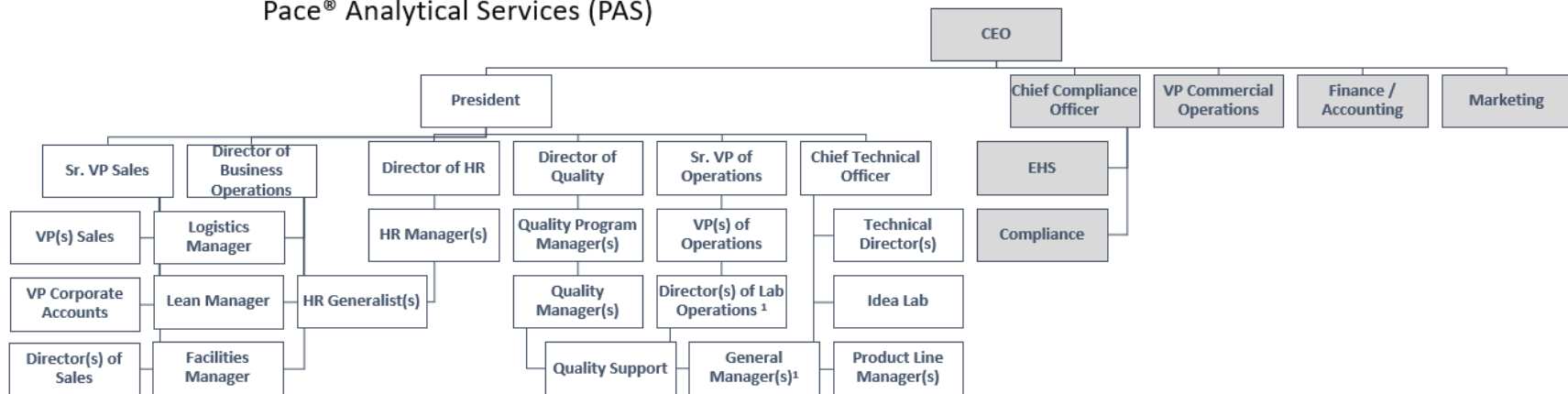
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Verification	TNI- Confirmation by examination and objective evidence that specified requirements have been met. In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values 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.
Voluntary Action Program (VAP)	A program of the Ohio EPA that gives individuals a way to investigate possible environmental contamination, clean it up if necessary and receive a promise from the State of Ohio that no more cleanup is needed.
Whole Effluent Toxicity (WET)	The aggregate toxic effect to aquatic organisms from all pollutants contained in a facility's wastewater (effluent).

7.4 Appendix D: Organization Chart(s)

7.4.1 PAS Corporate Organization Chart(s)

Organization Structure: Position / Function
Pace® Analytical Services (PAS)



White Box = PAS Positions / Functions

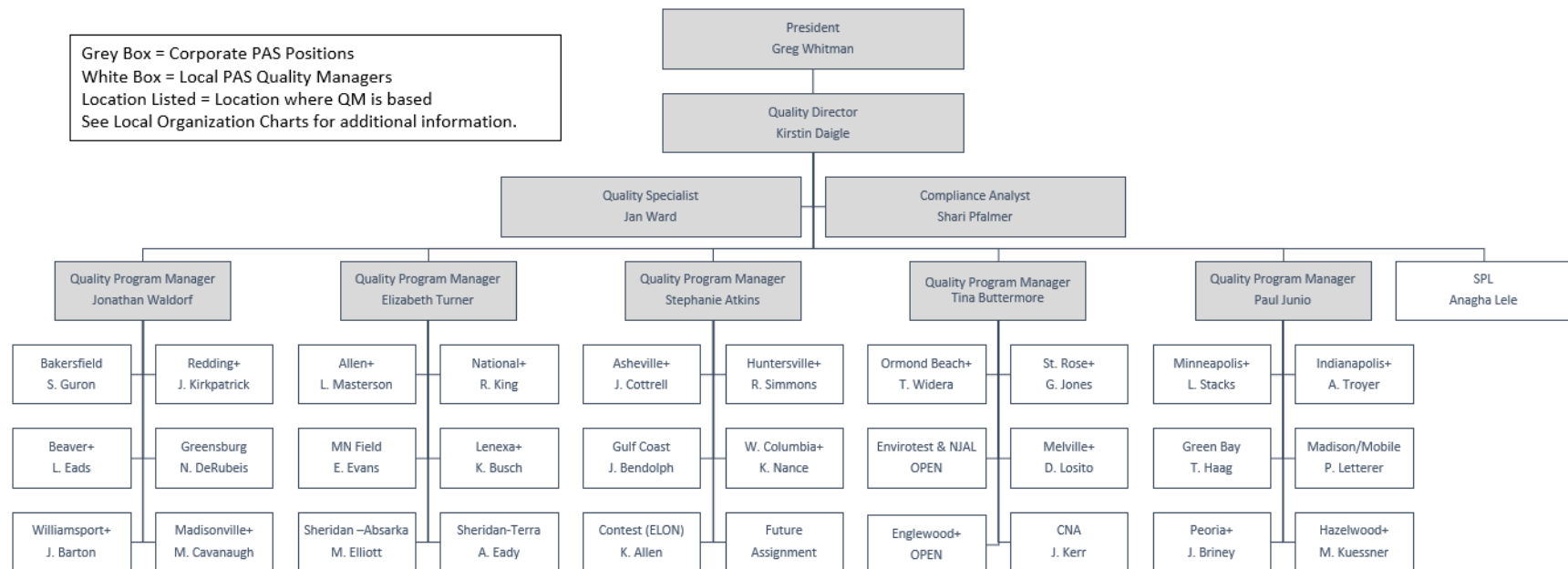
Grey Box = Pace®Corporate Positions / Functions

1= Positions not Assigned to all Locations – see location specific organization charts

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Subject to Change

7.4.2 PAS Quality Systems Management Organization Chart

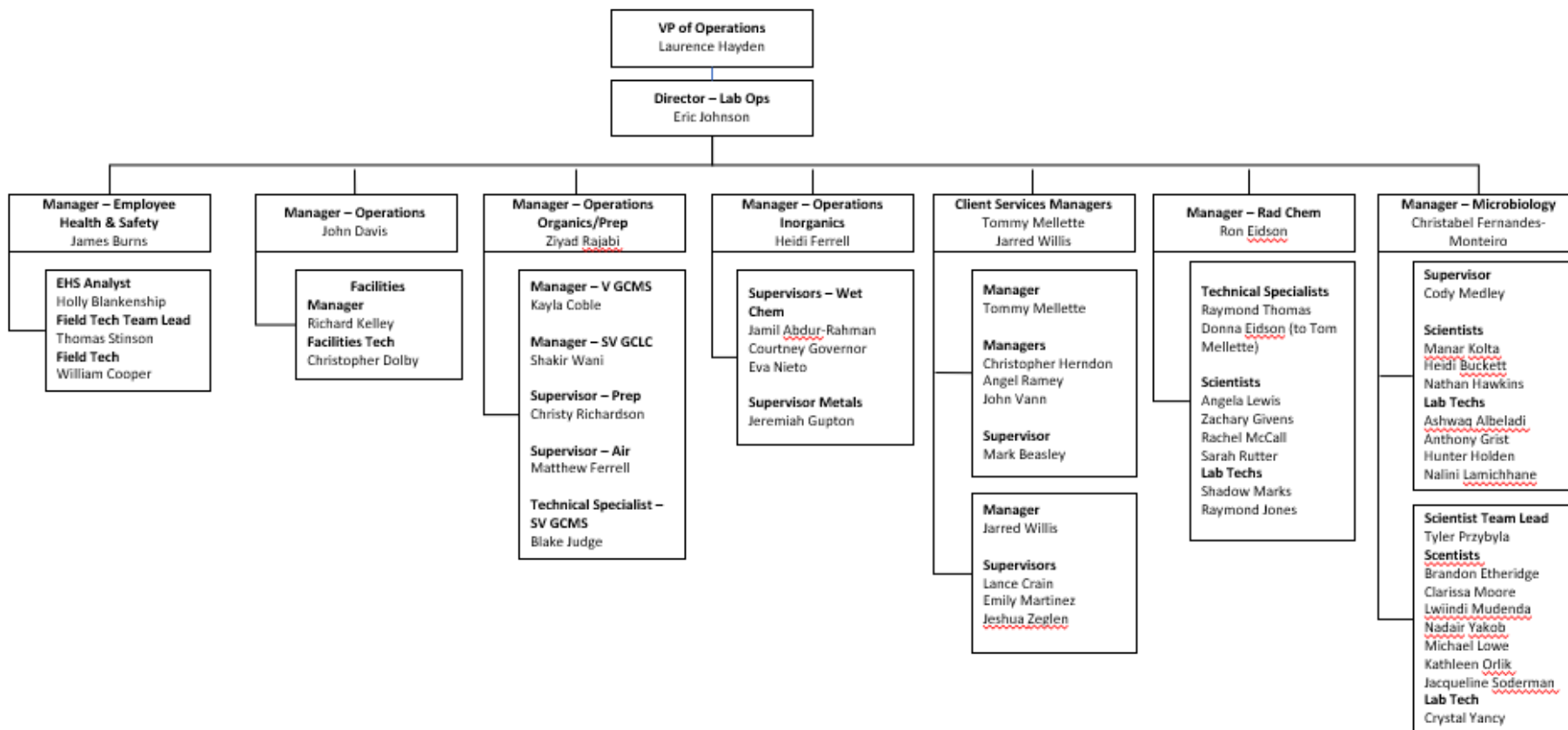
PAS Quality Management Structure



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Subject to Change

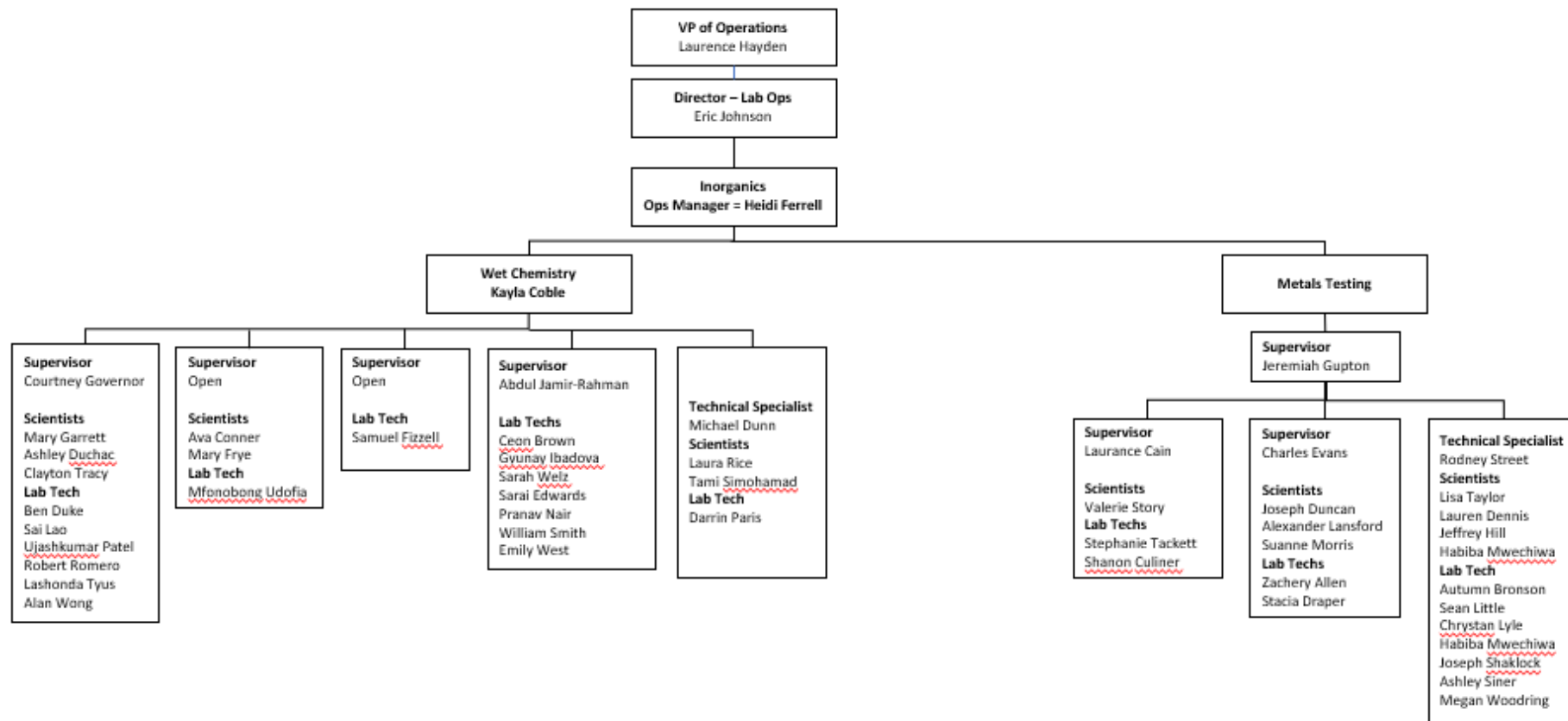
7.4.3 Mt. Juliet – Organization Chart

80 – Pace National Business Unit



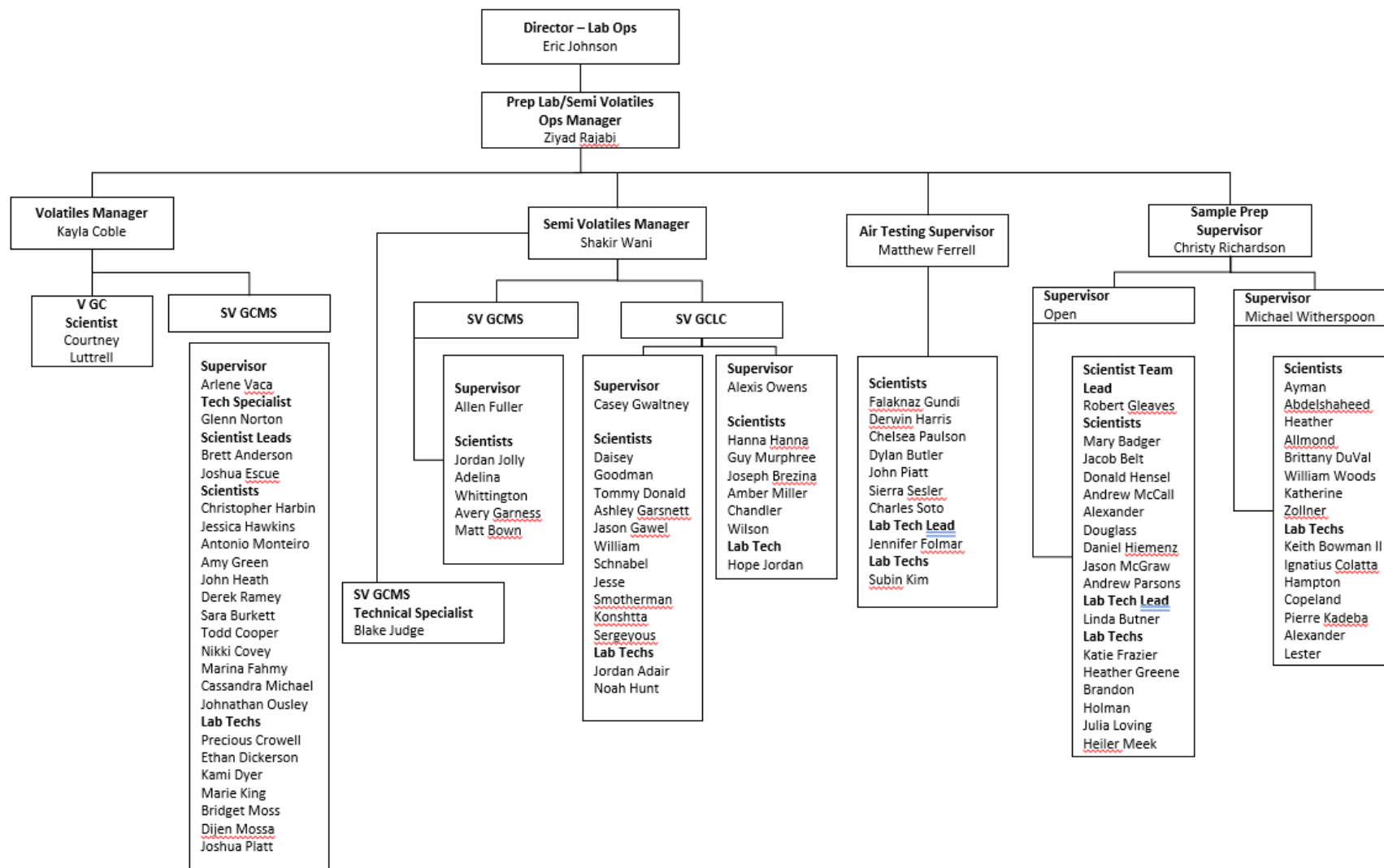
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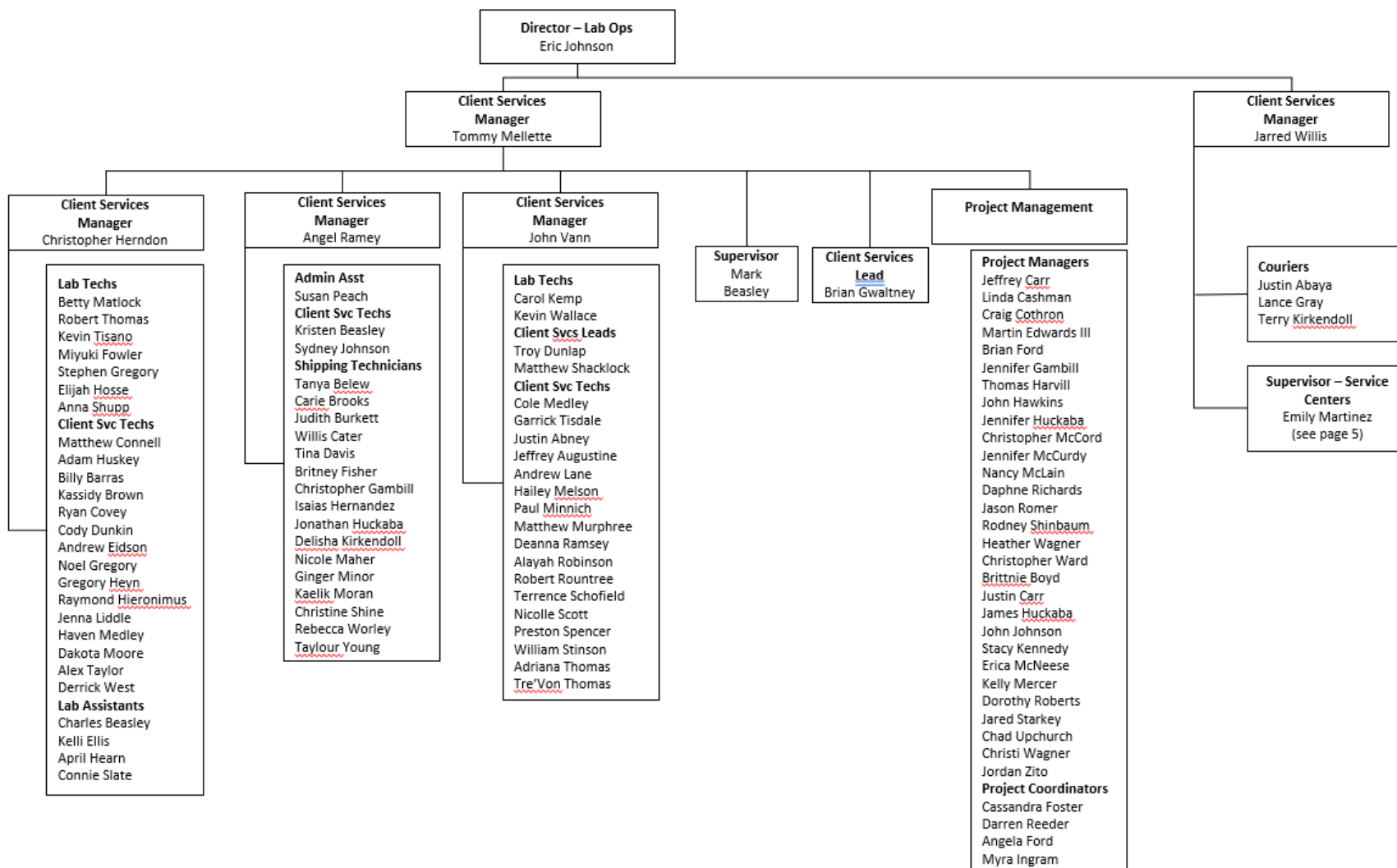
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Support Functions

Sales

VP Sales = Danny Ramsey
Director Sales = Wes Vance
Managers – Sales
Jeff Croston
Gabriel Stivala
Sr. Account Execs
Phillip Johnson
David Veratti
Account Executives
Paul Collier
Duane Hatterm
Matthew Holmes (Decatur, AL)
Jeffrey Jordan
Katelyn Lazar
Melvin Mitchell
Marty Steward (Midland, TX)
Shannon Tyrell-Swadis

Quality Assurance

Director QA = Kirstin Daigle
Quality Program Mgr = Elizabeth Turner
Quality Manager = Rebecca King
Quality Analysts:
Michael Jones
Lakeisha Crouch
Adam Hamm
Penny Hunter
Fallon Labeots
Pamela Langford
Uliana Rezkalla
Kristen Sweeney

Finance & Accounting

Controller = Stacy McClintock
Manager Finance = Jeff Anderson
Accounting Generalist
Juanita Green
A/R Associate
Cynthia Carson
A/P Associates
Melinda Clary
Amy Rooker
Inventory Control Associates
Nicholas Lawing
Brian Lukasik
Collections Associates
Melanie Belcher
Ashley Daniel
Corinne Holloway

Human Resources

VP HR = Nicole Ott
Director HR = Kim Moore
HR Business Partner = Steven Petersen
HR Generalists
William Coleman
Jessica Williams
Recruiter
Open

Local Administration

HR Rep = Lisa Nickerson
Receptionist = Anita Pace

Information Technology

VP – CIO = Kyle Korzenowski
Director – IT Infrastructure = Jeremy Jenkins
Manager – Systems Admin = Laz Espinosa
Supervisor – Regional Systems = Kevin Herring
Systems Administrators
Tim Bell
Kyle Biles

7.5 Appendix E: Equipment Listing

The equipment listed represents equipment were held by each location on the effective date of this manual. This information is subject to change without notice. External parties should contact the location for the most current information.

7.5.1 PAS-Mt. Juliet

Equipment List: PAS-Mt. Juliet

Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
GC/FID	Agilent	6890N	US10137006	As Needed	Used	Air Lab	AIRGC2	Online
GC/FID	Agilent	6890N	US10137006	As Needed	Used	Air Lab	AIRGC2	Online
Gas Chromatograph	HP	6890N TCD	US10726007	As Needed	Used	Air Lab	AIRGC3	Online
GC/FID	Agilent	7890B	CN14513033	As Needed	Used	Air Lab	AIRGC4	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	7890A/5975	CN13231014 US50680012	As Needed	Used	Air Lab	AIRMS1	Online
Preconcentrator	Entech	7200	1683	As Needed	Used	Air Lab	AIRMS1	Online
Canister Autosampler	Entech	7016D	1708	As Needed	Used	Air Lab	AIRMS1	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	6890N/5975	CN10551083 US61332744	As Needed	Used	Air Lab	AIRMS2	Online
Preconcentrator	Entech	7200	1005	As Needed	Used	Air Lab	AIRMS2	Online
Tedlar Autosampler	Entech	7032A	1017	As Needed	Used	Air Lab	AIRMS2	Online
Canister Autosampler	Entech	7016D	1871	As Needed	Used	Air Lab	AIRMS2	Online
Gas Chromatograph	Agilent	6890	US000011333	As Needed	Used	Air Lab	AIRMS3	Online
Injector	Agilent	G2614A	CN40327743	As Needed	Used	Air Lab	AIRMS3	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	6890/5973	US00024695 US82311265	As Needed	Used	Air Lab	AIRMS4	Online
Preconcentrator	Entech	7200	1174	As Needed	USED	Air Lab	AIRMS4	Online
Canister Autosampler	Entech	7016D	1870	As Needed	Used	Air Lab	AIRMS4	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	6890/5973	GCUS00039611 MSUS0340681	As Needed	Used	Air Lab	AIRMS5	Online
Preconcentrator	Entech	7200	1162	As Needed	Used	Air Lab	AIRMS5	Online
Canister Autosampler	Entech	7016D	1741	As Needed	Used	Air Lab	AIRMS5	Online
Tedlar Autosampler	Entech	7032AB	1044	As Needed	Used	Air Lab	AIRMS5	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	7890A/5975C	GCUS10831022 MSU91732329	As Needed	Used	Air Lab	AIRMS6	Online

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Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Canister Autosampler	Entech	7016D	1505	As Needed	Used	Air Lab	AIRMS6	Online
Preconcentrator	Entech	7200	1322	As Needed	Used	Air Lab	AIRMS6	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	6890/5975C	US00024616 US71236615	As Needed	Used	Air Lab	AIRMS7	Online
Preconcentrator	Entech	7200	1720	As Needed	Used	Air Lab	AIRMS7	Online
Canister Autosampler	Entech	7016D	1991	As Needed	Used	Air Lab	AIRMS7	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	8890/5977B	US2008A003 US2007M007	As Needed	Used	Air Lab	AIRMS8	Online
Preconcentrator	Entech	7200A	00118	As Needed	Used	Air Lab	AIRMS8	Online
Canister Autosampler	Entech	7016D	1869	As Needed	Used	Air Lab	AIRMS8	Online
Canister Autosampler	Entech	7016D	1828	As Needed	Used	Air Lab	AIRMS8	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	8890/5977B	US2007A038 US2006M061	As Needed	Used	Air Lab	AIRMS9	Online
Preconcentrator	Entech	7200A	00117	As Needed	Used	Air Lab	AIRMS9	Online
Canister Autosampler	Entech	7016D	1872	As Needed	Used	Air Lab	AIRMS9	Online
Canister Autosampler	Entech	7016D	1990	As Needed	Used	Air Lab	AIRMS9	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	8890/5977B	US2209A075 US2201R007	As Needed	Used	Air Lab	AIRMS10	Online
Preconcentrator	Entech	7200A	00145	As Needed	Used	Air Lab	AIRMS10	Online
Canister Autosampler	Entech	7016D	2000	As Needed	Used	Air Lab	AIRMS10	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	8890/5977B	US2209A079 US2202R013	As Needed	Used	Air Lab	AIRMS11	Online
Preconcentrator	Entech	7200A	00146	As Needed	Used	Air Lab	AIRMS11	Online
Canister Autosampler	Entech	7016D	2001	As Needed	Used	Air Lab	AIRMS11	Online
Canister Autosampler	Entech	7016D	2002	As Needed	Used	Air Lab	AIRMS11	Online
Canister Autosampler	Entech	7650-01	0130	As Needed	Used	Air Lab	AIRMS11	Online
Precision Diluter	Entech	4700	0371	As Needed	Used	Air Lab		Online
Dynamic Diluter	Entech	Model 4600A	1086	As Needed	Used	Air Lab		Online
TO Canister	Restek/Entech	TO-CAN/SiloniteCan	N/A	As Needed	Used	Air Lab	3024 cans owned	Online
Passive Sampling Kit	Restek/Entech		N/A	As Needed	Used	Air Lab	2218 owned	Online
Field hand held PID	RAE Systems	MiniRAE3000	592-929317	As Needed	Used	Air Lab		Online
Canister Cleaner	Entech	3100A	1178	As Needed	Used	Air Lab	Oven 1	Online

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Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Oven	Entech	3513ENT	1482050570384	As Needed	Used	Air Lab	Oven 1	Online
Oven	Entech	3513ENT	1482060344515	As Needed	Used	Air Lab	Oven 1	Online
Canister Cleaner	Entech	3100A	1473	As Needed	Used	Air Lab	Oven 2	Online
Oven	Entech	3513ENT	1482060344518	As Needed	Used	Air Lab	Oven 2	Online
Oven	Entech	31-350ER	B33ER-01180	As Needed	Used	Air Lab	Oven 2	Online
Canister Cleaner	Entech	3100A	1448	As Needed	Used	Air Lab	Oven 3	Online
Oven	Entech	31-350	B33-02663	As Needed	Used	Air Lab	Oven 3	Online
Oven	Entech	31-350ER	B33ER-01142	As Needed	Used	Air Lab	Oven 3	Online
Canister Cleaner	Entech	3100D	1741	As Needed	Used	Air Lab	Oven 4	Online
Oven	Entech	31-350ER	B33ER-01654	As Needed	Used	Air Lab	Oven 4	Online
Oven	Entech	31-350ER	B33ER-01652	As Needed	Used	Air Lab	Oven 4	Online
Canister Cleaner	Entech	3100D	2214	As Needed	Used	Air Lab	Oven 5	Online
Oven	Entech	09-OV6L8	0134	As Needed	Used	Air Lab	Oven 5	Online
Oven	Entech	09-OV6L8	0135	As Needed	Used	Air Lab	Oven 5	Online
Canister Cleaner	Entech	3100A	1154	As Needed	Used	Air Lab	Oven 6	Online
Oven	Entech	3513ENT	1482060344516	As Needed	Used	Air Lab	Oven 6	Online
Oven	Entech	3513ENT	1003-4123	As Needed	Used	Air Lab	Oven 6	Online
Canister Cleaner	Entech	3100D	1154	As Needed	Used	Air Lab	Oven 7	Online
Oven	Entech	09-OV6L12	0212	As Needed	Used	Air Lab	Oven 7	Online
Oven	Entech	09-OV6L12	0213	As Needed	Used	Air Lab	Oven 7	Online

Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Analytical Balance	Mettler	XSE 105 Dual Range	B634906554	Annual	Used	Aquatic Tox Lab	002929	Biomon
Class "I" weights (2)	Troemner	SN #67812	67812	Annual	Used	Aquatic Tox Lab	000565	UKN
Stereoscope	Olympus	SZX2-ILLD	7D48897	Annual	Used	Aquatic Tox Lab	N/A	Biomon
Oven (2)	Fisher	655F	30400142	Annual	Used	Aquatic Tox Lab	304	UKN
Cold Room	Thermo-Kool	Walk-In Refrigerator	49409	Annual	Used	Aquatic Tox Lab	1800	UKN
Stir plate	Fisher	170 US	HHKF65010	Annual	Used	Aquatic Tox Lab	N/A	Biomon
Stir plate	Fisher	120 US	HBKF63004	Annual	Used	Aquatic Tox Lab	N/A	Biomon
Stir plate	VWR		151211003	Annual	Used	Aquatic Tox Lab	N/A	Biomon
Stir plate	VWR	97042-626	151211016	Annual	Used	Aquatic Tox Lab	N/A	Biomon

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Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Chlorine meter	Hach	DR300	19110A002361	Annual	Used	Aquatic Tox Lab	P0148	Biomon
Hardness meter	Orbeco-Hellige	942	2444	Annual	Used	Aquatic Tox Lab	N/A	Biomon
Conductivity Probe		ZW1-10283	ZW1-10283	Annual	Used	Aquatic Tox Lab	N/A	Biomon
Hood 4	Labconco	6963401	111151057	12-1-21	Used	Micro	2329	Biomon
pH probe	Thermo Scientific	ZY1-18044	ZY1-18044	Annual	Used	Aquatic Tox Lab	N/A	Biomon
Incubator-I9	Thermo Scientific Precision			Annual	Used	Aquatic Tox Lab	2355	Biomon
Incubator I8	Thermo Scientific Precision	MH400-S	42499233	Annual	Used	Aquatic Tox Lab	N/A	Biomon
Incubator-I4	Thermo Scientific Precision		02010320	Annual	Used	Aquatic Tox Lab	N/A	Biomon
Stereoscope	Olympus	SZX2-ILLD (ESCP0004)	7B49859	Annual	Used	Aquatic Tox Lab	P0004	Biomon
pH meter	Orion	VersaStar	X61072	Annual	Used	Aquatic Tox Lab	X61072	Biomon
Waterbath 1	Lindberg/Bue	WB1130A	X05R-220204-XE	Annual	UKN	Aquatic Tox Lab	000601	N/A
Stereoscope	Olympus	SZH-ILLD (ESC125)	711005	Annual	Used	Aquatic Tox Lab	N/A	Biomon
Stereoscope	Olympus	SZXz-ILLD	9B49874	Annual	Used	Aquatic Tox Lab		Biomon
Waterbath	Thermo Scientific	C1R89	300253242	Annual	Used	Aquatic Tox Lab	P0131	UKN
Refrigerator	True	63366	909935	Annual	UKN	Aquatic Tox Lab		UKN
Water Purifier	ELGA Pure Lab	4LXXXSCM2	ULT00002887	N/A	Used	Aquatic Tox Lab	2628	Biomon
Mini fridge	Haier	HC27SG42RG	BS0882E1G00B KFCH0426	Annual	Used	Aquatic Tox Lab	n/A	N/A
RDO Probe	Thermo Scientific Orion	VSTAR-RD	15762	Daily	Used	Aquatic Tox Lab	N/A	Biomon
Oven (1)	Thermoscientific	Heratherm OGS400	41831936	Annual	New	Aquatic Tox Lab	2809	Biomon
Freezer	Kenmore	198.8130582	P20949206	Annual	Used	Aquatic Tox Lab	N/A	UKN
Incubator	Crown Tonka	Walk-In	260333-01 J01	Annual	New	Aquatic Tox Lab	N/A	Biomon

Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Balance - Top Loading	Mettler Toledo	PB3002-S	1121462199	See KanbanFlow	Used	Metals Prep	METBAL3	Supervisor's Office
Balance - Top Loading	Mettler Toledo	PB3002-S	1119070828	See KanbanFlow	Used	Metals Prep	METBAL2	Supervisor's Office
Balance - Top Loading	Torbal	AGN100	701001026	See KanbanFlow	Used	Metals Prep	METBAL5	Supervisor's Office
Balance - Top Loading	Mettler Toledo	PB3002-S	1128150150	See KanbanFlow	Used	TCLP	METBAL1	Supervisor's Office

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Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Balance - Top Loading	Mettler Toledo	XSR1202S	C20129128	See KanbanFlow	Used	TCLP	TCLPBAL2	Supervisor's Office
Balance - Top Loading	Mettler Toledo	XS40025	B712847753	See KanbanFlow	Used	TCLP	METBAL4	Supervisor's Office
Balance - Top Loading	Mettler Toledo	XS40025	B410367932	See KanbanFlow	Used	Mercury	HGBAL1	Supervisor's Office
Hotblock	Environmental Express	SC154	9062CECW3953	See KanbanFlow	Used	Metals Prep	MPE	Supervisor's Office
Hotblock	Environmental Express	SC154	2015CECW4278	See KanbanFlow	Used	Metals Prep	MPF	Supervisor's Office
Hotblock	Environmental Express	SC154	2015CECW4338	See KanbanFlow	Used	Metals Prep	MPG	Supervisor's Office
Hotblock	Environmental Express	SC154	2018CECW4965	See KanbanFlow	Used	Metals Prep	MPO	Supervisor's Office
Hotblock	Environmental Express	SC154	9062CECW3954	See KanbanFlow	Used	Mercury	HG1	Supervisor's Office
Hotblock	Environmental Express	SC154	9062CECW3956	See KanbanFlow	Used	Mercury	HG2	Supervisor's Office
Hotblock	Environmental Express	SC154	3994CEC1880	See KanbanFlow	Used	Mercury	MPC	Supervisor's Office
Hotblock	Environmental Express	SC154	missing	See KanbanFlow	Used	Mercury	MPD	Supervisor's Office
Hotblock	Environmental Express	SC154		See KanbanFlow	Used	Mercury	MPN	Supervisor's Office
Microwave	CEM	Mars 5 Xpress	MD7441	See KanbanFlow	Used	Metals Prep	MD7441	Supervisor's Office
Microwave	CEM	Mars 5 Xpress	MD4692	See KanbanFlow	Used	Metals Prep	MD4692	Supervisor's Office
Microwave	CEM	Mars 6	MJ2771	See KanbanFlow	Used	Metals Prep	MJ2771	Supervisor's Office
Microwave	CEM	Mars 6	MJ9747	See KanbanFlow	Used	Metals Prep	MJ9747	Supervisor's Office
Microwave	CEM	Mars 6	MJ9726	See KanbanFlow	Used	Metals Prep	MJ9726	Supervisor's Office
Centrifuge	Thermo Fisher	Sorvall ST 40	42496720	See KanbanFlow	Used	Metals Prep	N/A	Supervisor's Office
Turbidimeter	Hach	TL2300	2019060C0080	See KanbanFlow	Used	Metals Prep	N/A	Supervisor's Office
Turbidimeter	HACH	2100N	2020060C0093	See KanbanFlow	Used	Metals Prep	N/A	Supervisor's Office
Water Purifier	ELGA	Purelab Ultra	ULT00002665	See KanbanFlow	Used	Metals Prep	N/A	Supervisor's Office
Mercury Analyzer	Leeman	Hydra II AA	4049	See KanbanFlow	Used	Mercury	CVAA 5	Supervisor's Office

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Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Mercury Analyzer	Teledyne	QuickTrace 7600	US17016008	See KanbanFlow	Used	Mercury	CVAA 6	Supervisor's Office
Mercury Analyzer	PerkinElmer	FIMS 100	101S18111401	See KanbanFlow	Used	Mercury	CVAA 7	Supervisor's Office
ICP OES	Thermo	ICAP 7400 Duo	IC74DC141801	See KanbanFlow	Used	ICP	ICP 12	Supervisor's Office
ICP OES	Thermo	ICAP 7400 Duo	IC74DC143804	See KanbanFlow	Used	ICP	ICP 13	Supervisor's Office
ICP OES	Thermo	ICAP 7400 Duo	IC74DC151103	See KanbanFlow	Used	ICP	ICP 14	Supervisor's Office
ICP OES	Thermo	ICAP 6500 DUO	ICP-20074614		Used	Metals Lab	ICP15	Supervisor's Office
ICPMS	Agilent	7900 G8403A	JP16281469	See KanbanFlow	Used	ICPMS	ICPMS 8	Supervisor's Office
ICPMS	Agilent	(1) 7900 G8403A	JP14400452	See KanbanFlow	Used	ICPMS	ICPMS 9	Supervisor's Office
ICPMS	Agilent	7900 G8403A	JP14080164	See KanbanFlow	Used	ICPMS	ICPMS 10	Supervisor's Office
ICPMS	Agilent	7900 G8403A	JP17472096	See KanbanFlow	Used	ICPMS	ICPMS 11	Supervisor's Office
Refrigerator	Maxx Cold	MXM2-48RBHC	36031		Used	TCLP	P0136	On Line
TCLP Freezer	Danby Designer	DUFM043A1WDD	4315093419531	See KanbanFlow	Used	TCLP	Missing	Supervisor's Office
Stirrer/Hot Plate	Thermo	Cinarec+	C301001311514115	See KanbanFlow	Used	TCLP	1	Supervisor's Office
Stirrer/Hot Plate	IKA	RT15	3.492224	See KanbanFlow	Used	TCLP	2	Supervisor's Office
Stirrer/Hot Plate	IKA	RT15	3.503438	See KanbanFlow	Used	TCLP	3	Supervisor's Office
Stirrer/Hot Plate	IKA	RT15	3.503438	See KanbanFlow	Used	TCLP	4	Supervisor's Office
Stirrer/Hot Plate	IKA	RT15	3.527246	See KanbanFlow	Used	TCLP	5	Supervisor's Office
Tumbler	Environmental Express	12 Position	N/A	See KanbanFlow	Used	TCLP	A	Supervisor's Office
Tumbler	Environmental Express	12 Position	N/A	See KanbanFlow	Used	TCLP	E	Supervisor's Office
Tumbler	Environmental Express	12 Position	N/A	See KanbanFlow	Used	TCLP	I	Supervisor's Office
Tumbler	Environmental Express	12 Position	N/A	See KanbanFlow	Used	TCLP	L	Supervisor's Office
Tumbler	Environmental Express	12 Position	N/A	See KanbanFlow	Used	TCLP	O	Supervisor's Office

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Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Tumbler	Environmental Express	12 Position	N/A	See KanbanFlow	Used	TCLP	S	Supervisor's Office
Tumbler	Environmental Express	12 Position	N/A	See KanbanFlow	Used	TCLP	1	Supervisor's Office
Tumbler	Environmental Express	12 Position	N/A	See KanbanFlow	Used	TCLP	2	Supervisor's Office
Tumbler	Environmental Express	12 Position	N/A	See KanbanFlow	Used	TCLP	G	Supervisor's Office
Tumbler	Environmental Express	12 Position	N/A	See KanbanFlow	Used	TCLP	H	Supervisor's Office
Tumbler	Environmental Express	12 Position	N/A	See KanbanFlow	Used	TCLP	R	Supervisor's Office
Tumbler	Environmental Express	12 Position	N/A	See KanbanFlow	Used	TCLP	B	Supervisor's Office
pH Meter	Thermo	OrionVerastar	V04967	See KanbanFlow	Used	TCLP	V04967	Supervisor's Office
pH Meter	Thermo	OrionVerastarPro	V11227	See KanbanFlow	Used	TCLP	V11227	Supervisor's Office
pH meter	Thermo	Orion VersastarPro	V13429	See KanbanFlow	Used	TCLP	V13429	Supervisor's Office

Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Analytical Balance	Mettler Toledo	XSE1050DU	B634906554	Annual	New	Microbiology Lab	002929	Biomon
Class "I" weights	(1 set) Troemner	000565		Annual	New	Microbiology Lab	N/A	UKN
Autoclave	Barstead	Harvey	1277061222472	Annual	New	Microbiology Lab	1708	Biomon
Water Bath	Thermo Scientific	Precision CIR89	300380862	Annual	Used	Microbiology Lab		UKN
Quantitray Sealer	IDEXX	2X	QTP13172302569	Monthly	Used	Microbiology Lab	2803	Biomon
Incubator I10	Thermo Scientific Precision	PR505755L	300303584	Annual	Used	Microbiology Lab	30T8	Biomon
Colony Counter	Quebecor	3325	222649	N/A		Microbiology Lab		
Stereoscope	Olympus	SZXX-ILLD	9B48439	Annual	Used	Microbiology Lab	P0125	Biomon
UV light; short and long wave	Entela	UVP-56	F122708	Quarterly	Used	Microbiology Lab	F122708	Biomon
Autoclave	SterileMax	Harvey	1277061222472	Annual	Used	Microbiology Lab	1708	Biomon
pH meter/ Conductivity meter/LDO	Thermo Scientific Orion	VStar pro	V16919	Annual	New	Aquatic Tox Lab	V16919	Biomon
Incubator I7-2	Thermo Scientific	IGS100	42408345	Annual	Used	Aquatic Tox Lab	P0141	Biomon
Incubator I7-1	Thermo Scientific	IGS100	42408448	Annual	New	Aquatic Tox Lab	P0132	Biomon

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Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Analytical Balance	Mettler	PL602-S	1125081657	Annual	Unk	Bacteriology Lab	N/A	Mold Lab cabinet
Autoclave	Tuttnauer	2540EK	2906170	Annual	New	Bacteriology Lab	N/A	Mold Lab cabinet
Biolog MicroStation	Biolog, Inc.	Microlog 3	203222	Annual	New	Bacteriology Lab	1676	Mold Lab cabinet
BOD Skalar 2000	Skalar	2000	8123	Annual	New	BOD	1931	Mold Lab cabinet
Class I BSC	AirFiltronix	AirFiltronix HS 4500	41031	Annual	New	Mold Lab	1505	Mold Lab cabinet
Class II BSC	Labconco	Labconco 36209	30706555	Annual	USed	Bacteriology Lab	1374	Mold Lab cabinet
Class II BSC	Labconco	Labconco 36213	60554894	Annual	USed	Mold Lab	N/A	Mold Lab cabinet
COD Reactor	HACH	45600	900903221	N/A	New	BOD	N/A	Mold Lab cabinet
YSI ProOBOD LDS Probe	YSI		21C103980	N/A	New	BOD	N/A	Mold Lab cabinet
YSI ProOBOD LDS Probe	YSI		21C103978	N/A	New	BOD	N/A	Mold Lab cabinet
YSI ProOBOD LDS Probe	YSI		21G103335	N/A	New	BOD	N/A	Mold Lab cabinet
Fisher Scientific Vortex(q?)	Fisher Scientific		80109016	N/A	New	Mold	N/A	No
Incubator	Precision Scientific	30M	309100	N/A	New	Bacteriology Lab	1826	Mold lab cabinet
Incubator	Precision Scientific	ER505755R	300245487	N/A	New	BOD	P0127	Mold lab cabinet
Incubator	Thermo Scientific Precision	3721	233089-3323	N/A	New	BOD	2617	Mold Lab cabinet
Incubator	SHEL-LAB	SR120P	09000719	N/A	New	BOD	3079	BOD lab
Incubator	SHEL-LAB	SR120P	09000819	N/A	New	BOD	3079	BOD Lab
Incubator	SHEL-LAB	SR120P	11003819	N/A	New	BOD	N/A	BOD Lab
Incubator	VWR	2030	1000499	N/A	New	BOD	0902	Mold Lab cabinet
Incubator	Quincy Lab	10-100	I11-2454	N/A	New	Mold Lab	N/A	Mold lab cabinet
Incubator	Thermo Precision	PR505755R	300207736	N/A	New	Mold Lab	P0092	Mold lab cabinet
Microscope	NIKON	LABOPHOT	230064	Annual	Used	Mold Lab	N/A	UKN
Microscope	NIKON	LABOPHOT	235267	Annual	Used	Mold Lab	N/A	UKN
Microscope	Olympus	CH2	9G0216	Annual	Used	Mold Lab	N/a	UKN
Microscope	Olympus	BH-2	200733	Annual	Used	Mold Lab	1597	UKN
Microscope	Leitz	Laborlux	512663	Annual	Used	Mold Lab	N/A	UKN
pH meter	Thermo Scientific	Orion Star A211	X59095	N/A	New	BOD	N/A	BOD lab
Refrigerator	Frigidaire	FRT17G4BW9	BA703033306	N/A	NEW	Mold Lab	N/A	UKN
Refrigerator	Whirlpool	EL88TRRW503	442001106	N/A	New	Mold Lab	N/A	UKN
Refrigerator	Whirlpool	EL7ATRRMQ07	EWR4973976	N/A	New	Mold Lab	N/A	UKN
Refrigerator	Whirlpool	EL05PPXMQ	EEP3524864	N/A	NEW	Bacteriology Lab	N/A	UKN
Spectrophotometer	Hach	DR900	192180001065	N/A	New	BOD	N/A	BOD
Stereoscope	VWR Scientific	VWRS1	V168430	Annual	Used	Mold Lab	N/A	Mold lab cabinet
Stir Plate	VWR	DYLA-DUAL	120202001	N/A	New	Bacteriology Lab	N/A	UKN
Stir Plate	IKA	Big Squid	102	N/A	New	Bacteriology Lab	N/A	UKN
Stir Plate	VWR	7x7 AL4 HOT/STIR	180605003	N/A	New	BOD	N/A	UKN

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Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Stir Plate	VWR	205	7852	N/A	New	BOD	N/A	UKN
Turbidimeter	Biolog, Inc.	21907	06093898	Annual	New	Bacteriology Lab	N/A	Mold lab cabinet
Vortex Genie2 Mixer	VWR	G-560	2-223236	N/A	New	Bacteriology Lab	N/A	UKN
Waterbath	Fisher Sci	FSGPD20	300302839	N/A	New	Bacteriology Lab	N/A	Mold lab cabinet
Waterbath	Precision	Circulating 260	21-AJ11	N/A	New	BOD	N/A	Mold lab cabinet

Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Flow control valve	Plast-o-matic	FC050B	SA55CXFJN352	Semi-annual	New	Protozoan Lab	N/A	UKN
Centrifugal pump	Jabsco	18610-0271	0562309-MA	Semi-annual	Unk	Protozoan Lab	N/A	Crypto Lab
Graduated container	Nalgene	20 Liter Carboy	N/A	Semi-annual	New	Protozoan Lab	N/A	UKN
Laboratory shaker	Lab-Line	3587-4	0105-2679	Annual	New	Protozoan Lab	N/A	Crypto Lab
Laboratory shaker side arms	Lab-Line	3589	0105-2679	Annual	New	Protozoan Lab	N/A	Crypto Lab
1500 XG swinging bucket centrifuge	Damon/IEC Division	CRU-5000	23453388	Annual	Unk	Protozoan Lab	1863	Crypto Lab
1500 XG swinging bucket centrifuge	Damon/IEC Division	CRU-5000	23453744	Annual	Unk	Protozoan Lab	1863	Crypto Lab
1500 XG swinging bucket centrifuge	Damon/IEC Division	CRU-5000	2345497	annual	unk	Protozoan Lab	1863	Crypto Lab
Sample mixer/rotator	DYNAL	Cat#: 947.01	1004-3765	Annual	Unk	Protozoan Lab	RT1	UKN
Magnetic Particle Concentrator	DYNAL	MPC-1	N/A	N/A		Protozoan Lab	N/A	UKN
Magnetic Particle Concentrator	DYNAL	MPC-S	N/A	N/A		Protozoan Lab	N/A	UKN
Magnetic Particle Concentrator	DYNAL	MPC-6	N/A	N/A		Protozoan Lab	N/A	UKN
Flat-sided sample tubes	DYNAL	Cat#: 740.03	74003	N/A	New	Protozoan Lab	N/A	UKN
Epifluorescence/differential interference contract microscope	Olympus	BX-40	9E09944	Annual		Protozoan Lab	1554	Crypto Lab
Excitation/ band pass microscope for fluorescein isothiocyanate (FTIC)	C-squared	UN3100	023355	Annual		Protozoan Lab	1924	Crypto Lab
Excitation/ band pass filters for 4'6-diamidino-2-phenylindole (DAPI)	C-squared	UN41001	8H2122	Annual		Protozoan Lab	N/A	Crypto Lab
Masterflex pump	Cole Parmer	7553-50				Protozoan Lab		Crypto Lab
Balance	Denver Instrument	MXX-412	19053216	Annual		Protozoan Lab		Crypto Lab
Biosafety Cabinet	Labconco	Cat#: 36208043726	050J372	Annual		Protozoan Lab	1557	Crypto Lab

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Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Gas Chromatograph 2	HP 6890	HP 6890	US00004397	As needed	Used	SVOC	svcompa	Online
Gas Chromatograph 3	Agilent 6890	Agilent 6890	US00002051	As needed	Used	SVOC	svcompo	Online
Gas Chromatograph 7	Agilent 6890	Agilent 6890	US10350064	As needed	Used	SVOC	Svcompe	Online
Gas Chromatograph 8	Agilent 6890	Agilent 6890	DE00022534	As needed	Used	SVOC	svcompp	Online
Gas Chromatograph 9	HP 6890	HP 6890	US00029095	As needed	Used	SVOC	Svcompj	Online
Gas Chromatograph 10	Agilent 6890	Agilent 6890	US00039655	As needed	Used	SVOC	Svcompk	Online
Gas Chromatograph 11	Agilent 6890	Agilent 6890	US00040550	As needed	Used	SVOC	Svcompn	Online
Gas Chromatograph 12	Agilent 6890	Agilent 6890	US00034155	As needed	Used	SVOC	Svcompaf	Online
Gas Chromatograph 13	HP 6890	HP 6890	US00010364	As needed	Used	SVOC	Svcomps	Online
Gas Chromatograph 14	HP 6890	HP 6890	US00020581	As needed	Used	SVOC	svcompt	Online
Gas Chromatograph 16	Agilent 6890	Agilent 6890	US10212071	As needed	Used	SVOC	Svcompv	Online
Gas Chromatograph 17	Agilent 6890	Agilent 6890	US10344078	As needed	Used	SVOC	Svcompw	Online
Gas Chromatograph 18	Agilent 6890	Agilent 6890	US10351038	As needed	Used	SVOC	Svcompd	Online
Gas Chromatograph 19	Agilent 6890	Agilent 6890	CN10516070	As needed	Used	SVOC	Svompaa	Online
Gas Chromatograph 20	Agilent 6890	Agilent 6890	CN10543031	As needed	Used	SVOC	Svcompa b	Online
Gas Chromatograph 21	Agilent 7890	Agilent 7890	CN10730070	As needed	Used	SVOC	Svcompa e	Online
Gas Chromatograph 22	Agilent 7890	Agilent 7890	CN10730081	As needed	Used	SVOC	svcompa d	Online
Gas Chromatograph 23	Agilent 6890	Agilent 6890	CN92174366	As needed	Used	SVOC	Svcompa g	Online
Gas Chromatograph 24	Agilent 6890	Agilent 6890	CN92174369	As needed	Used	SVOC	Svcompa h	Online
Gas Chromatograph 25	Agilent 7890	Agilent 7890	CN10091009	As needed	Used	SVOC	Svcompaj	Online
Gas Chromatograph 26	Agilent 7890	Agilent 7890	CN11501138	As needed	Used	SVOC	Svcompar	Online
Gas Chromatograph 27	Agilent 7890	Agilent 7890	CN11501139	As needed	Used	SVOC	Svcompas	Online
Gas Chromatograph 28	Agilent 7890	Agilent 7890	US11521018	As needed	Used	SVOC	Svcompat	Online

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Gas Chromatograph 29	Agilent 7890	Agilent 7890	CN11521077	As needed	Used	SVOC	Svcompa u	Online
Gas Chromatograph 30	Agilent 7890	Agilent 7890	US11521020	As needed	Used	SVOC	Svcompa v	Online
Gas Chromatograph 31	Agilent 7890	Agilent 7890	CN13503096	As needed	Used	SVOC	Svcompb a	Online
Gas Chromatograph 32	Agilent 7890	Agilent 7890	CN14423060	As needed	Used	SVOC	Svcompb c	Online
Gas Chromatograph 33	Agilent 7890	Agilent 7890	CN15033026	As needed	Used	SVOC	Svcompb d	Online
Gas Chromatograph 34	Agilent 7890	Agilent 7890	CN15033027	As needed	Used	SVOC	svcompb e	Online
Gas Chromatograph 35	Agilent 7890	Agilent 7890	US10838014	As needed	Used	SVOC	svcompb h	Online
Gas Chromatograph 36	Agilent 7890	Agilent 7890	US10205134	As needed	Used	SVOC	svcompbi	Online
Gas Chromatograph 38	Agilent 7890	Agilent 7890	US10142052	As needed	Used	SVOC	svcompb k	Online
Gas Chromatograph 41	Agilent 7890	Agilent 7890	CN16123059	As needed	Used	SVOC	svcompb m	Online
Gas Chromatograph 42	Agilent 7890	Agilent 7890	US1952A007	As needed	Used	SVOC	svcompb p	Online
Gas Chromatograph 43	Agilent 7890	Agilent 7890	US1951A023	As needed	Used	SVOC	svcompb q	Online
Gas Chromatograph 45	Agilent 8890	Agilent 8890	US2016A022	As needed	Used	SVOC	svcompb x	Online
Gas Chromatograph 46	Agilent 7890	Agilent 7890	CN13443001	As needed	Used	SVOC	svcompb y	Online
Gas Chromatograph 47	Agilent 7890	Agilent 7890	CN10301152	As needed	Used	SVOC	svcompb z	Online
Gas Chromatograph 48	Agilent 6890	Agilent 6890	CN10344042	As needed	Used	SVOC	svcompca	Online
Gas Chromatograph 49	Agilent 7890	Agilent 7890	CN10814061	As needed	Used	SVOC	svcompc b	Online
Gas Chromatograph 50	Agilent 8890	Agilent 8890	US2119A057	As needed	Used	SVOC	svcompcc	Online
Gas Chromatograph Detectors 2	FID Detector	FID Detector	N/A	As needed	Used	SVOC	scvcompa	Online
Gas Chromatograph Detectors 3	NPD/NPD Detectors	NPD/NPD Detectors	N/A	As needed	Used	SVOC	Svcompo	Online
Gas Chromatograph Detectors 7	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompe	Online
Gas Chromatograph Detectors 8	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompp	Online

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Gas Chromatograph Detectors 9	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompj	Online
Gas Chromatograph Detectors 10	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompk	Online
Gas Chromatograph Detectors 11	ECD/ECD Detectors	ECD/ECD Detectors	F) U11750 B) U12481	As needed	Used	SVOC	svcompn	Online
Gas Chromatograph Detectors 12	FPD/FPD Detectors	FPD/FPD Detectors	N/A	As needed	Used	SVOC	Svcompaf	Online
Gas Chromatograph Detectors 13	Detectors	Detectors	N/A	As needed	Used	SVOC	Svcomps	Online
Gas Chromatograph Detectors 14	ECD/ECD Detectors	ECD/ECD Detectors	F) U3113 B) U2620	As needed	Used	SVOC	Svcompt	Online
Gas Chromatograph Detectors 16	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompv	Online
Gas Chromatograph Detectors 17	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompw	Online
Gas Chromatograph Detectors 18	ECD/ECD Detectors	ECD/ECD Detectors	F) U11613 B) U13988	As needed	Used	SVOC	Svcompd	Online
Gas Chromatograph Detectors 19	ECD/ECD Detectors	ECD/ECD Detectors	F) U6632 B) U8422	As needed	Used	SVOC	Svcompa a	Online
Gas Chromatograph Detectors 20	ECD/ECD Detectors	ECD/ECD Detectors	F) U13989 B) U0418	As needed	Used	SVOC	Svcompa b	Online
Gas Chromatograph Detectors 21	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompa e	Online
Gas Chromatograph Detectors 22	ECD/ECD Detectors	ECD/ECD Detectors	F) U12039 B) 12038	As needed	Used	SVOC	Svcompa d	Online
Gas Chromatograph Detectors 23	ECD/ECD Detectors	ECD/ECD Detectors	F) U2621 B) U8104	As needed	Used	SVOC	Svcompa g	Online
Gas Chromatograph Detectors 24	ECD/ECD Detectors	ECD/ECD Detectors	F) U8423 B) U12482	As needed	Used	SVOC	Svcompa h	Online
Gas Chromatograph Detectors 25	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompaj	Online
Gas Chromatograph Detectors 26	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompar	Online
Gas Chromatograph Detectors 27	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompas	Online
Gas Chromatograph Detectors 28	ECD/ECD Detectors	ECD/ECD Detectors	F) U26768 B) U26237	As needed	Used	SVOC	Svcompat	Online
Gas Chromatograph Detectors 29au	ECD/ECD Detectors	ECD/ECD Detectors	F) U20277 B) U20299	As needed	Used	SVOC	Svcompa u	Online
Gas Chromatograph Detectors 30	ECD/ECD Detectors	ECD/ECD Detectors	F) U20425 B) U20424	As needed	Used	SVOC	Svcompa v	Online
Gas Chromatograph Detectors 31	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompb a	Online

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Gas Chromatograph Detectors 32	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompb c	Online
Gas Chromatograph Detectors 33	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompb d	Online
Gas Chromatograph Detectors 34	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompb e	Online
Gas Chromatograph Detectors 35	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompb h	Online
Gas Chromatograph Detectors 36	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompbi	Online
Gas Chromatograph Detectors 38	ECD/ECD Detectors	ECD/ECD Detectors	F) U14736 B) U16284	As needed	Used	SVOC	Svcompb k	Online
Gas Chromatograph Detectors 41	NPD/NPD Detectors	NPD/NPD Detectors	N/A	As needed	Used	SVOC	Svcompb p	Online
Gas Chromatograph Detectors 42	ECD/ECD Detectors	ECD/ECD Detectors	F) U37659 B) U37661	As needed	Used	SVOC	Svcompb p	Online
Gas Chromatograph Detectors 43	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompb q	Online
Gas Chromatograph Detectors 45	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompb x	Online
Gas Chromatograph Detectors 46	ECD/ECD Detectors	ECD/ECD Detectors	F) U39219 B) U39356	As needed	Used	SVOC	Svcompb y	Online
Gas Chromatograph Detectors 47	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcompb z	Online
Gas Chromatograph Detectors 48	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcomp a	Online
Gas Chromatograph Detectors 49	FPD/FPD Detectors	FPD/FPD Detectors	N/A	As needed	Used	SVOC	Svcomp b	Online
Gas Chromatograph Detectors 50	FID Detector	FID Detector	N/A	As needed	Used	SVOC	Svcomp c	Online
Gas Chromatograph/Mass Spectrometer 1	Agilent 6890GC 5973 MSD	Agilent 6890GC 5973 MSD	GC CN10335001 MS US33220022	As needed	Used	SVOC	Svcompf	Online
Gas Chromatograph/Mass Spectrometer 2	Agilent 6890GC 5973 MSD	Agilent 6890GC 5973 MSD	GC US10409048 MS US35120400	As needed	Used	SVOC	Svcomp c	Online
Gas Chromatograph/Mass Spectrometer 4	Agilent 6890GC 5973 MSD	Agilent 6890GC 5973 MSD	GC CN10403067 MS US35120308	As needed	Used	SVOC	Svcomp h	Online
Gas Chromatograph/Mass Spectrometer 7	Agilent 6890GC 5973 MSD	Agilent 6890GC 5973 MSD	GC US00023180 MS US03940745	As needed	Used	SVOC	svcomp m	Online
Gas Chromatograph/Mass Spectrometer 9	Agilent 6890GC 5973 MSD	Agilent 6890GC 5973 MSD	GC CN10344042 MS US33220158	As needed	Used	SVOC	Svcomp x	Decomm issioned and repurpos ed as SVGC48

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Gas Chromatograph/ Mass Spectrometer 10	Agilent 6890GC 5973 MSD	Agilent 6890GC 5973 MSD	GC CN10340045 MS US33220183	As needed	Used	SVOC	Svcompy	Online
Gas Chromatograph/ Mass Spectrometer 11	Agilent 6890GC 5975 MSD	Agilent 6890GC 5975 MSD	GC CN10509031 MS US60532657	As needed	Used	SVOC	Svcompa c	Online
Gas Chromatograph/ Mass Spectrometer 12	Agilent 7890GC 5975 MSD	Agilent 7890GC 5975 MSD	GC CN10728074 MS 12-0706-1325	As needed	Used	SVOC	Svcompai	Online
Gas Chromatograph/ Mass Spectrometer 13	Agilent 7890GC 5975 MSD	Agilent 7890GC 5975 MSD	GC CN10301081 MS US10313621	As needed	Used	SVOC	Svcompa k	Online
Gas Chromatograph/ Mass Spectrometer 14	Agilent 7890GC 5975 MSD	Agilent 7890GC 5975 MSD	GC CN11031022 MS US11093726	As needed	Used	SVOC	Svcompal	Online
Gas Chromatograph/ Mass Spectrometer 15	Agilent 7890GC 5975 MSD	Agilent 7890GC 5975 MSD	GC CN10301081 MS US10313621	As needed	Used	SVOC	Svcompa m	Online
Gas Chromatograph/ Mass Spectrometer 16	Agilent 7890GC ~~5975 MSD~~	Agilent 7890GC ~~5975 MSD~~	GC CN10301152 ~~MS US10313616~~	As needed	Used	SVOC	~~Svcompa n~~	Decomm issioned and repurpos ed as SVGC47
Gas Chromatograph/ Mass Spectrometer 17	Agilent 7890GC 5975 MSD	Agilent 7890GC 5975 MSD	GC CN11191064 MS US11363807	As needed	Used	SVOC	Svcompa o	Online
Gas Chromatograph/ Mass Spectrometer 18	Agilent 7890GC 5975 MSD	Agilent 7890GC 5975 MSD	GC CN11401093 MS US11403903	As needed	Used	SVOC	Svcompa p	Online
Gas Chromatograph/ Mass Spectrometer 19	Agilent 7890GC 5975 MSD	Agilent 7890GC 5975 MSD	GC CN 11391051 MS US11383838	As needed	Used	SVOC	Svcompa q	Online
Gas Chromatograph/ Mass Spectrometer 20	Agilent 7890GC 5975 MSD	Agilent 7890GC 5975 MSD	GC CN12031161 MS US11503941	As needed	Used	SVOC	Svcompa w	Online
Gas Chromatograph/ Mass Spectrometer 21	Agilent 7890GC 5975 MSD	Agilent 7890GC 5975 MSD	GC CN12031160 MS US11513903	As needed	Used	SVOC	Svcompa x	Online
Gas Chromatograph/ Mass Spectrometer 22	Agilent 7890GC 5975 MSD	Agilent 7890GC 5975 MSD	GC CN11521157 MS US12023909	As needed	Used	SVOC	Svcompa y	Online
Gas Chromatograph/ Mass Spectrometer 23	Agilent 7890GC 5975 MSD	Agilent 7890GC 5975 MSD	GC CN12031114 MS US11433926	As needed	Used	SVOC	Svcompa z	Online
Gas Chromatograph/ Mass Spectrometer 24	Agilent 7890GC 5977 MSD	Agilent 7890GC 5977 MSD	GC CN14163165 MS US92043581	As needed	Used	SVOC	Svcompb b	Online
Gas Chromatograph/ Mass Spectrometer 25	Agilent 7890GC 5975 MSD	Agilent 7890GC 5975 MSD	GC CN10906031 MS US11343905	As needed	Used	SVOC	Svcompbf	Online

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Gas Chromatograph/ Mass Spectrometer 26	Agilent 7890GC 5975 MSD	Agilent 7890GC 5975 MSD	GC CN10021075 MS US10143111	As needed	Used	SVOC	Svcompbl	Online
Gas Chromatograph/ Mass Spectrometer (QQQ) 27	Agilent 7890GC 7010 MSD (QQQ)	Agilent 7890GC 7010 MSD (QQQ)	GC US18373018 MS US1730V003	As needed	Used	SVOC	Svcompbn	Transferred to IDEA Lab.
Gas Chromatograph/ Mass Spectrometer 28	Agilent 7890GC 5977 MSD	Agilent 7890GC 5977 MSD	GC CN13483185 MS US1349M227	As needed	Used	SVOC	Svcompbo	Online
Gas Chromatograph/ Mass Spectrometer 29	Agilent 8890GC 5977 MSD	Agilent 8890GC 5977 MSD	GC US1951A019 MS US1952M030	As needed	Used	SVOC	Svcompbr	Online
Gas Chromatograph/ Mass Spectrometer 30	Agilent 8890GC 5977 MSD	Agilent 8890GC 5977 MSD	GC US1947A006 MS US2040M022	As needed	Used	SVOC	Svcompbs	Online
Gas Chromatograph/ Mass Spectrometer 31	Agilent 8890GC 5977 MSD	Agilent 8890GC 5977 MSD	GC US2014A033 MS US2041M031	As needed	Used	SVOC	Svcompbu	Online
Gas Chromatograph/ Mass Spectrometer 32	Agilent 8890GC 5977 MSD	Agilent 8890GC 5977 MSD	GC US2016A007 MS US2041M015	As needed	Used	SVOC	Svcompbv	Online
Gas Chromatograph/ Mass Spectrometer 33	Agilent 8890GC 5977 MSD	Agilent 8890GC 5977 MSD	GC US2014A035 MS US2040M015	As needed	Used	SVOC	Svcompbw	Online
Liquid Chromatograph/ Mass Spectrometer (QQQ) LCMSMS1	Agilent 1290/1290/ 1290LC 6470 MSD (QQQ)	Agilent 1290LC 6470 MSD (QQQ)	Multisampler DEBAS01954 MS/MS SG1846G104 Pump DEBA202992 MCT DEBA404366	As needed	Used	SVOC	LCMSMS1	Online
Liquid Chromatograph/ Mass Spectrometer (QQQ) LCMSMS2	Agilent 1260/1200/ 1200LC 6460 MSD (QQQ)	Agilent 1260/1200/ 1200LC 6460 MSD (QQQ)	Multisampler DEAAC40230 MS/MS SG11477210 Pump DEAB715448 TCC DEACN42876	As needed	Used	SVOC	LCMSMS2	In development
High Performance Liquid Chromatography (HPLC1)	Agilent 1100 Series DAD/FLD	Agilent 1100 Series DAD/FLD	DAD de01608402 FLD de23904489	As needed	Used	SVOC	Hplc1	Online
High Performance Liquid Chromatography (HPLC2)	Agilent 1100 Series DAD/FLD	Agilent 1100 Series DAD/FLD	DAD de30518420 FLD de92001880	As needed	Used	SVOC	Hplc2	Online
High Performance Liquid Chromatography	Agilent 1100 Series DAD	Agilent 1100 Series DAD	DAD us64400711	As needed	Used	SVOC	Hplc3	Online
High Performance Liquid Chromatography	Agilent 1100 Series DAD	Agilent 1100 Series DAD	DAD de43623013	As needed	Used	SVOC	Hplc4	Online

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Analytical Balance	Mettler-Toledo XS204		1122411619	As needed	Used	Ext. Lab		Book shelf
Automated Soxhlet	Gerhardt Soxtherm		2951	As needed	Used	Ext. Lab	#1	In lab on shelf next to instrument
Automated Soxhlet	Gerhardt Soxtherm		2952	As needed	Used	Ext. Lab	#2	In lab on shelf next to instrument
Automated Soxhlet	Gerhardt Soxtherm		2953	As needed	Used	Ext. Lab	#3	In lab on shelf next to instrument
Automated Soxhlet	Gerhardt Soxtherm		2954	As needed	Used	Ext. Lab	#4	In lab on shelf next to instrument
Centrifuge	Sorvall ST-41		2225	As needed	Used	Ext. Lab		Book shelf in lab
Centrifuge	Sorvall ST-41		2227	As needed	Used	Ext. Lab		Book shelf in lab
Microwave	CEM MARS 6		MJ2518	As needed	Used	Ext. Lab	#3	Book shelf in lab
Microwave	CEM MARS 6		MJ6367	As needed	Used	Ext. Lab	#4	Book shelf in lab
Microwave	CEM MARS 6		MJZ868	As needed	Used	Ext. Lab	#2	Book shelf in lab
Microwave	CEM MARS 6	MARS 6	MY2163	As needed	New	Ext. Lab	#5	Book shelf in lab
Microwave	CEM MARS 6	MARS 6	MY2132	As needed	New	Ext. Lab	#6	Book shelf in lab
O&G Solvent Evaporator	Horizon Speed-Vap III		04-2020	As needed	Used	Ext. Lab	#1	Book shelf in lab
O&G Solvent Evaporator	Horizon Speed-Vap III		03-1001	As needed	Used	Ext. Lab	#3	Book shelf in lab
O&G Solvent Evaporator	Horizon Speed-Vap IV		15-0055	As needed	Used	Ext. Lab	#4	Book shelf in lab
O&G Solvent Evaporator	Horizon Speed-Vap IV		15-0056	As needed	Used	Ext. Lab	#2	Book shelf in lab
O&G SPE Extractor	Horizon SPE-DEX 3100		15-0113	As needed	Used	Ext. Lab		Disk in lab
O&G SPE Extractor	Horizon SPE-DEX 3100		15-0116	As needed	Used	Ext. Lab		Disk in lab
O&G SPE Extractor	Horizon SPE-DEX 3100		15-0117	As needed	Used	Ext. Lab		Disk in lab
O&G SPE Extractor	Horizon SPE-DEX 3100		15-0118	As needed	Used	Ext. Lab		Disk in lab

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Oven	Fisher		00700127	As needed	Used	Ext. Lab		Bookshelf in lab
Oven	Fisher		1000594 F210266022FD	As needed	Used	Ext. Lab		Bookshelf in lab
Ring & Puck Mill	SPEX ShatterBOX 8530		10191	As needed	Used	Ext. Lab		Bookshelf in lab
Sonicator	Qsonica Q700		92183M-16-16	As needed	Used	Ext. Lab		Bookshelf in lab
Sonicator	Qsonica Q700		92186M-10-16	As needed	Used	Ext. Lab		Bookshelf in lab
Sonicator	Qsonica Q700		92189M-10-16	As needed	Used	Ext. Lab		Bookshelf in lab
Sonicator	Qsonica Q700		9219M-10-16	As needed	Used	Ext. Lab		Bookshelf in lab
Sonicator	Qsonica Q700	Q700	120131U-05-21	As needed	New	Ext. Lab	#5	Bookshelf in lab
Sonicator	Qsonica Q700	Q700	120137U-05-21	As needed	New	Ext. Lab	#6	Bookshelf in lab
Water Bath	ThermoScientific		2033602-102	As needed	Used	Ext. Lab		Bookshelf in lab
Water Bath	Gant		VH1535002	As needed	Used	EXT. Lab		Bookshelf
Microwave	GEM MARS Xpress		MD2861	As needed	New	EXT. Lab	#1	Decommissioned
Centrifuge	Sorvall ST-41		42498357	As needed	Used	EXT. Lab		Bookshelf
Concentrator	Buchi	Buchi Syncore Plus	1100082324	As needed	New	EXT. Lab	#1	Bookshelf
Concentrator	Buchi	Buchi Syncore Plus	1100082473	As needed	New	EXT. Lab	#2	Bookshelf
Concentrator	Buchi	Buchi Syncore Plus	1100084062	As needed	New	EXT. Lab	#3	Bookshelf
Concentrator	Buchi	Buchi Syncore Plus	1100084063	As needed	New	EXT. Lab	#4	Bookshelf
Concentrator	XcelVap	Horizon Technologies	17-5548	As needed	Used	EXT. Lab		On Disc in Lab
Concentrator	XcelVap	Horizon Technologies	19-5688	As needed	Used	EXT. Lab		On Disc in Lab
Concentrator	XcelVap	Horizon Technologies	17-5564	As needed	Used	EXT. Lab		On Disc in Lab
Concentrator	XcelVap	Horizon Technologies	17-5686	As needed	Used	EXT. Lab		On Disc in Lab
Concentrator	XcelVap	Horizon Technologies	19-5687	As needed	Used	EXT. Lab		On Disc in Lab
Concentrator	XcelVap	Horizon Technologies	17-5549	As needed	Used	EXT. Lab		On Disc in Lab
Concentrator	XcelVap	Horizon Technologies	17-5541	As needed	Used	EXT. Lab		On Disc in Lab
Concentrator	XcelVap	Horizon Technologies	17-5545	As needed	Used	EXT. Lab		On Disc in Lab
Concentrator	XcelVap	Horizon Technologies	17-5547	As needed	Used	EXT. Lab		On Disc in Lab
Concentrator	XcelVap	Horizon Technologies	18-5619	As needed	Used	EXT. Lab		On Disc in Lab
O/G SPE Extractor		Horizon Technologies	15-0104	As needed	Used	EXT. Lab		On Disc in Lab
O/G SPE Extractor		Horizon Technologies	16-0169	As needed	Used	EXT. Lab		On Disc in Lab
O&G Solvent Evaporator	Horizon Speed-Vap IV	Horizon Speed-Vap IV	10-0778	As needed	Used	EXT. Lab		Bookshelf in Lab
O&G Solvent Evaporator	Horizon Speed-Vap IV	Horizon Speed-Vap IV	04-2020	As needed	Used	EXT. Lab		Bookshelf in Lab
Analytical Balance	Rad Wag		552935	As needed	Used	EXT. Lab	EXTBAL #4	Bookshelf in Lab
Analytical Balance	Rad Wag		537906	As needed	Used	EXT. Lab	EXTBAL #3	Bookshelf in Lab

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Analytical Balance	Rad Wag		552941	As needed	Used	EXT. Lab	EXTBAL #5	Bookshelf in Lab
Analytical Balance	Rad Wag		545380	As needed	Used	EXT. Lab	EXTBAL #7	Bookshelf in Lab
Analytical Balance	Rad Wag		537906	As needed	Used	EXT. Lab	EXTBAL #9	Bookshelf in Lab

Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Gas Chromatograph	Hewlett Packard	5890 Series II	3336A60095	As Needed	Used	Volatiles	VOCGC1 FID1A= FID FID2B= PID	Online
Gas Chromatograph	Agilent	6890	CN10609095	As Needed	Used	Volatiles	VOCGC2 FID1A= FID ELC2B= PID	Online
Gas Chromatograph	Hewlett Packard	5890 Series II	3336A50614	As Needed	Used	Volatiles	VOCGC4 FID1A= FID FID2B= PID	Online
Gas Chromatograph	Hewlett Packard	5890 Series II	3027A29678	As Needed	Used	Volatiles	VOCGC5 FID1A= FID FID2B= PID	Online
Gas Chromatograph	Hewlett Packard	5890 Series II	2950A27895	As Needed	Used	Volatiles	VOCGC6 FID1A= FID FID2B= PID	Online
Gas Chromatograph	Hewlett Packard	5890 Series II	3336A55283	As Needed	Used	Volatiles	VOCGC7 FID1A= FID FID2B= PID	Online
Gas Chromatograph	Agilent	6890	US00022519	As Needed	Used	Volatiles	VOCGC10 FID1A= FID FID2B= PID	Online
Gas Chromatograph	Agilent	6890	US00040221	As Needed	Used	Volatiles	VOCGC12 FID1A= FID FID2B= PID	Online
Gas Chromatograph	Hewlett Packard	5890 Series II	2921A23548	As Needed	Used	Volatiles	VOCGC13 FID1A= FID FID2B= PID	Online
Gas Chromatograph	Agilent	6890	CN10406054	As Needed	Used	Volatiles	VOCGC14 FID1A= FID ELC2B= PID	Online
Gas Chromatograph	Agilent	6890	US10232130	As Needed	Used	Volatiles	VOCGC15 ELC1A= FID ELC2B= PID	Online
Gas Chromatograph	Agilent	8890 GC	GC US2120A021	As Needed	Used	Volatiles	VOCGC16 FID1A=FID FID2B=PID	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC 5975 MSD	GC CN10517046 MS US63234371	As Needed	Used	Volatiles	VOCMS2	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC 5973 MSD	GC US00023465 MS US82311257	As Needed	Used	Volatiles	VOCMS4	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC 5973 MSD	GC CN10343037 MS US44647141	As Needed	Used	Volatiles	VOCMS6	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC 5973 MSD	GC CN10339006 MS US33220045	As Needed	Used	Volatiles	VOCMS13	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC 5973 MSD	GC US00006479 MS US82321899	As Needed	Used	Volatiles	VOCMS16	Online

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Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC 5975 MSD	GC CN621A4367 MS US469A4832	As Needed	Used	Volatiles	VOCMS20	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC 5975 MSD	GC CN621A4368 MS US469A4833	As Needed	Used	Volatiles	VOCMS21	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC 5975 MSD	GC CN99205324 MS US54441572	As Needed	Used	Volatiles	VOCMS22	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC 5975 MSD	GC CN10728068 MS US71236616	As Needed	Used	Volatiles	VOCMS23	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC 5975 MSD	GC CN10728074 MS US98003634	As Needed	Used	Volatiles	VOCMS25	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC 5975 MSD	GC CN11381060 MS US11383834	As Needed	Used	Volatiles	VOCMS26	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC 5975 MSD	GC CN10301155 MS US10313619	As Needed	Used	Volatiles	VOCMS27	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC 5973 MSD	GC US10208101 MS US10442380	As Needed	Used	Volatiles	VOCMS28	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	6890 GC 5973 MSD	GC US000034135 MS US94240103	As Needed	Used	Volatiles	VOCMS30	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC 5975 MSD	GC CN13113015 MS US92013978	As Needed	Used	Volatiles	VOCMS32	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC 5975 MSD	GC CN11351165 MS US63810153	As Needed	Used	Volatiles	VOCMS33	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC 5975 MSD	GC CN10849077 MS US83131017	As Needed	Used	Volatiles	VOCMS35	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC 5975 MSD	GC CN13153007 MS US83141150	As Needed	Used	Volatiles	VOCMS36	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC 5977 MSD	GC CN15333012 MS US1534M407	As Needed	Used	Volatiles	VOCMS37	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	7890 GC 5975 MSD	GC CN11281031 MS US1713D003	As Needed	Used	Volatiles	VOCMS38	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	7890A GC 5977A MS	GC CN10151020 MS US1417L240	As Needed	Used	Volatiles	VOCMS39	Online

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Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Gas Chromatograph/ Mass Spectrometer	Agilent	7890B GC 5977A MSD	GC CN15133171 MS US1542L427	As Needed	Used	Volatiles	VOCMS40	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	7890B GC 5977B MS	GC CN10940090 MS US1705M027	As Needed	Used	Volatiles	VOCMS41	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	7890B GC 5977B MS	GC CN17010001 MS US1706M049	As Needed	Used	Volatiles	VOCMS42	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	Intuvo 9000 GC 5977HES MS	GC CN17040005 MS US1714D003	As Needed	Used	Volatiles	VOCMS44	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	7890B GC 5973 MSD	GC US14453011 MS US1451L418	As Needed	Used	Volatiles	VOCMS52	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	8890B GC 5977B MS	GC US1946A049 MS US1945M023	As Needed	New	Volatiles	VOCMS53	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	8890B GC 5977B MS	GC US1946A050 MS US1946M007	As Needed	New	Volatiles	VOCMS54	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	8890B GC 5977B MS	GC US1946A054 MS US1946M008	As Needed	New	Volatiles	VOCMS55	Online
Gas Chromatograph/ Mass Spectrometer	Agilent	8890B GC 5977B MS	GC US1946A056 MS US1945M026	As Needed	New	Volatiles	VOCMS56	Online
as Chromatograph/ Mass Spectrometer	Agilent	8890 GC 5977B MS	GC US1947A068 MS US2040M031	As Needed	New	Volatiles	VOCMS57	Online
as Chromatograph/ Mass Spectrometer	Agilent	8890 GC 5977B MS	GC US2014A037 MS US2041M011	As Needed	New	Volatiles	VOCMS58	Online
as Chromatograph/ Mass Spectrometer	Agilent	8890 GC 5977B MS	GC US2014A036 MS US2040M033	As Needed	New	Volatiles	VOCMS59	Online
Centurion Autosampler	PTS/EST	Centurion	CENTS385091214	As Needed	Used	Volatiles	VOCGC2	Online
Centurion Autosampler	PTS/EST	Centurion	CENTS368051214	As Needed	Used	Volatiles	VOCMS6	Online
Centurion Autosampler	PTS/EST	Centurion	CENTS500041117	As Needed	Used	Volatiles	VOCMS13	Online
Centurion Autosampler	PTS/EST	Centurion	CENTW80106212 1	As Needed	Used	Volatiles	VOCMS16	Online
Centurion Autosampler	PTS/EST	Centurion	CENTS396112014	As Needed	Used	Volatiles	VOCMS21	Online
Centurion Autosampler	PTS/EST	Centurion	CENTW80306212 1	As Needed	Used	Volatiles	VOCMS22	Online
Centurion Autosampler	PTS/EST	Centurion	CENTS386091214	As Needed	Used	Volatiles	VOCMS23	Online
Centurion Autosampler	PTS/EST	Centurion	CENTS754102820	As Needed	Used	Volatiles	VOCMS25	Online

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Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Centurion Autosampler	PTS/EST	Centurion	CENTS170072010	As Needed	Used	Volatiles	VOCMS26	Online
Centurion Autosampler	PTS/EST	Centurion	CENTS375071714	As Needed	Used	Volatiles	VOCMS30	Online
Centurion Autosampler	PTS/EST	Centurion	CENTS163052610	As Needed	Used	Volatiles	VOCMS33	Online
Centurion Autosampler	PTS/EST	Centurion	CENTW802062121	As Needed	Used	Volatiles	VOCMS36	Online
Centurion Autosampler	PTS/EST	Centurion	CENTW804062121	As Needed	Used	Volatiles	VOCMS37	Online
Centurion Autosampler	PTS/EST	Centurion	CENTS171072010	As Needed	Used	Volatiles	VOCMS39	Online
Centurion Autosampler	PTS/EST	Centurion	CENTS338112213	As Needed	Used	Volatiles	VOCMS40	Online
Centurion Autosampler	PTS/EST	Centurion	CENTS395112014	As Needed	Used	Volatiles	VOCMS42	Online
Centurion Autosampler	PTS/EST	Centurion	CENTS499041117	As Needed	Used	Volatiles	VOCMS44	Online
Centurion Autosampler	PTS/EST	Centurion	CENTS667111119	As Needed	Used	Volatiles	VOCMS53	Online
Centurion Autosampler	PTS/EST	Centurion	CENTS664110519	As Needed	Used	Volatiles	VOCMS54	Online
Centurion Autosampler	PTS/EST	Centurion	CENTS673120319	As Needed	Used	Volatiles	VOCMS55	Online
Centurion Autosampler	PTS/EST	Centurion	CENTS674120319	As Needed	Used	Volatiles	VOCMS56	Online
Centurion Autosampler	PTS/EST	Centurion	CENTS756102820	As Needed	Used	Volatiles	VOCMS57	Online
Centurion Autosampler	PTS/EST	Centurion	CENTS755102820	As Needed	Used	Volatiles	VOCMS58	Online
Centurion Autosampler	PTS/EST	Centurion	CENTW800062121	As Needed	Used	Volatiles	VOCMS59	Online
Autosampler	Varian	Archon	13809	As Needed	Used	Volatiles	VOCGC1	Online
Autosampler	Varian	Archon	13999	As Needed	Used	Volatiles	VOCGC4	Online
Autosampler	Varian	Archon	13454	As Needed	Used	Volatiles	VOCGC5	Online
Autosampler	Varian	Archon	14157	As Needed	Used	Volatiles	VOCGC6	Online
Autosampler	Varian	Archon	14599	As Needed	Used	Volatiles	VOCGC7	Online
Autosampler	Varian	Archon	13391	As Needed	Used	Volatiles	VOCGC10	Online
Autosampler	Varian	Archon	VOLARCHON1	As Needed	Used	Volatiles	VOCGC12	Online
Autosampler	Varian	Archon	13827	As Needed	Used	Volatiles	VOCGC14	Online
Autosampler	Varian	Archon	13810	As Needed	Used	Volatiles	VOCGC15	Online
Autosampler	Varian	Archon	15261	As Needed	Used	Volatiles	VOCGC16	Online
Autosampler	Varian	Archon	14143	As Needed	Used	Volatiles	VOCMS2	Online
Autosampler	Varian	Archon	14605	As Needed	Used	Volatiles	VOCMS27	Online
Autosampler	Varian	Archon	14233	As Needed	Used	Volatiles	VOCMS28	Online
Autosampler	Teledyne	Centurion	CENTS317080513	As Needed	Used	Volatiles	VOCMS4	Online
Autosampler	Teledyne	Atomx	US14330003	As Needed	Used	Volatiles	VOCMS52	Online
Autosampler	OI Analytical	4100	D645410849	As Needed	Used	Volatiles	VOCMS20	Online
Autosampler	OI Analytical	4100	D627410770	As Needed	Used	Volatiles	VOCMS32	Online
Autosampler	OI Analytical	4100	D649410582	As Needed	Used	Volatiles	VOCMS35	Online
Autosampler	OI Analytical	4100	D619410106	As Needed	Used	Volatiles	VOCMS38	Online
Autosampler	OI Analytical	4100	D705410973	As Needed	Used	Volatiles	VOCMS41	Online
Purge and Trap	OI Analytical	Eclipse 4660	D833466009P	As Needed	Used	Volatiles	VOCGC6	Online
Purge and Trap	OI Analytical	Eclipse 4660	F023466618P	As Needed	Used	Volatiles	VOCGC16	Online
Purge and Trap	OI Analytical	Eclipse 4660	D726466961P	As Needed	Used	Volatiles	VOCMS2	Online
Purge and Trap	OI Analytical	Eclipse 4660	D742466578P	As Needed	Used	Volatiles	VOCMS16	Online
Purge and Trap	OI Analytical	Eclipse 4660	F026466142P	As Needed	Used	Volatiles	VOCMS26	Online
Purge and Trap	OI Analytical	Eclipse 4660	F024466460P	As Needed	Used	Volatiles	VOCMS27	Online
Purge and Trap	OI Analytical	Eclipse 4660	F026466139P	As Needed	Used	Volatiles	VOCMS28	Online
Purge and Trap	OI Analytical	Eclipse 4760	21J102730	As Needed	Used	Volatiles	VOCMS32	Online
Purge and Trap	OI Analytical	Eclipse 4660	D736466413P	As Needed	Used	Volatiles	VOCMS33	Online
Purge and Trap	OI Analytical	Eclipse 4660	D713466087P	As Needed	Used	Volatiles	VOCMS35	Online
Purge and Trap	OI Analytical	Eclipse 4660	E851466095P	As Needed	Used	Volatiles	VOCMS39	Online

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Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Purge and Trap	OI Analytical	Eclipse 4760	21J102729	As Needed	Used	Volatiles	VOCMS20	Online
Purge and Trap	OI Analytical	Eclipse 4760	21J102727	As Needed	Used	Volatiles	VOCMS25	Online
Purge and Trap	OI Analytical	Eclipse 4760	A627447776	As Needed	Used	Volatiles	VOCMS37	Online
Purge and Trap	OI Analytical	Eclipse 4760	21J102728	As Needed	Used	Volatiles	VOCMS38	Online
Purge and Trap	OI Analytical	Eclipse 4760	A620447864	As Needed	Used	Volatiles	VOCMS40	Online
Purge and Trap	OI Analytical	Eclipse 4760	A703447399	As Needed	Used	Volatiles	VOCMS41	Online
Purge and Trap	OI Analytical	Eclipse 4760	A707447491	As Needed	Used	Volatiles	VOCMS42	Online
Purge and Trap	OI Analytical	Eclipse 4760	A942447703	As Needed	Used	Volatiles	VOCMS53	Online
Purge and Trap	OI Analytical	Eclipse 4760	A031447210	As Needed	Used	Volatiles	VOCMS54	Online
Purge and Trap	OI Analytical	Eclipse 4760	A946447334	As Needed	Used	Volatiles	VOCMS55	Online
Purge and Trap	OI Analytical	Eclipse 4760	A946447333	As Needed	Used	Volatiles	VOCMS56	Online
Purge and Trap	OI Analytical	Eclipse 4760	A039447237	As Needed	Used	Volatiles	VOCMS57	Online
Purge and Trap	OI Analytical	Eclipse 4760	A041447860	As Needed	Used	Volatiles	VOCMS58	Online
Purge and Trap	OI Analytical	Eclipse 4760	A946447335	As Needed	Used	Volatiles	VOCMS59	Online
Purge and Trap	PTS/EST	Encon	301082903P	As Needed	Used	Volatiles	VOCGC1	Online
Purge and Trap	PTS/EST	Encon	269050803P	As Needed	Used	Volatiles	VOCGC2	Online
Purge and Trap	PTS/EST	Encon	273052803P	As Needed	Used	Volatiles	VOCGC4	Online
Purge and Trap	PTS/EST	Encon	156053001	As Needed	Used	Volatiles	VOCGC5	Online
Purge and Trap	PTS/EST	Encon	213073102E	As Needed	Used	Volatiles	VOCGC7	Online
Purge and Trap	PTS/EST	Encon	271051903P	As Needed	Used	Volatiles	VOCGC10	Online
Purge and Trap	PTS/EST	Eclipse	D719466252P	As Needed	Used	Volatiles	VOCGC12	Online
Purge and Trap	PTS/EST	Encon	302082903E	As Needed	Used	Volatiles	VOCGC14	Online
Purge and Trap	PTS/EST	Encon	280062503P	As Needed	Used	Volatiles	VOCGC15	Online
Purge and Trap	PTS/EST	Evolution	EV577051214	As Needed	Used	Volatiles	VOCMS6	Online
Purge and Trap	PTS/EST	Evolution	EV504082713	As Needed	Used	Volatiles	VOCMS4	Online
Purge and Trap	PTS/EST	Evolution	EV831041117	As Needed	Used	Volatiles	VOCMS13	Online
Purge and Trap	PTS/EST	Evolution	EV642112014	As Needed	Used	Volatiles	VOCMS21	Online
Purge and Trap	PTS/EST	Evolution	EV643112014	As Needed	Used	Volatiles	VOCMS22	Online
Purge and Trap	PTS/EST	Evolution	EV618091214	As Needed	Used	Volatiles	VOCMS23	Online
Purge and Trap	PTS/EST	Evolution	EV594071714	As Needed	Used	Volatiles	VOCMS30	Online
Purge and Trap	PTS/EST	Evolution	EV832041117	As Needed	Used	Volatiles	VOCMS44	Online
Purge and Trap	PTS/EST	Evolution II	EV20174062121	As Needed	Used	Volatiles	VOCMS36	Online

Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Analytical Balance	Mettler	XP205	1129420141	As Needed	Used	Wet Lab	Balance 3	Online
Analytical Balance	Mettler Toledo	AG204	1120381348	As Needed	Used	Wet Lab	WetBal 1	Online
Analytical Balance	VWR	403B	5262015128	As Needed	Used	Wet Lab	WetBa8	Online
Analytical Balance	VWR	403B	5262015102	As Needed	Used	Wet Lab	WetBa7	Online
Balance	RADWAG	WTC600	603664	2019	New	Wet Lab	WetBal 13	Online
Balance	Scout Pro		B513752877	As Needed	Used	Wet Lab	WetBal 9	Online
Analytical Balance	Mettler Toledo	MS204TS/00	B820869344	As Needed	Used	Wet Lab	WetBal 10	Online
Autoanalyzer	OI Analytical	FS 3100	301831056 (NH3) 251833391 (CN)	As Needed	Used	Wet Lab	FS 3100-1	Online
Distillation Unit-TKN/PT	Seal Analytical	BD50/28	5146001504	2021	New	Wet Lab	Block D	Online
Distillation Unit-TKN/PT	Lachat Instrument	BD40	1018420580	2022	New	Wet Lab	Block C	Online
Autoanalyzer	OI Analytical	FS 3100	407831164 (NO2NO3) 403833925 (PHT)			Wet Lab	FS 3100-3	Online
Autoanalyzer	Lachat	Quikchem 8000	A83000-1027	As Needed	Used	Wet Lab	Lachat 2	Online
Autoanalyzer	Lachat	Quikchem 8000	A83000-1638	As Needed	Used	Wet Lab	Lachat 3	Online
Autoanalyzer	Lachat	Quikchem 8500	60900000341	As Needed	Used	Wet Lab	Lachat 4	Online
Autoanalyzer	Lachat	Quikchem 8500	60900000342	As Needed	Used	Wet Lab	Lachat 5	Online
Autoanalyzer	Lachat	Quikchem 8500	70500000452	As Needed	Used	Wet Lab	Lachat 6	Online

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Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Autoanalyzer-digestor	Lachat	BD-46	100700000-982	As Needed	Used	Wet Lab	DIG1	Online
Autoanalyzer-digestor	Lachat	BD-46	1800-871	As Needed	Used	Wet Lab	DIG1	Online
Autoanalyzer-digestor	Lachat	BD-46	1000700000-982	As Needed	Used	Wet Lab	DIG2	Online
Autoanalyzer-digestor	Lachat	BD-46	1800-872	As Needed	Used	Wet Lab	DIG2	Online
Autoanalyzer-digestor	Lachat	BD-40	HTLC1018420580	As Needed	Used	Wet Lab	DIG3	Online
Automated Titrator	Metrohm	855 titrosampler	3256	As Needed	Used	Wet Lab	Titrand	Online
Automated Titrator	Metrohm	855 titrosampler	3315	2021	New	Wet Lab	Titrand	Online
Automated Titrator	Metrohm	855 titrosampler	3319	2021	New	Wet Lab	Titrand	Online
Balance	RADWAG	WTC600	603642	2019	New	Wet Lab	WetBal 11	Online
Balance	RADWAG	WTC600	603657	2019	New	Wet Lab	WetBal 12	Online
Balance	RADWAG	WTC600	603639	2019	New	Wet Lab	WetBal 14	Online
Bomb Calorimeter	Parr	1108 Oxygen Bomb	5424		Used	Wet Lab	Parr Bomb	Online
Bomb Calorimeter	Parr	1108 Oxygen Bomb	6420-1112-24696	2021	New	Wet Lab	Parr Bomb	Online
Centrifuge	Thermo	ST40	41179863	As Needed	Used	Wet Lab	Centrifuge	Online
Centrifuge	Damon	HNSII	23557225	As Needed	Used	We Lab	Centrifuge	Cabinet
Class "I" weights	Troemner	Serial # 7944	4057	As Needed	Used	Wet Lab		Online
COD Reactor	Environmental Express	B3000	2016CODW101	As Needed	Used	Wet Lab	COD Reactor	Online
Conductivity Meter	ORION	Model 170	32470051	As Needed	Used	Wet Lab	ATI Orion	Online
Conductivity Meter	Thermo Fisher	Orion VersaStar	V02971	As Needed	Used	Wet Lab	Orion VS-2	Online
Discrete Analyzer	Seal	AQ400	141032	2017	New	Wet Lab	Seal 1	Online
DI Water	Dionex	IC Pure	42034291	As Needed	Used	Wet Lab	Nanopure	Online
Distillation Unit-Cyanide	Environmental Express	Distillation 1	2270	As Needed	Used	Wet Lab	LMD1920-106	Online
Distillation Unit-Cyanide	Environmental Express	Distillation 2	2271	As Needed	Used	Wet Lab	LMD1920-106	Online
Distillation Unit-Cyanide	Environmental Express	Distillation 3	2272	As Needed	Used	Wet Lab	LMD1920-106	Online
Distillation Unit-Phenol	Westco Scientific	Model EASY-DIST	1062	As Needed	Used	Wet Lab	Dist 1	Online
Distillation Unit-Phenol	Westco Scientific	Model EASY-DIST	1198	As Needed	Used	Wet Lab	Dist 2	Online
Drying Oven	VWR	1390 FM	501202	As Needed	Used	Wet Lab	103-105	Online
Drying Oven	Shel Lab	FX28-2	12006713	As Needed	Used	Wet Lab	178-182	Online
Drying Oven	Shel Lab	SM028-2	8041917	As Needed	Used	Wet Lab	178-182	Online
Drying Oven	Shel Lab	-	-	As Needed	Used	Wet Lab	178-182	Online
Flash Point Tester	Koehler	Pensky-Martens K16200	R07002693B	As Needed	Used	Wet Lab	Manual	Cabinet
Flash Point Tester	Koehler	Pensky-Martens K16204	R070022328D	As Needed	Used	Wet Lab	Manual	Cabinet
Automated Flash Point Ignitability Tester	Tanaka	APM-8FC	34352	2019	New	Wet Lab	Automated	Online
Automated Flash Point Ignitability Tester	Tanaka	APM-8FC	34394	2020	New	Wet Lab	Automated	Online
Hot Block TDS	Environmental Express	TDS024	2017TDSW101	2018	New	Wet Lab	TDS Hot Block	Cabinet
Hot Plate	Cole Parmer	HS19 C-P	50000073	As Needed	Used	Wet Lab	Hot Plate	Unknown

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Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Hot Plate	Thermo Fisher	Type 2200	C1707140516473	As Needed	Used	Wet Lab	Hot Plate	Unknown
Hot Plate	Cole Parmer	HS19 CP	50002676	As Needed	Used	Wet Lab	Hot Plate	Unknown
Hot Plate	Cole Parmer	HS19 CP	50002447	As Needed	Used	Wet Lab	Hot Plate	Unknown
Hot Plate	Cole Parmer	HS19 CP	50002557	As Needed	Used	Wet Lab	Hot Plate	Unknown
Ion Chromatograph	Dionex	ICS-2000	6050731	As Needed	Used	Wet Lab	IC5	Online
Ion Chromatograph	Dionex	ICS 1500	8100010	As Needed	Used	Wet Lab	IC6	Online
Ion Chromatograph	Dionex	ICS 2000	8090820	As Needed	Used	Wet Lab	IC8	Online
Ion Chromatograph	Dionex	ICS 2100	10060822	As Needed	Used	Wet Lab	IC9	Online
Ion Chromatograph	Dionex	ICS 2100	10091285	As Needed	Used	Wet Lab	IC10	Online
Ion Chromatograph	Dionex	ICS 2100	11012204	As Needed	Used	Wet Lab	IC11	Online
Ion Chromatograph	Dionex	ICS 2100	12020460	As Needed	Used	Wet Lab	IC12	Online
Ion Chromatograph	Thermo Fisher	ICS 1600	13031204	As Needed	Used	Wet Lab	IC13	Online
Ion Chromatograph	Thermo Fisher	ICS-2100	15030082	As Needed	Used	Wet Lab	IC14	Online
Ion Chromatograph	Thermo Fisher	ICS-2100	15071973	As Needed	Used	Wet Lab	IC15	Online
Ion Chromatograph	Thermo Fisher	ICS-2100	15071973	As Needed	Used	Wet Lab	IC16	Online
Ion Chromatograph	Thermo Fisher	(1) ICS-1600	15110462	As Needed	Used	Wet Lab	IC17	Online
Ion Chromatograph	Thermo Fisher	ICS-2100	15120139	As Needed	Used	Wet Lab	IC18	Online
Ion Chromatograph	Thermo Fisher	Integrion	16070510	As Needed	Used	Wet Lab	IC19	Online
Ion Chromatograph	Thermo Fisher	Integrion	16090734	As Needed	Used	Wet Lab	IC20	Online
Ion Chromatograph	Thermo Fisher	Integrion	19050436	2019	New	Wet Lab	IC21	Online
Ion Chromatograph	Thermo Fisher	Integrion	19040421	2019	New	Wet Lab	IC22	Online
Ion Chromatograph	Thermo Fisher	Integrion	19050752	2019	New	Wet Lab	IC23	Online
Ion Chromatograph	Thermo Fisher	Integrion	19050751	2019	New	Wet Lab	IC24	Online
Muffle Furnace	Thermolyne	30400	23231	As Needed	Used	Wet Lab	FURNACE	Online
Muffle Furnace	Cole Parmer		CE3749	As Needed	Used	Wet Lab	FURNACE	Online
ORP Meter	YSI	ORP15	JC000114	As Needed	Used	Wet Lab	ORP	Online
pH Meter	Fisher	AB15	AB92329028	As Needed	Used	Wet Lab	AB 15+	Online
pH Meter	Orion	410A	58074	As Needed	Used	Wet Lab	Orion	Online
pH Meter	Thermo Fisher	Orion VersaStar	V00659	As Needed	Used	Wet Lab	Orion VS-1	Online
pH Meter	Thermo Fisher	Orion Starfall 1	J13992	As Needed	Used	Wet Lab	PH1	Online
pH Meter	Thermo Fisher	Orion Star A222	K12005	2018	New	Wet Lab	PH	Online
pH Meter	Thermo Fisher	Orion Star A111	J21101	As Needed	Used	Wet Lab	PH	Online
pH Meter	Thermo Fisher	Orion Star A111	J21983	2019	New	Wet Lab	pH	Online
Refrigerated Recirculator	Polyscience	Recirculator	1282	As Needed	Used	Wet Lab	Recirculator 1	Online

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Refrigerated Recirculator	Polyscience	Recirculator	1608	As Needed	Used	Wet Lab	Recirculator 2	Online
Shaker	GlasCol	099A LC1012	11325052	As Needed	Used	Wet Lab	Shaker	Online
SimpleDist	Env. Express	SC154	8940CECW3871	As Needed	Used	Wet Lab	SimpDist1	Online
SimpleDist	Env. Express	SC155	9062CECW3952	As Needed	Used	Wet Lab	SimpDist2	Online
SimpleDist	Env. Express	SC156	9062CECW3955	As Needed	Used	Wet Lab	SimpDist3	Online
SimpleDist	Env Express	MDI	2019MDISW159	2019	New	Wet Lab	SimpD4	Online
SimpleDist	Env Express	MDI	2019MDISW162	2019	New	Wet Lab	SimpD 5	Online
Spectrophotometer	Hach	DR6000	1646676	As Needed	Used	Wet Lab	DR6000-1	Online
Spectrophotometer	Hach	DR6000	1646781	As Needed	Used	Wet Lab	DR6000-2	Online
Spectrophotometer	Hach	DR6000	1894098	2019	New	Wet Lab	DR6000-3	Online
Spectrophotometer	Hach	Dr6000	1893736	2022	New	Wet Lab	DECSP02	Online
Stir Base	Env. Express	STIR	2019 STIR132	2019	New	Wet Lab	STIR	Online
TOC Analyzer	Shimadzu	Model TOC-VWS	39830572	As Needed	Used	Wet Lab	TOC2	Online
TOC Analyzer	Shimadzu	TOC-VCPh	H51304435	As Needed	Used	Wet Lab	TOC3	Not in Service
TOC Analyzer	Shimadzu	TOC-L	H54335232035	As Needed	Used	Wet Lab	TOC5	Online
TOC Analyzer	Shimadzu	TOC	H51725600306	As Needed	Used	Wet Lab	TOC6	Online
TOC Analyzer	EST	TE Explorer	2019.154	2019	New	Wet Lab	TOC8	Online
TOC Analyzer	Shimadzu	TOC-L	H54215000551	2021	Used	Wet Lab	TOC10	Online
TOX Analyzer	EST	TE Explorer	2017.287	2017	New	Wet Lab	TOX5	Online
TOX Analyzer	EST	TE Explorer	2017.286	2017	New	Wet Lab	TOX6	Online
TOX Analyzer	EST	TE Explorer	2015-184	2015	New	Wet Lab	TOX3	Online
TOX Analyzer	EST	TE Explorer	2016202	2016	New	Wet Lab	TOX4	Online
Turbidimeter	Hach	TL2300	2017070C0008	2018	New	Wet Lab	TURB1	Online

Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Chemchek KPA-11 Kinetic Phosphorescence Analyzer w/ Gilson Sample Changer and Gilson Dilutor 401 Syringe Pump	Chemchek	KPA-11	1418986; 649025031; 91-5050024	As Needed	Used	Rad Lab		At the Instrument
Canberra 2404 Alpha/Beta Counter	Canberra	2404	1090352; 988600/787196; 488584	As Needed	Used	Rad Lab		At the Instrument
Packard Tri-Carb 2200CA Liquid Scintillation Counter	Packard	2200CA	102180	As Needed	Used	Rad Lab		At the Instrument
Canberra LB4100 Alpha/Beta Counter	Canberra	LB4100U2	1300001; 1300002; 1300000; 117	As Needed	Used	Rad Lab		At the Instrument
Canberra Genie 2000 Alpha Spectrometer System	Canberra	Genie 2000	See Description	As Needed	Used	Rad Lab		At the Instrument
Canberra Genie 2000 Gamma Spectrometer System	Canberra	Genie 2000	See Description	Clean Chambers monthly, Vacuum pump-6 months. As needed.	Used	Rad Lab		At the Instrument

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Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
LSC 8000 Liquid Scintillation Counter	Hitachi	LSC-8000	GR30025119	As Needed	New	Rad Lab		At the Instrument
Hot Plate	Presto	703016	NA	As Needed	Used	Rad Lab	G1	Online
Hot Plate	Presto	NA	NA	As Needed	Used	Rad Lab	G2	Online
Hot Plate	Presto	703016	NA	As Needed	Used	Rad Lab	G3	Online
Hot Plate	Bella	TSK-2470P	NA	As Needed	Used	Rad Lab	G4	Online
Hot Plate	Bella	TSK-2470P	NA	As Needed	Used	Rad Lab	G5	Online
Hot Plate	Presto	TSK-2470P	NA	As Needed	Used	Rad Lab	G6	Online
Hot Plate	Presto	703016	NA	As Needed	Used	Rad Lab	G7	Online
Hot Plate	Bella	TSK-2470P	NA	As Needed	Used	Rad Lab	G8	Online
Hot Plate	Presto	703016	NA	As Needed	Used	Rad Lab	G9	Online
Hot Plate	Mainstays	NA	NA	As Needed	Used	Rad Lab	G10	Online
Hot Plate	Mainstays	NA	NA	As Needed	Used	Rad Lab	G11	Online
Furnace	Fisher Scientific	550-126	902NOO12	As Needed	Used	Rad Lab	M1	Online
Furnace	Barnstead	FB1415M	7.46951E+11	As Needed	Used	Rad Lab	M2	Online
Centrifuge	Beckman	TJ-06	96006	As Needed	Used	Rad Lab	C1	Rad Lab
Centrifuge	Beckman	TJ-06	9A010	As Needed	Used	Rad Lab	C2	Rad Lab
Centrifuge	Beckman	TJ-06	8953	As Needed	Used	Rad Lab	C3	Rad Lab
Centrifuge	Fisher Scientific	ST-40	42502680	As Needed	Used	Rad Lab	C4	Rad Lab
Hot Water Bath	Oster	NA	NA	As Needed	Used	Rad Lab	HB1	Online
Hot Water Bath	Mainstays	NA	NA	As Needed	Used	Rad Lab	HB2	Online
Hot Water Bath	Sunbeam Products	CKSTR51B-VHD-D	192847	As Needed	Used	Rad Lab	HB3	Online
Sonicator	CD FCC RoHS	PS-30A	20150720	As Needed	Used	Rad Lab	So1	Online
Hot Plate	Troemner, LLC	984VWOAHPUSS	171027003	As Needed	Used	Rad Lab	HP1	Online
Hot Plate	Troemner, LLC	984VWOAHPUSS	161026002	As Needed	Used	Rad Lab	HP2	Online
Hot Plate	Troemner, LLC	984VWOAHPUSS	161026001	As Needed	Used	Rad Lab	HP3	Online
Hot Plate	Troemner, LLC	984VWOAHPUSS	160927002	As Needed	Used	Rad Lab	HP4	Online
Shaker	Eserbach	NA	NA	As Needed	Used	Rad Lab	Sh1	Online
Shaker	NA	6000	NA	As Needed	Used	Rad Lab	Sh2	Online
Hot Plate/Stirrer	NA	NA	NA	As Needed	Used	Rad Lab	St1	Online
Hot Plate/Stirrer	Labline Instruments	1287	NA	As Needed	Used	Rad Lab	St2	Online
Hot Plate/Stirrer	Labline Instruments	1287	3055447	As Needed	Used	Rad Lab	St3	Online
Hot Plate/Stirrer	NA	NA	NA	As Needed	Used	Rad Lab	St4	Online
Hot Plate/Stirrer	NA	NA	NA	As Needed	Used	Rad Lab	St5	Online
Hot Plate/Stirrer	NA	NA	NA	As Needed	Used	Rad Lab	St6	Online
Hot Plate/Stirrer	NA	NA	NA	As Needed	Used	Rad Lab	St7	Online
Hot Plate/Stirrer	NA	NA	NA	As Needed	Used	Rad Lab	St8	Online
Hot Plate/Stirrer	NA	NA	NA	As Needed	Used	Rad Lab	St9	Online
Hot Plate/Stirrer	NA	NA	NA	As Needed	Used	Rad Lab	St10	Online
Hot Plate/Stirrer	Labline Instruments	1268	NA	As Needed	Used	Rad Lab	St11	Online
Hot Plate/Stirrer	Labline Instruments	1268	NA	As Needed	Used	Rad Lab	St12	Online
Hot Plate/Stirrer	Labline Instruments	1268	8039816	As Needed	Used	Rad Lab	St13	Online
Hot Plate/Stirrer	Labline Instruments	1268	0185	As Needed	Used	Rad Lab	St14	Online
Hot Plate/Stirrer	SYMA	HJ6A	NA	As Needed	New	Rad Lab	St15	Online
Hot Plate/Stirrer	SYMA	HJ6A	NA	As Needed	New	Rad Lab	St16	Online
Hot Plate/Stirrer	SYMA	HJ6A	NA	As Needed	New	Rad Lab	St17	Online
Hot Plate/Stirrer	SYMA	HJ6A	NA	As Needed	New	Rad Lab	St18	Online
Oven	Binder	NA	NA	As Needed	Used	Rad Lab	O1	Online

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Oven	Shel Lab	1326	5057405	As Needed	Used	Rad Lab	O2	Online
Sealer	Automatic Canning	NA	3108	As Needed	Used	Rad Lab	S1	Rad Lab
Grinder	Straus Co.	4E	NA	As Needed	Used	Rad Lab	GR1	Rad Lab
Grinder	Arthur H. Thomas Co.	NA	4352	As Needed	Used	Rad Lab	GR2	Rad Lab
Tumbler	US Stoneware	NA	CN12005	As Needed	Used	Rad Lab	T1	Rad Lab
Tumbler	US Stoneware	NA	CN32108	As Needed	Used	Rad Lab	T2	Rad Lab
Balance	RADWAG	PS360R2	530077	As Needed	Used	Rad Lab	RADBAL 1	Rad Lab
Balance	RADWAG	PS4500R2	544404	As Needed	Used	Rad Lab	RADBAL 2	Rad Lab
Balance	RADWAG	AS60/220R2	415543	As Needed	Used	Rad Lab	RADBAL 3	Rad Lab
Balance	RADWAG	PS4500R2	544401	As Needed	Used	Rad Lab	RADBAL 4	Rad Lab
Pipettor/Repeater	RAININ	EDP3-PLUS	C040040E	Quarterly	Used	Rad Lab	E-31	Rad Lab/Online
Pipettor/Repeater	RAININ	EDP3-PLUS	K0203177E	Quarterly	Used	Rad Lab	E-44	Rad Lab/Online
Pipettor/Repeater	RAININ	EDP3	J0400734E	Quarterly	Used	Rad Lab	E-33	Rad Lab/Online
Pipettor/Repeater	RAININ	EDP3-PLUS	H0300753E	Quarterly	Used	Rad Lab	E-63	Rad Lab/Online
Pipettor/Repeater	RAININ	EDP3-PLUS	A00978	Quarterly	Used	Rad Lab	E-41	Rad Lab/Online
Pipettor/Repeater	RAININ	EDP3-PLUS	J0400699E	Quarterly	Used	Rad Lab	E-43	Rad Lab/Online
Pipettor/Repeater	RAININ	EDP3-PLUS	J0300147E	Quarterly	Used	Rad Lab	E-54	Rad Lab/Online
Pipettor/Repeater	RAININ	EDP3-PLUS	G0200223E	Quarterly	Used	Rad Lab	E-32	Rad Lab/Online
Pipettor/Repeater	RAININ	EDP3-PLUS	H0000585E	Quarterly	Used	Rad Lab	E-53	Rad Lab/Online
Pipettor/Repeater	RAININ	EDP3-PLUS	B0200477E	Quarterly	Used	Rad Lab	E-42	Rad Lab/Online
Pipettor/Repeater	OXFORD	MACRO SET	NA	Quarterly	Used	Rad Lab	102	Rad Lab/Online
Pipettor/Repeater	OXFORD		NA	Quarterly	Used	Rad Lab	130	Rad Lab/Online
Pipettor/Repeater	Ward Science	2.5-30	NA	Quarterly	Used	Rad Lab	RP-1	Rad Lab/Online
Pipettor/Repeater	RAININ	EDP3-PLUS	F200510E	Quarterly	Used	Rad Lab	E-34	Rad Lab/Online
Pipettor/Repeater	RAININ	EDP3-PLUS	D1100091E	Quarterly	Used	Rad Lab	E-64	Rad Lab/Online
Survey Meter		9	79445	Annually	Used	Rad Lab		Rad Lab
Survey Meter		3	156503	Annually	Used	Rad Lab		Rad Lab
Survey Meter		12	88002	Annually	Used	Rad Lab		Rad Lab
Survey Meter		3-98	71211	Annually	Used	Rad Lab		Rad Lab
Survey Meter		3-98	455984	Annually	Used	Rad Lab		Rad Lab
Survey Meter		3	292175	Annually	Used	Rad Lab		Rad Lab
Survey Meter		3	292202	Annually	Used	Rad Lab		Rad Lab
Survey Meter		177	287820	Annually	Used	Rad Lab		Rad Lab
Survey Meter		2221	172021	Annually	Used	Rad Lab		Rad Lab
Survey Meter		19	156438	Annually	Used	Rad Lab		Rad Lab
Survey Meter		9	74528	Annually	Used	Rad Lab		Rad Lab
Survey Meter		3	156232	Annually	Used	Rad Lab		Rad Lab
Survey Meter		3	156193	Annually	Used	Rad Lab		Rad Lab
Survey Meter		3	56439	Annually	Used	Rad Lab		Rad Lab
Survey Meter		12	63765	Annually	Used	Rad Lab		Rad Lab
Survey Meter		177	96337	Annually	Used	Rad Lab		Rad Lab
Survey Meter		12	47797	Annually	Used	Rad Lab		Rad Lab



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Description	Manufacturer	Model	Serial Number	Service Date	Condition	Location	Internal ID	Manual Location
Survey Meter		12	87918	Annually	Used	Rad Lab		Rad Lab
Survey Meter		2221	154201	Annually	Used	Rad Lab		Rad Lab
Survey Meter		19	499190	Annually	Used	Rad Lab		Rad Lab
Survey Meter		19	156468	Annually	Used	Rad Lab		Rad Lab
Survey Meter		3-98	155387	Annually	Used	Rad Lab		Rad Lab
Survey Meter		3	156193	Annually	Used	Rad Lab		Rad Lab

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Description	Manufacturer	Model	Serial Number	Service date	Condition	Location	Internal ID	Manual Location
Centrifuge	Eppendorf	5424R	5404IR839716	As needed	New	PCR		PCR Lab
Centrifuge	Thermo Scientific	Sorvall Legend Micro 21R	42930526	As needed	New	PCR		PCR Lab
Galaxy Tablet with PLatr	Samsung	SM-T510	R52MA0T1C5E	As needed	New	PCR		PCR Lab
Heat Block	Thermo Scientific	Dry bath Standard 1 Blck 100-120V	KABT70001011	As needed	New	PCR		PCR Lab
Isotemp Large Oven	Fisherbrand	3511FSQ	300403777	As needed	New	PCR		PCR Lab
Mini Centrifuge	Fisherbrand	SPROUT PLUS	HSG04861	As needed	New	PCR		PCR Lab
Mini Centrifuge	Fisherbrand	SPROUT PUS	HSG04753	As needed	New	PCR		PCR Lab
Mini Vortex Mixer	Fisherbrand	Mini Vortex Mixer (Variable Speed)	200020151	As needed	New	PCR		PCR Lab
Mini Vortex Mixer	Fisherbrand	Mini Vortex Mixer (Variable Speed)	200020151	As needed	New	PCR		PCR Lab
Minus 80 Freezer	SCIENTEMP	86-01A	S8008781	As needed	New	PCR		PCR Lab
Precisiom CIR 89 Water Bath	Thermo Scientific	TSCIR89	300399766	As needed	New	PCR		PCR Lab
Refrigerator	Frigidaire	FRT18L4JW5	BA92344749	As needed		PCR		PCR Lab
Repeater Pipette	Eppendorf	Repeater E3	N296671	As needed		PCR		PCR Lab
Repeater Pipette	Eppendorf	Repeater E4	H40109J	As needed		PCR		PCR Lab
RT-PCR Machine	Applied Biosystems by Thermo Scientific	QuantStudio5	272531538	As needed	New	PCR		PCR Lab
RT-PCR Machine	Applied Biosystems by Thermo Scientific	QuantStudio7	278872930	As needed	New	PCR		PCR Lab
Refrigerator	Danbury Designer	DAR110A1WDD	4320043102086	As needed	New	PCR		PCR Lab
Oven	Quincy Lab Inc	10-100	I11-2454	As needed	Used	PCR		PCR Lab
Sorvall X Pro Centrifuge	ThermoFisher Scientific	SorvallX4R Pro-MD	42632360	As needed	New	PCR		PCR Lab
UPS (Surge Protector/Power Backup)	CyberPower	CP1500PFCLCDa	CXXJY2002934	As needed	New	PCR		PCR Lab
UPS (Surge Protector/Power Backup)	CyberPower	CP1500PFCLCD	CXXJY2002934	As needed	New	PCR		PCR Lab
Incubator	Fisherbrand	Isotemp	300403777	As needed	New	PCR		PCR Lab
Plate Shaker	Fisherbrand	88861023	K4CF61023014	As needed	New	PCR		PCR Lab

8.0 ADDENDUM: PROGRAM REQUIREMENTS

Section 8.0 provides additional requirements the locations covered by this manual are required to follow when performing work under the program. Only requirements that are not covered by the main body of the manual are listed in addendum.

8.1 DoD/DOE

PAS-Mt. Juliet maintains accreditation for DoD/DOE Environmental Laboratory Approval Program (ELAP)

This addendum outlines additional policies and processes established by this laboratory to maintain compliance with DoD/DOE program specific requirements as outlined in the DoD/DOE Consolidated Quality Systems Manual (QSM) for Environmental Laboratories. The QSM incorporates ISO/IEC 17025 and the TNI Standard and includes additional program-specific requirements for laboratories that perform analytical testing services for DoD and DOE, and which must be followed for DoD / DOE projects.

Section 4.2.5: Supporting Documents

In addition to the requirements specified in Section 4.2.5, technical SOPs used for DoD/DOE testing must also include instructions for equipment and instrument maintenance, computer software/hardware, and troubleshooting.

The review frequency for technical SOPs used for DoD/DOE testing is annual, instead of every 2 years.

Section 4.4: Review of Analytical Service Requests

If the DoD/DOE customer requests a statement of conformity, the standard used for the decision rule must be communicated to and agreed on with the customer and identified in the final test report.

Laboratory requests to deviate from the requirements specified in the DoD/DOE QSM must be requested on a project-basis and include technical justifications for the deviation. These requests are submitted to and approved by the DoD/DOE project chemist or contractor, however name, in addition to the PAS client.

For DoD / DOE projects, will also seek clarification from the customer when the customer has requested an incorrect, obsolete, or improper method for the intended use of data; the laboratory needs to depart from its test method SOP in order to meet project-specific data quality objectives; information in project planning documents is missing or is unclear,

Section 4.5: Subcontracting

In addition to written client approval of any subcontractor for testing, the customer is notified of the laboratory's intent to use a subcontractor for any management system element (such as data review, data processing, project management or IT support) and consent for subcontracting is obtained approved in writing by the DoD/DOE customer and record of consent kept in the project record.

Section 4.6: Purchasing and Supplies

The laboratory procedure for records of receipt of materials and supplies used in testing also include a specification to record the date opened (DOE only).

Section 4.9.3: Nonconforming Work

The laboratory's procedure for client notification includes the 15-business day DoD /DOE timeframe for notification of the problem and the 30-business day timeframe for submission of the corrective action plan or corrective actions taken. This procedure also includes the DoD/DOE requirement for AB notification of discovery.

Section 4.13: Control of Records

Technical Records: The laboratory's procedure for logbooks includes measures to prevent the removal of or addition of pages to the logbook (applies to both hardcopy and electronic). Hardcopy logbooks are version controlled, pre-numbered and bound. Initials and entries are signed or initialed and dated by the person making the entry and the entry is made at the time the activity is performed and in chronological order. Each page of the logbook must be closed by the last person making the entry on the page. Closure is recorded by the initial and date of the person making the last entry.

Section 5.4.5.3.3: Limit of Detection

For DoD/DOE the LOD is an estimate of the minimum amount of an analyte that can be reliably detected by an analytical process. For clarification, the LOD is the analyte concentration necessary to distinguish its presence from its absence. The LOD may be used as the lowest concentration for reliably reporting a non-detect (ND). The LOD is specific to each suite of analyte, matrix, and method including sample preparation.

After each DL determination, the laboratory establishes the LOD by spiking a quality system matrix at a concentration of least 2X but no greater than 4X the DL (i.e., $2X \text{ DL} \leq \text{LOD Spike} \leq 4X \text{ DL}$). The spike concentration establishes the LOD and the concentration at which the LOD is verified.

The LOD is established during method validation and after major changes to the analytical system or procedure that affects sensitivity of analysis or how the procedure is performed.

An LOD study is not required for any component for which spiking solutions or quality control samples are not available. Additionally, an LOD study is not required if the laboratory does not report data below the LOQ.

The LOD must be verified on a quarterly basis. Each preparation method listed on the scope of accreditation must have quarterly LOD verifications; however, verification of all possible combinations of preparation and clean-up techniques is not required. Where LOD verifications are not performed on all combinations, the LOD verification is based on the worst-case combination (preparation method with all applicable cleanup steps).

The laboratory's procedure for LOD determination and verification is detailed in SOP ENV-SOP-MTJL-0016 *Method Detection Limits (MDL), Limits of Detection (LOD) and Limits of Quantitation (LOQ)* and ENV-SOP-MTJL-0340 *Radiochemistry Method Performance Criteria*.

Section 5.4.5.3.4: Limit of Quantitation

For DoD/DOE, the LOQ is established for each analyte-matrix-method combination, including surrogates. When an LOD is determined or verified by the laboratory, the LOQ must be above the LOD [$\text{DL} < \text{LOD} < \text{LOQ}$].

At a minimum, the LOQ must be verified quarterly; however, verification of all possible combinations of preparation and clean-up techniques is not required. Where LOQ verifications are

not performed on all combinations, the LOQ verification on the worst-case combination (preparation method with all applicable cleanup steps).

The laboratory's procedure for LOQ determination and verification is detailed in laboratory SOP ENV-SOP-MTJL-0016 *Method Detection Limits (MDL), Limits of Detection (LOD) and Limits of Quantitation (LOQ)* and ENV-SOP-MTJL-0340 *Radiochemistry Method Performance Criteria*.

Section 5.4.7: Control of Data

The laboratory will assure LIMS passwords are changed at least once per year.

An audit of the LIMS will be incorporated into the laboratory's annual internal audit schedule.

The laboratory will have procedures in place to notify DoD/DOE customers of changes to LIMS software or hardware configurations that may impact the customer's integrity of electronic data

Section 5.9.1: Quality Control

For DoD/DOE, storage blanks are essential QC to monitor the storage of samples for volatile organic analysis (VOA). The SOP for storage of VOA samples must include a contamination monitoring program based on the performance of storage blanks. (See QSM 5.3.3)

Section 5.8.5: Sample Disposal

For DOE projects, the record of disposal must also include how the sample was disposed and the name of the person that performed the task.

Appendix E: Support Equipment Calibration

Mechanical Volumetric Pipette: In addition to the quarterly verification check, pipettes used for DoD/DOE projects are checked daily before use using the same procedure and criteria specified for the quarterly check.

Water Purification System: The performance of the water purification system is checked daily prior to use in accordance with SOP ENV-SOP-MTJL-0366 *Reagent Water Quality*.

Radiological Survey Equipment: The performance of the radiological survey equipment is checked daily prior to use in accordance with SOP ENV-SOP-MTJL-0344 *Radiation and Contamination Surveys*.

Additional: (DOE): Section 6.0 of the QSM outlines additional management system requirements for the management of hazardous and radioactive materials management and health and safety practices. The laboratory, if approved for DOE, will consult with the PAS Health and Safety Director to establish plans, policies and procedures that conform to these comprehensive specifications and incorporate these documents into the QMS.

8.2 ADDENDUM: AIHA-LAP, LLC

Section 4.1.5.4: Confidentiality

While the laboratory does not typically make client information public, the customer will be informed in advance if the laboratory intends to place any client-identifying information in the public domain.

Information about the customer obtained from sources other than the customer (e.g., complainant, regulators) will remain confidential between the customer and the laboratory. The source of the information will remain confidential to the laboratory and will not be shared with the customer, unless agreed by the source.

Personnel, including any committee members, contractors, personnel of external bodies, or individuals acting on the laboratory's behalf, shall keep confidential all information obtained or created during the performance of laboratory activities, except as required by law.

All personnel of the laboratory, either internal or external, that could influence the laboratory activities shall act impartially, be competent and work in accordance with the laboratory's management system.

Section 4.2.1.2: Risk and Opportunity Assessment

Actions taken to address risks and opportunities shall be proportional to the potential impact on the validity of laboratory results.

Section 4.3.1: Document Control – General

All documentation, processes, systems, records, related to the fulfilment of the requirements of ISO/IEC 17025 are included in, referenced from, or linked to the management system. All personnel involved in laboratory activities have access to the parts of the management system documentation and related information that are applicable to their responsibilities.

Section 4.4: Analytical Service Request, Tender, and Contract Review

If a contract is amended after the work has commenced, the contract review shall be repeated and any amendments shall be communicated to all affected personnel.

Section 4.13.2.3: Error Correction

Amendments to technical records can be tracked to previous versions or to original observations. Both the original and amended data and files are retained as applicable, including the date of alteration, an indication of the altered aspects and the personnel responsible for the alterations.

Section 4.14.1: Internal Audit

- **Quality System Audits:** A review of all management system requirements of ISO/IEC 17025 and any other regulatory or applicable policy document (e.g., AIHA-LAP, LLC). These audits are also performed annually per a pre-determined schedule.

Section 5.5.2: Calibration

Laboratory staff performing in-house calibrations and verifications shall have received documented training.

Section 5.5.7: Calibration Status

Measuring equipment shall be calibrated when:

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- The measurement accuracy or measurement uncertainty affects the validity of the reported results, and/or
- Calibration of the equipment is required to establish the metrological traceability of the reported results

8.3 ADDENDUM: SOP Review

DoD and drinking water SOPs are reviewed annually.

8.4 ADDENDUM: RADIOLOGICAL REQUIREMENTS

8.4.1 Estimate of Analytical Uncertainty

Radiological tests often report uncertainty and the manner in which it is derived are in accordance with Multi-Agency Radiological Laboratories Analytical Protocols Manual (MARLAP) and Evaluation of Measurement Data – Guide to the Expression of Uncertainty in Measurement (GUM). The means by which these criteria are applied can be found in the method SOPs.

8.4.2 Radiological Equipment Calibration

Radiological calibrations may follow one of several methodologies based on technology of the counting; these can include efficiency curves, energy calibrations and quench curves. The various calibrations should ensure that the range chosen encompasses the activities expected in the client samples.

Radiological Equipment should be calibrated at the appropriate frequency and whenever the equipment undergoes maintenance. In the case of liquid scintillation counters the equipment shall be recalibrated when a significant move has taken place.

Calibrations can vary with equipment; in the case of gas flow proportional counters standards that range the expected residue range for gross alpha and beta shall be used, with efficiency curves developed to encompass the range of client sample residues. Any samples outside of this range shall be evaluated and the aliquot changed to accommodate the curve if necessary. Beta emitters, or isotopes that are shown to have less than a 2% efficiency change with residue that are known to not experience self attenuation may be calibrated by using a least 3 standards of known activity and comparing the efficiency results to ensure all agree to a relative standard deviation of less than 5%.

Quench factors for liquid scintillation counters shall be prepared by adding varied amounts of quenching agent. Any sample displaying a quench factor outside of the curve shall be evaluated. If the quench factors are shown to not vary in efficiency by greater than 2% then an efficiency calibration can be established using at least 3 standards of known activity and comparing the efficiency results to ensure all agree to a relative standard deviation of less than 5%.

Cross talk factors must also be evaluated when samples are known to contain more than one beta or an alpha and beta emitter.

All detectors must pass various daily tests depending upon the technology. The criteria of these various tests should be known to the analyst. Any detector that does not pass the daily check must be re-checked.

If the daily test fails a second time the detector must be taken out of service for that day. Any detector that fails two daily checks must be evaluated and serviced if required. In most instances two passing daily checks are required to put a detector back into service.

8.4.3 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

For radiochemical analyses, tests that do not incorporate the use of a carrier or tracer for yield assessment must contain an associated MS and MSD (or sample duplicate) using the same matrix collected for the specific DOD project. Gamma spectroscopy analyses are excluded from the MS/MSD requirement as the test does not require chemical processing of samples for analysis.

8.5 ADDENDUM: QUALITY CONTROL CALCULATIONS

PERCENT RECOVERY (%REC)

$$\%REC = \frac{(MSConc - SampleConc)}{TrueValue} * 100$$

NOTE: The SampleConc is zero (0) for the LCS and Surrogate Calculations

PERCENT DIFFERENCE (%D)

$$\%D = \frac{MeasuredValue - TrueValue}{TrueValue} * 100$$

where:

TrueValue = Amount spiked (can also be the CF or RF of the ICAL Standards)

Measured Value = Amount measured (can also be the CF or RF of the CCV)

PERCENT DRIFT

$$\%Drift = \frac{CalculatedConcentration - TheoreticalConcentration}{TheoreticalConcentration} * 100$$

RELATIVE PERCENT DIFFERENCE (RPD)

$$RPD = \frac{|(R1 - R2)|}{(R1 + R2)/2} * 100$$

where:

R1 = Result Sample 1

R2 = Result Sample 2

CORRELATION COEFFICIENT (R)

$$CorrCoeff = \frac{\sum_{i=1}^N W_i * (X_i - \bar{X}) * (Y_i - \bar{Y})}{\sqrt{\left(\sum_{i=1}^N W_i * (X_i - \bar{X})^2 \right) * \left(\sum_{i=1}^N W_i * (Y_i - \bar{Y})^2 \right)}}$$

With: N Number of standard samples involved in the calibration
i Index for standard samples
Wi Weight factor of the standard sample no. i
Xi X-value of the standard sample no. i
X(bar) Average value of all x-values
Yi Y-value of the standard sample no. i
Y(bar) Average value of all y-values

CALIBRATION FACTOR (CF)

$$CF = \frac{A_s}{C_s}$$

where:

A_s = Average Peak Area over the number of peaks used for quantitation

C_s = Concentration of the analyte in the standard

RESPONSE FACTOR (RF)

$$RF = \frac{(Conc_{IStd})(Area_{Analyte})}{(Conc_{Analyte})(Area_{IStd})}$$

where:

A_s = Response for analyte to be measured

A_{is} = Response for the internal standard

C_{is} = Concentration of the internal standard

C_s = Concentration of the analyte to be measured

LINEAR CALIBRATION MODEL

$$y = mx + b$$

where:

m = Slope of the line

b = The y intercept

QUADRATIC CALIBRATION MODEL

$$y = ax^2 + bx + c$$

where:

c = The y intercept

STANDARD DEVIATION (S)

$$S = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{(n - 1)}}$$

where:

n = number of data points

X_i = individual data point

$\bar{X}$ = average of all data points

AVERAGE ($\bar{X}$)

$$\bar{X} = \frac{\sum_{i=1}^n X_i}{n}$$

where:

n = number of data points

X_i = individual data point

RELATIVE STANDARD DEVIATION (RSD)

$$RSD = \frac{S}{\bar{X}} * 100$$

where:

S = Standard Deviation of the data points

$\bar{X}$ = average of all data points

PERCENT ERROR

$$\%Error = \frac{x_i - x'_i}{x_i} * 100$$

where:

x'_i = Measured amount of analyte at calibration level i

x_i = True amount of analyte at calibration level i

RELATIVE STANDARD ERROR (RSE)

$$RSE = 100 \times \sqrt{\frac{\sum_{i=1}^n \left[\frac{x'_i - x_i}{x_i} \right]^2}{(n - p)}}$$

where:

x_i = True amount of analyte at calibration level i

x'_i = Measured amount of analyte at calibration level i

p = Number of terms in fitting equation (Average = 1, Linear = 2, Quadratic = 3)

n = Number of calibration points

AVERAGE RESPONSE 1/X FOR MASS HUNTER INSTRUMENTS

$$RF_{\frac{1}{x}} = \frac{\sum_{s=1}^n \frac{1}{C_s}}{\sum_{s=1}^n \left(\frac{(A_s * C_{is})}{(A_{is} * C_s)} \right)}$$

where:

A_s = Response for analyte to be measured

A_{is} = Response for the internal standard

C_{is} = Concentration of the internal standard

C_s = Concentration of the analyte to be measured



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MINIMUM DETECTABLE ACTIVITY (MDA)

The MDA is used for radiochemical analysis and is calculated with the following equations:

MDA with Blank Population

$$\frac{3.29 * S_b}{KT_s} + \frac{3}{KT_s}$$

MDA =

Where:

$$K = E \times V \times R \times Y \times F \times 2.22$$

E = efficiency

V = sample volume

R = tracer recovery

Y = gravimetric carrier recovery

F = ingrowth or decay factor

2.22 = conversion from dpm to pCi

T_s = count time of sample in minutes

S_b = standard deviation of the blank population

MDA without Blank Population

$$\frac{3.29 * \sqrt{\frac{b}{T_s} + \frac{b}{T_b}}}{K} + \frac{3}{KT_s}$$

MDA =

Where:

b = background count rate in cpm

T_b = Count time of background in minutes

Relative Error Ratio (RER)/Normalized Absolute Difference (NAD)/Duplicate Error Ratio (DER)

RER, NAD, and DER are used for radiochemical analysis and are calculated by the following:

$$RER/NAD/DER = \frac{|S - R|}{\sqrt{U_S^2 + U_R^2}}$$

Where:

S = Sample Value

U_S = Sample Uncertainty (at 2 sigma)

R = Replicate Value

U_R = Replicate Uncertainty (at 2 sigma)



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Controlled Copy #: QM-27

Dave Gayer, Laboratory Director

Paul Ellingson, Vice President

Ron Fuller, QA Officer

Quality Manual

This Quality Manual meets the requirements of ISO 17025, ISO 9001, and TNI. This Quality Manual is confidential and assigned as outlined below.

Original Document: Quality Manager

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This Quality Manual has been approved for use by affiliate laboratories of Chemtech-Ford, Inc.

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- 5.9 Assuring the Quality of Test and Calibration Results
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Introduction

Purpose

This Quality Manual contains all the requirements that our laboratory uses to demonstrate our quality management system, technical competence, and valid results.

Section 4 specifies how we demonstrate sound management and maintain client satisfaction.

Section 5 specifies how we demonstrate technical competence in our laboratory.

In addition, this Quality Manual outlines how we meet:

- ISO 17025
- ISO 9001
- TNI

All personnel are to take an active role in establishing, implementing, and maintaining our quality management program. We do not separate quality from our daily business. Quality is integrated into every facet of the decision-making process in the management of our laboratory and the science that we practice.

It is the policy of Chemtech-Ford, Inc. and its employees to perform their duties in a consistently legal and ethical manner. A professionally high level of ethical behavior is characterized by, but not limited to, dealing honestly and forthrightly with all clients and co-workers, maintaining data integrity, the open and timely treatment of inaccurate, invalid, or misreported analytical data, and abiding by all pertinent rules, regulations, company policies, and standard operating procedures.

Chemtech-Ford, Inc. encourages its employees to demonstrate consistently ethical and professional behavior by implementing programs consonant with that purpose. These programs, generally, include:

- 1) a thorough training program for new employees and continuing seminars throughout employment which reflect Chemtech-Ford, Inc.'s commitment to integrity and quality control and which present specific ways to honor that commitment

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2) a comprehensive documentation program for all facets of laboratory operation, which allows ready reconstruction of any quality process

3) a program of continual evaluation, both internally and externally, with required levels of quality acceptance

4) a management monitoring system which routinely evaluates the overall performance of the laboratory.

This Quality Manual summarizes the policies and procedures employed by Chemtech-Ford, Inc. It is the purpose of these policies and procedures to maintain the highest level of integrity and ethical behavior in all aspects of laboratory work.

Distribution List

The approved version of this manual is available to all employees through Quality Manager and/or Chemtech-Ford Laboratories intranet. All printed copies are uncontrolled.

In the event that a controlled copy of this manual is necessary, the Quality Manager will maintain a distribution list.

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1. Scope

This Quality Manual facilitates:

- Recognition of technical competence for standardized methods, non-routine methods, and laboratory-developed methods we perform
- Inspection and product certification capabilities and/or services we provide
- Total quality for our administrative and technical systems
- Audits by clients, regulatory authorities and accreditation bodies
- Meeting the requirements of ISO 17025, ISO 9001, and TNI
- Client satisfaction

Chemtech-Ford Laboratories displays all Fields of Accreditation on our website.

2. Normative References

Reference List

ISO/IEC 17000, Conformity assessment – Vocabulary and general principles

VIM, International vocabulary of basic and general terms in metrology, issued by BIPM, IEC, IFCC, ISO, IUPAC, IUPAP and OIML.

ISO 9001:2000 – Quality Management Systems – Fundamentals and vocabulary.

ISO/IEC 17025:2005 – General Requirements for the Competence of Testing and Calibration Laboratories.

TNI Standard, Volume 1, 2009 NELAC Standard.

Cross-references

This manual is numerically aligned with the international standard ISO 17025. Furthermore, each section cross-references the ISO 9001 standard.

For ease of use, each section starts with a brief summation of what the section addresses and a listing of the quality terminology and key words.

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3. Terms and Definitions

For the purposes of this manual, the following documents and their corresponding definitions apply: ISO/IEC 17000; ISO/IEC Guide 30; ISO Council Committee on Conformity Assessment (CASCO); ISO 9000; ISO 5725-1; ISO 17025; TNI 2009 Standard; AOAC; and International Vocabulary of Basic and General Terms in Metrology (VIM).

Accreditation – formal recognition of a laboratory by an independent science-based organization that the laboratory is competent to perform specific tests.

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4.1 Organization

Section Synopsis

This section tells you our laboratory has:

1. Appointed a Quality Manager
2. Organized the workforce to achieve quality
3. Provided adequate resources to ensure quality

Key Words

Quality Manager
 Organizational Chart
 Authority
 Resources
 Confidential Information
 Proprietary Rights
 Responsibilities
 Conflict of Interest

Cross-references

ISO 17025:2005 Section 4.1
 ISO 9001:2000 Section 4.1, 5.1, 5.3, 5.4.1, 5.5.1, 5.5.2, 5.5.3, 6.1, 6.2.1, 6.2.2, 6.3.1, 7.1, 7.5.4

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4.1.1 Legal Identification / Registration

Chemtech-Ford, Inc.
9632 South 500 West.
Sandy, UT 84070
(801)262-7299
(866)792-0093

4.1.2 Laboratory Requirements

The work area of Chemtech-Ford, Inc has been organized to satisfy the needs of the customer and regulatory authorities and to meet the international standards TNI, ISO 17025 and ISO 9001. Chemtech-Ford, Inc. is composed of the following work areas:

President/CEO/Vice Presidents
Lab Director
QA/QC Department
Customer Service Department
Receiving/Shipping Department
Organics Lab
Inorganics Lab
Microbiology Lab
Metals Lab

4.1.3 Scope of Management System

The management system covers activities all of the laboratory's facilities. The fields of activities include:

Environmental Sample Testing
Medical Device Testing
Nutraceutical Product Testing
Specialty Testing

The laboratory's scope of tests is listed in the current Price List.

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4.1.5 Organization

A) Management and Technical Personnel

Policy:

The laboratory managerial and technical personnel, irrespective of other responsibilities, have the necessary authority and resources needed to meet the mandates assigned to their areas.

Details:

Responsibilities are detailed in 5.2.5

Departures from the organizational and management policies in this manual can only be approved by a Vice President.

Departures from quality management system procedures can only be approved by a Vice President or the Quality Manager.

Departures from test methods or technical standard operating procedures (SOPs) can only be approved by the Quality Manager and/or the Laboratory Director.

See also section 5.2.

B) Conflict of Interest

Policy:

Management and personnel are to be free from any undue internal and external commercial, financial and other pressures that may adversely affect the quality of their work. The integrity of test results is the responsibility of all personnel. Management ensures that employees are never instructed or forced to alter or falsify data. Chemtech-Ford Laboratories performs annual data integrity training. A review of the undue pressure policy is part of this training.

Details:

The following list provides some guidelines on how employees avoid conflict of interest situations. Employees shall not:

- falsify records, prepare fraudulent reports, or make false claims

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- seek or use privileged or confidential company information, or data from any customer, for any purpose beyond the scope of employment
- conduct non-laboratory business on laboratory time, or use company facilities or equipment to conduct outside interests in business, unless prior approval has been obtained
- solicit business on their own behalf (rather than the laboratory) from a customer
- be employed by, or affiliated with, organizations whose products or services compete with laboratory products or services
- have employment that negatively affects or interferes with their performance of laboratory duties
- compete with the laboratory in the purchase, sale, or leasing of property or goods
- allow association, family, or friends to influence business decisions to their benefit. Decisions must be made on a strictly business basis, always in the best interest of the laboratory
- make any decision that provides gains or benefits to the employee and/or others
- have personal financial dealings with an individual or company that does business with the laboratory which might influence decisions made on the laboratory's behalf

Firm adherence to this code of values forms the foundation of our credibility. Personnel involved in dishonest activities are subject to a range of disciplinary action including dismissal.

C) Customer Confidentiality

Policy:

It is the policy of our laboratory to protect the confidential information and proprietary rights of our customer including the electronic storage and transmission of results.

Details and Procedures:

All employees sign a Confidentiality Agreement. The signed agreement is retained in each employee's Human Resources file.

Test results are only released to the customer. Release to someone other than the customer requires the express permission of the customer, except when the situation contravenes State or Federal Legislation and the results must be provided to the appropriate agency. The release of test results to anyone other than the customer requires the permission of management. Laboratory reports are reviewed for accuracy prior to release.

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D) Operational Integrity

Policy:

The laboratory will avoid involvement in any activities that would diminish confidence in its competence, impartiality, judgment, or operational integrity.

Details and Procedures:

To ensure confidence in laboratory operations a formal quality assurance program is implemented. Technical competence is ensured through commercial performance testing studies and data formatted in DOCs (Demonstration of Competency) reports. Impartiality is assessed through audits and approvals. Judgment is ensured through the hiring of qualified personnel and by continuously refining, upgrading, and improving his or her skills. Operational integrity is reviewed by management on a regular basis at management review meetings to ensure continued suitability and effectiveness of laboratory policies and procedures. Any problems are acted on immediately through corrective action procedures.

E) Organizational Structure

Policy:

The organization and management structure of the laboratory and the relationships between management, technical operations, support services, and the quality management system is defined through the aid of an organizational chart.

Details:

The most current organizational structure is contained within Quality Manager. The organizational structure is reviewed at regular intervals (at least two times per calendar year).

F) Responsibility and Authority

The responsibility, authority and interrelationships of all personnel who manage, perform or verify work affecting the quality of the tests and/or calibrations is defined in section 5.2.5

G) Laboratory Supervision

Policy:

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Adequate supervision is provided in each area of the laboratory for all testing and calibration personnel, including trainees, by persons familiar with the methods and procedures.

Details:

Adequate supervision is ensured through designated supervisors as well as through documentation such as this Quality Manual, test methods and SOPs. Initial and ongoing training for regular personnel is required. The successful completion of analyses in the commercial PT study program, and/or DOC studies are evidence of successful and continued training.

H) Technical Management

Policy:

A technical manager is assigned to each major work area of the laboratory. They have overall responsibility for the technical operations and the provision of resources needed to ensure the required quality of laboratory operations.

Details:

While the technical manager may at times delegate duties to other personnel, the technical manager is responsible for the work produced in his area of the laboratory, and is accountable for any nonconforming activities.

I) Quality Manager

Policy:

The Quality Manager is appointed by the highest level of management. The Quality Manager, who, irrespective of other duties and responsibilities, has defined responsibility and authority for ensuring that the management system related to quality is implemented and followed. The Quality Manager has direct access to the highest level of management where decisions are taken on laboratory policy or resources.

Details:

This statement notifies all laboratory personnel that the Quality Manager is authorized by senior management and the President to administer all activities relating to the Chemtech-Ford Laboratories quality system. A formal announcement to the laboratory and appropriate certification/regulatory authorities will be made if a change is made to the person filling this position.

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J) Managerial Substitutions

Policy:

Deputies for key personnel are appointed to fulfill the key personnel's duties in their absence.

Details:

In the absence of the Lab Director, the Quality Manager or Deputy Lab Director will assume his/her responsibilities.

In the absence of the Quality Manager, the Lab Director will assume his/her responsibilities.

In the absence of the Laboratory Supervisor, the Lab Director, Deputy Lab Director and/or Quality Manager will assume his/her responsibilities.

Management is responsible for ensuring that current and/or increased workload requirements are met. This includes making adjustments as a result of employee absence. Only fully trained employees are utilized to fulfill the duties of personnel who are absent. Evidence of a DOC for each specific analysis must be recorded prior to allowing the employee to perform any testing in the laboratory. If sufficient human resources are not available, management will identify the best possible solution to meet operational requirements.

K) Awareness

Policy:

Management ensures that its personnel are aware of the relevance and importance of their activities and how they contribute to the achievement of the objectives of the management system.

Details:

Supervisors review the details of each employee's job description with the appropriate employee and how the overall Quality Policy Statement (Section 4.2.2) relates to their activities to achieve the objectives of the management system.

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4.1.6 Communication Processes

Policy:

Top management ensures that appropriate communication processes are established within the laboratory and that communication takes place regarding the effectiveness of the management system.

Details:

Management meetings are held regularly. Assignments and important communications are made in this meeting. The appropriate manager communicates the assignment or communication to their direct reports. These meetings are documented and follow-up activities are recorded.

Revision History

Changes from Revision 26

Modified section 4.1.3 to include all of the facilities of the company rather than just the main facility.

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4.2 Management System

Section Synopsis

This section tells you that our Management System (or Quality Management System) is based on:

1. A well-defined quality policy statement
2. Say what you do through documentation
3. Do what you say following your documentation
4. Record what you did

Key Words

Establish, Implement, and Maintain
Policies, Systems, Processes, Programs, Procedures, Instructions
Communicate, Understand
Quality Policy Statement
Quality Manual
SOP
Test Method

Cross-references

ISO 17025:2005 Section 4.2

ISO 9001:2000 Section 4.1, 4.2.1, 4.2.2, 5.1, 5.3, 5.4.1, 5.4.2, 5.5.1, 5.5.2, 6.2.1, 7.1

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4.2.1 Policies and Procedures

Policy:

The Quality Management System is established, implemented, and maintained by management. It is applicable to all the fields of testing and activities in which the laboratory is involved and undertakes. All policies, systems, programs, procedures and instructions are documented to the extent necessary to enable the laboratory to assure the quality of results generated. These documents are communicated to, understood by, available to, and implemented by the appropriate personnel.

Details:

The purpose of our Quality Management System is to ensure that all services and products satisfy the customer's requirements and have been designed, tested, and delivered under controlled conditions.

The effectiveness of the Quality Management System is assessed in several ways:

- by a program of planned internal audits, covering all aspects of the operation of the quality management system
- by regular management reviews of the suitability and effectiveness of the quality management system
- by analysis of potential and actual problems as shown by customer complaints and supplier and subcontractor assessments
- by other methods approved from time to time by the appropriate authority.

This Quality Manual and associated documents (including procedures) and records serve as the quality plan for the laboratory. Other documents and records may include:

- standard operating procedures (SOPs)
- quality control plans in test methods
- organizational charts
- proposals
- project management schemes
- Equipment manuals
- Reference methods
- Regulations
- Accreditation standards
- Software

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4.2.2 Quality Policy Statement

Policy:

The policies and objectives for laboratory operations are documented in this Quality Manual. The overall objectives are set out in the Quality Policy Statement and reviewed during management review. The Quality Policy Statement is issued under the authority of the Senior Management on the effective date.

Quality Policy Statement:

To ensure accurate and timely analytical services and to continuously meet or exceed the stated or implied expectations of our customers through day-to-day interactions.

Effective Date: February 15, 2016

a) *Management commitment to good professional practice and quality of services provided to the customer:* tests and calibrations are always carried out in accordance with stated standardized methods and customers' requirements. Requests to perform tests that may jeopardize an objective result or have a low validity are rejected, or the laboratory's concerns are noted in the certificate of analysis.

b) *Standards of service include:*

- Customer Satisfaction
- Accuracy
- Timeliness
- Compliance with applicable standards and procedures

Excellence in the workplace is promoted by providing all employees with the knowledge, training, and tools necessary to allow for the completion of accurate and timely work.

c) *Purpose of management system related to quality:* to manage our business by meeting the needs of our customers and the requirements of the applicable standards and procedures.

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d) *Personnel*: familiarize them with quality documentation and implement the policies and procedures in their work.

e) Management is committed to complying with the applicable standards and regulations (e.g. TNI, ISO, OGWDW etc.) and to continually improve the effectiveness of the management system: the objective of this Quality Manual is to document the compliant policies and associated procedures that are integrated into our daily activities. Continual improvements are established, implemented, and locked into the management system.

Additional objectives include:

- to establish the level of the laboratory's performance
- to make test method changes to improve performance
- to participate in proficiency testing or quality evaluation programs with peer laboratories
- to ensure that all personnel are trained to a level of familiarity with the quality management system appropriate to the individual's degree of responsibility
- to improve and validate laboratory methodologies by participation in method validation collaborative tests
- to establish and report on quality savings

4.2.3 Commitment to the Management System

Policy:

Top management is committed to the development and implementation of the management system and continually improving its effectiveness.

Details:

The results of the management system are regularly reviewed during management review (see Section 4.15) and continual improvements are made as outlined in Section 4.10 – Improvements.

4.2.4 Communication of Requirements

Policy:

Top management communicates to the organization the importance of meeting customer requirements as well as statutory and regulatory requirements.

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Details:

In general, the underlying message in all oral and written management communications involves meeting the aforementioned requirements. Meeting customer requirements ensures that ongoing business relationships secure the contracts that keep everyone employed. Meeting statutory and regulatory requirements ensures that laboratory operations will not be disrupted and the organization can continue to meet customer needs.

4.2.5 Quality Manual

Policy:

This Quality Manual outlines the structure of the documentation used in the quality management system. This Quality Manual makes reference to supporting procedures including technical procedures and is maintained up to date.

Details:

This quality management system is structured in three tiers of documentation. The tiers are as follows:

- I. Quality Manual
- II. Standard Operating Procedures and Test Methods
- III. Records

For most customers, this Quality Manual and the associated documents form a general Quality Plan. If necessary, specific Quality Plans will be prepared on a ‘per-customer’ basis. These Quality Plans will modify the general requirements stated in the Manual and associated documents.

All of the above documents are controlled documents. Not all quality system documents and procedures are maintained in this manual, rather some are referenced and located in other documents. The following records and directive documents are contained or referenced in the Quality Manual:

- organizational chart (section 4.1.5.E)
- identification of resources and management review (section 4.15.1)
- job descriptions (section 5.2.4)
- statistical techniques (section 5.9)
- test reports (section 4.13.2 and 5.10)
- identification of the laboratory’s approved signatures (section 5.10.2)

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- laboratory's scope of tests (section 4.1.3)
- equipment inventory and records (sections 5.5.4 and 5.5.5)
- calibration status indicators (section 5.5.8)
- reference standards inventory (section 5.6.3)
- verification records (section 5.9)
- quality control plan / criteria for workmanship (section 5.4.1)
- corrective action records (section 4.11)
- preventive action records (section 4.12)
- customer complaint records (section 4.8.1)
- audit schedule and records (section 4.14.3)
- procurement and subcontracting records (sections 4.6 and 4.5.4)
- training records (section 5.2.5)
- master list of documentation (section 4.3.2)
- confidentiality agreements (section 4.1.5 C)
- contract review (section 4.4.2)
- validation of test methods (section 5.4.5)
- facility floor plan (section 5.3.1)

4.2.6 Change Management

The roles and responsibilities for change management are outlined in QSP 4-2-6.

4.2.7 Technical Management and the Quality Manager

The roles and responsibilities for technical management and the Quality Manager are outlined in section 5.2.5 of this manual.

Technical management ensures that section 5 of this manual is implemented and maintained. The Quality Manager ensures that section 4 of this manual is implemented and maintained.

4.2.8 Maintenance

Policy and Details:

Top management ensures that the integrity of the management system is maintained when changes to the management system are planned and implemented.

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Revision History

Changes from Revision 24

Revision 25 is a significant revision with numerous additions, deletions and corrections. These are not all documented in the revision history, rather all persons on the distribution list are required to read the entire document.

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4.3 Document Control

Section Synopsis

This section tells you that Document Control involves:

1. Writing good procedures
2. Getting them to the users
3. Keeping procedures good

Key Words

Controlled Document
Master List
Unique Identification
Revise
Revision Number
Effective Date
Review and Approval
Obsolete
Archive
Hand-written changes

Cross-references

ISO 17025:2005 Section 4.3

ISO 9001:2000 Section 4.2.1, 4.2.3, 4.2.4

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4.3.1 Policies and Procedures

Policy:

The SOP# QSP 4-3-1 is used to control all quality management system documents (internally generated and from external sources). These include documents of external origin, such as regulations, standards, other normative documents, test and/or calibration methods, as well as drawings, specifications, instructions, and manuals.

Details:

Document means any information or instructions including policy statements, procedures, specifications, charts, text books, posters, notices, memoranda, software, drawings, and plans. These may be in various media, whether hard copy or electronic and they may be digital, analog, photographic or written.

The documents to be controlled include:

- Quality Manual
- Standard Operating Procedures and test methods
- Forms
- Standards
- Software manuals
- Reference methods and manuals
- Equipment manuals
- Applicable regulations/statutes

The control of data related to testing and calibration is covered in section 5.4.7. The control of records is covered in section 4.13.

4.3.2 Document Approval and Issue

4.3.2.1 Review / Approval / Master List

Policy and Details:

All documents issued to personnel in the laboratory as part of the quality management system are reviewed and approved for use by authorized personnel prior to issue (i.e., reviewed by personnel knowledgeable in the documented activity and then approved by management). A master list can be obtained by viewing the lists located on the Chemtech Quality Manager and the SOP database for performance based methods, or intranet under the SOP section. The categories are divided by folders. Each folder has a hyperlinked list

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of the SOPs. A listing of document revision is posted on the announcement area of the Chemtech Document Archive tab. A revision history is maintained. Documents are formally reviewed periodically to ensure their continuing suitability.

4.3.2.2 Availability and Obsolete Documents

Policy and Details:

The master list shows the current status of all controlled documents. The master list document is organized with the following information:

- Document Title
- Effective Date
- Revision Number
- Method Reference (if applicable)
- Date of last review

Controlled documents are approved before issue.

The SOP# QSP 4-3-1 for document control ensures that:

- authorized editions of appropriate documents are available at all locations where operations essential to the effective functioning of the laboratory are performed
- documents are periodically reviewed and where necessary revised to ensure continuing suitability and compliance with applicable requirements
- invalid or obsolete documents are promptly removed from all points of issue or use to assure against unintended use
- obsolete documents retained for either legal or knowledge preservation purposes are suitably marked (i.e., "INACTIVE" and dated) and/or archived appropriately.

4.3.2.3 Identification

Policy and Details:

All quality management system documentation is identified by:

- date of issue and/or revision number
- page numbering
- total number of pages (e.g., page 5 of 5)
- issuing authority (i.e., reviewer approval)

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4.3.3 Document Changes

4.3.3.1 Review / Approval

Policy:

Changes to documents are reviewed and approved by the same function (i.e., personnel or position) that performed the original review.

Details:

Developments in policies and procedures require documents to be changed from time to time. Changes to documents receive the same level of review and approval as the originals.

The Quality Manual is reviewed annually by the Quality Manager. Records are kept of this review.

Test methods and SOPs are reviewed on a biennial basis. Procedures for this are outlined in SOP# QSP 4-3-1.

Obsolete documents are withdrawn, but are retained for archive purposes and clearly labeled as obsolete.

4.3.3.2 Identification of Changes

Policy:

The nature of document changes is identified in the document.

Details:

As outlined in SOP# QSP 4-3-1.

In general, the nature of changes is identified in the document by changing the font color to blue. Revision history is recorded at the end of the document.

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4.3.3.3 Amendments by Hand

Policy and Details:

Hand-written amendments to documents are permitted only by those personnel authorized to do so (see section 4.1.5 A). Amendments are clearly marked, initialed, and dated. A revised document is formally re-issued at the time of the annual review. For further details refer to SOP# QSP 4-3-1.

4.3.3.4 Computerized Documents

Policy and Details:

The SOP# QSP 4-3-1 details how changes in documents maintained in computerized systems are made and controlled.

Revision History

Changes from Revision 24

None

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4.4 Review of Requests, Tenders, and Contracts

Section Synopsis

This section tells you that you must:

1. Clearly understand customer requirements

Key Words

Requirements
Subcontractor
Request
Tender
Contract
Review

Cross-references

ISO 17025:2005 Section 4.4

ISO 9001:2000 Section 5.2, 6.1, 7.2.1, 7.2.2, 7.2.3

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4.4.1 Policies and Procedures

Policy:

Prior to the commencement of any services that fall within the scope of this Quality System, Chemtech-Ford will ensure that the scope of the work is clearly defined and that the objectives of the project can be met. In some cases, the requests are formalized through a statement of work and signed contract. Other cases require less formalized contracts. In all instances Chemtech-Ford formalizes a contract between the laboratory and the client. The lab ensures that:

- a) the customer requirements including the methods to be used are adequately defined, documented and understood (see section 5.4.2)
- b) the laboratory has the capability and resources to meet the requirements
- c) the appropriate test method is selected and capable of meeting the customer's requirements (see section 5.4.2)

When practicable, any differences between the request or tender and the contract are resolved before any work commences. Each contract must be acceptable by both the laboratory and the customer.

Details:

The review of capability establishes that the laboratory possesses the necessary physical, personnel, and information resources, and that the laboratory's personnel have the skills and expertise necessary for the performance of the tests in question. The review may also encompass results of earlier participation in inter-laboratory comparisons or proficiency testing and/or the running of trial test using samples or items of known value in order to determine uncertainties of measurement, limits of detection, and confidence limits.

Some contracts are formalized through a bidding process, RFP etc. Some contracts are less formal. When a formal process initiates the work, the specifications of the project are agreed upon and programed into the LIMS. When appropriate contracts are signed by necessary parties.

All work orders at Chemtech-Ford Laboratories are considered contracts between the lab and the customer. After logging the sample(s) into the LIMS and after a login review is performed by the lab, a login summary of requested analyses is submitted to the customer for their review. The customer is informed of tests to be performed including test method, subcontracted work, conditions of samples upon receipt and any other anomaly that might have an adverse effect on the results of the analyses. The customer is requested to review the work order for accuracy and note any discrepancies to the lab in a

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timely manner. If the customer does not reply in a timely manner, Chemtech-Ford Laboratories proceeds with the work. For some analyses, the lab is required to start work immediately (e.g. short holding times or rush analyses). The customer has the ability to stop this work as needed.

The contract review ensures that each customer's requirements are adequately defined and documented in a timely manner. This should ensure that any order, once accepted, can be completed without delay, and that the customer's requirements including delivery date, technical specification can be met.

Typical types of contracts include:

- approved service quotations
- confidentiality agreements
- non-disclosure agreements
- sample submission requests
- memorandum of agreement
- memorandum of understanding
- research proposals and contracts
- verbal orders (oral agreements)
- activity plans

4.4.2 Records of Review

Policy:

Records of request, tender and contract review, including significant changes, are maintained. Records of pertinent discussions with a customer relating to the customer's requirements or the work during the period of execution of the contract are also maintained.

Details:

Records of request is made by the client via chain-of-custody. Alternative requests may also be made through other mechanisms (e.g. email). In the event that an alternative mechanism besides the chain-of-custody is used for a request, such documentation is retained. After samples have been entered into the LIMS and reviewed for correctness, a summary of the requested work is sent to the client via email to verify the accuracy of their request compared to Chemtech-Ford Laboratories interpretation of the request. Chemtech-Ford Laboratories assumes that the request is accurate unless the client

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informs us otherwise. If there is a discrepancy, the change is noted and documented in the LIMS or chain-of-custody.

Other work may demand more complex and formalized contract review. These contracts are maintained by Chemtech-Ford Laboratories and the client. Formal contracts should be stored in the project in LIMS. The LIMS project can be customized for most of the project requirements such as pricing, analyte lists, reporting limits, QC limits, report format, report recipients, etc.

When a formal contract is entered into between the lab and the client, the appropriate lab member of management must sign the contract (usually the Vice President or their designee). The person responsible for managing the project ensures that all of the aspects of the project can be met. That person coordinates the project plan and execution of the project with the appropriate laboratory staff. They also communicate any problems meeting the client objectives to the client and will advise the lab how to proceed.

4.4.3 Review of Subcontracted Work

Policy:

Request, tender, and contract review also includes work that is subcontracted by the laboratory.

Details:

Subcontractor laboratories are reviewed as described in section 4.5. Performance based methods developed by Chemtech-Ford Laboratories are not subcontracted.

4.4.4 Notification of Customer

Policy and Details:

Customers are informed of deviations from the contract. This is typically communicated to the customer prior to the performing the deviation.

4.4.5 Contract Amendment

Policy and Details:

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If a contract needs to be amended after the work has commenced, the same contract review process is repeated and any amendments are communicated to all affected personnel.

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4.5 Subcontracting of Tests and Calibrations

Section Synopsis

This section tells you that we must:

1. Know what tests and calibrations need to be done by another laboratory
2. Check out the other laboratories

Key Words

Competence
Register of Subcontractors
Assessment

Cross-references

ISO 17025:2005 Section 4.5

ISO 9001:2000 Section 7.2.3, 7.4.1, 7.4.3, 8.2.4

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4.5.1 Subcontractor Competence

Policy:

Performance based methods developed by Chemtech-Ford Laboratories are not subcontracted unless directed by the client. Work that must be subcontracted is done so to a technically competent laboratory due to:

- unforeseen circumstances
- workload
- project specifications/requirements
- contracts requiring some extra technical expertise

Details:

The subcontracted laboratory demonstrates technical competence by possession or receipt of one or more of the following:

- recognized technical accreditation (e.g. TNI, ISO, EPA etc.)
- satisfactory performance of appropriate quality control check samples, certified reference material, in-house reference material or replicate analysis
- audit of the subcontractor's quality management system by our auditors

It is the responsibility of the Quality Manager to assess and approve the competence level of subcontractor laboratories. The approved subcontract laboratories are maintained in Quality Manager.

4.5.2 Customer Approval

Policy:

Customers are advised of work (or any portion thereof) that is being subcontracted to another laboratory and their approval is obtained (preferably in writing).

Details:

Customers are advised of subcontracted work through the contracting process (see 4.4).

4.5.3 Assurance of Subcontractor Competence

Policy:

If the laboratory selects the subcontracted lab, then the laboratory is responsible to the customer for the subcontractor's work. Technical competence of subcontractor

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laboratories is demonstrated through various records including accreditation records from the laboratories Accreditation Body. There may be circumstances where the customer specifies which subcontractor is to be used. In such cases we may not be able to demonstrate the competence of the subcontractor and therefore are not responsible for the results.

Details:

Records of subcontractor competence can include, but are not limited to, the following:

- accreditation certificates or documentation
- registration certificates
- check sample results
- audit results
- approval by the Quality Manager
- approval by the client

4.5.4 Subcontractor Register

Policy:

A register of all subcontractors performing tests and calibrations is maintained in Quality Manager or within the project records.

Details:

The approved register of subcontractors is maintained by the applicable Accreditation Body or in the project records.

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4.6 Purchasing Services and Supplies

Section Synopsis

This section tells you that we must:

1. Know what we want
2. Check out our suppliers

Key Words

Selection
Verify
Specifications
History

Cross-references

ISO 17025:2005 Section 4.6

ISO 9001:2000 Section 6.3.1, 7.4, 7.5.5, 8.2.4

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4.6.1 Policies and Procedures

Policy:

The SOP# QSP 4-6-1 is used to select and purchase services and supplies. The SOP# QSP 4-6-1 is used for procurement, reception, and storage of supplies.

Details:

Consumable materials are stored according to the appropriate test method, SOP, or work instruction.

4.6.2 Specifications

Policy:

Only services and supplies of the required quality are used. These quality requirements are detailed in laboratory SOPs under the “*Equipment and Supplies*” and “*Reagents and Standards*” sections and will identify the appropriate minimum specifications when necessary.

Details:

Packing slips are checked against package content labels and matched with the Purchase Order if accepted. Once accepted, the packing slip is dated and initialed as evidence of compliance. Certificates of analysis (COA) are scanned and maintained on file in the LIMS or other appropriate area after the COA is checked to ensure the received item meets minimum specifications.

Chemicals are purchased with manufacturer’s certificates where possible. Uncertified chemicals are purchased from ISO 9000 registered companies. Whatever the source, the laboratory verifies the quality of the standards by comparing the new batch of standards to the old. Due regard is paid to the manufacturer’s recommendations on storage and shelf life.

Reagents are generally purchased from manufacturers who have a quality management system based on ISO 9000. The grade of any reagent used (including water) is stated in the method together with guidance on any particular precautions to be observed in its preparation or use.

Where no independent assurance of the quality of procured goods or services is available or the supplier’s evidence is insufficient the laboratory ensures that purchased goods and

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services comply with specified requirements. Where possible and practical the laboratory ensures that goods are inspected, calibrated, or are otherwise in compliance with any standard specification relevant to the calibrations or tests concerned.

4.6.3 Purchasing Documents

Policy:

Purchasing requests are recorded on the Purchase Order form and contain data describing the product ordered. The Purchase Order is reviewed and approved for technical content prior to release.

Details:

The description may include type, class, grade, precise identification, specifications, drawings, inspection instructions, other technical data including approval of test results, quality required and quality management system standard under which they were produced.

The completion of the Purchase Order is the responsibility of the originator or supervisor. Either reviews the Purchase Order for accuracy and approve the technical content prior to release with their signature and the date.

4.6.4 Approved Suppliers

Policy:

Suppliers of critical services are evaluated and approved before use. An approved supplier list is maintained.

Details:

Audits or tender evaluation is conducted to qualify suppliers of critical services prior to use. The criteria for evaluation may include, but is not limited to the following:

- references
- accreditation
- formal recognition

The records are maintained by purchasing personnel.

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4.7 Service to the Customer

Section Synopsis

This section tells you that we must:

1. Facilitate clarification of the customer's request
2. Give customer access to relevant testing area
3. Maintain customer contact
4. Inform customer of delays or deviations
5. Utilize customer surveys

Key Words

Clarification
Deviations
Delays
Customer Satisfaction Survey

Cross-references

ISO 17025:2005 Section 4.7

ISO 9001:2000 Section 6.1, 7.2.1, 7.2.3, 7.4.3, 7.5.1

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4.7.1 Service

Policy:

Customer requests are clarified for the customers or their representatives. Furthermore, the customer or their representative will be afforded the right to monitor the performance of the laboratory in relation to the work performed, provided that the laboratory ensures confidentiality to other customers.

Details and Procedures:

Service to the customer includes:

- Affording the customer or the customer's representative reasonable access to relevant areas of the laboratory for the witnessing of work performed for the customer; it is understood that such access should not conflict with rules of confidentiality of work for other customers or with safety.
- Maintaining of open contacts. The customer values advice and guidance in technical matters, and opinions and interpretations based on results. Contact with the customer, especially in large assignments, should be maintained throughout the work. The laboratory should inform the customer of any delays or major deviations in the performance of the tests.

4.7.2 Feedback

Policy and Details:

The laboratory seeks feedback from the customer. Positive and negative feedback can be obtained passively through ongoing communications with the customer (e.g., review of test reports with customers) or actively through customer satisfaction surveys. The feedback is used to improve the quality management system, testing activities, and customer service.

One mechanism Chemtech-Ford Laboratories has established is a database that allows for the entry of customer feedback (both positive and negative). The database categorizes each item of feedback. When a laboratory representative receives feedback from a client or other interested party, this should be reported in the database. When feedback requires an action this is documented and assigned to the appropriate team member for review.

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Other mechanisms are in place to review customer feedback. During weekly management meetings, customer feedback is reviewed (positive and negative).

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4.8 Complaints

Section Synopsis

This section tells you that you must:

1. Maintain records of Complaints
2. Maintain records of Corrective Action

Key Words

Resolving
Investigation
Corrective Action
Follow-up Verification

Cross-references

ISO 17025:2005 Section 4.8

ISO 9001:2000 Section 7.2.3

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4.8.1 Policies and Procedures

Policy:

The SOP# QSP 4-8-1 is used for resolving complaints received from customers or other parties. Records are maintained of all complaints and follow-up.

Details:

Records of complaints include the following information:

- description of the complaint
- investigation
- corrective action (if necessary)
- solution notes and date
- follow-up verification
- issuance level

See also section 4.11.

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4.9 Control of Nonconforming Testing and Calibration Work

Section Synopsis

This section tells you that you must:

1. Stop testing when nonconforming work is identified
2. Determine what is causing nonconforming work

Key Words

Nonconforming
Root Cause

Cross-references

ISO 17025:2005 Section 4.9

ISO 9001:2000 Section 5.5.1, 7.4.3, 7.5.1, 8.2.4, 8.3, 8.5.3

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4.9.1 Procedures to Control Nonconforming Work

Policy:

The SOP# QSP 4-9-1 is used to control any aspect of testing and/or calibration work, or the results of this work, when they do not conform with the test methods or the agreed requirements of the customer.

Details:

The procedure ensures that:

- Responsibilities and authorities for the management of nonconforming work are designated and actions (including halting of work and withholding of test reports as necessary) are defined and taken into consideration when nonconforming work is identified
- an evaluation of the significance of the nonconforming work is made
- correction is taken immediately, together with any decision about the acceptability of the nonconforming work
- where necessary, the customer is notified and the work is recalled
- the responsibility for authorizing the resumption of work is defined

Identification of nonconforming work or problems with the quality management system or with testing activities can occur at various locations within the quality management system and technical operations such as:

- customer complaints
- quality control
- instrument calibration
- checking of consumable materials
- staff observations or supervision
- test report checking
- management reviews
- internal or external audits

4.9.2 Root Cause Analysis

Policy:

Where evaluation indicates that nonconforming work could recur or that there is doubt about the compliance of the laboratory's operations with its own policies and procedures, the corrective action procedures given in 4.11 are followed to identify the root cause(s) of the problem and to eliminate this (these) cause(s). All notes, discoveries, and actions

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taken by participating personnel are to be reflected on the corrective action form. The QM directs this process and retains all documentation within the appropriate files for future reference. These corrective action documents will be stored for five years.

Details:

The SOP# QSP 4-11-1 outlines the recording of the root cause analysis for investigating nonconforming work.

Situations warranting corrective action investigation include:

- failure to comply with test method including all applicable procedures necessary to ensure the integrity and representative nature of the sample
- presentation of uncertain knowledge as to compliance with test methods including all applicable procedures necessary to ensure the integrity and representative nature of the sample
- failure or suspected failure in method performance as demonstrated by results provided by quality control samples
- lack of relevant evidence provided by quality audit, proficiency testing, or customer feedback
- lack of relevant evidence provided by data validation
- neglect to check the inherent property of the sample that compromises the testing

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4.10 Improvements

Section Synopsis

This section tells you that you must:

1. Review procedures for improvements
2. Continually implement improvements

Key Words

Continually
Effectiveness
Analysis of data

Cross-references

ISO 17025:2005 Section 4.10

ISO 9001:2000 Section 6.1, 8.1, 8.2.1, 8.4, 8.5.1

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4.10.1 Policies and Procedures

Policy:

The laboratory continually improves the effectiveness of its management system through the use of the quality policy, quality objectives, audit results, analysis of data, corrective and preventive actions, and management review.

Details:

The laboratory has implemented a continual improvement philosophy within the management system. Every employee in the laboratory is encouraged to suggest new ideas for improving services, processes, systems, productivity, and the working environment.

Opportunities for improvement of operations and processes are identified by managers on a continual basis from ongoing feedback on operations and through management reviews. Opportunities for improvement of services are identified by anyone within the organization including Sales, and Marketing.

Inputs for improvement opportunities may be obtained from the following sources:

- customer satisfaction surveys and any other customer feedback
- market research and analysis
- employees, suppliers, and other interested parties
- internal and external audits of the management system
- records of service nonconformities
- data from process and service characteristics and their trends

Opportunities for improvement may also be identified on a special project basis. The following are listed only as examples:

- improving usefulness of bench space
- reducing excessive inspection/testing
- reducing excessive handling and storage
- reducing test/calibration failures

Opportunities for improvement from daily feedback on operational performance (i.e., internal audits, customer feedback, test/calibration failures) are evaluated by the Technical or Quality Manager. Typically, they are implemented through the corrective and preventive action system.

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Opportunities for improvement from analysis of longer-term data and trends are evaluated and implemented through the management review process. They are prioritized with respect to their relevance for achieving quality objectives. When opportunities for improvement are no longer supported by the current policy and objectives, management will establish new quality objectives, and possibly change the policy. The process for this evaluation is described in Section 4.15. Longer-term improvement projects are initiated through the management review process, as well as the corrective and preventive action system.

Service improvement opportunities are evaluated by management. They are implemented through the supervisor of the laboratory who ensures that the improvements are validated as outlined in Section 4.12 of this manual and appropriate level of quality control is performed on an ongoing basis.

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4.11 Corrective Action

Section Synopsis

This section tells you that you must:

1. Identify problems
2. Determine why the problem occurred
3. Fix the cause of the problem
4. Verify that your changes worked

Key Words

CAR
Root Cause
Monitor
Audit
Nonconforming work

Cross-references

ISO 17025:2005 Section 4.11
ISO 9001:2000 Section 5.5.1, 5.5.2, 8.1, 8.2.2, 8.2.3, 8.4, 8.5.2, 8.5.3

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4.11.1 General

Policy:

The SOP# QSP 4-11-1 is utilized for implementing corrective action when nonconforming work or departures from policies and procedures in the quality management system or technical operations have been identified. The procedure requires that appropriate authority be designated for the implementation of corrective actions and includes cause analysis, selection and implementation of corrective action, and monitoring of actions.

Details:

Problems with the quality management system or technical operations of the laboratory may be identified through a variety of activities, such as control of nonconforming work, internal or external audits, management reviews, feed-back from customers, or staff observations.

Corrective action investigations are documented and required changes to operational procedures are implemented. The corrective action request (CAR), investigation and resolution are recorded in the CAR database.

4.11.2 Cause Analysis

Policy:

Corrective action always begins with an investigation to determine root cause(s) of the problem (see SOP# QSP 4-11-1).

Details:

Potential causes of the problem could include customer requirements, the samples, sample specifications, methods and procedures (see 4.11.6), personnel skills and training, consumable materials, or equipment and its calibration.

4.11.3 Selection and Implementation of Corrective Actions

Policy and Details:

After determining the cause(s) of the problem, potential corrective actions are identified. The most likely action(s) (this includes practical and/or reasonable) are selected and implemented to eliminate the problem and to prevent recurrence. It should be noted that

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any corrective actions taken to eliminate the cause(s) of nonconformities or other departures are to a degree appropriate to address the magnitude of the problem and commensurate with the risks encountered (Note – in plain language, this means determine whether the benefit outweighs the cost). Controls are applied to prevent recurrence. The laboratory documents and implements the required changes resulting from corrective action investigations.

4.11.4 Monitoring of Corrective Action

Policy:

After implementing the corrective action(s), the laboratory monitors the results to ensure that the actions taken have been effective in overcoming the problems originally identified.

Details:

Monitoring is assigned to an appropriate individual such as the originator of the CAR or the originator's manager. Changes resulting from corrective action are documented.

4.11.5 Additional Audits

Policy:

Where the identification of nonconformities or departures casts doubts on compliance of policies, procedures, regulations, international quality standards, the appropriate areas of activity are promptly audited in accordance with section 4.14.

Details:

Special audits follow the implementation of corrective actions to confirm their effectiveness. A special audit is only necessary when a serious issue or risk to the business is identified. Special audits are carried out by trained and qualified personnel who are [whenever resources permit] independent of the activity to be audited. See section 4.14 for more details.

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4.11.6 Responsibility

Policy:

Analytical data routinely generated by the laboratory is evaluated to determine acceptability, including precision and accuracy. Laboratory analyst and supervisors are responsible for evaluating QC in comparison to acceptance criteria.

Details:

When data falls outside of the established control limits or acceptance limits for a given method (as defined by the SOP), that information is evaluated and appropriate action taken. If a problem is discovered that could merit corrective action, the person that discovers the problem should discuss with the Quality Manager the need to initiate a formal corrective action. All Chemtech-Ford Laboratories employees can recommend corrective action. If it is determined that the problem merits corrective action, the Quality Manager will initiate the corrective action.

Revision History

Changes from Revision 24

None

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4.12 Preventive Action

Section Synopsis

This section tells you that you must:

1. Identify potential problems
2. Determine why the problem could occur
3. Fix the cause of the potential problem
4. Verify that your changes worked

Key Words

PAR
Potential Nonconformity
Action Plan

Cross-references

ISO 17025:2005 Section 4.12

ISO 9001:2000 Section 4.2.4, 6.3.1, 8.4, 8.5.1, 8.5.2, 8.5.3

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4.12.1 Preventative Action Identification

Policy:

Opportunities for needed improvement and potential sources of nonconformities, either technical or with the quality management system shall be identified. If action is required, action plans are developed, implemented and monitored, to reduce the likelihood of occurrence of such nonconformities and to take advantage of the improvement opportunities.

Details:

Records of preventive action include the following information:

- details of potential nonconformities
- investigation
- preventive action
- follow-up verification

4.12.2 Preventive Action Plans

Policy:

The preventive action procedure includes the initiation of such actions and application of controls to ensure that they are effective.

Details:

Preventive action may result from the review of operational procedures and analysis of data. Analysis of data includes trend analysis, analysis of proficiency testing results, and risk analysis.

Preventive actions can be designated and documented in the Corrective Action database or in management meeting notes or other approved laboratory mechanism for recording/monitoring preventive actions.

Revision History

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4.13 Control of Records

Section Synopsis

This section tells you that you must:

1. Identify the records to be kept
2. Keep identified records in a useful state
3. Destroy records when they are no longer needed

Key Words

Collection
Indexing
Access
Storage
Maintenance
Disposition
Legible
Traceable
Retrievable
Secure

Cross-references

ISO 17025:2005 Section 4.13

ISO 9001:2000 Section 4.2.4, 6.3, 6.4, 7.1, 7.5.1, 7.5.2, 7.5.3, 8.1, 8.2.2, 8.2.3, 8.2.4

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4.13.1 General

4.13.1.1 Procedures

Policy:

The SOP# QSP 4-13-1 is used to identify, collect, index, access, file, store, maintain, protect, backup, and dispose quality and technical records. Quality records include reports from internal audits and management reviews as well as corrective and preventive action records.

Details:

Records are available to demonstrate conformance to requirements and effective operation of the Quality Management System. Quality records from suppliers are also controlled.

All records, including test reports, are safely stored and held secure (either electronically or physically), and in confidence to the customer. Records are maintained in the designated archival area for five (5) years.

4.13.1.2 Record Integrity

Policy:

All records are to be legible and shall be retained in such a way that they are readily retrievable in facilities that provide a suitable environment to prevent damage or deterioration and to prevent loss.

Details:

The retention times for records are generally set at five (5) years. Records may be in the form of any type of media, such as hard copy or electronic media.

4.13.1.3 Record Security

Policy:

All records are held secure and in confidence.

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Details:

Access to records is secured through locked rooms, filing cabinets, passwords.

4.13.1.4 Record Backup

Policy:

The SOP# QSP 4-13-1 is followed to protect and backup data/records held on computers at all times and to prevent unauthorized access to or amendment of data/records on computers.

Details:

Data is password protected.

Backups ensure integrity and availability of data/information in the event of a system/power failure.

4.13.2 Technical Records

4.13.2.1 Record Information

Policy:

Original observations, calculations, derived data and sufficient information to establish an audit trail, calibration records, personnel records and a copy of each test report issued are retained for five (5) years.

The records for each test or calibration shall contain sufficient information to facilitate, if possible, identification of factors affecting the test uncertainty and to enable the test or calibration to be repeated under conditions as close as possible to the original. The records include the identity of personnel responsible for sampling, performing of each test and/or calibration and checking of results.

Details:

Technical records are accumulations of data (see 5.4.7) and information that result from carrying out tests and/or calibrations and which indicate whether specified quality or process parameters are achieved. They may include forms, contracts, work sheets, work

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books, note books, instrument printouts, magnetic media, check sheets, work notes, control graphs, test reports, calibration certificates, customer's notes, papers and feedback, and test reports to customers.

The records for each test contain sufficient information to permit its repetition. Records include:

- date of sampling
- sample receipt
- sample handling, storage, and disposal
- identification of personnel
- analyst proficiency
- equipment identification and performance
- calibration records
- media performance, where appropriate
- test organism batch # or lot #, where appropriate
- results
- reports (mailed, emailed, or faxed)
- review

Note – the above records may be stored in separate locations. They are cross-referenced for easy retrieval.

4.13.2.2 Recording

Policy:

Observations, data, and calculations are clearly and permanently recorded and identifiable to the specific job at the time they are made.

Details:

Handwritten records must be legible and made with indelible ink immediately after an observation, after data is collected and/or after calculations are made.

4.13.2.3 Corrections to Records

Policy:

Changes to test data are made so as not to obscure or delete the previous data entry.

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Details:

Mistakes are crossed out with a single line, initialed, dated and the correct value entered alongside. Mistakes are not erased, made illegible, or deleted. All alterations to records are signed or initialed by the person making the correction. In the case of computer-collected data, similar measures are taken to avoid loss or change of original data.

4.13.2.4 Transfer of records

Policy:

Records will be maintained or transferred in the event that a laboratory transfers ownership or goes out of business.

Details:

In the event that the laboratory changes ownership, all records will be transferred to the new owners. The new owner(s) will then be given the responsibility of maintaining the records.

If the laboratory goes out of business, all hard copy and electronic records will be maintained by the ownership group at the time of the dissolution of the company for a period of 5 years.

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4.14 Internal Audits

Section Synopsis

This section tells you that:

1. Trained internal auditors examine your internal operations for quality
2. Auditors report the results to those in charge
3. You must correct any areas that need fixing

Key Words

Schedule
Elements
Independent
Nonconformity
CAR

Cross-references

ISO 17025:2005 Section 4.14

ISO 9001:2000 Section 8.1, 8.2.2, 8.2.3

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4.14.1 Internal Audit Program

Policy:

The internal audit program involves periodic audits conducted according to a predetermined schedule for each year. Each year different aspects of the Quality System are evaluated. The schedule is reviewed during the managerial review. All elements of the management system including the testing activities are covered on a regular basis. These audits are performed to verify operations continue to comply with the requirements of this Quality Manual and are effective.

Details:

The tracking of internal audit results is maintained in Quality Manager. The frequency is also maintained in Quality Manager. The Quality Manual, test procedures, and laboratory results are verified for compliance. It is the responsibility of the Quality Manager to plan and organize audits as required by the schedule and requested by management. Audits are carried out by trained and qualified personnel who are [wherever resources permit] independent of the activity to be audited. Personnel are not to audit their own activities except when it can be demonstrated that an effective audit will be carried out (see also 4.11.5). Audits are performed through the aid of a checklist prepared in advance to minimize the possibility of overlooking any details during the audit. The results of the internal audit are maintained and accessible.

Generally, the types of audits include:

- quality management system
- technical methods
- products, services, and reports

4.14.2 Corrective Action

Policy:

When audit findings cast doubt on the effectiveness of the operations or on the correctness or validity of test or calibration results, timely corrective action is taken and customers are notified if investigations show that laboratory results may have been affected.

Details:

Nonconformities that can be resolved easily are to be corrected immediately, ideally during the audit. Records are made on the audit checklist. Nonconformities that require a

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more involved resolution are recorded on a CAR and resolved as described in section 4.11.

Corrective actions and customer notifications must be kept on record for each audit deviation that casts doubt as described in this section.

4.14.3 Records and Management

Policy:

Records are made of the activity being audited, the audit findings, and corrective actions that arise. Management ensures that corrective actions are discharged within an appropriate and agreed timeline.

Details:

A report is prepared by the auditors and distributed to those audited and/or the area manager/supervisor within an appropriate and agreed timeline. The audit report may include the following sections, as appropriate:

- audit objective and scope
- area or section audited
- personnel involved – auditors and auditees
- date of audit
- reference documents
- observations including nonconformities and commendations
- opening and closing meetings
- recommendations
- audit report distribution

The appropriate manager is responsible for ensuring that corrective actions are sufficiently recorded. Follow-up is performed by the auditor and recorded when corrective action is complete and deemed effective. The audit records are kept in the laboratory.

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4.14.4 Follow-up Audits

Policy:

Follow-up audits are performed to verify and record the implementation and effectiveness of the corrective action taken.

Details:

The follow-up audit is performed at a mutually acceptable time between the area implementing corrective action and the auditor. This time is determined when the CAR is issued.

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4.15 Management Reviews

Section Synopsis

This section tells you that management must:

1. Periodically review technical competence and customer satisfaction
2. Keep records of reviews
3. Ensure follow-up is executed
4. Measure progress

Key Words

Supervisor Reports
Audit Reports
CAR / PAR
Proficiency Results
Customer Satisfaction Survey
Resources

Cross-references

ISO 17025:2005 Section 4.15

ISO 9001:2000 Section 5.1, 5.4.2, 5.6, 6.2.1, 7.1, 8.5.1

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4.15.1 Review of Quality Management System and Testing

Policy:

Top management periodically (at least annually) and in accordance with a predetermined schedule and SOP# QSP 4-15-1, conduct a review of the laboratory's quality management system and testing and/or calibration activities to ensure their continuing suitability and effectiveness and to introduce any necessary changes or improvements.

Details:

The review takes account of:

- suitability of policies and procedures (including the Quality Policy outlined in this manual)
- reports from managerial and supervisory personnel
- the outcome of recent internal audits
- corrective and preventive actions
- assessments by external bodies
- results of inter-laboratory comparisons or proficiency tests
- changes in the volume and type of work undertaken
- feedback from customers, including complaints and customer satisfaction surveys
- recommendations for improvement
- other relevant factors, such as quality control activities, resources and personnel training

A minimum period for conducting a management review is once a year. Results of the review feed into the laboratory planning system and include goals, objectives and action plans for the coming year.

A management review can be supplemented by consideration of related subjects at regular management meetings.

4.15.2 Findings, Actions, and Records

Policy and Details:

Findings from management reviews and the actions that arise are recorded in the minutes of the meeting. Management will ensure that the actions are discharged within an appropriate and agreed upon timeline.

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5.1 General

Section Synopsis

This section informs you that:

1. Many factors contribute to the correctness and reliability of tests and/or calibrations
2. The laboratory must account for these factors

Key Words

Correctness
Reliability
Uncertainty

Cross-references

ISO 17025:2005 Section 5.1

ISO 9001:2000 Section 7.1, 7.5.1

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5.1.1 Correctness and Reliability

Policy and Details:

Correctness and reliability of the tests and/or calibrations performed have many contributing factors including:

- Human factors (see section 5.2)
- Accommodation and environmental conditions (see section 5.3)
- Test and calibration methods and method validation (see section 5.4)
- Equipment (see section 5.5)
- Measurement traceability (see section 5.6)

5.1.2 Measurement Uncertainty

Policy:

When developing test and calibration methods and procedures, total measurement uncertainty must be accounted for in the training and qualification of personnel, and in the selection and calibration of equipment.

Details:

The extent to which the factors contribute to total measurement uncertainty differs between tests, matrices, methodologies.

See section 5.4.6 for more details.

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5.2 Personnel

Section Synopsis

This section tells you that management:

1. Analyzes training needs
2. Provides training to employees for them to do their jobs
3. Qualifies people performing specific tasks

Key Words

Competence
Qualification
Authorize
Training Needs
Job Description
Registry of Skills

Cross-references

ISO 17025:2005 Section 5.2

ISO 9001:2000 Section 5.5.1, 6.2.1, 6.2.2, 7.5.1, 7.5.2

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5.2.1 Competence and Qualification

Policy:

Management ensures the competency of all employees including specific equipment operators, those performing tests and/or calibrations, those evaluating results and signing test reports. Appropriate supervision is provided for employees undergoing training. Personnel performing specific tasks are qualified on the basis of appropriate education, training, experience and/or demonstrated skills, as required.

In addition, personnel responsible for the opinions and interpretations included in test reports also have:

- Relevant knowledge of the technology used in the performance of analyses, materials, products tested, or the way they are used or intended to be used and of the defects or degradation that may occur during sampling, analysis, or use.
- Knowledge of the general requirements expressed in the legislation and standards.
- An understanding of the significance of deviations found with regard to the normal use of the items, materials, or products concerned.

Details:

Management defines the minimum levels of qualification and experience necessary for all posts within the laboratory. The educational and experience requirements for various laboratory positions are listed in the following sections:

5.2.1.1 Laboratory Director – The minimum requirements for the technical director are:

Bachelor's degree in the chemical, environmental, biological sciences, physical sciences or engineering with at least twenty-four (24) college semester credit hours in chemistry and at least two (2) years of experience in the environmental analysis of representative inorganic and organic analytes for which the Chemtech-Ford Laboratories seeks or maintains accreditation. A master's or doctoral degree in one of the above disciplines may be substituted for one (1) year of experience.

For microbiological analyses the technical manager must have a minimum of an associate's degree with at least four (4) college semester credit hours in general microbiology when the laboratory is engaged in microbiological analysis limited to fecal coliform, total coliform, E. coli and standard plate count. In

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addition, the person shall have one (1) year of experience in microbiological analyses.

If the laboratory maintains a scope beyond fecal coliform, total coliform, E. coli and standard plate count, then the technical director must have a bachelor's degree in microbiology, biology, chemistry, environmental sciences, physical sciences or engineering with a minimum of sixteen (16) college semester credit hours in general microbiology and biology and at least two (2) years of experience in the environmental analysis of representative analytes for which the laboratory seeks or maintains accreditation. A master's or doctoral degree in one of the above disciplines may be substituted for one (1) year of experience.

5.2.1.2 **Quality Manager** - The minimum requirements for the quality manager are:

Bachelor's degree and 2 years of experience in environmental laboratory analysis/operation or an associate's degree and 4 years of experience in environmental laboratory analysis/operation. Understanding of quality systems including QA/QC. Understanding of laboratory operations. Strong communication skills including to work with a variety of staff and management

5.2.1.3 **Supervisor** - The minimum requirements for a laboratory supervisor are:

A bachelor's degree plus one-year work experience in a certified environmental laboratory or in a laboratory that the prospective supervisor demonstrates as one that substantially meets equivalent quality standards for a certified laboratory;
or

An associate's degree in the biological, chemical, or physical sciences from an institution of higher education, plus four years work experience in a certified laboratory or in a laboratory that the prospective supervisor demonstrates as one that substantially meets equivalent quality standards for a certified laboratory.

The supervisor must demonstrate competency to supervise testing in the areas over which they supervise.

5.2.1.4 **Technical Employees** - The minimum requirements for technical laboratory employees vary as to position and job requirements. The education requirements

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differ based on the job assignments. In general, the requirements are:

A bachelors degree in the biological, chemical, or physical sciences from an institution of higher education; or

An associates degree in the biological, chemical, or physical sciences from an institution of higher education; or

A high school degree.

Continued competence is monitored through the use of blind performance evaluation samples and Demonstrations of Competency. Where this is not achieved, the need to retrain personnel is considered. Where a method or technique is not in regular use, verification of personnel performance before they undertake tests, may be necessary.

5.2.2 Training Policies and Procedures

Policy:

Management will formulate the goals with respect to the education and the skills of the laboratory personnel. The training program is relevant to the present and anticipated tasks of the laboratory. SOP# QSP 5-2-1 is utilized to identify training needs and providing the necessary training for personnel.

Details:

The skills and knowledge are defined in the job description for each job function as described in section 5.2.1. Management compares the job description to the skills and knowledge of the new incumbent to determine the training needs.

5.2.2.1 QA Program - Chemtech-Ford, Inc. provides easy access to controlled copies of this “quality assurance program” as written within this document for all employees of this laboratory.

5.2.2.2 Training Files - Chemtech-Ford, Inc. maintains training files for all employees involved with data generation and reduction. The training files contain the following sub-files:

- Job description (minimum qualifications, experience, and skills defined).

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- Analytical qualification documentation “Demonstrations of Capability,” (DOC’s). DOCs are neither appropriate nor required for the analyses of Odor, Color, and Paint Filter Test. Also alternatively, duplicate checks of capability are performed for Dissolved Oxygen, Flashpoint, and all microbiological analyses.
- Training attendance sheets.
- SOP reading documentation.
- Certificates, degrees, etc.
- Signed “Ethics Statement.”

Training in the laboratory must include all methods or parts of methods and techniques that personnel are asked to perform. Minimally, the analyst must demonstrate competency through observation by management and verification using replicate and/or check samples. For technicians who perform only parts of the method, confirmation of competency may be verified by observation only. Re-verification of all personnel must be performed annually on all methods or techniques pertinent to their job description by use of blind performance evaluation samples and/or Demonstrations of Competency tests.

5.2.3 Employees

Policy:

Competent permanent or contractual employees are employed in the laboratory. The technical manager ensures that contractual, additional technical employees, and key support personnel are supervised and work in accordance to the policies and procedures of this Quality Manual.

Details:

Testing must be either performed or supervised by an experienced person qualified by the experience and/or degree level requirements from section 5.2.1.

5.2.4 Job Descriptions

Policy:

Current job descriptions for managerial, technical and key support personnel involved in tests and/or calibrations are maintained centrally in the administration area of the laboratory.

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Details:

Minimum contents of job descriptions include:

- The duty of performing tests.
- The act of planning tests and evaluation of results.
- The responsibility of developing and validating new methods as / when requested.
- Expertise and experience.
- Qualifications and training programs.
- Managerial duties.

5.2.5 Key Personnel and Responsibilities

Policy:

Chemtech-Ford, Inc. complies with the managerial staff requirements as identified and required by “Utah Rule R444-14-8.”

Details:

Key Personnel include the following listed positions:

5.2.5.1 Authority and Interrelationships – The laboratory has designated the following lines of authority:

- CEO
- President – Reports to CEO
- Executive Vice President reports to President
- Vice President, Quality Manager, Laboratory Director report to Executive Vice President
- Deputy Lab Director report to Lab Director
- Section Manager reports to Lab Director or Deputy Lab Director
- Team Leader reports to Section Manager
- Analysts & Technicians report to Team Leader

These lines of authority may have exceptions (e.g. there may not be a Team Leader and the analyst/technician may report to a Section Manager. The organizational chart is reviewed and updated (as needed) at least semi-annually (or more frequently as needed).

5.2.5.2 Laboratory Director - The Laboratory Director is responsible for the administrative oversight and overall technical operation of the laboratory. The laboratory director will:

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- Define minimum qualifications, experience, and skills necessary for all technical employees.
- Ensure and document through an annual competency check that each technical employee demonstrates initial and on-going proficiency for the tests performed by that employee.
- Review the Quality Managers audit findings and document such reviews.
- Oversee laboratory technical and support staff.
- Review and approve all new and existing analytical procedures.
- Review and approve all deviations from normal analytical protocols.
- Review external and internal quality control audits and all other relative documentation/information.
- Perform final review and approval of new laboratory projects including reports and documents.
- Nominate deputies in case of temporary absence. Unless otherwise specified, the QM or deputy Lab Director will serve as acting laboratory director in the director's absence.
- Review laboratory resources and capabilities prior to accepting new non-routine project work that may affect or adversely tax the present capacity of the laboratory.
- Ensure that subcontracted laboratories are capable and appropriately certified for analytical work sent to them.

5.2.5.3 Quality Manager (QM) - The QM reports directly to the executive team. The QM has the responsibility for the quality system and its implementation (See Section 6 of the QM). The Quality Assurance Officer will:

- Have direct access to the highest level of management at which decisions are taken on laboratory policy and resources, and to the laboratory director.

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- Serve as the focal point for quality assurance and oversee and review quality control data.
- Have functions independent from laboratory operations for which he or she has quality assurance oversight.
- Have documented training or experience in quality assurance procedures and be knowledgeable in the quality assurance requirements of Utah Rule R444-14; also be knowledgeable in the quality systems.
- Have knowledge of the approved methods used by the laboratory in order to accurately evaluate laboratory performance.
- Objectively evaluate data and objectively perform assessments without undue influence.
- Oversee all quality aspects of sample handling, testing, and report generation.
- Schedule, oversee, and be responsible for reviews of the entire technical operation of the laboratory. This includes conducting annual technical audits.
- Arrange, when available, analytical participation in inter-laboratory comparisons and proficiency testing programs. For purposes of qualifying for and maintaining accreditation, the QM shall arrange for participation in an external proficiency test program according to Utah Rule R-444-14 and as identified in the Quality Systems of NELAP.
- Notify laboratory management of deficiencies in the quality system and monitor corrective actions (ensure managers review all corrective actions initiating from their areas of concern, using corrective action reports as references during QA training meetings).
- Serve as the back-up to the Laboratory Director in the absence of the Laboratory Director.

5.2.5.4 Laboratory Area Supervisors - These managers are responsible for the day-to-day operation of the laboratory. Their responsibilities include:

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- Supervise all technical and non-technical employees.
- Be responsible for the production and quality of all data reported by the laboratory.
- Review and approve analytical data generated within the area.
- Develop and submit new methods and operating procedures for approval by the Laboratory Director.
- Evaluate instrument and personnel needs.
- Ensure that all samples are accepted, analyzed, and reported in accordance with laboratory SOPs.

5.2.5.5 Technical Staff - Technical personnel, generally, are responsible for the routine receipt, analysis and reporting of all laboratory samples. The technical staff will:

- Report directly to the assigned supervisor.
- Perform duties in accordance to laboratory policy and procedures.
- Read, understand, and follow the Quality Manual and all appropriate SOPs.

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5.2.6 Laboratory Organizational Chart

The official organizational structure is contained in Quality Manager.

5.2.7 Staff Management Policies

Policy:

Management authorizes specific personnel to perform particular types of testing, to issue test reports, to give opinions and interpretations and to operate particular types of equipment. Records of the relevant competence, educational and professional qualifications, training, skills and experience of all technical personnel and contracted personnel are maintained. This information is readily available and includes the date on which authorization and/or competence was confirmed and the criteria on which the authorization is based and the confirming authority.

Details:

5.2.7.1 Confidentiality

Each employee shall read, understand, and acknowledge that the analytical work performed in the laboratory demands a high degree of confidentiality. In a practical sense, this has to do with the potential communication of laboratory procedures and analytical results to clients, regulatory agencies, and other interested parties. All employees should understand that **analytical data legally belongs to the client who contracted such work.**

5.2.7.1.1 Telephone Correspondence

A request for analytical results via telephone should be verified by requesting the name of the requestor (and as applicable the phone number, FAX number, e-mail address, or mailing address) before releasing data. It should be clear that the contracting client is the same as the client requesting the data. **For any data request from a client other than the contracting client, the contracting client must approve its use by the requesting client before release.** Such permission must be documented (requestor, contracting client, date and time of request, staff member taking request) and placed in the client data file.

5.2.7.1.2 E-mail and FAX Correspondence

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Similar guidelines to 5.2.7.1.1 apply to requests for results transmitted by e-mail or FAX. Chemtech-Ford, Inc. will keep electronic records of e-mail/FAX requests and reports for 5 years.

5.2.7.1.3 "In-Person" Requests

Similar guidelines to 5.2.7.1 apply to clients who appear at the laboratory in person and request analytical data or other laboratory documentation. Copies of such reports or documentation may be released only after determining that the requestor is the contracting party, or has written permission from the contracting party to release the data.

5.2.7.1.4 Statement of Confidentiality

Each employee shall sign a Confidentiality Agreement, which describes the understanding of such laboratory confidentiality and acknowledges the penalties for failing to follow established laboratory procedures regarding confidentiality.

5.2.7.2 Improper, Unethical, and Illegal Actions

It is the policy of Chemtech-Ford, Inc. and its employees to perform their duties in a consistently legal and ethical manner. A high level of ethical behavior is characterized by, but not limited to, dealing honestly and forthrightly with all clients and co-workers, maintaining data integrity, open and timely treatment of inaccurate, invalid, or misreported analytical data, and abiding by all pertinent rules, regulations, company policies, and standard operating procedures.

Deliberate violations of such behavior will result in disciplinary action up to and including termination, the consequences of which could additionally lead to direct liability and legal action against the responsible individual.

It is the responsibility of each Chemtech-Ford, Inc. employee to report any observed violation of this policy. This observation may result from a visual or studied review of protocol, generated data, or reported information. Laboratory management will review the evidence of any such reported violation; confirmation that such a violation occurred will result in severe disciplinary action, up to and including termination and possible legal action.

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Serious violations of Chemtech-Ford, Inc.'s ethical policy include, but are not limited to, the following:

- Changing a reported value in the LIMS database without proper support of documentation;
- Intentionally misrepresenting data generated by instrument or calculation;
- Recording invalid or otherwise altered data to make the analysis conform to "expected" levels;
- Recording invalid or otherwise altered data at someone else's suggestion or insistence;
- Recording invalid or otherwise altered data to satisfy quality assurance acceptance criteria;
- Manually integrating chromatographic data to satisfy quality assurance acceptance criteria;
- Withholding information that was noted during sample receipt or analysis;
- Purposefully destroying a sample prior to the completion of analysis; and
- Willfully circumventing the sample disposal Standard Operating Procedure.

Each Chemtech-Ford, Inc. employee is required to participate in a training session within two weeks of employment. The training will include Chemtech-Ford's ethical policies, examples of unethical behaviors, and penalties for non-compliance. The new employee will be required to sign an attestation statement as a condition of employment which will again define Chemtech-Ford's policies and penalties.

Each year, or more frequently if needed, each Chemtech-Ford, Inc. employee is required to attend ethical training to review company policies and penalties. At the conclusion of the training, each employee will be required to sign an attestation called an Ethical Attestation Statement that summarizes the employee's ethical and legal responsibilities. This Statement acknowledges that penalties exist for deliberately violating this policy.

In order to promote an atmosphere of integrity, management will reiterate at routine staff meetings the importance of reporting discovered errors and the insistence that such reporting will not necessarily result in personal punishment, even though the company may suffer financially.

Furthermore, management will institute internal proficiency testing (blind and double blind samples) where applicable; QC meetings whose emphasis is on

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appropriate and inappropriate laboratory technique and instrument/data manipulation will be held routinely to address this topic.

5.2.7.2 Manual Integration

In keeping with Chemtech-Ford's policy of producing data of the highest possible quality, integrations performed in the laboratory must be generated by fully calibrated instruments and not altered in an unsubstantiated manner.

Improper manual integrations performed for the purposes of meeting quality control criteria or any other reason are not allowed. Such unsubstantiated integrations are subject to possible disciplinary action by laboratory management.

If a manual integration is necessary, the integration produced after manual integration shall both be labeled and present in the raw data package. The intent is to demonstrate the results of the integration are appropriate and according to good laboratory practices. It is recommended that a short explanation be provided if an unusual integration has to be made (e.g. for unusual tailing due to matrix effect).

All manual integrations are subject to strict scrutiny to ensure that they are performed appropriately. Analysts are advised that they must be prepared at any time to defend a manual integration. When there is a question to the validity of the manual integration by the analyst, then they should discuss the integration with their supervisor. Supervisors should regularly review the manual integrations of employees.

Manual integrations are noted in the raw data package. Typically, these are denoted by an "m" next to the integrated area or concentration.

5.2.7.3 Undue Pressure

An appropriate working atmosphere will be provided at Chemtech-Ford, Inc. so that all employees will be free from any commercial, financial, or other undue pressures, which might adversely affect the quality of their work.

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If a Chemtech-Ford, Inc. employee feels that his or her work has been affected by undue pressure of any sort, the following recourses are available:

5.2.7.3.1 The employee may report the source of the pressure(s) affecting lab performance to his or her supervisor, or to the laboratory director or owner if the employee believes notifying the supervisor will be ineffective or problematic; and/or

5.2.7.3.2 The employee may generate a Corrective Action Form. This form will specify those requests, behaviors, or other pressures, which adversely affect the quality of the employee's work. The form will then follow normal review channels through the laboratory in order to be resolved.

5.2.7.4 Validation of Employee Qualifications

It is the responsibility of Chemtech-Ford, Inc. management to ensure that all employees have demonstrated capability in the activities for which they have been hired and are responsible. This includes verification that a potential employee possesses all of the technical, organizational, and communication skills prior to employment; and that, once hired, each employee continues to upgrade his knowledge and skills.

Each new employee is required to read, sign, and understand a comprehensive employment documents provided at time of employment. These documents verify the position's required skills as well as educating the employee in all aspects of the company's operations and policies. This documents include, but are not limited to containing:

- An attestation that all educational qualifications and technical and communication skills requirements have been fulfilled and reviewed by management.
- A Confidentiality Agreement.
- An Ethics Statement.
- A Harassment Prevention Policy.
- An attestation that the employee has read, acknowledged, and understood the Chemtech-Ford, Inc. Quality Manual.
- An attestation that the employee has read, understood, and agreed to perform the most recent version(s) of the test method(s) for which the employee is responsible.

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- Demonstrations of Capability for all technical competencies required.
- An explanation of the Chemtech-Ford, Inc. Laboratory Information Management System (LIMS) and its functions.

New employees are apprised of all laboratory security systems and the Training Files to be kept by each employee.

Specialized training sessions will be routinely held to 1) review current policies and procedures; 2) institute new policies and procedures; 3) review particular technical skills, Quality Assurance topics, or corrective actions; and 4) institute cross training. These training sessions/courses will be documented in each employee's training file.

Prior to the initiation and acceptance of test results from an employee on any test method, satisfactory demonstration of capability is required. Following the completion of all capability demonstration work, the initial analytical work of any new employee will be carefully reviewed for accuracy, thoroughness, and timeliness by the laboratory supervisor. Correct and accurate entry of data into the LIMS will also be monitored. Once the supervisor is satisfied of the technical competency of the new employee, a less rigorous review of the employee's skills and generated data will be required.

Records are held in Quality Manager.

Revision History

Changes from Revision 24

Revision 25 is a significant revision with numerous additions, deletions and corrections. These are not all documented in the revision history, rather all persons on the distribution list are required to read the entire document.

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5.3 Accommodation and Environmental Conditions

Section Synopsis

This section tells you:

1. That laboratory facilities are suitable for attaining correct performance of tests and calibrations
2. Critical environmental conditions are monitored, controlled and recorded
3. Incompatible activities are separated
4. Access to laboratories is controlled
5. Good housekeeping is practiced

Key Words

Incompatible activities
Prevent cross-contamination
Controlled access

Cross-references

ISO 17025:2005 Section 5.3

ISO 9001:2000 Section 6.3, 6.4, 7.1, 7.5.1, 7.5.2, 7.6, 8.2.3

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5.3.1 Facility

Policy:

Laboratory facilities shall be appropriate to allow for the proper performance of analytical testing. This may include, but not limited to, energy sources, lighting, heating, ventilation and any other environmental conditions.

Appropriate care is taken to ensure that the environment does not invalidate the results or adversely affect the required quality of any measurement. The technical requirements for accommodation and environmental conditions that can affect the results of tests and calibrations are documented.

Details:

This section deals with the test areas in the laboratory and premises for support such as sample receipt and storage. Central laboratory supplies and services, such as water purification systems, air supply, vacuum source, and sample storage, are appropriate to facilitate proper performance of tests.

5.3.2 Monitoring

Policy:

Critical environmental conditions are monitored, controlled and recorded as required by the relevant specifications, methods, and procedures or where they may influence the quality of the results. Tests and calibrations are stopped when the environmental conditions jeopardize the results of the tests and/or calibrations.

Details:

Laboratories are ventilated to reduce the levels of contamination, lower humidity, and control temperature. Laboratories' test areas are air-conditioned and the temperature is 20-25 °C.

Bench tops and floors are made of impervious, smooth easily cleaned materials. There is at least two linear meters workspace per analyst while working. Walls and ceilings are made of materials that are smooth and easily cleaned.

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5.3.3 Separation of Incompatible Activities

Policy:

Effective separation between neighboring areas is made when the activities are incompatible. Measures are taken to prevent cross-contamination.

Details:

Reference materials and certified reference materials must be kept separated from samples (log-in and storage). Sample log-in and storage must be segregated, ideally in a separate area from the testing laboratory, and include proper sanitation to exclude the possibility of cross-contamination. Segregation of activities is achieved through time and space allocations.

5.3.4 Controlled Access

Policy:

Access to and use of areas affecting quality of the tests is defined and controlled.

Details:

Access to the laboratory is restricted to authorized personnel only. The authorized personnel are made aware of the following items:

- the intended use of the area
- the restrictions imposed on working within such areas
- the reasons for imposing the restrictions

5.3.4.1 Sample Receiving - The sample receiving area is designed to be independent of the other laboratory areas. The sample receiving area is designed with a convenient access from the out-of-doors. This access is controlled allowing security of the laboratory and sample storage. The sample receiving area may also be used for preparing and shipping of containers to clients.

5.3.4.2 Volatiles Laboratory - The volatiles laboratory is located within a climate controlled area away from the main laboratory in order to eliminate solvent cross-contamination from other areas of the laboratory. As with the main laboratory, access to this building is limited to authorized personnel only. All GC/MS volatiles work is performed in this area.

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5.3.4.3 Inorganic Chemistry Laboratory - The inorganic chemistry laboratory occupies the largest of the lab area within the building. The area consists of a centrally located spacious rooms equipped with several large benches for analytical work. Conventional wet techniques such as gravimetric, colorimetric, titrimetric are performed here. Several fume hoods are located within the rooms to provide ease of sample preparation.

5.3.4.4 Wet Chemistry Laboratory - This laboratory is adjacent to the inorganic chemistry laboratory and contains the necessary equipment required to perform various wet chemistries (e.g., BOD, COD, and TSS).

5.3.4.5 Metals Laboratory - The metals analysis laboratory contains all of the metals analytical equipment. However, samples are prepared for metals analysis in the inorganic laboratory, thus reducing the possibility of instrument contamination. The metals laboratory is designed for ICP, ICP/MS, and Hg cold-vapor instrumentation.

5.3.4.6 GC and Semi-Volatile GC/MS Laboratory - The preparation lab contains standard fume hoods and ample bench space for sample extraction. The GC and Semi-volatile GC/MS instrument laboratory has several benches with GC and GC/MS instrumentation and supplies.

5.3.4.7 Microbiology Laboratory - The microbiology laboratory is a separate room that is climate-controlled with ample bench space on which to perform the required analytical procedures. The laboratory contains its own supplies and storage facilities for ease of analysis and for prevention of contamination.

5.3.4.8 Sample Storage - Samples remaining in the sample analysis stream are located within their respective holding areas (refrigerators, etc.) until required analyses have been complete. Additional post-analysis storage for metals-preserved sample bottles is accomplished via storage shelves located within the metals laboratory. All other inorganic/organic samples are kept for a maximum of three months (following data reporting) in refrigerated storage throughout the laboratory.

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5.3.5 Good Housekeeping

Policy:

Measures are taken to ensure good housekeeping in the laboratory. Special procedures are followed when necessary.

Details:

Controlled use of cleaning and pest control materials is exercised. The laboratory complies with the local health and safety requirements.

Revision History

Changes from Revision 25

Section 5.4.5.3 Title edited for grammar.

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5.4 Test Methods and Method Validation

Section Synopsis

This section tells you:

1. Preference is given to the use of a standard method when selecting procedures
2. All methods must be validated before use
3. Measurement uncertainty is estimated
4. Data is controlled

Key Words

Standard Methods
Laboratory-Developed Methods
Non-standardized Methods
Validation
Uncertainty of Measurement
Data Checks

Cross-references

ISO 17025:2005 Section 5.4

ISO 9001:2000 Section 4.2.1, 4.2.3, 6.1, 6.3, 6.4, 7.1, 7.2.1, 7.2.2, 7.3, 7.4.3, 7.5.1, 7.5.2, 7.6, 8.1, 8.2.3, 8.2.4

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5.4.1 General

Policy:

Methods and procedures used for all tests and/or calibrations are appropriate as per:

- sampling, handling, transport, storage, and preparation of items to be tested and/or calibrated
- an estimation of the measurement of uncertainty as well as statistical techniques for analysis of test and/or calibration data where appropriate

Instructions on the use and operation of all relevant equipment and on the handling and preparation of items for testing and/or calibration are available. All instructions, standards, manuals and reference data relevant to the work of the laboratory are maintained current and readily available to personnel. Deviation from test and calibration methods must be documented, technically justified, authorized, and accepted by the customer.

Details:

There are SOPs for sample handling, storage, preparation of test items, QA/QC procedures (media QC, incubation times and temperatures, equipment calibration and maintenance, process control QC), and standards for approving / rejecting results. These may be combined with or separate from the method. The content of an environmental (TNI) test method should include:

- Applicable Matrices
- Detection Limit
- Method Scope
- Method Summary
- Definitions
- Interferences
- Safety
- Equipment and Supplies
- Reagents and Standards
- Sample Collection, Preservation, Shipment and Storage
- Quality Control
- Calibration and Standardization
- Procedure
- Calculations
- Method Performance
- Changes to the Approved Method
- Data Assessment and Acceptance Criteria

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- Corrective Action & Contingencies for Out of Control Data
- Pollution Prevention and Waste Management
- References
- Editorial Changes to SOP
- Appendices

International, national, or regional standards or other recognized specifications that contain sufficient and concise information on how to perform the tests and/or calibrations are not necessarily supplemented or rewritten as an internal procedure when they are written in a way that can be used as published by laboratory staff. Consideration may need to be given to providing additional documentation for optional steps in the method.

5.4.2 Selection of Methods

Policy:

Test and/or calibration methods, including methods for sampling, meet the needs of the customer and are appropriate for the tests and/or calibrations it undertakes. Preference is given to reference methods published as international, national, or regional standards. The laboratory ensures that the latest edition of a standard is used unless it is not appropriate or possible to do so. When necessary, the standard is supplemented with additional details to ensure consistent application.

Details:

Methods that have been published either in international, national, or regional standards, or by reputable technical organizations, or in relevant scientific texts or journals, or as specified by the manufacturer are selected when the customer does not specify the method to be used. Methods may be adopted from but are not limited to the following sources: EPA, Standard Methods, USP, AOAC, FDA BAM, USDA FSIS & AMS, APHA SMEDP, APHA, AWWA, WEF, NELAC, TNI, Compendium of Methods for the Microbiological Examination of Foods, ISO, ICMSF, National Food Processors, American Association of Cereal Chemists, Association of Dressing and Sauces, Health Canada, Environmental Protection Agency, OIE, and ASTM.

The ability of the laboratory to achieve satisfactory performance against documented performance characteristics is verified before samples are analyzed.

Laboratory-developed methods or methods adopted by the laboratory may also be used if they are appropriate for the intended use and if they are validated. The customer is

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informed as to the method chosen. The laboratory confirms that it can properly operate standardized methods before introducing the tests or calibrations. If the standardized method changes, the confirmation is repeated.

The customer is informed when the method proposed by the customer is considered to be inappropriate or out of date.

5.4.3 Laboratory-Developed Methods

Policy:

Introduction of test and calibration methods developed internally is a planned activity and is assigned to qualified personnel equipped with adequate resources. Plans are updated as development proceeds and ensures effective communication among all personnel involved.

Details:

Methods developed in-house are validated and authorized before use. Where available, Certified Reference Materials (CRMs) are used to determine any systemic bias, or where possible results are compared with other techniques, preferably based on different principles of analysis. As applicable, determination of uncertainty is part of this validation process and is essential for ongoing quality control.

5.4.4 Non-Standard Methods

Policy:

Utilization of non-standard methods is subject to agreement with the customer and includes a clear specification of the customer's requirements and the purpose of the test. The developed method is validated appropriately before use.

Details:

Discussion and agreement for the use of non-standard methods is recorded as part of contract review procedures (see section 4.4).

All non-standard and new tests are validated for their intended purpose. Qualitative test methods must be validated to demonstrate estimated sensitivity and specificity, relative accuracy to official methods (if appropriate), positive and negative deviation, limit of detection, matrix effect, repeatability, and reproducibility.

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Quantitative test methods are validated to demonstrate specificity, sensitivity, relative accuracy, positive and negative deviation, repeatability, reproducibility, and limit of determination.

For new methods where procedures are developing rapidly, especially for emergency situations, it may be necessary to circumvent normal validation procedures. Minimally, this must be a demonstrated recovery in replicate.

New test and/or calibration methods are documented prior to providing test and/or calibration results to customers and contain at least the following information:

- appropriate identification
- scope
- description of the type of item to be tested or calibrated
- parameters or quantities to be determined
- apparatus and equipment, including technical performance requirements
- reference standards and reference materials required
- environmental conditions required and any stabilization period needed
- description of the procedure, including:
 - affixing identification marks, handling, transporting, storing and preparing of items
 - ensuring checks are made before the work is started
 - checking that the equipment is working properly and, where required, calibrating and adjusting the equipment before each use
 - listing method of recording the observations and results
 - indicating any safety measures to be observed
- criteria and/or requirements for approval/rejection (quality control plan)
- data to be recorded and method of analysis and presentation
- uncertainty or procedure for estimating uncertainty

5.4.5 Validation of Methods

5.4.5.1 Performance Characteristics

Policy:

Validation of a method establishes, by systematic laboratory studies, that the performance characteristics of the method meet the specifications related to the intended use of the test results.

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Details:

The performance characteristics of a validation plan includes, as applicable:

- selectivity and specificity
- range
- linearity
- sensitivity
- limit of detection
- limit of quantitation
- accuracy
- precision
- reporting limit
- repeatability
- reproducibility
- recovery
- confirmation techniques
- criteria for the number of samples tested to validate method as per defined scope of method
- action levels where defined by regulation
- quality control incorporating statistics as applicable

Performance characteristics that are selected take into account the intended use of the method, whether for screening, confirmatory analysis, or quantitation.

The design, verification of the method and documentation procedures for validation are planned and conducted by qualified personnel, equipped with adequate resources.

This section lists a few acceptable validation procedures. The choice of the procedure depends on the extent of the deviation from the published method.

Validation of methodology is a value judgment in which the performance parameters of the method are compared with the requirements for the test data. A prerequisite for a valid method is that data produced by the method must attain a state of statistical control. Such a state is obtained when the mean value of a large number of individual values tends to approach a limiting value called the limiting mean.

Methods may be validated by one or more alternative procedures. Some of these procedures are described below. Apparent differences can be analyzed statistically to

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confirm their significance. In all cases, the reasons for choosing one or more alternatives must be documented.

- analysis of standard reference materials (SRM) that are identical or almost identical to the test samples
- in the absence of suitable SRMs, analysis of reference materials that are similar in all respect to the test samples; the use and validity of this reference material must be documented
- using an alternative method to measure the same parameter provides a very high level of confidence if results are confirmed
- recovery studies by the addition of a known concentration of the parameter of interest to some of the replicates being measured

The parameters to be determined include:

- the scope of the method and any known interference
- detection limit
- the range of concentration where the method is valid
- precision and bias

Judgment is required to determine if some or all of the above is required. Requirements will depend largely on the extent of deviation from the original method.

Developments in methodology and techniques require methods to be changed from time to time. The difference in performance between revised and obsolete methods is established so that it is possible to compare old and new data.

Where a change in method involves only minor adjustments, such as sample size, or different reagents, the amended method is validated and the changes brought to the attention of the accreditation body at the next accreditation audit. Where the proposed change involves technology or methodology, the laboratory seeks the approval of the accreditation body.

Records are kept on all validation activities. The records include any of the performance characteristics chosen, reference procedures or guidance documents followed to validate the method or custom validation procedure, and a final confirmation (memo to file) that the method validation results are acceptable for continued use of the method. An example statement would be “This serves as record that the validation of the XYZ Test Method has been approved for use by [name and title of approver]”.

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5.4.5.2 Fit for Use

Policy:

The laboratory validates non-standardized methods, laboratory-designed/developed methods, standardized methods used outside their intended range, and amplifications of standard methods to confirm that the methods are fit for the intended use. The validation is as extensive as is necessary to meet the needs in the given application or field of application (may include procedures for sampling, handling, and transportation). The laboratory records the results obtained, the procedure used for the validation, and a statement as to whether the method is fit for the intended use.

Details and Procedure:

Validation records are kept as in section 5.4.5.1. Included in these records is the validation procedure. The procedure used for the validation is likely to vary between different methods. Therefore, the procedures included in the laboratory records are not as detailed as a typical SOP, but are sufficient enough to re-create how the method was validated.

The techniques used for the determination of the performance of a method, are one of, or a combination of, the following:

- calibration using reference standards or reference materials
- comparison of results achieved with other methods
- inter-laboratory comparisons
- systematic assessment of the factors influencing the result
- assessment of the uncertainty of the results based on scientific understanding of the theoretical principles of the method and practical experience.

When changes are made in the validated non-standard method, the influence of such changes carried out is documented and if appropriate a new validation is performed.

5.4.5.3 Customer's Needs

Policy:

The range and accuracy of the values obtainable from validated methods (e.g., the uncertainty of the results, detection limit, selectivity of the method, linearity, limit of repeatability and/or reproducibility, robustness against external influences and/or cross-sensitivity against interference from the matrix of the sample/test object) as assessed for the intended use is relevant to the customer's needs.

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Details:

Validation includes the specification of the requirements, determination of the characteristics of the methods, the comparison of the requirements with the values of the characteristics of the method, and a statement on the validity.

As method development proceeds, regular review is required to verify that the needs of the customer are still being fulfilled. Changing requirements requiring modifications to the development plan are approved and authorized.

Validation is always a balance between costs, risks, and technical possibilities.

5.4.6 Uncertainty of Measurement

5.4.6.1 Calibration

Policy:

Physical, chemical, and biological standards are calibrated or characterized by qualified subcontractors.

Details and Procedures:

Repeatability and reproducibility data are components of measurement uncertainty and are determined as a first step towards producing estimates of this parameter. The uncertainty of measurement may be made available on the certificate of analysis or calibration certificate from a subcontractor.

Note – in-house calibrations include procedures for uncertainty of measurement estimates where practicable.

5.4.6.2 Testing

Policy:

The SOP# QSP 5-4-1 is utilized to estimate uncertainties of measurement in testing, except when the test methods preclude such rigorous calculations. In certain cases, it is not possible to undertake metrologically and statistically valid estimations of uncertainty of measurement. In these cases, the laboratory attempts to identify all the components of uncertainty and make the best possible estimation, and ensure that the form of reporting does not give an exaggerated impression of accuracy. Reasonable estimation is based on

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knowledge of the performance of the method and on the measurement scope and makes use of previous experience and validation data.

Details:

The degree of rigor needed in an estimation of uncertainty of measurement depends on factors such as:

- requirement of the test method
- requirement by the customer
- if there are narrow limits on which decisions on conformity to a specification are based

In cases where a well-recognized test method specifies limits to the values of the major sources of uncertainty of measurement and specifies the form of presentation of calculated results, the laboratory is considered to have satisfied the estimation uncertainty of measurement by following the reporting instructions (see section 5.10).

5.4.6.3 Uncertainty Components

Policy:

When estimating the uncertainty of measurement, all uncertainty components that are of importance in the given situation are taken into account using accepted methods of analysis.

Details:

Sources contributing to the uncertainty include, but are not necessarily limited to, the reference standards and reference materials used, methods and equipment used, the environmental conditions, the item being tested or calibrated and the operator.

The predicted long-term behavior of the tested and/or calibrated item is normally not taken into account when estimating the measurement uncertainty.

For further information, see ISO 5725 and the Guide to Expression of Uncertainty in Measurement.

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5.4.7 Control of Data

5.4.7.1 Calculations and Data Transfers

Policy:

Calculations and data transfers are subject to appropriate checks in a systematic manner.

Details:

Test data are approved through the following arrangements by the QM, supervisor, lab director, peer etc.:

- checks to determine accuracy of calculations, conversions, and data transfers
- checks for transcription errors, omissions, and mistakes
- checks to determine consistency with normal or expected values

For those analyses where manual data reduction is required, it is performed according to the instructions provided in the test method or SOP.

5.4.7.2 Computers and Automated Equipment

Policy:

When computers or automated equipment are used for the acquisition, processing, manipulation, recording, reporting, storage or retrieval of test or calibration data, the laboratory ensures that:

- computer software developed by the user is documented in sufficient detail and suitably validated or otherwise checked as being adequate for use
- procedures are established and implemented for protecting the integrity of data; such procedures include, but are not be limited to, integrity and confidentiality of data entry or collection, data storage, data transmission, and data processing (see section 4.13.1.4)
- computers and automated equipment are maintained to ensure proper functioning and are provided with the environmental and operating conditions necessary to maintain the integrity of test and calibration data
- data is securely maintained by preventing unauthorized access to, and unauthorized amendment of, computer records

Details and Procedures:

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Data generated using computer software programs that are interfaced directly to instruments incorporates all dilutions and calculations, thereby eliminating the need for manual data reduction.

Commercially developed software in general use within its designed application range may be considered sufficiently validated. Laboratory software configuration / modifications are validated as outlined in SOP# QSP 5-5-1.

It is the **stated goal** of Chemtech-Ford Laboratories to meet the requirement for Electronic records, electronic signatures, and handwritten signatures executed to electronic records as defined by 21 CFR. Part 11 (Docket No. 92NO251) RIN0910-AA29; Federal Register: March 20, 1997, Volume 62, Number 54), Rules and Regulations, pages 13429-13466. Chemtech-Ford is not now fully compliant, but records of compliance evaluation are maintained and can be inspected upon request.

For details of the requirement see:

http://www.fda.gov/ora/compliance_ref/part11/

Revision History

Changes from Revision 24

Revision 25 is a significant revision with numerous additions, deletions and corrections. These are not all documented in the revision history, rather all persons on the distribution list are required to read the entire document.

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5.5 Equipment

Section Synopsis

This section tells you to:

1. Identify information needs for accept / reject decisions
2. Install equipment capable of providing that information
3. Use the equipment in the proper environment
4. Periodically check the equipment calibration

Key Words

Required Equipment and Accuracy
 Authorized Personnel
 Unique Identification
 Inventory
 Maintenance
 Procedures
 Out of Service
 Calibration Status
 Re-verification
 Checks
 Correction Factors
 Safeguards against Adjustment

Cross-references

ISO 17025:2005 Section 5.5

ISO 9001:2000 Section 4.2.1, 4.2.3, 5.1, 6.2.2, 6.3.1, 7.1, 7.4, 7.5.1, 7.5.2, 7.5.3, 7.6, 8.1, 8.2.3, 8.2.4

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5.5.1 Required Equipment

Policy:

The laboratory is furnished with all items for sampling, measurement and test equipment required for the correct performance of the tests and/or calibrations (including sampling, preparation of test and/or calibration items, processing and analysis of test and/or calibration data). When equipment is used outside the laboratory's permanent control, it ensures that the requirements of this Quality Manual are met.

Details:

Equipment is used in an environment appropriate to its proper performance. All equipment required by a test is described in each method, including the equipment's tolerances.

A current list of equipment is maintained in Quality Manager.

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5.5.2 Required Accuracy

Policy:

Equipment and software used for testing, calibration and sampling are capable of achieving the accuracy required and comply with specifications relevant to the tests and/or calibrations concerned. Calibration programs are established for key quantities or values of the instruments where these properties have a significant effect on the results. When received, equipment, including that used for sampling, is checked to establish that it meets the laboratory's specification requirements, complies with the relevant standard specifications, and is checked and/or calibrated in accordance with section 5.6 before use.

Details:

The procedures for checking newly received equipment are as determined by manufacturers' specification and/or those determined by the laboratory during procurement.

5.5.3 Authorized Personnel

Policy:

Equipment is operated by authorized personnel. Up-to-date instructions on the use and maintenance of equipment (including any relevant manuals provided by the manufacturer of the equipment) are readily available for use by the appropriate laboratory personnel.

Details:

Access to laboratory equipment is controlled to ensure that only authorized personnel use equipment.

5.5.4 Unique Identification

Policy:

Each item of equipment used for testing and calibration is uniquely identified when practicable.

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Details:

Measuring and testing equipment is uniquely identified. Typical identification includes instrument type, make, model, serial number or other unique markings. Measuring and testing equipment includes any instrument that could affect the quality of test results. Components that can be interchanged between various instruments are tracked in equipment logbooks but are not assigned individual identification.

5.5.5 Inventory and Maintenance Records

Policy:

Records are maintained for each item of equipment significant to the tests and/or calibrations performed. The records include the following:

- identity of the item of equipment (and its software)
- manufacturer's name, type identification, and serial number and/or other unique identification
- Date received (if available)
- Date placed into service (if available)
- checks that equipment complies with the specification (see section 5.5.2)
- current location, where appropriate
- the manufacturer's instructions, if available, or reference to their location
- dates, results and copies of reports and certificates of all calibrations, adjustments, acceptance criteria, and due date of next calibration
- maintenance carried out to date and the maintenance plan (includes calibration)
- damage, malfunction, modification or repair to the equipment
- Analysts initials

Details:

A database is used to capture the above inventory information. The above information related to service and maintenance is kept in Quality Manager. Other information recorded may include:

- date received and date placed in service
- condition when received (e.g., new, used, refurbished)
- dates and results of calibration and/or verification and date of next calibration and/or verification
- performance history, where appropriate (e.g., response time, drift, noise level)

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5.5.6 Equipment Procedures

Policy:

The SOP# QSP 5-5-1 is utilized as an established plan for safe handling, transport, storage, use and maintenance (including calibration) of measuring equipment, and appropriate use of correction factors to ensure proper functioning and in order to prevent contamination or deterioration.

Note – additional procedures may be necessary when measuring equipment is used outside the permanent laboratory for tests, calibrations, or sampling (currently not applicable at our laboratory).

Details and Procedures:

The procedures for each piece of measuring equipment are located in the appropriate room where the equipment is located. These procedures detail any information for safe handling, transport, storage, use, and maintenance of measuring equipment.

5.5.7 Out of Service Equipment

Policy:

Equipment that has either been subjected to overloading or mishandling, or gives suspect results, or has been shown to be defective or outside specified limits, is taken out of service, clearly marked, and appropriately stored until it has been repaired and shown by calibration or test to perform correctly.

Details:

Routine testing work is completely discontinued on equipment that even shows minor nonconformances. Not only do we do this for ethical reasons in support of our customer, but minor nonconformances are often indicative of major breakdowns in expensive equipment. These breakdowns need to be avoided wherever possible.

Out of service equipment is clearly marked as outlined in section 5.5.8.

The laboratory examines the effect of the defect or departure from specified limits on previous test and/or calibrations and institutes the “Control of Nonconforming Work” procedure as outlined in section 4.9.

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5.5.8 Calibration Status

Policy:

Equipment requiring calibration is labeled to indicate the calibration status and/or operational status and the date when re-calibration is due when appropriate.

Details:

Calibration labels have a write-on surface and a pressure sensitive adhesive. The areas that are filled out include the person who performed the calibration, the date it was performed, the date it is due for re-calibration, and the equipment's identification number.

CALIBRATION	
BY _____	DATE _____
DUE _____	ID# _____

Measuring equipment that has failed calibration or is deemed out of service is labeled with one of the following labels:

CALIBRATION VOID DO NOT USE

OUT OF SERVICE DO NOT USE

A piece of equipment that is not calibrated or checked is labeled with the following label:

5.5.9 Return to Service

FOR REFERENCE ONLY

Policy:

When equipment goes outside the direct control of the laboratory for a period, the laboratory ensures that the function and calibration status of the equipment are checked and validated and shown to be satisfactory before the equipment is returned to service.

Details and Procedures:

The procedures used to check and ensure that the function and calibration status of the equipment are satisfactory before the equipment is returned to service are outlined in the

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manufacturer's equipment manual. Any additional quality control checks are outlined in the "Quality Control Plan" section of the appropriate test method.

5.5.10 Periodic Checks

Policy:

When intermediate checks are needed to maintain confidence in the calibration status of equipment, these checks are carried out periodically according to defined procedure.

Details and Procedures:

As stated in section 5.5.6, the procedures for each piece of measuring equipment are available on the laboratory computer network. SOP# QSP 5-5-1 outlines a general maintenance plan for equipment and includes various checks. Internal quality control checks are specified in individual test methods that are located in the appropriate laboratory areas thereby providing procedures for intermediate checks.

5.5.11 Correction Factors

Policy

Calibrations that give rise to a set of correction factors are updated along with all copies of this data (e.g., in computer software).

Details and Procedures:

The updating of correction factors, including all copies, is assured by following the appropriate test method or SOP. It is the responsibility of the QM to ensure that all copies are updated.

5.5.12 Safeguards against Adjustments

Policy:

Test and calibration equipment, including hardware and software, are safeguarded from adjustments that invalidate test and/or calibration results/status.

Details:

Safeguards against adjustment for laboratory equipment include:

- detailed SOPs and manufacturer's manuals on the operation of the equipment

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- policies permitting only fully trained and competent personnel to operate equipment
- access to the laboratory is restricted to authorized personnel

Safeguards against adjustment for software includes:

- password protection for important files and packages
- access to the laboratory is restricted to authorized personnel
- An electronic audit trail is maintained on for the changes made in the LIMS software

Revision History

Changes from Revision 24

Revision 25 is a significant revision with numerous additions, deletions and corrections. These are not all documented in the revision history, rather all persons on the distribution list are required to read the entire document.

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5.6 Measurement Traceability

Section Synopsis

This section tells you:

1. Measurements are traceable to SI units (when applicable)
2. Reference Standards and Reference Materials are used

Key Words

Systemè International
Reference Standard
Reference Material
Traceability

Cross-references

ISO 17025:2005 Section 5.6

ISO 9001:2000 Section 6.3.1, 7.1, 7.5.1, 7.6

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5.6.1 General

Policy:

Test and/or calibration equipment for subsidiary measurements (e.g., for environmental conditions) having a significant effect on the accuracy or validity of the result of the test, calibration, or sampling are calibrated before being put into service. All measurement and test equipment having an effect on the accuracy or validity of tests is calibrated and/or verified before being put into service. As mentioned in section 5.5, the SOP# QSP 5-5-1 outlines an established program for the maintenance of equipment and includes calibration.

Details:

The program includes a system for selecting, using, calibrating, checking, controlling, and maintaining:

- measurement standards
- reference standards used as measurement standards
- measuring and test equipment used to perform tests and calibrations

Procedures are documented where appropriate. All measurements that play a defining role in testing accuracy are based directly or indirectly on reference standards, reference materials, certified reference materials, or other standards or materials having appropriate traceability.

Records are maintained in the LIMS for each standard. These records include, as applicable:

- supplier, grade, lot number, and concentration
- dates of preparation or verification
- measurement of weights, volumes, time intervals, temperatures, and pressures and related calculations
- relevant processes (e.g., pH adjustment, sterilization)
- verification results
- identification of personnel involved

Reagents prepared in the laboratory are labelled to identify substance, strength, solvent (where not water), and date of preparation and/or expiry. The person responsible for the preparation of the reagent is identified either from the label or from records.]

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5.6.2 Specific Requirements

5.6.2.1 Calibration

Policy:

The program for calibration equipment is designed and operated to ensure that calibration measurements are traceable to the System International (SI) units of measurement.

Details:

Traceability of measurement is assured by the use of calibration services from laboratories that can demonstrate competence, measurement capability and traceability. The calibration certificates issued by these laboratories show that there is a link to a primary standard or to a natural constant realizing the SI unit by an unbroken chain of calibrations. The calibration certificates contain the measurement results including the measurement uncertainty and/or a statement of compliance with an identified metrological specification (see also section 5.10.4.2).

Calibration laboratories accredited to ISO 17025 are considered competent to provide the appropriate calibration services.

Traceability to SI units of measurement may be achieved by reference to an appropriate primary standard or by reference to a natural constant the value of which, in terms of the relevant SI unit, is known.

The term “identified metrological specification” means that it must be clear from the calibration certificate against which specification the measurements have been compared with, by including the specification or by giving an unambiguous reference to the specification.

When the terms “international standard” or “national standard” are used in connection with traceability, it is assumed that these standards fulfil the properties of primary standards for the realization of SI units.

Maintain certificates of all reference standards, measuring equipment, or certified reference material used in ensuring traceability. Where traceability to national standards of measurement is not applicable, the laboratory provides satisfactory evidence of correlation

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of results, for example by participation in a suitable program of inter-laboratory comparisons or proficiency testing.

Reference standards, such as thermometers and weights, are traceable to a national or international standard (e.g., NIST).

5.6.2.1.1 Instrument Performance Evaluation

5.6.2.1.1.1 General calibration of laboratory instruments falls into two categories: 1) calibration which is conducted on a routine basis as part of the analytical procedure prior to each use; and 2) periodic, scheduled calibration of instruments and gauges against known standards to ensure the continuing precision and accuracy of such instruments.

5.6.2.1.1.2 All instrumentation must be demonstrably calibrated and evaluated for appropriateness before analysis is initiated. Divergence from acceptable benchmark criteria requires correction before analyses may be performed. The instrument performance evaluation material may be a standard spiked into the solvent used for analysis, but it is not extracted as if it were a sample.

5.6.2.1.2 Calibration

5.6.2.1.2.1 Generally, as applicable to the method, calibration curves are established for each parameter using known concentrations of standards. At least three different concentrations in non-interfering matrices, that span the range of expected sample values are analyzed and plotted. Generally, a correlation coefficient of better than 0.995 constitutes an acceptable calibration.

5.6.2.1.2.2 Method-specific calibration requirements are included in individual SOPs. In this case, the analytical method will take precedence.

5.6.2.1.3 Continuing Calibration

5.6.2.1.3.1 Prior to use each day, the initial calibration must be verified. Typically, one of the mid-point calibration standards are analyzed and the results are compared to the expected results. If the results fall within the method acceptance limits, then analysis can proceed. If the results are not within the acceptance limits, then the problem must be corrected prior to analysis of samples. Some methods require that samples be bracketed by valid opening and closing

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calibration standards. When bracketing is required, only results between valid calibration verification standards can be used.

5.6.2.1.3.2 Reportable analytical results are those within the calibration range of the parameter. In general, values above the highest standard are not reported. The lowest reportable value is the MRL. Instrumental calibration will be verified either initially and during sample analysis or at a rate that the established method requires. The continuing calibration (may be substituted by the check standard) is made with standards independent from that used for instrumental calibration. The calibration check must agree within established limits with the calibration or the instrument is re-celebrated. Continuing calibration standards must agree within established limits of calibration. If not, the cause of the discrepancy is identified, corrected, and documented.

5.6.2.1.4 Initial Calibration Verification (ICV)

5.6.2.1.4.1 An ICV is a well-characterized material that is run, at a minimum, with each calibration. The material, which is obtained from a documented second source. In order to assess the performance of the method, the ICV is run in the same manner as the other calibration standards. If the results are not within acceptable limits, the source of the problem is evaluated. Continual failure indicates there is a problem with the system, the ICV standard or the calibration standards. Prior to analysis, the ICV must pass method criteria. A calibration check solution or sample material should be analyzed at least each day of analysis to demonstrate that calibration and standardization of instrumentation is within acceptable limits.

5.6.2.1.5 Calibration Policy

5.6.2.1.5.1 The calibration policies and procedures set forth in this section apply to all instruments requiring scheduled calibrations against traceable standards, including: analytical and test equipment in the laboratory, flow rate (e.g., rotometers), volume (e.g., dry gas meters), temperature measurement equipment, balances, weights, thermometers, pH meters, SRM's, etc.

5.6.2.1.5.1.1 The standards used in the laboratory measurement system will be calibrated against higher-level, primary standards having certified accuracy. NIST or other equivalently-recognized standardization will certify these higher-level standards.

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5.6.2.1.5.3 Calibration standard reagents purchased from commercial vendors will be required to have a certificate of analysis. Whenever a certified, calibration standard is available from NIST, commercial vendors will be required to establish traceability of the certificate of analysis to the certified standard.

5.6.2.2 Testing

5.6.2.2.1 Uncertainty

Policy:

The requirements given in section 5.6.2.1 apply to measuring and test equipment with measuring functions used, unless it has been established that the associated calibration uncertainty contributes little to the total uncertainty of the test result. When this situation arises, the laboratory ensures that equipment used can provide the accuracy of measurement needed.

Details:

The extent to which the requirements in section 5.6.2.1 are followed depends on the relative contribution of calibration uncertainty to the total uncertainty. If calibration is the dominant factor, the requirements are strictly followed. If, however, calibration is not one of the major contributors to the total uncertainty, other ways for providing confidence may be used, as given in section 5.6.2.2.2.

5.6.2.2.2 Traceability

Policy:

Where traceability to SI units of measurement is not possible and/or not relevant, other means for providing confidence in the results are applied such as:

- the use of suitable reference materials certified to give a reliable characterization of the material
- mutual-consent standards or methods which are clearly specified and agreed upon by all parties concerned
- participation in a suitable program of inter-laboratory comparisons or proficiency testing

Details:

Reliable characterization involves an estimate of recovery.

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The laboratory participates in proficiency testing and/or check sample programs. The list of programs is maintained by the Quality Manager.

5.6.3 Reference Standards and Reference Materials

5.6.3.1 Reference Standards

Policy:

The SOP# QSP 5-6-1 outlines the program for the calibration of reference standards. Reference standards are obtained or calibrated by a body that can provide traceability as described in section 5.6.2.1. Such reference standards of measurement held by the laboratory are used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

Details:

Reference standards are obtained from ISO certified vendors], if applicable.

5.6.3.2 Reference Materials

Policy:

Where possible, reference materials are traceable to SI units of measurement, or to certified reference materials. Internal reference materials are checked as far as is technically and economically practicable.

Details:

Reference materials, including calibration standards, used in chemical measurement are prepared so that the point of measurement is similar or equivalent to that of the samples. The matrix, prior to the addition of the analyte does not have a detectable concentration of the analyte. Reagents used in the preparation of reference materials, including calibration standards are of certified purity.

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5.6.3.3 Intermediate Checks

Policy:

Checks needed to maintain confidence in the calibration status of reference, primary, transfer or working standards and reference materials are carried out according to defined procedures and schedules.

Details and Procedures:

The control check standards used to verify the accuracy of all the other standards are prepared independently from all the other standards used to establish the original calibration. These control check standards are preferably prepared from a separate lot # or source. It is the responsibility of the Quality Manager to establish and maintain the individual schedule for each SOP and/or test method. In some cases, where the first two source standards agree but the results are called into question, then it may be appropriate to obtain an additional source for verifications.

5.6.3.4 Transport and Storage

Policy:

The SOP# QSP 5-6-1 outlines safe handling, transport, storage and use of reference standards and reference materials in order to prevent contamination or deterioration and in order to protect their integrity.

Revision History

Changes from Revision 24

Revision 25 is a significant revision with numerous additions, deletions and corrections. These are not all documented in the revision history, rather all persons on the distribution list are required to read the entire document.

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5.7 Sampling

Section Synopsis

This section tells you:

1. There must be a sampling plan and procedure
2. Appropriate records of sampling are kept
3. Deviations, additions, and exclusions from the plan or procedure are recorded

Key Words

Sampling Plan and Procedure
Deviation, Addition, or Exclusion

Cross-references

ISO 17025:2005 Section 5.7

ISO 9001:2000 Section 4.2.4, 7.5.1

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5.7.1 Sampling Plan and Procedures

Chemtech-Ford, Inc. Does not currently perform sampling.

Revision History

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5.8 Handling of Test and Calibration Items

Section Synopsis

This section tells you to:

1. Keep samples in good condition.

Key Words

Identification
Receipt
Protection

Cross-references

ISO 17025:2005 Section 5.8

ISO 9001:2000 Section 6.3, 6.4, 7.1, 7.4.3, 7.5, 8.2.4

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5.8.1 Procedures

Policy:

The SOP# QSP 5-8-1 outlines the procedures for the transportation, receipt, handling, protection, storage, retention and/or disposal of test and/or calibration items, including all provisions necessary to protect the integrity of the test or calibration item, and the interests of the laboratory and the customer.

Details:

Samples, reagents, and standards are stored so as to ensure their integrity by preventing against deterioration, contamination, and loss of identity. It is recognized that this is a general statement, but details are elaborated upon in SOP# QSP 5-8-1.

5.8.2 Identification of Test and/or Calibration Items

Policy:

Test and/or calibration items are systematically identified as they arrive at the laboratory. The identification is retained throughout the life of the item in the laboratory. The system is designed and operated so as to ensure that items cannot be confused physically, or when referred to in records or other documents. The system accommodates a sub-division of groups of items and the transfer of items within and from the laboratory when appropriate.

Details:

Sample labelling indicates the unique identification and conforms to applicable legal requirements. The laboratory has established and documents a system for appropriate chain-of-custody.

5.8.3 Receipt

Policy:

Upon receipt of the test or calibration item, any abnormalities or departures from normal or specified conditions, as described in the relevant test or calibration method, are recorded. When there is any doubt as to the suitability of an item for test or calibration, or when an item does not conform to the description provided, or the test or calibration required is not specified in sufficient detail, the laboratory consults the customer for further instructions before proceeding and keeps a record of the discussion.

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The Chemtech-Ford sample acceptance policy is detailed in document QSP 5-8-3.

Details:

Conform to applicable regulations or contractual arrangements. The condition of sample may include or relate to damage, quantity, preparation, packaging, or temperature. Preparation may include addition of chemical preservative, removal of moisture, isolation of portion of sample to be tested, homogenization, or subsampling.

Procedures are in place to document that the elapsed time between sampling and testing does not exceed test method specifications (holding time) once the sample is received in the laboratory.

5.8.4 Protection

Policy:

The SOP# QSP 5-8-1 outlines the procedures and appropriate facilities for avoiding deterioration, loss or damage to the test or calibration item during storage, handling and preparation and testing; instructions provided with the item are followed. When items have to be stored or conditioned under specified environmental conditions, these conditions are maintained, monitored, and recorded. Where a test item is to be held secure (e.g., for reasons of record, safety or value, or to enable complementary test and/or calibrations to be performed later), the laboratory has arrangements for storage and security that protect the condition and integrity of the secured item concerned.

Details:

A sampling procedure and information on storage and transport of samples, including all information that may influence the test or calibration result, is provided to those responsible for taking and transporting the samples.

The laboratory establishes whether the sample has received all necessary preparation or whether the customer requires preparation to be undertaken or arranged by the laboratory. Proper requirements for packaging, environmental conditions, and separation from incompatible materials are observed. Where samples have to be stored or conditioned under specific conditions, these conditions are maintained, monitored, and recorded, where necessary.

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Where a sample, or portion of a sample, is to be held secure (e.g., for reasons of record, safety, or value, or to enable check tests to be performed later), the laboratory has storage and security arrangements that protect the condition and integrity of the sample.

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5.9 Assuring the Quality of Test Results

Section Synopsis

This section tells you:

1. That results are monitored
2. There is a plan for monitoring

Key Words

Internal Quality Control
 Statistical Techniques
 Inter-laboratory Comparisons
 Proficiency Testing
 Certified Reference Materials
 Secondary Reference Material
 Replicates
 Re-testing
 Correlation

Cross-references

ISO 17025:2005 Section 5.9

ISO 9001:2000 Section 6.3, 6.4, 7.1, 7.2.1, 7.2.2, 7.3, 7.4.3, 7.5.1, 7.5.2, 7.5.3, 7.5.5, 8.1, 8.2.3, 8.2.4, 8.4

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5.9.1 Quality Control / Quality Assurance

Policy:

Quality control procedures are utilized to monitor the validity of test and/or calibration results. These procedures are for each test method utilized in the laboratory. The resulting data are recorded so that trends are detectable (and where practicable, statistical techniques are applied to the reviewing of the results). This monitoring is planned and reviewed and may include, but not limited to, the following:

- regular use of certified reference materials and/or internal quality control using secondary reference materials
- participation in inter-laboratory comparisons or proficiency testing programs
- replicate tests or calibrations using the same or different methods
- re-testing or re-calibration of retained items
- correlation of results for different characteristics of an item

Details:

The methods utilized from the above list will be appropriate for the type and volume of the work undertaken. Records are maintained of assurance activities and any actions taken.

As a guide, for routine analyses the level of internal quality control is typically 5% of the sample throughput. For more complex procedures, 20% is not unusual and on occasions even 50% may be required. For analyses performed infrequently, a full system validation is performed on each occasion. This may typically involve the use of a reference material containing a certified or known concentration of analyte, followed by replicate analyses of the sample and spiked sample. For analyses undertaken more frequently, systematic quality control procedures incorporating the use of control charts and check samples are implemented. These procedures are documented in the "Quality Control Plan" of each test method.

Proficiency testing helps to highlight not only repeatability and reproducibility performance between laboratories, but also systematic errors such as bias. It is important to monitor proficiency testing results as a means of checking quality assurance and take action as necessary.

The QM maintains a list of all the current proficiency testing programs the laboratory participates in, monitors the results, and notifies the appropriate personnel of both problematic and successful results.

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Technical personnel use certified reference materials and reference materials to evaluate test performance on a daily basis and include daily process control checks. These data are used to evaluate the validity of the test results.

Replicate tests may be used if suitable reference material is available. These materials and proficiency test materials are available for improving repeatability.

Re-testing of test items is performed occasionally at the discretion of the supervisor or when test results seem anomalous.

5.9.1.1 Quality Control Procedures

The determination of precision and accuracy is an important analytical tool in evaluating the quality of generated data. Precision is defined as the ability to reproduce a value within defined limits. Accuracy is defined as producing the correct answer. Different methods are employed to measure each of these parameters.

5.9.1.1.1 Precision - Utilizing duplicate samples and comparing their respective results is the primary method for the analysis of precision. However, it has no bearing on accuracy. A result may be precise and inaccurate at the same time. One duplicate sample is analyzed for each matrix type and method, and for each sample batch, or for each sample batch containing 20 samples, whichever is less. The relative percent difference (RPD) for each component is then calculated and compared to the acceptance limits for the matrix and method.

5.9.1.1.2 Accuracy - Utilizing matrix-matched standards of known concentration and comparing them to the analyte of interest is the primary method for measuring accuracy. Participation in independent Performance Evaluation (PE) studies is also utilized to monitor accuracy of data in the laboratory.

5.9.1.1.3 Reproducibility - The tracking of reproducibility ensures that analyses performed at different times or by different individuals may be acceptably reproduced. This demonstrates that the method, instrumentation, and analytical technique are resilient enough to reproduce results within a specified range over time.

5.9.1.2 Quality Control Samples

The quality control principles contained in this section will be implemented consistently, dependent upon the type of analysis to be performed and any

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associated, specific requirements of such analysis. In addition, the analyst is to use his/her best judgment to evaluate the use of additional QC bracketing samples which have a difficult matrix, react differently, or have distinctive client or reporting requirements. The additional QC can take the form of additional spikes, standards, and/or SRM's. Sufficient QC should be performed to insure that the analyst has performed due diligence with regard to QC while analyzing the sample.

5.9.1.2.1 Matrix Spike and Matrix Spike Duplicate - Matrix spikes are employed to monitor recoveries and maintain extraction and/or concentration techniques at acceptable levels. Compounds of interest are added to samples prior to extraction and analysis. Compound recoveries and reproducibility are then compared with tables of acceptance for each method. The established acceptance ranges are contained in each method SOP.

5.9.1.2.1.1 This QC procedure provides information about the effect of the sample matrix on the analyte in question. Generally, a ratio of one spike sample for each ten samples for drinking water and for each twenty samples for RCRA and wastewater analyzed must be maintained. In the event that an analytical run will have less than ten samples one spike shall accompany the batch. The method SOP should be consulted to determine the proper frequency. Solutions used to fortify samples should, when possible, be made from a source other than that from which the calibration standards are made. Percent recovery of matrix spikes is determined using the following:

$$\text{Percent Recovery} = (\text{SSR} - \text{SR}) / \text{SA} \times 100$$

Where:

SSR = Spiked Sample Result

SR = Sample Result

SA = Spike Added

5.9.1.2.1.2 Spike Recoveries - Percent spike recoveries range between ± 3 standard deviations (SD) of the historical percent recoveries when method-specified criteria are not available. It is recognized that this will not always be achievable due to matrix effects. In that case, the data will be reported and an explanation made concerning the problem.

5.9.1.2.1.3 Laboratory matrix spikes and matrix spike duplicates must be prepared and analyzed for each ten samples for drinking water and for each twenty

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samples for RCRA and wastewater analyses. This procedure provides information regarding the precision of an analysis. (These sample types are not always possible due to the type of analysis, for example pH.) The relative difference between duplicate measurements is assessed using the following equation:

$$\text{Relative Percent Difference (RPD)} = |D_1 - D_2| / ((D_1 + D_2) / 2) \times 100$$

Where:

D_1 = Sample Value

D_2 = Duplicate Sample Value

5.9.1.2.2 Laboratory Control Spikes - Compounds of interest are added to reagent blank samples prior to extraction and analysis, as required by each method SOP. Compound recoveries and reproducibility are then compared with tables of acceptance for each method.

5.9.1.2.3 Duplicates and Spike Duplicates - Both routine sample analysis and spiked samples are run in duplicate at a prescribed frequency. The relative percent difference between duplicate sample analysis or duplicate spike analysis must range between ± 2 standard deviations (SD) of historical relative percent difference (RPD), when method-specified criteria are not available. It is recognized that this will not always be achievable due to matrix effects. If a matrix effect is confirmed, the data will be reported and an explanation concerning the problem will be noted on the final report.

5.9.1.2.4 Surrogates - Surrogate spike compounds of interest are added to each sample prior to extraction and analysis. Compound recoveries and reproducibility are then compared with tables of acceptance for each method.

5.9.1.2.5 Method and Reagent Blanks - Method blanks must be prepared with each batch of samples and analyzed to ensure that sample contamination has not occurred. If blank analyses do not fall within acceptable limits, as noted in the method specific SOP, a modification of method reagents or cleaning of glassware may need to be implemented before further analysis is attempted. In addition to method blanks, reagent blanks shall be prepared whenever the lot number of a reagent used in the analysis has changed.

5.9.1.2.6 Internal Standards - Internal standards will be prepared from a solution containing a known amount of analyte and will be traceable to a certified reference solution. Internal standard levels spiked into the sample for analysis

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will be according to method SOP protocol. During analysis, internal standard intensities will be monitored and compared to the intensities established in the calibration blank. In general, intensities should be within 60 – 135% of the original response in the calibration blank, or as otherwise specified in the method SOP.

5.9.1.2.7 Quality Control Check Samples - Quality control check samples will be prepared from a solution containing a known amount of analyte and will be traceable to a certified reference solution. These solutions will be prepared from a solution that is “second source” in difference from the calibration standards/tuning standards. These solutions will be used to verify the stability of the analytical curve established for the current analytical run.

5.9.1.2.7.1 After calibration and calibration verification, continued calibration blanks (CCB) and continued calibration verification samples (CCV) will typically be analyzed after every 10 samples and at the end of every analytical run. Control limits during analysis of these solutions will be subject to the QA protocol as defined by the method SOP.

5.9.1.2.7.2 Quality control check samples will be used to verify the efficacy of the sample preparation procedure via the analyses of preparation blanks (PB) and laboratory control samples (LCS) derived from a certified reagent traceable to a certified reference material or solution. Laboratory control samples must agree within ± 2 standard deviations of the historical data base or no greater than ± 20 percent of the true value. Where method specific ranges exist, they may be used.

5.9.1.2.8 Calibration Standards - Calibration Standards will be prepared from a solution containing a known amount of analyte and will be traceable to a certified reference solution. Calibration standards will be prepared from a solution that is “second source;” that is, different from the continued calibration verification (CCV) solution.

These solutions are to be utilized for the calibration/tuning of analytical instruments at the beginning of an analytical run and to be used for tuning frequency as required by the method SOP protocol. These solutions are also used to evaluate method MDL's and effective quantitative ranges (linearity).

When required, these samples will be analyzed as samples with control limits as required by the method QA SOP protocol. Selection of appropriate

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formulae to reduce raw data to final results is included in the method analyte SOP

5.9.1.3 Other Quality Control Measures

5.9.1.3.1 Control charts can be produced by analyte for the evaluation of QA/QC data. The charts are produced by the LIMS software.

5.9.1.4 Out-of-Control Situations

On occasion, a quality control sample may fail; i.e., the recovery for one or more specific analytes may lie outside the acceptable range (creating an "out-of-control" situation). This failure may or may not affect the acceptability of the analytical run and the quality of associated generated data. Quality control guidelines, contained in Chemtech-Ford, Inc.'s Data Validation and Acceptance Procedure, have been established to be used in the evaluation of out-of-control data for each analytical SOP

5.9.2 Correction and Prevention

Policy and Details:

Quality control data are analyzed and, where they are found to be outside pre-defined criteria, planned action is taken to correct and to prevent incorrect results from being reported.

Revision History

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5.10 Reporting of Results

Section Synopsis

This section tells you:

1. What needs to be on a report
2. How to handle amendments to reports

Key Words

Specific Information
 Required Information
 Interpretation
 Opinion
 Subcontractor
 Electronic Transmission of Results
 Format
 Amendments

Cross-references

ISO 17025:2005 Section 5.10
 ISO 9001:2000 Section 6.1, 6.3.1, 7.1, 7.2.1, 7.2.2, 7.4.3, 7.5.1,
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5.10.1 General

Policy:

The results of each test, or series of tests are reported accurately, clearly, unambiguously and objectively, and in accordance with any specific instructions in the test methods.

The results are reported, normally in a test report and include all the information requested by the customer and necessary for the interpretation of the test results and all information required by the method used. This information may include what is outlined in section 5.10.2, 5.10.3 and 5.10.4.

Details:

Test reports are issued as either hard copy or by electronic data transfer.

5.10.2 Test reports and certificates

Policy:

Test reports include the following information, as appropriate:

- a title (e.g., “Certificate of Analysis”)
- name and address of laboratory, and location where tests were carried out if different from the address of the laboratory
- Unique identification of the test report, and on each page an identification in order to ensure that the page is recognized as a part of the test report
- name and address of the customer
- identification of the method used
- Description, condition, and unambiguous identification of the item(s) tested.
- date of receipt of test items (where this is critical to the validity and application of the results) and date(s) of performance of the analysis
- reference to sampling procedures used by the laboratory or other bodies where these are relevant to the validity or application of the results
- test results with, where appropriate, units of measurement
- the name(s), function(s) and signature(s) or equivalent of person(s) authorizing the test report
- where relevant, a statement to the effect that the results relate only to the items tested

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Details:

Signing authority for test reports is the responsibility of the Lab Director. Records for individuals with signing authority for test reports are approved by the Quality Manager and maintained by same.

Analytical reports include the individual page number and total number of report pages (Page 3 of 16).

A statement is included specifying that the test report is not to be reproduced except in full, without written approval of the laboratory. Data reported to the customer contains the appropriate significant digits for each test method. Low level data are identified as being below specified limits and are flagged with a 'J' flag indicating a value found between the MDL and MRL.

5.10.3 Test Reports

5.10.3.1

Policy and Details:

In addition to the requirements listed in section 5.10.2, test reports include the following, where necessary for the interpretation of results:

- deviations from, additions to, or exclusions from the test method, and information on specific test conditions, such as environmental conditions
- where relevant, a statement of compliance/non-compliance with requirements and/or specifications
- where applicable, a statement on the estimated uncertainty of measurement of the test result; information on uncertainty is needed in test reports when it is relevant to the validity or application of the test results, when a customer's instruction so requires, or when uncertainty affects compliance to a specification limit
- where appropriate and needed opinions and interpretations (see section 5.10.5)
- additional information required by specific methods, customers, or groups of customers

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5.10.3.2

Policy and Details:

In addition to the requirements listed in sections 5.10.2 and 5.10.3.1, test reports containing the results of sampling include the following, where necessary for the interpretation of test results:

- date of sampling
- unambiguous identification of substance, matrix, material or product sampled (including name of manufacturer and lot number as appropriate)
- location of sampling
- reference to sampling plan and procedures used
- details of any environmental condition during sampling that may affect the interpretation of the test results
- any standard or other specification for the sampling method or procedure, and deviations, additions to or exclusions from the specification concerned

5.10.4 Calibration Certificates

5.10.4.1

Policy:

The testing laboratory does not issue calibration certificates. However, the laboratory often receives calibration services from a calibration laboratory and needs to be familiar with the information on a calibration certificate.

Details:

In addition to the requirements listed in 5.10.2, the calibration certificate could include the following, where necessary for the interpretation of calibration results:

- the conditions (e.g., environmental) under which the calibrations were made that have an influence on the measurement results
- the uncertainty of measurement and/or a statement of compliance with an identified metrological specification or clauses thereof
- evidence that the measurements are traceable (see 5.6.2.1.1)

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5.10.4.2

Policy:

This section is not applicable to a testing laboratory.

5.10.4.3

Policy:

This section is not applicable to a testing laboratory.

5.10.4.4

Policy:

A calibration certificate (or calibration label) shall not contain any recommendation on the calibration interval except where this has been agreed with the customer or it is to be used by the laboratory itself.

5.10.5 Opinions and Interpretations

Policy:

When opinions and interpretations are included in the test report, the basis upon which the opinions and interpretations have been made is documented. Opinions and interpretations are clearly marked as such in the test report.

Note - Opinions and interpretations should not be confused with inspections and product certifications as intended in ISO/IEC 17020 and ISO/IEC Guide 65.

Details:

Opinions and interpretations included in a test report may comprise, but not be limited to the following:

- opinion on conformity of the results with requirements
- fulfilment of contractual requirements
- recommendations on how to use the results
- guidance to be used for improvements

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In many cases it is appropriate to communicate the opinions and interpretations by direct dialogue with the customer.

5.10.6 Testing and Calibration Results Obtained from Subcontractors

Policy and Details:

Test reports containing the results of tests performed by subcontractors are clearly identified for the subcontracted results. The subcontractor reports the results either in writing or electronically to our laboratory.

5.10.7 Electronic Transmission of Results

Policy:

In the case of transmission of test results by telephone, facsimile or other electronic or electromagnetic means, the requirements of the policies and procedures of this Quality Manual continue to apply (see also 5.2.7.1.2).

Details:

Signatures are recorded on file at the laboratory. Clients may request a hardcopy example of signatures.

5.10.8 Format of Reports

Policy:

The format of reports is designed to accommodate each type of test carried out and to minimize the possibility of misunderstanding or misuse.

Details:

The layout of the test report is such that the presentation of the test data facilitates ease of assimilation by the reader.

	Quality Manual <i>Only documents located on the intranet are controlled. All other forms are uncontrolled.</i>	Effective Date: 10/01/2017	Rev: 27
Chemtech-Ford Laboratories Quality Manual		Approved for affiliate laboratory use	Page No. 139 of 139
Prepared by: Ron Fuller	Reviewed by: Paul Ellingson	Status: Active	

5.10.9 Amendments to Reports

Policy:

Material amendments to a test report after issue are made only in the form of a further document, or data transfer, which includes the statement “Amended Report”. Such amendments meet all the requirements in this Quality Manual.

Details:

When it is necessary to issue a complete new test report, it is uniquely identified and contains a reference to the original that it replaces. A narrative accompanies the amended report which details the changes in the report as well as justifications for the change. Details for producing an amended report are located in document QSP-5-10-9.

Revision History

Changes from Revision 24

Revision 25 is a significant revision with numerous additions, deletions and corrections. These are not all documented in the revision history, rather all persons on the distribution list are required to read the entire document.



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Quality Systems Manual

Revision 21
Revised: July 11, 2022
Effective: July 11, 2022

Approved:

A handwritten signature in cursive script, appearing to read 'Lisa Eminhizer'.

Lisa Eminhizer
Laboratory Director

07/11/2022

Date

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Kristin Beckley
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07/11/2022

Date

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Dave Balkenbush
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7/19/22

Date

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Eric Corson
Field Service Manager

7/11/22

Date

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INTRODUCTION

This Quality Systems Manual (QSM) was established and is implemented by H&P Mobile Geochemistry, Inc. (H&P) is a California fixed and mobile laboratory specializing in environmental laboratory services as well as environmental field sampling services. H&P provides analytical testing of soil, water and vapor media along with sample collection capabilities for these media. H&P's repertoire of environmental services includes many forms of field sampling techniques, well installation, on-site and off-site analytical testing of soil, water and/or vapor media for tank removals, ground water monitoring and vapor intrusion projects.

All reference materials used in the preparation of this document and the Standard Operating Procedures (SOPs), as well as the definitions of terms used throughout the document are presented in Appendix 1.

1.0 PURPOSE AND OBJECTIVES

This QSM was prepared to comply with the California Environmental Laboratory Accreditation Program (CA-ELAP) certification as well as other state and national laboratory accreditation programs such as NELAP, ISO 17025, NEFAB (National Environmental Field Activities Program) and the Department of Defense (DoD ~~ELAP~~). The manual applies to our fixed and mobile laboratory services, as well as our field sampling services that are supported by an administration and QA/QC management at the fixed facility.

The purpose of this QSM is to:

- Define corporate quality assurance (QA) policies and objectives and to state our commitment to accepted laboratory practices and quality of testing services and to state our commitment to good FSMO (Field Sampling and Measurement Organization) practices and quality of FSMO services.
- To ensure that laboratory and field personnel understand and implement the policies defined in the QSM.
- To provide SOPs for all laboratory procedures, protocols and testing methods.
- To provide SOPs for all field sampling procedures, protocols and sampling methods
- To meet and/or exceed the requirements of the California ELAP, the Environmental Protection Agency (EPA), DoD ~~ELAP~~, NELAP and NEFAP in all analytical testing and/or sampling services.

1.1 Quality Assurance Policy and Objectives

It is the corporate QA policy to provide the highest quality data, through good laboratory and FSMO practices, and services to our clients and to continually strive to improve our capabilities and standards so that we may maintain our position as a leader in the field of soil vapor analysis and sampling. To accomplish this, the quality assurance (QA) system at H&P is designed to be a

system of activities that will result in producing legally defensible data that meet customer data quality requirements in terms of completeness, precision, accuracy, representation, traceability, documentation and comparability, as well as meet or exceed ELAP, DoD, NELAP, NEFAB and other accrediting agency requirements. The system is also designed to allow for upgrading of procedures and methods, for both the laboratory and FSMO practices, when applicable. H&P is committed to implementation of accepted sampling protocols, laboratory practices and quality of testing services. H&P personnel will be familiar with the quality practices in this manual and SOPs and abide by them. All personnel will acknowledge receipt of and adherence to these policies. This QSM applies to all data produced by all mobile and fixed based laboratories and to all operations performed by sampling crews operating under the name of H&P.

1.1.1 Quality System Review Process:

It is the responsibility of the President to see that the quality system is reviewed on an annual basis and that any problems identified are solved through the application of appropriate corrective actions. The Laboratory Director, the QA Officer, field **services manager** ~~operations~~ and the **field** QA/QC manager will assist in this process. It is the policy of H&P to review the QSM and all SOPs on a yearly basis.

System/managerial reviews are to involve a review of the QA documentation for completeness and compliance with Quality Assurance Plan specifications, reviews of internal audits and performance evaluation samples, external body review, comments by customers and personnel and all other sources having knowledge of the lab activities. All laboratory reviews will be conducted by the laboratory director and QA officer and will cover those activities he/she chooses. All field sampling reviews will be conducted by the field **service manager** and field QA/QC manager or the field **service manager** ~~operations~~ and field QA/QC manager's designee. If problems are identified, it is the responsibility of the President and the Laboratory Director and/or the Field Service manager or field QA/QC Manager to see that appropriate corrective action is taken.

The results of the review will be documented in memos to applicable employees and maintained on file by the laboratory director and/or the field operations and QA/QC manager.

1.2 Standard Operating Procedures (SOPs)

All of H&P's technical activities are described in this QSM and in SOPs. The QSM and SOP documents refer to analytical, calibration, computational, quality control, sampling procedures and operating procedures, as well as laboratory notebook policy and the handling of bench data. The QSM and SOPs provide a mechanism through which activities will be carried out in a technically correct, documented and uniform fashion. The QSM may not contain the specific details of how QA/QC standards are maintained. In these cases, SOPs are provided which will contain all the details on how an analyst or technician can meet these standards. All SOPs must clarify all QA/QC criteria so that technical personnel can easily determine when and if their analytical or sampling system is out-of-control or not in conformance. The SOPs must also provide guidance on steps to perform to bring the system in control.

Additions and/or changes to the QSM and SOPs may be recommended by any employee and presented to the President, Lab Director, **QA/QC Officer**, ~~Field Service Operations Manager or Field QA/QC Manager Officer~~. The recommendation may be verbal or written. Either the President, Lab Director ~~or Field Operations Services Manager or Field~~ and QA/QC Manager may decide to take positive action but it is the responsibility of the QA Officer to see that it is implemented. Implementation consists of having the change/addition written up for review by technical personnel. If the change/addition can have an impact on data or sampling quality, it must be tested experimentally to demonstrate that it generates better or equivalent results. The new procedure is to be validated per H&P's Method Validation SOP. Once the review is complete the change/addition is incorporated into the set of SOPs and distributed as described in Section 10 on Document Control.

1.2.1 Good Laboratory Practices/Field Sampling Practices

Laboratory procedures related to Good Laboratory Practices (GLP) include such things as the acquisition and use of laboratory supplies and general laboratory equipment. Examples of such GLP related procedures are the acquisition of solvents and standards, cleaning and storage of glassware and maintenance of refrigerators, freezers and balances. The content addressed for these procedures depends heavily on the topic they address.

Field Sampling Practices related to Good Field Sampling Practices (GFSP) include such things as the acquisition and use of field sampling supplies and general sampling equipment, the decontamination and storing of supplies and equipment, and the maintenance of equipment.

1.2.2 Sample Preparation Methods

Sample preparation methods that are not specific to analytical methods are covered in the QSM. In general, the sample preparation procedures will contain specific information describing:

- Applicable sample matrix or matrices,
- Intended application(s),
- Initial sample size (including units),
- Final sample size (including units),
- Summary of the technique,
- Specifics related to required steps in the method, and
- Specifics related to optional steps in the method.

The extent of detail in these procedures will depend on the extent to which the method is documented elsewhere. For example, if there is a well-documented EPA sample preparation method, the procedure needs to contain summary information only but must reference the EPA method and the EPA method must be on file and readily accessible to laboratory personnel. If a detailed method does not exist, the procedure must contain sufficient detail to allow laboratory personnel experienced in the general area of sample preparation to carry out the procedure.

1.2.3 Sample Analysis Methods

Analysis methods are to be covered by separate SOPs for each analysis. In general, analysis method SOPs will contain specific information describing:

- The method in summary, including the applicable analytes
- Deviations from the EPA method for which H&P is certified for
- Instrument and operating conditions
- Calibration technique (response factor, regression, etc.)
- Initial calibration procedures including the frequency, the number of data points, and the acceptance criteria
- Continuing calibration procedures including the frequency, and the acceptance criteria.
- Continuing quality control such as, internal standard responses, and internal standard retention times, blank requirements
- Analyte identification procedure
- Calculations
- Troubleshooting and Corrective action procedures
- **Summary of changes to the SOP, following a technical review, will be documented at the end of the SOP.**

The extent of detail in these procedures will depend on the extent to which the method is documented elsewhere.

1.2.4 Quality Control Procedures

Quality control (QC) procedures are to be covered in each analytical or field sampling SOP which will contain specific information describing:

- Calibration procedures and criteria
- Frequency of daily calibration and criteria
- Frequency of spiked samples and criteria
- Frequency of duplicate or replicate samples and criteria
- Frequency of blanks and criteria
- The use of surrogates and criteria and
- The use of reference materials
- Any Decontamination procedures relative to field sampling

The extent of detail in these SOPs will depend on the extent to which QC is documented in related analysis methods or documented in the field sampling SOPs.

1.2.5 Acceptance Criteria

Acceptance criteria for QC activities may be specified in the method, the SOP for a method, field sampling activity, or they may be specified by regulation, project, or the

client. If various standards of Quality Control apply in a given instance, H&P will use the most stringent requirements that are in effect at the time of analysis.

In general acceptance criteria describe limits for:

- Percent difference for daily calibration,
- Percent recovery from spiked samples
- Percent difference for duplicate or replicate samples
- Percent recovery for surrogates
- Percent error for reference materials

The extent of detail for the acceptance criteria depends on the requirements and specifications of the applicable method and its application and/or the end use of the data generated. The acceptance criteria are to be accompanied with corrective actions where appropriate.

1.2.6 Field Sampling Procedures

Field sampling procedures are covered by separate SOPs, and/or sampling guides, detailing each type of field sampling activity. In general, field sampling SOPs will contain specific information describing:

- Collection of soil and groundwater samples
- Collection of soil vapor samples into the appropriate sample containers
- Proper sampling procedures to fulfill specific regulatory guidelines
- Conducting the appropriate leak check procedures
- Sample handling

The extent of detail in these procedures will depend on specific sampling guidance to be followed on a per job basis. The sampling guides act as a more detailed, step-by-step, instruction guide for specific sampling procedures. Procedures found to be outside of the standard SOPs and sampling guides are to be accompanied with corrective actions where appropriate.

2.0 ORGANIZATION, MANAGEMENT, PERSONNEL AND TRAINING

Organization and management of the QA function at H&P involves two independent functions among five people.

The President is responsible for seeing that appropriate staff, materials and facilities are available such that customer data quality requirements can be met. This includes review of work plans, work orders, quotations and contracts for technical feasibility and practical application. The President is further responsible for seeing that there is a system in place to allow verification of these requirements. The President is assisted by the Laboratory Director, QA Officer, Field Service Manager, and Field QA/QC Manager.

The QA Officer is responsible for seeing that the QA system is being used to generate data will meet customer requirements. To do this the QA Officer will, 1) review all QAPs and SOPs and 2) provide training for technical personnel in the QA/QC requirements and procedures for all methods employed. When review of QA data indicates that corrective action is required, the QA Officer is responsible for seeing that the correct action is identified and carried out. It is the responsibility of the QA Officer to maintain SOPs and to see that all technical personnel have access to and have reviewed the most recent version.

The Laboratory Director is responsible for seeing that the staff, materials and facilities being used to accomplish a task are capable of carrying out the task in a technically correct fashion. To accomplish this, the Laboratory Director will, 1) review and authorize all Quality Assurance Plan (QAP) documents and SOPs, and 2) operate a Data Quality Audit system independent of all technical and laboratory personnel. It is the responsibility of the Laboratory Director to see that all technical personnel are familiar with and use the company established SOPs.

The Field Service Manager and Field QA/QC Manager are responsible for seeing that the staff, materials and facilities being used for all field sampling activities are done so in a technically correct manner. In order to accomplish this, the Field Service Manager or the Field QA/QC Manager will review and authorize all field sampling SOPs and sampling guides as well as conduct a field sampling audit system for all field personnel. It is the responsibility of the Field Service Manager and/or Field QA/QC Manager to see that all field sampling personnel are familiar with the use of the sampling SOPs and sampling guides.

H&P's technical personnel are responsible for carrying out methods as described in the SOPs and documentation and for fully applying all QA/QC procedures to the work they perform. This includes completing all documentation in an accurate and timely fashion and taking corrective action when their QC data indicates this is necessary.

Because technical personnel generate data, the flow of QC data and paperwork is transferred from them to the QA Officer/ Lab Director. (Figure 2.1A – Sample and Data Flow Chart for In-house received samples) (Figure 2.1B – Sample and Data Flow Chart for Field received samples).

2.1 Company Management

Company management consists of:

President/Owner:	Louise Adams
Financial Officer:	Louise Adams
Secretary:	Louise Adams
Operations Manager:	Suzie Nawikas
Human Resources Manager:	Serena Souza (Independent Consultant and Integrity Officer)
Laboratory Director:	Lisa Eminhizer
QA Officer:	Kristin Beckley
Field Service Manager:	Eric Corson
Field QA/QC Manager:	Dave Balkenbush

Management meetings are held periodically, with all available managers, as needed. Items discussed include any variety of topics to help with the day-to-day operations of H&P. These meetings are not mandatory and provide an informal discussion of managerial duties. Records of these meetings, including list of attendees, topics discussed, and action items are kept by Louise Adams. Copies of these meetings are kept on the H&P server in the management folder.

2.2 Company Organization

Other company responsibilities are assigned as follows:

Project Managers:	Louise Adams, Suzie Nawikas, Kristin Beckley, Scott Mayfield
Sample Custodian:	Tori Unsworth and various field & company personnel
Logistics/Lab Assistant:	Tori Unsworth
Technical Services Manager:	Dave Balkenbush
Document Control Officer:	Noah Unsworth
Deputy Laboratory Director:	Thu Nguyen
LIMS and IT Manager:	Noah Unsworth
Purchasing Manager:	Therese Torres
Office Manager:	Noah Unsworth

Safety responsibilities are assigned as follows:

Health & Safety Officer:	Dave Balkenbush

A company organization chart is outlined in Figure 2.2.

2.3 Personnel

Specific Job Descriptions/Responsibilities and Minimum Qualifications.

These requirements apply to all full-time, part-time, permanent, and temporarily assigned personnel.

Quality Assurance Officer (QA Officer):

Responsibilities of the QA Officer include:

- Serving as the focal point for QA/QC and be responsible for the oversight and review of quality control data.
- Have functions independent from laboratory operation for which they have quality assurance oversight.
- Be able to evaluate data objectively and perform assessments without outside managerial influence.
- Have documented training and or experience in QA/QC procedures and be knowledgeable in the quality systems defined under ELAP, DoD, NELAP and ISO 17025:2017.

- Have a general knowledge of the analytical test methods for which data review is performed.
- Arrange for or conduct internal audits on the entire technical operation annually.
- Notify laboratory management of deficiencies in the quality system and monitor corrective action.
- Assist with the updating and review of the QSM and related SOPs
- Assuring that data meets the requirements of the NELAC, DoD, ELAP and ISO/IEC 17025:2017 Standards under which the lab performs the analyses including but not limited to this QSM.
- Direction of laboratory personnel in QA/QC issues

Minimum Requirements:

Bachelor's degree in related science and 10 years' experience in analytical chemistry techniques including 5 years performing QA/QC functions

Laboratory Director:

The laboratory director is responsible for all aspects of laboratory operation from a scientific and technical standpoint. This involves:

- Direction of laboratory personnel and processes, including hiring of qualified personnel.
- Training and certification of laboratory personnel
- Assisting the project manager in the scheduling of equipment and labor.
- Technical analysis of projects to assure that correct methods and procedures are applied to samples.
- Resolution of "out-of-control" events.
- Monitoring standards of performance in quality control and quality assurance.
- Monitoring the validity of analyses performed and data generated in the laboratory to assure reliable data.
- Assuring that data meet the requirements of the NELAC, DoD, ELAP and ISO/IEC 17025:2005 Standards under which the lab performs the analyses including but not limited to this QSM.
- Update and review the QSM and related SOPs

Minimum Requirements:

Bachelor's degree in chemical, environmental, biological science, physical science or engineering, with at least 24 college semester credit hours in chemistry and at least ten years of experience in the environmental analysis of representative inorganic or organic analytes for which the laboratory seeks or maintains accreditation. Supervisory experience is preferred. A master's degree or doctoral degree may substitute for one year of experience.

Should the laboratory director be absent from the lab for more than 15 days, management will select a temporary director to assume the responsibilities above. The person chosen must meet the full requirements of the laboratory director position. If the laboratory director will be absent for more than 35 consecutive calendar days, the primary accrediting authority CA ELAP, NELAC and DoD (PJLA) will be advised of that fact.

Project Manager:

The project manager is responsible for the communication and the scheduling of all fixed base laboratory work and all field work for the chemists and technicians. The project manager is also the main contact with client project managers and has the responsibility to clarify client requests, plan appropriate work to meet those requests and to receive feedback from the client both positive and negative concerning the analyses performed. These responsibilities include:

- Providing cost estimates to clients.
- Scheduling of equipment and labor.
- Assisting the president with work plans.
- Managing field work
- Tracking deliverables.
- Analyzing feedback to ensure proper response to client. Documenting feedback by informing the employee(s) and their supervisors of the feedback. This information may be provided by email.
- Maintain a list of subcontract laboratories which meet various Quality Standards and/or maintain specific accreditations (e.g., NELAP and/or DOD etc.)

Minimum Requirements:

High school diploma or equivalent. Bachelor's degree in science or 3 years related job experience preferred.

Field Services Manager:

The Field Services Manager is responsible for overseeing all field sampling activities and personnel. This includes:

- Direction of all field personnel (excluding chemists) and procedures, including hiring of all qualified personnel.
- Oversee training of personnel (including chemists) for all field sampling procedures.
- Assist the project manager in the scheduling of field equipment and labor.
- Technical analysis of projects to assure that correct methods and procedures are applied to sample collection.
- Responsible for the development of field sampling procedures as well as developing and validating new methods
- Review of all field sample collection documentation.
- Assist Field QA/QC Manager with monitoring standards of performance for sample collection procedures.
- Maintaining field equipment and instrumentation.

Minimum requirements:

At least 5 years related job experience with direct push drilling and environmental field sampling.

Field QA/QC Manager:

The Field Services QA/QC Manager is responsible for overseeing all the quality assurance associated with field sampling. This includes:

- Maintain and update field sampling SOPs.
- Assist the Field Services Manager with the development of field sampling procedures as well as developing and validating new methods
- Review field sample collection documentation, if needed.
- Monitoring standards of performance for sample collection procedures.
- Maintaining field instrumentation, including obtaining professional calibrations of meters.
- Acting as qualifying employee for company C57 license.
- Assuring that field sample collection activities meet the requirements of the NEFAP, DoD, and ISO/IEC 17025:2017 Standards under which the company performs these activities including, but not limited to, this QSM.

Minimum requirements:

At least 5 years related job experience with direct push drilling and environmental field sampling.

Technical Services/Health & Safety Manager:

The Technical Services/Health & Safety Manager is responsible for the maintenance and repairs of all H&P's equipment, vehicles, and sampling equipment excluding laboratory instrumentation. In addition, he/she is responsible for ensuring that H&P Mobile Geochemistry Inc.'s safety practices and programs are maintained including general laboratory safety, safety requirements for equipment operation and for chemical handling and storage. These responsibilities include:

- Ensures that the summa canister inventory is sufficient and acceptable for client's samples by performing or subletting repairs in according to H&P's specifications and updating H&P summa canister inventory accordingly.
- Manages all vehicle maintenance and repairs including mobile laboratories, drill rigs and field sampling trucks. Other equipment includes rig hydraulics and hammers, generators, back-up cameras and Navman systems.
- Updates Navman fleet maintenance schedule and vehicle maintenance logs as required.
- Ensures all field and laboratory personnel are provided with all required safety equipment.
- Ensures all field and laboratory personnel follow H&P's Safety practices through audits and Safety meetings.
- Manages all safety training and ensures that field/lab employees are kept up to date and their safety certifications are maintained and tracked.
- Ensures all client required Safety programs and protocols are completed and up to date.
- Manages all employee's medical surveillances and ensures that they are kept up to date and reviewed for physical limitations or other health issues that may affect performance.
- Manages all wastes and ensures that H&P is in compliance with CERS.
- Manages annual CERS reporting.
- Represents H&P as the Hazardous Material Shipper and ensures that the certificate is renewed every 3 years.

- Maintains H&P's hazardous Materials Business Plan and Emergency Response Plan is reviewed annually and maintained. This includes a responsibility to provide training annual training to meet these objectives.
- Acts as qualifying employee for company C57 License.
- Assists Field Services Manager to assure that field sample collection activities meet the requirements of the NEFAP, DoD, and ISO/IEC 17025:2005 standards under which the company performs.

Auditor (Internal):

Internal audits are typically performed by the laboratory director, QA Officer, Field **Services Manager or Field QA/QC** Manager. It is appropriate for a scheduled internal audit to be delegated to another employee if they meet the following requirements:

- Knowledgeable in the area being audited as to the requirements, criteria, and procedures
- Knowledgeable and trained in the audit process.
- Minimum Requirements: At least 2 years of experience in the procedures being audited.

Office, Human Resources and Purchasing Managers –

The responsibilities of this position may be divided between several individual. Together, they will be responsible for all human resource, office and accounting functions which include:

- Assure compliance with State and Federal employment laws, EDD programs, workers compensation, OSHA and COBRA.
- Handle all accounting functions such as payroll, accounts receivable and accounts payable. Ensure that orders are placed through approved vendors according to DoD and ISO/IEC 17025:2005 2017 requirements.
- Assist Operations Manager with recruiting tasks checking references and driver records, and drug testing.
- Schedule office repairs and building maintenance as needed.

Minimum requirements:

Bachelor's degree in business, accounting and/or human resources management preferred or at least 3 years related job experience.

LIMS and IT Manager:

- Maintain Server which includes Cloud backup, user permissions, remote control access, anti-virus updates, Window server updates, installing new software, defragmenting hard drive, and to troubleshooting errors.
- Maintain Element LIMS including database archiving/backups, user permissions, audit trail, Element updates, report format revisions, EDD generation, and troubleshooting errors.
- Maintain lab computers and printers which includes the setup of new computers, installing instrument software, Window updates, anti-virus updates, network server connections,

mobile lab Internet access, and troubleshooting computer and printer error or replace faulty hardware if necessary.

- Manage IT inventory and supplies which includes spare computers, printers, cables and accessories.

Minimum requirements:

Bachelor's degree and/or at least 3-5 years related job experience.

Document Control Officer:

The document control officer functions to maintain the technical records for the company. Responsibilities of the Document Control Officer include:

- Maintenance of records concerning reports, quality control information, instrument logs, extraction logs, etc.
- Maintenance of electronic records of instrument data.

Minimum Requirements:

Bachelor's degree or related experience

Report Signatory Personnel:

The Laboratory Director and/or QA/QC Officer will determine those employees who have the training and experience to sign and issue reports. The laboratory director will inform all members of the company in memo form of the names and hierarchy of signatory personnel. Personnel signing reports will perform a final review prior to signing the report.

An electronic signature may be used to sign reports; however, it may not be a computer-generated signature. The electronic signature must be a scan of the real signature of the person signing the report. The electronic signatures are to be kept only by approved report signatory personnel and the document control officer.

Minimum Requirements:

Bachelor's degree in science or related discipline and at least two years' experience in organic analysis.

Sample Custodian:

The sample custodian is responsible for all phases involved with the receipt of samples. The duties of the sample custodian are:

- Receive samples
 - Unpack and verify labels
 - Inspect for damage, and other irregularities including proper documentation.
 - Report problems to Lab Director and Project Manager as necessary
- Complete sample chain-of-custody documentation

- Place samples in storage area
- Log in samples
 - Log into tracking system
 - Generate internal tracking forms
- Notify managers and analysts
- Dispose of unused sample at the appropriate time
- Dispose of extracts at appropriate time
- Assemble all related documents into a case file

Minimum Requirements:

High School diploma or equivalent

Data Reviewer:

The functions of the data reviewer are:

- Assemble Data
 - Tracking database
 - Lab Prep
 - Various analysis from all labs
- Verify data completeness
- Verify compliance with QA/QC requirements
- Verify compliance with client requirements
- Create LIMS report
- Compose project summary narrative
 - Technical difficulties
 - QA/QC results
 - Conclusions
- Produce final report
 - Compile
 - Duplicate
 - Transmit to client

Minimum Requirements:

Bachelor's degree in science or related discipline, a good understanding of the method being reviewed, or related job experience.

Chemist/Analyst – Mobile Laboratory/In-House:

The functions of the chemist are:

- Preparation and analysis of environmental samples including but not limited to soil, water and soil vapor. Chemists may also be assigned vapor sample collection.
- Maintenance and operation of the equipment used in the analysis of environmental samples.
- Remain knowledgeable of current QSM, SOPs and QA/QC requirements of the job.

- Review and interpretation of data.
- Preparation of preliminary drafts of customer reports and case data packages for the data reviewer.
- Acceptance of samples under proper procedures (for mobile lab chemists).
- Interface with client on site to provide analytical chemistry consultation (mobile lab chemists).
- Mobile Lab Chemists are considered mid-level supervisors in GC and/or GC/MS techniques.

Minimum Requirements:

For in house laboratory:

Bachelor's or Associate's degree in science or related discipline, or related job experience.

For mobile laboratory:

Bachelor's or Associate's degree in science or related discipline is preferred. In lieu of a degree, appropriate, thorough training or experience is acceptable.

Field Sample Technician:

The functions of the strataprobe operator and field technician are:

- Understanding and proficiency in the collection of environmental samples including, but not limited to, soil sampling, ground water sampling, indoor air sampling and soil vapor sampling.
- Maintenance and operation of the equipment used for the collection of environmental samples.
- Accurate documentation of field collection data.
- Knowledge in the proper handling and transport of environmental samples.
- Interface with the client in the field to provide field sampling consultation.

Minimum requirements:

High School diploma with 1-2 years' environmental field sampling experience preferred.

Temporary or Part Time Duty Assignments:

Laboratory Director

In the absence of the laboratory director, the most senior Chemist will serve as the technical director assuming he/she meets the minimum requirements of the technical director position (see above under "Laboratory Director"). This person is called the Deputy Lab Director.

Quality Assurance Officer

In the absence of the QA Officer, the most senior data review Chemist will serve as the QA Officer assuming that person meets the minimum requirements of the QAO position.

Chemist/Analyst

Temporary assignments are only acceptable for in-house chemists. Mobile laboratory chemists require a significant amount of safety training and cannot be closely monitored as an in-house chemist. The requirements for a temporary in-house chemist are the same as a permanent in-house chemist. They must also undergo training and must demonstrate their proficiency in the analysis they are to perform before they are allowed to work on client samples. Part-time analyst/chemist positions do not require a completed bachelor's/associates degree as long as they are closely supervised by a senior chemist or the laboratory director.

Field Services Manager and Field QA/QC Manager

In the absence of the Field Services Manager or the Field QA/QC Manager, the most senior Strataprobe operator/field technician will serve as the field sampling director- assuming he/she meets the requirements of the position (see above under "Field Services Manager Operations and Field QA/QC Manager").

2.4 Personnel Training

2.4.1 Technical Training

All technical employees must undergo training in the use and application of new methods, techniques and equipment. It is the responsibility of the Laboratory Director, Field Services Manager and/or Field QA/QC Manager to see that appropriate training is provided and to test the effectiveness of the training. At no time, will this training activity involve generation of customer data or the collection of client samples unless it is under the direct supervision of an instructor. Data generated in the training programs are to be reviewed immediately and any problems identified corrected by the trainee. No analyst or technician will be permitted to perform analysis or sampling operations until he/she has demonstrated the ability to correctly collect samples or produce accurate and precise data as well as to correctly maintain the required documentation. As part of their training all new employees are required to review, understand and implement the SOP designated by H&P prior to the end of their training period. The Laboratory Director, Field Services Manager and/or Field QA/QC Manager will maintain records to show that the analyst or technician have been certified as properly trained.

For an analyst, initial training involves a demonstration of initial capability, which includes a reproducibility study. A reproducibility study is performed by the analyst analyzing 4 replicates of a blank spike prepared at a concentration that is at the mid-point or lower. The %RSD is calculated for each analyte using the following formula:

$$\%RSD = (STD/A) * 100$$

Where...
 %RSD = % Relative Standard Deviation
 STD = The standard deviation of the 4 replicates for each analyte
 A = The average of the 4 replicates

The %RSD determined must be at or below the % precision requirements for the method. In addition, the % Recovery is calculated for each analyte using the following formula:

$$\% \text{ Recovery} = (A/TV) * 100$$

TV = true value of analyte's spiked concentration

A Demonstration of Initial Capability and associated Reproducibility Studies are kept on file for each chemist (Appendix 2A).

Each analyst must demonstrate his or her proficiency annually by successfully analyzing a Performance Evaluation (PT) sample every year and/or by successfully completing an intra-laboratory study every year. The chemist must achieve an acceptable result on 80% or greater in order to demonstrate performance in the method. If PTs are not available or if an intra-laboratory study is not possible, a reproducibility study may be performed. The chemist must demonstrate that their precision and accuracy meet method requirements. (Appendix 2B – Demonstration of Continuing Proficiency)

For a field sampling technician (mobile lab chemists are considered field sampling technicians as well), initial training involves a demonstration of initial capability, which includes a field sampling audit to be observed by the Field Services Manager and/or Field QA/QC Manager or qualified senior field technician. This audit will include all the necessary sampling tasks for the proper collection of soil vapor samples. Some of these tasks include: Collection of soil vapor samples using a glass syringe sample container, collection of soil vapor samples using a summa canister sample container, and collection of soil vapor samples using a summa canister in conjunction with helium shroud leak detection. Each person must show proficiency in any task they are to perform in order to begin collecting samples on their own. (Appendix 2A2)

Each field sampling technician must also demonstrate his/her proficiency annually by being observed by the Field Services Manager, Field QA/QC Manager, or a qualified senior field technician while conducting these sampling tasks. This may be done onsite while field operations are being performed or simulated at the in-house facility. (Appendix 2B2)

As part of the continuing proficiency, the sample technician must also demonstrate his or her proficiency in vapor sample collection by successfully collecting a Performance Evaluation (PT) sample. This is accomplished by following H&P soil vapor sample procedures to pull vapors from mock soil vapor probe attached to a 6L summa containing a certified VOC standard prepared by the lab. The sample technician must achieve an acceptable result of 80% or greater in order to demonstrate performance in soil vapor sample collection. (SOPS 007) This may be done onsite while field operations are being performed or simulated at the in-house facility.

H&P is committed to using the newest and most reliable techniques in sample collection and analysis. To accomplish this, new and better sampling and analytical procedures are continually being developed. All technical personnel receive training in these new protocols once established and a SOP is developed and distributed. In addition, as part of H&P's on-going training, when changes or additions are made to the SOPs, the previous SOP is removed from the server and replaced with the revised copy. **In addition, a summary of any changes made to the SOP from the previous year are summarized at**

the end of the SOP. The employee then reviews the updated SOP. The Field QA/QC Manager shall maintain documentation of the SOP distribution.

Company technical training staff:

Laboratory Director: Lisa Eminhizer
Deputy Laboratory Director: Thu Nguyen
Field Services Manager: Eric Corson
Field QA/QC Manager: Dave Balkenbush

2.4.2 Ethical/Legal Training

All employees must undergo training in the legal and ethical responsibilities of environmental sampling and analysis. Ethics training is performed during employee orientation and on an annual basis. Attendance sheets are used for documentation of Ethical training. Make up sessions will be provided for any employee that cannot make the annual meeting. This training is to ensure that personnel are capable of providing quality work that is not affected by outside influences. It is the responsibility of the President to see that appropriate training is provided. H&P is in the business of providing environmental sampling and analytical chemistry data. H&P will not become involved in any activities that would diminish their impartiality, judgment, or integrity. We are subject to rules, regulations, and guidelines etc., which emanate from many sources. Among these are the various Federal, State and local agencies that have access to and receive our data. We must also be sensitive to our clients' requirements. It is our policy that data is presented objectively, without subjective or biased interpretation by the analyst or reviewer. It is also our policy to provide full and adequate disclosure of the quality of the data that we produce. In other words, quality control parameters are to be used to assess data quality and should not be viewed as "pass/fail", to be achieved at all costs. In addition, when parameters are out of current SOP specifications, it is our policy to identify that data which is affected and to offer probable or possible explanations in the form of a narrative or data flags.

2.4.3 Safety Training

All technical field employees receive 1) 40-hour OSHA Training; 2) Annual 8-hour Refresher course; 3) Defensive Driving Training; 4) API (American Petroleum Institute) Worksafe Training; 5) CPR Training; and, 6) Annual Medical Surveillance OSHA Examination and 7) Annual Respirator Fitness Certification. With the exception of respirator certification, which is conducted by the Technical Services/Health & Safety Manager, all other training is provided through certified third-party programs. In addition, all chemists and field technicians may undergo site-specific training when requested by clients, such as LPO certification.

Quarterly safety meetings are held which will cover a variety of safety topics for field staff and bi-annual safety meetings are held for the fixed laboratory and office staff. The topics covered will be selected by the Technical Services/Health & Safety Manager to cover areas of concern in the daily operation of laboratories, drilling equipment, sampling equipment

and office equipment. Signup sheets are circulated to document attendance. Make up sessions will be provided for any employee that cannot make the quarterly meeting.

2.4.4 Computer Security Awareness Training

All employees must receive training on computer security by the LIMS & IT manager and be made aware of how to protect H&P's computers, LIMS and email systems from security breaks or hackers. Employees will be instructed as to the consequences of computer security problems and be provided with instructions as to how to prevent these issues. Computer security training is performed during employee probationary period and on an annual basis.

2.5 Personnel Records

Records of the qualifications, training and experience performance evaluations of all analysts and field technicians are maintained in the company administrative files. A master file of signatures (Appendix 2C) for all employees is to be maintained by the Human Resources Manager for reference. Employees are to be instructed that their initials and signature must be consistent to what they will use in all H&P documentation.

3.0 FACILITIES, NEW METHODS AND EQUIPMENT PURCHASES

H&P operates fixed and mobile laboratories and field vehicles including strataprobe rigs and support vehicles. The fixed facilities provide administrative support to all mobile laboratories.

All experimental data generating activities at H&P must operate in an environment that will not invalidate the data produced. In general, laboratory test areas should have proper lighting, heating and cooling and ventilation to facilitate proper performance. Care must be taken to ensure freedom from excessive dust, electromagnetic interference, humidity and maintenance of sound and vibration levels. Work areas are to be kept neat and unencumbered to facilitate analysis activities. Effective separation is to be maintained to eliminate cross contamination (e.g., volatiles away from extraction solvents.) Access to work areas should be controlled. If a test method specifies monitoring of environmental controls, then this must be implemented as part of the QC procedures. Specific details on laboratory work environments and monitoring controls are discussed in the following sections:

3.1 Laboratory Security

The purpose of this section is to describe the procedures used to secure the laboratory. It identifies responsible parties and establishes the mechanism used to see that security is maintained.

3.1.1 Buildings

H&P's office buildings have a security alarm system and commercial response company. An entry code system is used for access after opening of the door and must be set at the end of the day by the last person leaving. At no time should the building be left unattended and unlocked. Outside lighting and cameras add to the overall security of the H&P facilities.

3.1.2 Mobile Laboratory Security

Mobile labs are not left unattended and unlocked when parked on customer sites. If the operator needs to leave, a second party (the customer) must be made aware that the lab is left unattended and should watch the vehicle.

When not in the field, mobile labs are parked in the indoor bay area of the fixed facility or behind a locked gate.

3.1.3 Strataprobe and Field Vehicle Security

Field vehicles are typically stored outside the company facility. Strataprobe rigs and field tech trucks are to be secured so that nothing of value can be easily accessed. All doors and storage boxes are to be locked when the vehicle is left unattended.

In the event a field vehicle is stocked for the following day project with expensive equipment, such as field instruments or meters, the vehicle must be parked overnight in the warehouse.

3.2 Laboratory Management/Field Equipment Management

3.2.1 Mobile Laboratories

Each mobile laboratory is assigned a chemist to maintain the instruments, computer, and the mobile lab itself. The following items are responsibilities of each chemist assigned a mobile laboratory:

- All instruments are tied securely to the counters as to not fall during mobilization.
- All refrigerators are operating properly for sample and standard storage
- All instruments are calibrated, and calibrations are valid.
- All instruments are kept free from excessive dust and heat.
- All instruments are properly maintained.
- The generators are properly maintained and are working well
- The outside and inside of the mobile laboratory are kept clean.
- Maintenance is up to date on engine, tires, transmission etc
- Computers are kept dust free, and data and methods backed up and deleted

The Laboratory Director, senior chemists and the Technical Services/Health & Safety Manager are responsible for assisting each chemist with the above and will assist in keeping the maintenance log up to date. The updated maintenance log will be sent to each chemist after it is updated. Each mobile lab chemist will perform a vehicle inspection on their mobile lab and complete a Mobile Lab Inspection Sheet (Appendix 3A) on a weekly basis. Before mobilization to a job each chemist will check to ensure their lab is stocked with all the items required to perform a job. Appendix 3B1 and 3B2 is a recommended checklist.

The environmental conditions of any field analysis are to be documented. Included in the log record will be the date, site location, analyst/driver, test methods, sample matrix and internal and external field conditions, including internal laboratory temperature, and weather conditions. These conditions are recorded on the Mobile Lab Project Notes (Appendix 9D1 & 9D2) the Excursion Log (Appendix 9C) and in the Chemist's Run Log (Appendix 9E-L).

The lab environment will be monitored for temperature by an internally mounted wall thermometer. Initial acceptance limits for temperature will be set at 16-30 ° Celsius (60 to 86 F). If the laboratory temperature is not maintained within this temperature range, the laboratory director is to be contacted immediately.

Equipment utilized in the laboratories such as refrigerators, GCs, GC/MS, etc. are monitored and recorded as specified in Section 4.0 and documented in the Excursion Log.

3.2.2 Fixed Base Laboratories

The fixed base laboratory is separated into areas for different analytical procedures, for example, the EPA 8260 and GC area are separated from the EPA TO-15 area. These areas are separated in order to minimize contamination and to provide enough area for each analyst to work and prepare their samples for analysis. Each area has its own temperature control unit which is to be monitored and kept in the acceptable temperature range for analysis. The laboratory temperature is to be recorded onto the Chemist's Run Log (Appendix 9E-L). The following items are responsibilities of the chemist and/or lab personnel assigned to the area:

- All refrigerators, if present are operating properly for sample and standard storage
- All instruments are calibrated, and calibrations are valid.
- All instruments are kept free from excessive dust and heat.
- All instruments are properly maintained.
- The laboratory is to be kept clean and organized.
- Computers are kept dust free, and data and methods backed up and deleted

Equipment utilized in the laboratories such as refrigerators, GCs, GC/MS, etc. are monitored and recorded as specified in Section 4.0 and documented in the maintenance log or refrigerator logs.

3.2.3 Strataprobe Rigs and Field Vehicles

Each Strataprobe rig and field vehicle is assigned to a primary operator who is responsible for the maintenance of the vehicle and the equipment needed to perform their duties. The following items are the responsibilities of each field technician assigned to a field vehicle:

- All tooling is free from cracks, and threads are in good working order
- Tooling on truck is properly stored and organized
- Generator and power tools maintained and in good working order
- All supplies necessary for required field activities stocked and organized

- The vehicle is kept clean on the inside and outside
- Maintenance is up to date on the engine, tires, transmission, etc.

The Field Services Manager and Field QA/QC manager are responsible for assisting each field technician with the above items and will keep the maintenance log up to date. The maintenance log will be sent to each technician after it has been updated. Each technician will perform a vehicle inspection on their vehicle and complete a Strataprobe Vehicle Inspection Sheet or a Support Vehicle Inspection Sheet (Appendix 3E1 or 3E2) on a weekly basis. Before mobilization to a job, each field technician will check to ensure their vehicle is stocked with all the items required to perform the job.

Equipment Audits are also done on each Strataprobe rig and field vehicle at least once a year to help maintain the proper amount of tooling and supplies on each vehicle. This audit is performed by the Field Services Manager and/or Field QA/QC Manager or a senior field technician (Appendix 3F & 3G).

3.2.4 Portable Field Instruments, Meters and Detectors

The use of portable analytical field meters and detectors are often required to perform various analyses in the field. Examples of these instruments are: Landtec GEM 5000 Gas Analyzer, and the Radio detection MGD 2002 Multi Gas Leak Detector. All field instruments must meet the same criteria as in-house equipment which includes:

- Documentation of yearly factory calibration. Instrumental information regarding accuracy and precision is to be provided and checked to ensure that the analytical requirements are met.
- Each instrument must undergo a daily field calibration, before and after use, to ensure instrument is within acceptable ranges.
- Upon receiving any field instrument back from any repairs or calibrations, the instrument will be tested and a calibration check is to be run to assure it is working properly. This data will be kept in the instrument file folder kept by the Field QA/QC Manager.
- Daily calibration results are recorded on the specified sample log sheet.
- The analyst or technician is to obtain training that is verified by the Lab Director or the Field QA/QC Manager-prior to field analysis.
- Uncertainty budgets are maintained and reviewed yearly to provide uncertainty of measurement and to establish trends of meters.

Once these conditions are met, analysis can proceed. All recorded data is to be kept in the project file for the samples that were analyzed.

3.2.5 Rental Equipment

It may be necessary for H&P to obtain rental equipment to perform various analysis in the field. Examples of rental equipment are Landtec meters, Helium meters, Hydrogen Sulfide meters, PID meters, portable GCMSs or GCs. All rental equipment must meet the same criteria as in-house equipment which includes:

- Must include documentation from the rental supplier that the instrument is calibrated and in good condition. Instrumental information regarding accuracy and precision is to be provided and checked to ensure that the analytical requirements are met.
- The analyst or technician is to obtain training that is verified by the Lab Director or Field QA/QC Manager prior to field analysis.
- The calibration must be validated prior to being used on client's samples.
- Forms must be available to record calibration and results.

Once these conditions are met, analysis can proceed. All recorded data is to be kept in the project file for the samples that were analyzed. A copy of the rental documents is to be maintained by H&P and kept on file as well.

3.3 Laboratory Equipment Changes

This section is to be followed if a newer model replaces analytical equipment or if the current or new instrumentation is used for an alternative methodology than currently used in the individual mobile laboratory. Any rental equipment or test instruments normally outside of H&Ps control must be checked to ensure they meet the requirements. (See section 3.2.5). The laboratory director, senior chemist, Field Services Manager and/or Field QA/QC Manager is required to oversee these procedures.

When a new methodology is being developed, there is a mechanism that is to be followed to ensure it is a marketable analysis that will meet client needs. The following steps are to be included in the systematic approach to method development:

3.3.1 Market Evaluation (alternative methodology only) –

Primarily the project managers will do this as they obtain client requests for an analytical method. Requests by regulators for a specific analytical method may also prompt interest in developing a new technology. The president must approve this new technology to be developed so that proper resources can be assigned.

3.3.2 Technical Research (alternative methodology only) –

Once the market need for this alternative analytical technology is confirmed, research may proceed to determine the technical requirements such as analyte lists, required reporting limits, sampling requirements, QA/QC requirements, and what matrices will be analyzed. In addition, research should be done on what analytical instrumentation is necessary to obtain that will meet these requirements once determined. This is to be evaluated by laboratory director. An attempt is to be made to evaluate more than one vendor of such instrumentation to ensure the wisest purchase is made. It must be verified that the instrument purchased will have the sensitivity, precision and accuracy required for the method to be performed. Things to consider in an instrument purchase are: cost, efficiency, ease of use, owner feedback, and reliability. The accessories such as sampling

equipment, analytical columns, analytical standards, etc. are also to be determined and evaluated.

3.3.3 Instrumental Set Up

Once the instrument is purchased it can be placed in a mobile laboratory or at the fixed facility. The intended location is to be prepared for this instrument by:

- Adding the required electrical outlets with the proper voltage and plug configurations.
- Setting up and securing the needed gas supplies such as helium, nitrogen, or air. The instrument may require a water supply and/or a drain. There may also be a need for cryogenics.
- Setting up the computer and software will require access to the server and possibly the Internet.

3.3.4 Instrumental Operating Conditions

After the instrument is delivered, it is recommended that the vendor, or someone knowledgeable in its design, set the instrument up. The chemist or laboratory director should be present during instrument installation so that all the necessary information to operate, maintain, and calibrate the instrument is obtained from the installers. In most cases, the installers will assist in the method development and set the parameters for the specific analytes so the chemist can proceed to the next sections. It is also recommended that a training session be scheduled so that the operating chemist will have some knowledge of its operation. After setup, the vendor must demonstrate that the instrument is fully functional. These steps are to be overseen by the laboratory director so that proper instrumental setup and training is verified. All these records are to be kept with the instrument.

After the chemist is trained and the instrument is set up, the chemist is to gain familiarity with the instrument. Application notes offered by the vendor may provide a starting point for analytical conditions that can be used to determine analytes of interest. All test results must be kept and analytical conditions that were used, documented. Once acceptable results are obtained, the chemist must demonstrate that the instrument meets the requirements of the client's standard and any other project or regulatory requirements that exist.

The software must also be validated to show that it provides acceptable calculations according to the method. (See Section 3.3.9 for more detail)

A standard operating procedure (SOP) is to be written and then reviewed by both the laboratory director and the QA Officer.

3.3.5 Demonstration of Capability and Method Validation

Before an instrument can be used on client samples, the laboratory must demonstrate that the instrument and procedures used are capable of generating acceptable data. For more detail on Method Validation, see Method Validation SOP, which provides details and steps required for method development and annual method validation.

This section also applies to the analysts who may use the equipment and is covered in more detail in the section on training. Proper demonstrations of capability include:

- PT sample testing or other reference material testing
- Intralaboratory comparison of results (if PTs are not available)
- Precision and Accuracy studies`
- Comparing results obtained from other validated methods

When the above techniques are not feasible, the following options must be used:

Systematic assessment of factors that could influence the result; and/or assessment of the precision and bias of the result based on the science of the method and practical experience.

3.3.6 Method Detection Limits and Reporting Limits

In addition to demonstrating the capability of an instrument and reading its Standard Operating Procedure, the chemist must determine the instrument's method detection limit (MDL). This MDL study is performed according to the published procedure for determining MDLs and/or outlined in the specific analytical method SOP or published method. The MDL must be performed for each matrix to be analyzed. The MDL study determines the detection limit (DL) that is the smallest quantity of a target that can be differentiated from zero with a specified probability. Once this is determined, it is tested by analysis of a clean matrix spiked at 2-4 times the estimated MDL to determine the limit of detection (LOD). The LOD should be 2 to 4 times the MDL. All MDLs must be validated by the Laboratory Director or QA/QC Officer.

In addition to performing an MDL study and a LOD determination, the limit of quantitation (LOQ) is to be verified. The analyst may choose a potential LOQ and demonstrate its suitability by analysis of a spiked matrix. The analyst should spike each matrix at 1 to 2 times the potential or set LOQ to determine if the instrument can report at this level with the laboratories' specified accuracy and precision. If the instrument cannot reach the desired LOQ it may be necessary to alter the instrument or sample preparation procedures to meet these requirements. The LOQ must be greater or equal to the LOD. If the instrument can determine compounds present at the desired LOQ, the LOQ may be used as a reporting limit within the requirements for accuracy and precision. All LODs and LOQs must be validated by the Laboratory Director or QA/QC Officer. The forms used for this are Calculation sheets CALC 005A through 005F. (See the Method Validation SOP for more information.)

The LOD and LOQ are to be validated on a quarterly basis and after a significant instrument change. Examples of this are changing an analytical column or placing a new auto sampler into service.

3.3.7 Modifications to Standard Methods

Some clients request that H&P add an analyte to the standard VOC list for either EPA 8260, H&P 8260 SV, ~~H&P TO-15~~ or EPA TO-15. To be able to report this analyte there are two choices:

1. To report the analyte as a Tentative Identified Analyte (TIC) and to estimate its concentration and reporting limit or
2. To purchase the analyte and prepare a calibration for the analyte.

Regardless of how this new analyte is reported, the laboratory director is to oversee and approve the process. Reporting an analyte as a TIC is not the most accurate procedure and the analyte may not be successfully identified. Therefore, the client must be informed that this approach is not the most desirable.

For TIC analysis, the mass assignments and the approximate retention time is to be obtained from information sources. The analyst will then be instructed to scan for these masses in the estimated retention time range. Library search techniques may be used on any peak that has the masses to determine if it is the analyte. The software can be used to estimate the concentration which can be hand-entered into element and flagged as a "TIC".

For EPA 8260B or H&P 8260SV calibration, the analyte is to be prepared in methanol at a concentration of 20 ppm or 200 ppm. If the analyte is not water soluble it can be assumed that a 20-ppm solution will be acceptable. For water, soluble analytes, it may be more appropriate to use a 200-ppm stock or higher. For TO-15 methods a vapor standard which contains 1 ppmv of the analyte, must be purchased.

The analyst is to prepare a calibration curve using a minimum of 3-5 standard levels (see specific method SOP requirements). The lowest calibration level will determine the reporting limit to use in element. The calibration curve must be approved by either the laboratory director or QAO prior to use. Since MDL or LOD studies are not performed on this analyte, it is not acceptable to report below the RL. The client is to be informed that this analyte is not on H&P's standard list and that it is not routinely analyzed for.

3.3.8 Data Reporting

After completing the above sections, a method is to be created in the Element LIMS system that will be used for reporting client sample results using the method detection limit and reporting limit study results obtained. The method should also include any surrogates used and the QA/QC criteria set for in the applicable EPA, DTSC, ASTM method or SOP. The method is to be created in the proper department, TO, GC/MS or GC. The full analyte list is to be added to the method, along with the MDL and reporting limits. The units in the

Element database must coincide with the units used in the Chemstation or Peaksimple method. If new analytes are created in the static tables, their molecular weights are to be added as well. The cross tables are to be set up in Datatool so that the data can be successfully merged with Chemstation.

3.3.9 Software Validation

New software obtained for analytical data processing must be validated prior to use on client's samples. This can be done by performing a hand calculation of an analyte and verifying that the software provides the same value. These records are to be kept available for review.

For instruments that have been in use but are having the version of software updated, validation is also required. This can be done by reprocessing a blank and a standard to verify proper results are obtained. These records are to be kept available for review.

4.0 **SUPPLIES & EQUIPMENT CHECKS & MAINTENANCE**

Equipment, materials and supplies that are necessary to complete analytical testing, as well as environmental field sampling, are provided by H&P. The purchase of materials, equipment and supplies which impact data and sampling quality is to be accomplished in such a way that a preset of defined quality and/or performance specifications is included as part of the bid package. The standards for equipment, supplies and materials are established based on the current regulatory requirements, industry standards and lab certification requirements established by ELAP and other certifying agencies. The supplier must meet the defined quality and/or performance specifications before H&P will purchase/accept any materials, equipment or supplies. Where possible, all reference materials, reagents, solvents and gases are to be obtained from vendors that are ISO/IEC 17025:2005 certified. Approved vendors for laboratory equipment and supplies are listed in Appendix 7B1. Approved vendors for field sampling equipment and supplies are listed in Appendix 7B2.

Once performance specifications have been met, supplies are to be dated and equipment labeled. When possible, the date is to be written on the item itself. If the item has a useful shelf life it should also be noted. Records of services and supplies should include but not be limited to:

- Date of receipt
- Expiration date (if Applicable)
- Source
- Lot or serial number
- Calibration and verification records; and
- Certifications by the manufacturer

The laboratory director is responsible for maintaining the Approved Vendor List for laboratory equipment and supplies. The Field Services Manager and/or Field QA/QC Manager, and QA/QC Officer are responsible for maintaining the Approved Vendor List for field sampling equipment and supplies. If the vendors are required to be ISO/IEC 17025:2017 certified, this must be verified annually.

4.1 Laboratory Supplies

4.1.1 Solvents

This section defines the purity specifications for organic solvents used in extracting chemicals from various sample media and for glassware cleaning. Logbooks tracking stock solutions and standard preparation are maintained at the Carlsbad Facility. All solvents used must be identified by date of receipt, expiration date, lot number and certifications (if any).

Extraction Solvents

All solvents used for organic analysis should be “distilled in glass” grade (for extractions) or “purge and trap” grade (for P&T) or equivalent. The purity of solvents as extraction solvents or purge and trap solvents should be evaluated using the "Blank Test".

Blank Test

The Blank Test involves using the solvent to prepare a laboratory reagent blank and then analyzing it to demonstrate that any impurities present in the solvent will not interfere with the target analytes. The maximum amount of any target analyte in a reagent blank should

- Not be higher than the reporting limit (dilution factors taken into account) in effect at the time
- Not exceed a concentration greater than 1/10 of the measured concentration of any sample in the associated batch
- Not exceed the concentration present in any sample and is greater than 1/10 of the specified regulatory limit

If a contamination problem is present, the source of contamination will be investigated and measures taken to correct, minimize or eliminate the problem.

When the Blank Test is used, the solvent tested is deemed acceptable only for the analysis situation evaluated and records are kept to this effect.

Washing and Cleaning Solvents

Technical grade solvents may be purchased and used for washing without performance specifications.

4.1.2 Standards

This section establishes the criteria for acceptable materials for use as calibration standards. The program is designed and operated to ensure that, when applicable, measurements made by the laboratory are traceable to national standards of measurement where available. The ordering of all reagents and standards is to be approved by the

laboratory director. Upon receipt, the receipt date is to be written on the container. All standards are to be placed in the proper area in the standards freezer.

The laboratory maintains calibration certificates that indicate the traceability to national standards of measurement and the uncertainty of the measurement.

Analytical Standards

In-House Standards

Standards used in the calibration of analytical instruments that are prepared in-house are prepared from neat materials or compounds. They are weighed to three significant figures on an analytical balance or measured by a volumetric glass syringe and dissolved in an appropriate solvent. Solvent volume is established using Class A volumetric glassware at the specified temperature. Materials are considered neat if:

The purity as specified by the supplier is >99%,

Chromatographic analysis using a non-specific detector (GC-FID or HPLC-UV) shows less than a 1% total impurity.

Out-of-House Standards (Purchased)

Standards purchased from suppliers are utilized as received. Crosschecking is achieved using a similar standard from a second supplier. Not all standards require a second source. These include TPH for gasoline in 8260 analysis and fixed gases, helium and methane. In addition, analytes that are not reported on the standard H&P reporting list do not require second source validation. For EPA Method 8260, H&P 8260SV and EPA TO-15 analysis the calibration curve is created using one source and validated using a second source prior to analyzing client samples. The prepared working standards are to be verified against the old calibration curve. The standard validation data is maintained by the laboratory director. All standards used must be assigned a unique ID number, and identified by date of receipt, expiration date, lot number and certifications.

The procedures used for standard preparation are presented in each method SOP. All preparations are to be documented in blue ink in the standard prep log books kept at the Carlsbad facility. The conventions used for unique ID#s for EPA 8260 standards are: LP standards are assigned to standards purchased directly from the vendor. LS standards are mid-concentration stocks used to prepare LSS working stock solutions. The LSS working stocks are used for calibration curve preparation. For TO-15 standards, AIS standards are used to classify internal and surrogate standards and ACC standards are used to classify VOC standard preparations. All preparations are to be labeled with ID#, name and expiration date. In the log books the documentation must include:

- Preparation date
- Unique ID # assigned
- Name of standard and concentration of analytes within

- Volume, lot# and ID# of all solutions used to prepare standard along with their expiration dates
- Expiration date
- Initials of person preparing standard
- Summa Can # used for TO-15 and ~~TO-14~~ standard preparations

The expiration dates for standards are determined as follows:

- The opened LP vials are allowed to keep the vendor expiration dates as long as they are properly sealed and kept per vendor specifications. The exception is with gaseous 8260 standards which must be discarded once opened and used to make standards.
- LS primary source standards are given 6-month expiration dates unless they are gaseous which are given 1-month expiration dates.
- LSS working stock standards are given 3 months unless they are gaseous which are given 1-month expiration dates.

4.1.3 Water

Clean water is used as a method blank for every analysis that is performed for water matrices. The water that can be used for this purpose is bottled drinking water that is typically free of VOCs and other target analytes. At times, it may be required for the analyst to purge the drinking water with nitrogen gas for 5 –10 minutes prior to use if low level target analytes are found in the method blank prepared with this water.

Other uses for water are for the Tekmar's Solatek auto samplers which are used in conjunction with the Tekmar concentrators. The Solateks are equipped with a large water tank that must be kept full of water. The only water type suitable for this is distilled water. Drinking and deionized water are not suitable.

4.1.4 Reagents

Some methods may require other reagents to be used in the sample preparation of in the analysis. These chemicals are to be purchased at the same grade that is recommended in the main EPA or ASTM method. If the method is not a standard method or the purity of the reagent is not specified, "reagent grade" is to be ordered. The vendor must supply certificates of analysis for every lot number delivered.

4.1.5 VOA Vials

Volatile Organic Analysis (VOA) vials are used for 8260 analyses and for TPH extractions. The vials used for 8260 are 40 ml size and must have septa style caps. These vials are typically baked before use with the caps removed at 200° C for 10 minutes due to low level contamination. The vials for TPH extractions are 40 ml size for soils or 60 ml size for waters and have solid caps. Vendors that supply these must be approved and their vials tested before used on client samples. Acceptance is based upon acceptable

contamination levels, sample size, cost and compatibility with the Solatek auto samplers. The vendor must supply certificates of analysis for every lot number delivered.

4.1.6 Tedlar bags

Tedlar bags are used to collect samples for ~~H&P TO-14~~, methane, fixed gases, helium and H&P 8260SV analyses ~~as well as to perform some dilutions for H&P TO-15 analyses.~~ H&P uses a variety of sizes but the 500-cc size is the most regularly used size. Tedlars can be made from different materials than “Tedlar” but these are not recommended as they can easily split during storage or shipment. Vendors that supply these must be approved and their bags tested before used on client samples. Acceptance is based upon contamination levels, storage stability, strength and cost.

4.1.7 High Pressure and Cryogenic gases

High pressure gases are used in the operation of the gas chromatographs either as a carrier gas, for or for the operation of the detectors and autosamplers. These include helium, nitrogen, hydrogen and air. It is required that all carrier and purge high pressure gases are high purity as they can cause problems during analysis if they have contamination. All carrier and purge gases, such as nitrogen and helium, must come with a certificate of analysis from the vendor. It is the responsibility of the analyst to obtain this certificate and to provide it to the laboratory director as documentation that the lot they are using is certified. The analyst is to date and initial this certificate.

Cryogenic **nitrogen** gases is used for TO-15 autosamplers which use them to focus analytes prior to injection. ~~These include liquid CO₂ and liquid N₂.~~ These do not require certificates of analysis since they must be of high purity.

4.2 Equipment Maintenance & Checks

Equipment that has been subjected to overloading or mishandling or otherwise thought to be defective is taken out of service until the appropriate measures/repairs are completed and the instrument has been tested and calibrated to perform satisfactorily. If any equipment is found to be malfunctioning or unable to meet the specifications required in a method, it is to be taken out of service until repaired.

Preventive maintenance procedures are listed in the maintenance and operating manuals for each instrument. These are available on the server and are to be used to determine the frequency and type of maintenance to be performed. All activities are to be documented in the maintenance log book assigned to the instrument. All maintenance logbooks must be assigned a unique ID# and be identified with vendor, model# and serial # of the instrument it applies to. All entries in the maintenance log book must be initialed and dated by the person completing or witnessing the activity. Analysts are also responsible for recording the maintenance completed by a service contactor on their instrument. **Examples of maintenance items to be entered into maintenance logbooks are source cleaning, pump oil change, column maintenance, such as clipping the column or changing the column. Note that all column information, including column type and serial number, should be entered in the maintenance log.**

H&P also has a variety of support equipment that is used. The support equipment performance checks and acceptance criteria is set forth in Appendix 4D to this QSM.

4.2.1 Gas Chromatographs (GC)

This section identifies the procedures associated with scheduled and unscheduled, and daily, routine and non-routine GC maintenance.

Daily Operational Check

The following steps are to be followed by each instrument operator on a daily basis:

- Check and replace the injection port septum if necessary. Injection septa typically lasts for 50 injections. The injection liner should be evaluated and may also need to be replaced if dirty samples have been analyzed.
- Check GC column fittings to be sure they are secure. A leak check solution (SNOOP) may be used on units other than purge and trap units. An electronic leak detector may also be used.
- Check injector, column and detector temperatures for proper settings for the particular method; adjust as necessary.

Check gas cylinders for content and pressure. A gas chromatograph must have at least 60 psi set on the delivery pressure or second stage on the carrier pressure regulator. Change or adjust as necessary. Any change in carrier or purge gases must be documented in the instrument maintenance logbook.

Biannual Maintenance

The first working days of January and July, or as close as feasible, will be the time designated for biannual maintenance. Instrument preventive maintenance will take place on or around these dates if it is due. Completion of maintenance will be recorded in the instrument logbooks.

Unscheduled Maintenance

Unscheduled maintenance includes all activities not addressed in the preventative maintenance. It includes cleaning detectors and injectors, replacing gas cylinders, and any activities that require dismantling any portion of the instrument except for GC column replacement. It is usually undertaken when the instrument fails to perform acceptably. The activities involved may or may not be routine in nature. When they are non-routine, consult the manufacturer's instrument manual and take the action indicated.

4.2.2 GC/MS

The purpose of this section is to identify routine procedures associated with scheduled and unscheduled operation and maintenance of GC/MS.

Daily Operational Check

The following steps are to be followed by each instrument operator on a daily basis:

- Inspect and replace as needed the injection port septum.
- Check GC column fittings to be sure they are secure.
- Check the injector, column and ion source temperature.
- Check gas cylinders for pressure and content. Adjust or replace as necessary. Any change in carrier or purge gases must be documented.
- Check gas flow rates by monitoring of retention times; adjust as necessary.
- Check vacuum gauges for proper vacuum. Take corrective action if unacceptable. GC/MS rough vacuum gauges are instrument specific and vary with ambient temperature. Any deviation of more than +/- 5 millitorr may indicate a problem.

Monthly Instrument Check

On the first working day of each calendar month, the first instrument operator to use a GC/MS should do the following:

- Check the oil level in the mechanical pumps; add as required.
- Give the instrument a complete visual inspection for problems.
- Remove dust from rear and top of instrument and around cooling slits and fans.

Biannual Maintenance

On the first working days of January and July, or as close as feasible, perform preventive maintenance not previously done. Indicate completion in the instrument logbook.

Unscheduled Maintenance

Unscheduled maintenance includes all activities not addressed in the sections above. It includes cleaning ion sources, replacing rough pump oil, and any activity that requires breaking vacuum except GC column replacement. It is usually undertaken when the instrument fails to perform acceptably. The activities involved may or may not be routine in nature. When they are non-routine consult the manufacturer's instrument manual and take the action indicated. Record all activities in the Log along with name and date. The log should include the name of the piece of equipment, manufacturer's model, a unique identifier, details of maintenance carried out to date and a history of any damage, malfunctioning and modification or repair.

4.2.3 Balance, Top loaders and Weights

The purpose of this section is to identify the procedures associated with the scheduled and unscheduled maintenance of balances and top loaders.

Operational Check

The following steps are to be followed by each user prior to each series of weight recordings:

1. Tare the balance and place an ASTM Class 3 standard weight on it to verify that it reads correctly. Note: Do not touch weight with bare hands, always use gloves or forceps to handle weights.
2. Record the weight(s) on the analytical run log. (Appendix 9E-N) For DoD accredited laboratories, two analytical weights that encompass the target weight must be checked and recorded. **One of the weights should include the weight of the VOA vial, solvent (water or methanol) and the soil sample aliquot.**
3. Sign and date the log.
4. Notify the Laboratory Director if the balance is not within its acceptance weight error of +/- 2%.

Annual Maintenance

Every 12 months check the laboratory weight used to check each balance or top loader against an NIST Standard Class 1. Record results in the Analytical Weight Calibration Check Form (Appendix 4A).

Unscheduled Maintenance

Unscheduled maintenance includes all activities not addressed in the section above. The activities involved may or may not be routine in nature. When they are non-routine consult the manufacturer's instrument manual and take the action indicated. Record all maintenance activities in the Log along with name and date.

4.2.4 Refrigerators

The purpose of this section is to identify the procedures associated with the scheduled and unscheduled refrigerator maintenance.

Daily Operational Check

Once per day the **Logistics/Lab Assistant** ~~Lab QA Monitor~~ or analyst is to:

1. Read the temperature (Centigrade) on each refrigerator's thermometer. If there is a correction factor on the thermometer, apply it to the reading. Both the uncorrected and corrected temperatures are recorded.

2. Record it in the Daily Refrigerator/Freezer QA Log (Appendix 9A &B) or Excursion Log. (Appendix 9C) or Run Logs (Appendix 9C through N).
3. Initial and date the log.

If the reading on any refrigerator is outside its acceptance range, the QA Officer or Laboratory Director is to be notified immediately and corrective action taken. If the temperature is $3^{\circ}\text{C} \pm 3^{\circ}\text{C}$, the unit is functioning properly.

The refrigerators in the mobile laboratories that hold either client samples or VOC standards, must also be monitored on a daily basis. The temperatures are to be recorded onto the excursion log (Appendix 9C) listing the “HP Project” as “In House”. An alternative is to place the samples and/or VOC standards in the fixed base refrigerators that are monitored daily.

Corrective Action

The corrective action taken in the event of a refrigerator being “off” temperature depends on the degree of the problem.

If the temperature is lower than expected by no more than 3°C monitoring will take place to determine if the lower temperature is consistent. A new thermometer will be used to determine if the thermometer is the cause. If the thermometer is functioning properly, then after 3 days of low temperature the refrigerator temperature may be adjusted using the control.

If the temperature is no more than 6°C , monitor and adjust the temp control to achieve a lower temperature. If the temp is greater than 6°C move the standards/samples to another refrigerator.

If a catastrophic failure occurs to a refrigerator that contains client samples that have not been analyzed and reported, the H&P project manager is to be informed that the integrity of the client’s samples may have been jeopardized. The project manager will then inform the client of the situation so that a decision can be made whether to resample.

Calibration

The refrigerators that hold client samples must be calibrated routinely to maintain their temperature at $3^{\circ}\text{C} \pm 3^{\circ}$. This will require periodic adjustment of the temperature control unit.

Bi-Weekly Contamination Check

Every 2 weeks the refrigerators used to store unanalyzed client samples are to be checked for contamination. This is performed by the analysis of prepared trip blanks that have been kept in the refrigerator for at least 5 days but less than 14 days. If the trip blanks are determined to have contamination present above the reporting limit, corrective action is to be taken.

Corrective Action

Remove all samples from affected refrigerator and document these project numbers. Find source of contamination and remove from refrigerator. Decontaminate refrigerator and repeat trip blank test. Once test confirms that refrigerator is free of contamination, samples may be returned.

Maintenance

Maintenance includes all activities not addressed in the sections above. The activities involved may or may not be routine in nature. When they are non-routine consult the manufacturer's manual and take the action indicated. Record all maintenance activities in the Refrigerator's Log along with name and date.

4.2.5 Freezer

The purpose of this section is to identify the procedures associated with scheduled and unscheduled freezer maintenance.

Daily Operation Check

Once per day the Lab QA Monitor or analyst is to:

1. Read the temperature (Centigrade) on each freezer thermometer. If there is a correction factor on the thermometer, apply it to the reading. Both the uncorrected and corrected temperatures are recorded.
2. Record it in the Daily Refrigerator/Freezer QA Log (Appendix 9A1, 9A2 & B).
3. Initial and date the Log.
4. Notify the Laboratory Director immediately if any temperature is out of its acceptance range.

If the temperature is $< -10^{\circ}\text{C}$, the unit is functioning properly.

Corrective Action

The corrective action taken in the event of a freezer being "off" temperature depends on the degree of the problem.

If the temperature is lower than expected by no more than 10°C monitoring will take place to determine if the lower temperature is consistent. A new thermometer will be used to determine if the thermometer is the cause. If the thermometer is functioning properly, then after 3 day of low temperature the freezer temp may be adjusted using the control.

If the temperature is more than -10°C , monitor and adjust the temp control to achieve a lower temperature. If the temperature is greater than -10°C check the quality of the ~~standards~~/samples in the freezer and move to another freezer if necessary. If only standards are stored in the freezer or freezer compartment, the freezer is not required to be -10°C or colder. Standards are only required to be kept refrigerated or $< 3^{\circ}\text{C}$. It is required,

however, to monitor the freezer temperature of the freezer to ensure that this criterion is met. These are to be recorded onto the excursion log (Appendix 9C) or the In-house refrigerator form (Appendix 9A).

If a catastrophic failure occurs to a refrigerator that contains client samples that have not been analyzed and reported, the H&P project manager is to be informed that the integrity of the client's samples may have been jeopardized. The project manager will then inform the client of the situation so that a decision can be made whether to resample.

Calibration

Once per year check the thermometer against a NIST calibrated thermometer to ensure accuracy and recorded in the Thermometer Calibration Certification Sheet (Appendix 4B). The acceptance range will be adjusted accordingly. If the difference exceeds $\pm 3^{\circ}\text{C}$ perform maintenance until the problem is corrected.

Unscheduled Maintenance

Unscheduled maintenance includes all activities not addressed in the sections above. The activities involved may or may not be routine in nature. When they are non-routine consult the manufacturer's manual and take the action indicated. Typically, freezers must be defrosted at least once a year to help maintain proper operation. Record all maintenance activities in the Freezer Log along with name and date.

4.2.6 Thermometers

The purpose of this section is to identify the procedures associated with scheduled and unscheduled thermometer maintenance and use.

Operational Check

The following steps are to be followed by the first person using a thermometer on a given day:

1. Read the temperature on the thermometer.
2. Record it on the Run Log. Both the uncorrected and corrected temperatures are recorded.
3. Sign and date the Log Run Log once completed.

The analyst or technician is to inform the laboratory director immediately if any thermometer is broken or not working properly. Digital thermometers may lose some of their function which will result in an un-clear display. The laboratory director will supply a new thermometer and will sign and date the certificate that comes with the thermometer and document which lab or refrigerator it was assigned to.

Calibration

Once per year, check the liquid thermometers against a NIST calibrated thermometer to ensure accuracy and record the results in the Thermometer Calibration Certification Sheet (Appendix 4B). This NIST calibrated thermometer is sent annually to an ISO/IEC

17025:2005 certified company that is capable of certifying it and providing a certificate of calibration. The annual check correction factor will be entered on the face of the thermometer. The analyst/technician is to subtract or add this value to the thermometer's reading and record it onto the refrigerator, excursion and/or run log.

Digital thermometers must be checked quarterly against a verified liquid thermometer. For digital thermometers on refrigerators, the chemist is to record the inside (lab temp) temperature from the digital thermometers and the liquid thermometer quarterly and record it onto the Digital Thermometer Check Form (Appendix 4F). For digital thermometers on ovens (summa can cleaning ovens), a liquid certified thermometer is to be placed through the thermometer hole on the top of the oven. This temperature is to be recorded onto Appendix 4F along with the digital reading on the can cleaning software for verification.

Unscheduled Maintenance

Unscheduled maintenance includes all activities not addressed in the section above. The activities involved may or may not be routine in nature. When they are non-routine consult the manufacturer's manual and take the action indicated.

4.2.7 Water Dispensers

Water dispensers are used to deliver 20 ml of purged drinking water to VOA vials in the preparation step for EPA 8260 and H&P 8260SV.

Calibration

These devices are to be calibrated every quarter to ensure that they are delivering the appropriate volume. Calibration is performed by weighing the delivered volume of water and adjusting the dispenser to be within 3% of the set volume. This is recorded onto the Water Dispenser Check Form (Appendix 4G).

Unscheduled Maintenance

Water dispensers are prone to calcium build up and corrective action may need to be performed if it fails to deliver consistent water volumes or large water bubbles during the pumping action. If this happens, the laboratory director is to be informed so that the unit can be repaired and recalibrated.

4.2.8 Digital Vacuum Gauges

Digital vacuum gauges are used to measure the vacuum on summa canisters before they are sent to clients and when they are returned to H&P for analyses.

Operational Check -Daily

Before use, each vacuum gauge should be zeroed before use. This is accomplished by attaching the proper quick connect to the end so that it could measure atmospheric

pressure. Once the reading is stable, verify that the digital readout is at “0.0”. If not, press and hold the “Zero” key until the readout stabilizes at this value.

Decontamination Procedures

Before a digital vacuum gauge is used to measure the vacuum in a summa canister it is to be de-contaminated. This involves removing the “dead-volume” for the gauge by attaching it to an evacuated canister (usually called a “COW”). This action is performed before use and between measuring the vacuum on client’s samples that are in canisters. This “COW” is to be evacuated weekly to ensure it is suitable for de-contamination procedures.

Calibration

Vacuum gauges are to be certified or verified against a certified vacuum gauge annually. This program involves sending one of the vacuum gauges to an ISO/IEC 17025:2005 certified company that is capable of certifying it and providing a certificate of calibration. This can be performed on alternative gauges so that each one is re-certified every other year. This certified gauge is then used to validate the calibration of the other one(s) and the data documented on Appendix 4E.

Unscheduled Maintenance

If the digital gauge does not operate properly, refer to the recalibration/troubleshooting section in the operation manual. The laboratory director is to be informed if the problem cannot be solved.

4.2.9 Mass Flow Controllers

Mass flow controllers (MFC) are used to measure the flow rate on flow chokes and sample kits before they are sent to clients. H&P uses two types of MFCs, one to use for flow between 0 and 25 cc/min and the other for flows between 0 and 500 cc/min.

Calibration

MFCs are to be certified or verified against a certified MFC annually. This program involves sending one of the MFCs to an ISO/IEC 17025:2017 certified company that is capable of certifying it and providing a certificate of calibration. This can be performed on alternative MFCs so that each one is re-certified every other year. This certified MFC is then used to validate the calibration of the other one(s) and the data documented on Appendix 4H.

Operational Check -Daily

Before use, each mass flow controller should be checked that it’s display is set to “0.0” when powered on and not yet attached to the vacuum pump or sample. If the digital display is not at zero, the controller can be zeroed by using a very small screwdriver to turn zeroing screw on the side of the unit.

4.2.10 Summa Canisters

H&P has a variety of summa canisters for sampling ambient air and soil vapor. For ambient air, a 6-liter summa canister is typically used although a 1-liter may be used if the reporting limits are higher for a specific client. All summa cans used for ambient air must have a gauge and valve on them to determine vacuum when sampling. All 6-liter cans also have a female quick connect attached. Summa canisters that are used for soil vapor range in size from 200 mL to 1000 cc. The smaller cans, 200, 400, 450 cc in size, do not come equipped with gauges, only valves and male quick connects. It is recommended that only cans that are SiloCoated be purchased for H&P sample collection.

4.2.11 TO-15 Summa Canister Cleaning Systems

H&P has 3 summa canister cleaning systems that are used to clean the summa canisters described in section 4.2.10. Care must be taken when using these systems since they use a high vacuum pump that can be easily damaged if not used properly. Summa canisters are not to be attached to the cleaning system unless the high vacuum pump is confirmed to be off. In addition, the digital thermometers must be verified quarterly, and recalibrated if necessary, to prevent damage to the gauges due to overheating during the cleaning process. (See Section 4.2.6)

Scheduled Maintenance and Calibration

The humidifying chamber is to be checked daily to ensure that it is half filled with reagent water prior to starting the cleaning cycle. Calibration of the thermocouples must be performed if they fail the quarterly digital thermometer checks. This is done using the SLNetView folder for Ovens 1 and 2 and through the calibration folder under “settings” tab for Oven 3.

4.2.12 LIMS and Server

Except for software updates that do not adversely affect our customer’s electronic data, H&P does not make any changes to the software or hardware configuration of the LIMS we license from Promium. All requests for customized EDDs are created per client requirements and do not change the standard EDD templates in our LIMS.

In the event that H&P needs to make changes to the software or hardware configuration of our LIMS that adversely affect our customer’s electronic data, we will notify our customers by email before the changes take effect.

4.3 Field Sampling Supplies

4.3.1 Soil Vapor Probe Construction Materials

All materials used in the construction of soil vapor wells (i.e. Sand, bentonite, tubing, filters), have been laboratory tested by H&P to show that they are acceptable for use and

meet the requirements as put forth by H&P. Any new materials or supplies obtained from sources outside of the approved vendor list (Appendix 7B2) must be laboratory tested prior to use in the field. These records are kept on file with the Field QA/QC Manager.

4.3.2 Field Sample Collection Supplies

All materials and supplies used in the collection of field samples (i.e. Tubing, Luer fittings), have been performance tested to show that they are acceptable for use and meet the requirements as put forth by H&P. Any new materials or supplies obtained from sources outside of the approved vendor list (Appendix 7B2) must be performance tested prior to use in the field. These records are kept on file with the Field QA/QC Manager.

Equipment and supply lists with current supplies and lot numbers are kept on each field vehicle, along with dates added, to track supplies used for field sampling activities. See Appendix 4I.

5.0 GENERAL LABORATORY PROCEDURES

This section provides descriptions of general laboratory procedures that do not fall readily into the categories identified by other operating procedures.

5.1 Glassware

This section applies to glassware that is reused and requires cleaning. Much of the glassware used by the laboratory is pre-cleaned disposal one-time use glassware and does not require cleaning or washing. Other glassware, such as the glass syringes used for vapor collection, require regular cleaning. These syringes collect soil vapor samples which will cause the syringes to become coated with oil and contaminants. The syringes should be inspected daily and cleaned if any film is observed on the inside walls or if any soil grains are found inside. The oil residue will absorb target analytes and could affect results. Any soil grains will cause the syringe barrel to jam inside rendering the syringe useless.

The steps in this procedure that are used with all glass syringes are described below.

1. Wash with Alconox detergent or Simple Green and hot water.
2. Rinse liberally with tap water.
3. Rinse liberally with distilled water three times.
4. Rinse with methanol.
5. Bake syringes until dry

5.2 Waste Management / Pollution Prevention

The purpose of this section is to identify the standard procedures associated with non-hazardous/hazardous waste removal. It is the policy of H&P to comply with all Federal, State and Local regulations governing the generation, storage, and removal of waste. H&P's procedures are designed to prevent pollution of environmental media through proper handling, storage and disposal.

5.2.1 Waste Handling

There are 5 types of wastes that are stored at H&P's facility. These are solid waste, water waste, organic solvent waste, oil filter and oil waste. The solid waste includes all soils, and solids, which are primarily from client samples. Water waste includes all client water samples and water from prepared VOA vials for the Solatek auto samplers. Organic waste generally consists of solvent waste that is generated during method procedures or instrument maintenance. Organic and oil wastes may be recycled through organic/waste oil recycling programs. Waste oil consists of all oils obtained from maintenance procedures such as oil changes on generators, pumps and engines. Oil filter waste is to consist of only used oil filters. See the H&P SOP on Waste and Sample Disposal for more details.

5.2.2 Waste Removal

Waste drums are removed from H&P's facility as needed by a licensed waste hauler. No more than two drums of each type of solid or liquid waste are stored at the facility at any one time.

6.0 **PROJECT MANAGEMENT & FIELD SAMPLING**

The purpose of this section is to provide guidelines for acceptable field sampling activities. It addresses planning, site evaluation, and documentation.

6.1 Project Management

Once a client has contacted H&P for services, it is the responsibility of the H&P project manager to determine if H&P has the resources, instrumentation and equipment to meet the requirements of the project. (See SOP on Contracts Requests and Tenders). This applies to all field projects and in-house analyses. In addition, proper field sampling requires planning to assure that all required samples are collected, that they are collected in the correct manner, that they are preserved, stored and shipped in such a way as to maintain their integrity, and that chain-of-custody procedures are appropriate for the end use of the data. To assure that this is the case, a meeting is held between H&P's project manager and the client's project manager. This meeting is typically conducted via emails and or phone. The result of this meeting is a Preliminary Sampling/Analysis Plan that covers:

- Client project manager, billing address, contact information
- Site evaluation requirements and permitting
- Site safety requirements and utility clearances
- For vapor samples; vapor probe information, purge volumes and leak check type
- Matrix type and total samples to be analyzed and/or collected
- Analyte lists and reporting limits,
- Sampling points and techniques,
- Field analyses and data deliverables,
- Sample containers and preservation techniques,

- Storage and shipping procedures, and
- Chain-of-Custody procedures.

Once this information is obtained, the H&P project manager will complete a Strataprobe and/or Mobile Lab Confirmation Sheet (Appendix 6N1 & 6N2). This will be scheduled as a temporary job until the client's project manager confirms the job.

6.1.1 Site Evaluation

Once the Preliminary Sampling Plan has been prepared, a site evaluation is carried out to verify that the anticipated sampling points, sampling methods and, sample storage and shipping procedures are appropriate for the location to be sampled. Based on the findings, a final Sampling Plan is prepared and agreed to by the original parties. This will be planned before the project begins. Once the project is confirmed and the H&P drillers and/or chemists are at the site, they will review the sampling plan with the Client's field representative to ensure that the sampling can go as planned.

6.1.2 Documentation

Documentation of a sampling expedition consists of the Sampling Plan, a description of any deviations from the plan, sampling log sheets (FMS 001-012), results of any field analyses, and Chain-of-Custody records (Appendix 6A&B).

6.1.3 Enhanced Quality Assurance

Additional quality control samples may be used by the laboratory in a field setting as needed. These include increased frequency of sampling, method and instrument blanks as well as calibration checks. The frequency of and need for enhanced quality assurance may be determined by the analyst while in the field or in concert with a supervisor, normally the laboratory director/QAO. The analysts will report any out of control situations, or non-conformances to the laboratory director/QAO at the earliest possible moment. The director/QAO may assign additional quality control parameters if necessary. The analyst is to record the reasons and corrective actions on corrective action forms (if appropriate) or directly on extraction and run logs.

6.2 Sample Containers and Sample Preservation

The purpose of this section is to specify proper sample containers and sample preservation techniques for field sampling activities. For samples that are to be analyzed in the field by the mobile lab are to be stored in the laboratory refrigerator. Samples that are not analyzed in the field or require additional analysis not performed by the mobile laboratory will be preserved as stated in the procedures below. Where local regulatory guidelines are issued (~~e.g. San Diego County SAM~~), these guidelines may supersede this section.

6.2.1 Volatile Organic Compounds, Gaseous Samples

Samples are collected and stored in glass bulbs with Teflon stopcocks, in Tedlar bags, summa canisters or syringes. The sampling environment will dictate the type of sampling container. The combined storage and shipping times for each sampling container are as follows:

Glass Syringes	<15 minutes
Tedlar Bags	<72 hours*
Summa Canisters	30 days
Sorbent Tubes	7 days

* Note: Tedlar bags may need to be analyzed within 6 hours for the H&P 8260SV method to meet regulatory requirements.

Upon receipt at the Carlsbad fixed facility, all summa canisters will have their vacuum measured. The can # and its vacuum are to be recorded onto the COC next to the corresponding sample. For soil vapor samples, the vacuum should be from 0 to -10 psi. For ambient air samples, the vacuum must be at negative pressure but not greater than -10 psi. If any sample is received outside of these criteria, the project manager is to be informed so the client can be contacted. If analysis proceeds, the data may be flagged, the RL raised, or a narrative written to describe the sampling issue.

Samples can also be collected in sorbent tubes as per the method specifications (e.g., EPA Method TO-17) and shipped in glass culture tubes sealed with Teflon lined caps. Alternatively, sorbent tubes can be shipped in metal sleeves with metal/Teflon sealed caps. Currently, H&P is not performing the analysis on sorbent tubes **but will collect samples in these containers, as requested** ~~subcontracting the analysis out.~~

6.2.2 Volatile Organic Compounds in Water

Samples are collected into 40-mL glass vials with HCL preservative and Teflon sealed caps or plastic caps with septa. There is to be no headspace gas in the vial at the time of sampling (bubble present must be equal to or smaller than ¼ inch in diameter). The vials used are to be either pre-cleaned one-time use disposable vials or are to be cleaned and stored in accordance with Section 5.1. Preservation consists of maintenance at ice temperature at 3°C +/-3° plus any activities specified by the analysis method. Holding time for water samples are 14 days for preserved samples and 7 days for non-preserved samples. When water samples are received, the container used is to be inspected to determine if the samples were placed into preserved contained. If there are no acid stickers or indication that the containers were the pre-preserved type, it is to be assumed that the samples are not preserved. This is to be noted on the comments section of the COC so that analysis will be performed within 7 days of the sampling date.

6.2.3 Volatile Organic Compounds in Solid and Semi-Solid Media

Samples such as soil, sediment and sludge, are packed into 4 ounce wide-mouthed glass jars with Teflon lined caps, brass sleeves or Encore® like samplers. Care should be taken to minimize headspace. The jars and caps used are to be either pre-cleaned one-time use disposable jars or caps or are to be cleaned and stored in accordance with Section 5.1. Combined storage and shipping time are not to exceed 48 hours until preparation for encores or 14 days until preparation for non-EPA 5035 methods. Preservation consists of maintenance at ice temperature at 3°C +/-3° plus any activities specified by the analysis method. Although 3°C +/-3° is acceptable, the preferred storage method for soil samples is to place them in a freezer at <10 °C.

6.2.4 Extractable Organic Compounds in Water

Water samples intended for sample preparation via solvent extraction are collected in VOAs and can also be collected amber glass bottles with Teflon lined caps. The bottles and cap liners used are to be either pre-cleaned one-time use disposable bottles and cap liners or are to be cleaned and stored in accordance with Section 5.1. Preservation consists of maintenance at refrigerator temperature at 3°C +/-3° plus any activities specified by the analysis method.

6.2.5 Extractable Organic Compounds in Solid and Semi-Solid Media

Solid and semi-solid samples such as soil, sediment and sludge, or plant or animal tissue, which are intended for sample preparation via solvent extraction, are collected in 4- or 8-ounce glass jars with Teflon lined caps. The bottles and cap liners used are to be either pre-cleaned one-time use disposable bottles and cap liners or are to be cleaned and stored in accordance with Section 5.1. Combined storage and shipping time is not to exceed 48 hours. Preservation consists of maintenance at refrigerator temperature at 3°C +/-3° temperature plus any activities specified by the analysis method.

7.0 **SAMPLE HANDLING, TRACKING AND SUBCONTRACTING**

The purpose of this section is to describe the standard procedures used to assure that samples can be related to their data and that the data is valid and traceable.

7.1 Sample Handling

Sample control is the process by which samples are tracked in the field and in the laboratory. The process includes a documented sample tracking system, assignment of a responsible individual to see that the system is being used properly and occasional audits of the system by management.

The purpose of this section is to describe the procedures used to track samples in field and laboratory environments. It identifies responsible parties and establishes the mechanism used to see that samples do not become confused and/or lost.

7.1.1 Sample Control

This section describes how samples are received and tracked at H&P and who is responsible for various aspects of these activities.

Samples delivered to mobile laboratories in the field are treated in the same manner as those received at the fixed laboratory facility with the exception that the analyst begins the process as the sample custodian. The analyst is responsible for performing checks of sample integrity and to see that the sample is logged on a chain of custody. If the samples require additional analyses that must be run at a fixed facility or shipped to another lab the analyst must see to it that the proper people are notified and that the chain-of-custody has been marked appropriately.

7.1.1.1 Sample Receipt

Samples are logged in at the time of receipt by the "Sample Custodian" or analyst, who signs for them, verifies their integrity and fills out any customer specific forms. All boxes containing summas or tedlar samples that are received at the H&P Carlsbad facility via UPS, FedEx or other shipping vendor, must be opened, the samples counted and the CoC signed as received on the day that H&P takes custody (the date received by H&P). They can be processed/logged in on the subsequent day or when someone is available. If the Sample Custodian is not available, his/her designate performs this task. Sample log in includes completing the Chain-of-Custody(s)(COC) (Appendix 6A&B) and assigning a project number to the set of COCs that make up the client's project. For samples received at the fixed lab facility, this assigned project number is recorded onto the Sample Log In Sheet (Appendix 7A). The project number consists of Client Code, date of receipt and a sequential number. For example, samples received from SCS on 2/10/2010 that are the first project received for that date will be assigned a project number SCS021010-10. The Sample Log In Sheet is to be completed for this project. For mobile lab jobs, the project number is determined by the project manager and is listed onto the confirmation sheets. For both in-house and field received samples, the assigned project number is also recorded onto the COC under "H&P Project#".

The time of collection of the samples and the delivery to the laboratory are important pieces of data and should be recorded at time of acceptance of the samples. If no time is given (only date), the earliest possible time shall be taken as the time sampled or received. This is also true of sample preparation times and analysis times later in the procedure.

Each container must receive a unique identifier at this point. Samples with multiple containers (e.g., water VOAs) can be labeled a, b, c, etc. using indelible ink.

Samples not meeting the conditions for acceptance may be accepted if the custodian records the out-of-control conditions on the COC. The laboratory director or QAO is to be informed of the non-conformance. This is to be recorded in the

"Comments/Problems" column of the COC and are recorded in the case narrative or flagged as appropriate. To minimize paperwork and to accomplish the task of sample receipt H&P uses chains-of-custody forms as sample receipt logs and analysis request forms. Any list of samples can easily be tracked by day, project number and finally the chain-of-custody.

If there is any doubt concerning the samples suitability for testing, where the sample does not conform to the description provided, or where the test required is not fully specified, the client is to be consulted prior to proceeding. All transmittals to or from the client are to be kept as permanent records.

If arrangements are made to accept client samples after regular business hours, or over the weekend, the employee receiving the samples must be able to perform the following tasks:

- Check the condition of the samples (i.e. temperature, intact and proper containers etc.) and evaluate.
- Check that all samples and the number of containers listed on the COC are present.
- Transfer samples to proper storage area (i.e. refrigerator or freezer)

Once regular business hours' resume, the samples can then be properly logged into the Element data system and assigned a project number.

7.1.1.2 Sample Acceptance

Samples coming into the lab should be accompanied with a COC that contains proper documentation including:

- Unique sample identification
- Location*, date and time of collection (e.g., California global ID)
- Collector's name and signature under sampler information as appropriate and/or available. Some clients do not know to complete this section. It would be appropriate for the H&P project managers to assist clients in proper COC procedures.
- Container type – for vapor samples, the size and ID# of the can must be identified (see below)
- Preservation type (if applicable)

Other sample requirements are:

- Durable labels which have the sample identity written in indelible ink.
- Appropriate sample containers:

Water samples for VOC or TPH gasoline analysis should be received in preserved VOA vials. If they are not preserved, this is to be documented on the COC. VOA vials should not have any headspace or bubbles that are greater than ¼ inch in diameter.

Soil samples are to be received in glass jars, Encore containers (For 5035), metal sleeves or acetate sleeves. If the samples are in glass jars, they should not be broken. Samples in broken containers are to be transferred to another glass jars. This is to be documented on the COC.

Vapor samples are to be received in Tedlars or in summa canisters. Tedlar bags containing samples are to be placed in a box or dark plastic bag to keep them away from sunlight. Summa canisters are to be checked by a vacuum gauge upon receipt and their vacuum is to be documented on the COC along with the gauge ID# used to measure vacuum. The measured vacuum is to be compared to the gauge reading on the can (1-liter and 6-liter cans with gauges). ~~This can only be done on 1-liter and 6-liter cans as they are the only ones with a gauge.~~ If there is a discrepancy between the two readings, the Technical Services/Health & Safety Manager is to be informed as the summa gauge may need replacement. The can number is also to be recorded onto the COC for each sample. Any sample that has a vacuum greater than -10 psi may not have enough sample in the summa canister to perform analysis. The project manager is to be made aware of this issue.

- Adherence to holding times
- Adequate sample volume to perform tests.
- Proper temperature ** (not applicable to samples received and analyzed in the field). The inside temperature of the sample cooler containing the samples is to be measured using the IR thermometer. The cooler is to be checked to see if a temperature blank has been included. If one is available, the IR gun is to be used to record the temperature of these blanks. Vapor samples received in tedlars or summas are received at room temperature and indicating this as “RT” is acceptable. Document on chain-of-custody.

The sample receiver should check that all containers meet the above criteria.

* Optional item/information

** If the samples are less than 4 hours old, they may be accepted even if they exceed the temperature limits if there is evidence of the chilling process having begun (e.g., arrival on ice)

7.1.1.3 Sample Storage Locations

Unprepared soil and water samples received in the field are stored in the mobile lab refrigerators or in an ice chest. If an ice chest is used, the temperature is to be checked routinely to ensure the proper temperature is maintained. The samples are then transferred to a refrigerator for water samples or a freezer for soil samples at the fixed facility at the end of the day or upon return to the fixed facility. Samples received at the fixed laboratory are stored in a refrigerator or freezer as appropriate, at the fixed facility. Any soil or water sample that is suspected or designated as a “hot” or highly contaminated sample is to be stored in a separate refrigerator or

freezer than other samples for mobile laboratories, the analyst is to double bag contaminated samples and place them in a cooler, separate from other samples. Vapor or ambient air samples are stored at room temperature.

7.1.1.4 Reviews, Tenders & Contracts (See SOP)

Samples may be received at H&P that are from a contract or from a project that has been organized and scheduled by the H&P project managers. Therefore, it is critical that all COCs received are reviewed by the project manager to ensure that the COC reflects what was set up in the project or contract. All contracts are reviewed and accepted only if H&P has the resources and capabilities to perform the work. The projects managers will review the COC received and perform the following:

- Verify that the sample analyses, analyte list, units and RLs match the contract/project
- Contact the client to discuss any deviation from contract/project
- Communicate to Lab Director or to receipt personnel what the client wants.
- Ensure that the client's information, including email is clearly written and correct

Once the project and work order (COC) is entered into Element, the laboratory director or authorized person, is to verify that the analyses to be reported will meet the client's expectations.

7.1.1.5 Sample Analysis

Sample analysis, or sample screening, shall not proceed unless the analyst has a copy of the COC to review.

Water Samples: The analyst will check the preservation of water samples using pH paper prior to analysis and note the pH and any discrepancies on the analytical run log. For VOC analysis, an aliquot of the water sample is measured using a volumetric glass syringe. If an aliquot between 1 – 20 mL is to be analyzed, the sample is to be poured directly from the VOA into the appropriate size glass syringe to the top to minimize headspace. The barrel is then inserted into the syringe and the volume adjusted accordingly. For smaller aliquots than 1 mL, the syringe must be placed into the VOA containing the sample and the sample slowly pulled into the syringe to the desired volume. If reanalysis is necessary, an unopened VOA containing the sample is to be used to obtain a new sample aliquot.

Soil Samples: Soil samples are typically non-homogenous in nature. The analyst is to make an attempt to reduce this by obtaining an aliquot of sample that is more representative of the entire sample. Any twigs, rocks, or asphalt is to be removed from the sample aliquot obtained. The sample should be mixed but not to an extent that volatiles are lost. For EPA 5035 this is not possible as the soil samples are collected in Encore samplers.

Multiphase samples: In the case that a client submits a multiphase sample for analysis they should be informed that this sample will be treated as more than one sample and charged accordingly. The client may choose one phase only to be analyzed and this must be documented in writing and described in the narrative of the report. If both phases are analyzed they are to be separated into separate containers, labeled and analyzed per the standard operating procedures for the specific matrix.

Vapor samples: These are received in tedlars bags or summa canisters. If they are received in tedlars bags, the CoC is to be reviewed promptly as the holding time is only 72 hours or less. Vapor samples received in summa canisters have a holding time of 30 days, so it may be necessary to transfer the samples that arrived in tedlars into summa canisters if analysis cannot be completed within the holding time.

When samples or sample extracts are being analyzed, instrument RUN LOGS are to be filled in by the instrument operator as per the SOP associated with the instrument used.

7.1.1.6 Sample Disposal

All hazardous samples are to be returned to the client if possible. Non-hazardous samples are returned to the fixed facility and placed in appropriate disposal containers. The disposal containers are removed by a certified waste hauler according to all local, State and Federal regulations. Non-hazardous samples may be disposed of as deemed appropriate by the Sample Custodian.

7.2 Sample Tracking and Traceability of Measurement

All samples received by H&P and all fractions generated from those samples are logged into our Laboratory Information System (LIMS) for tracking and reporting. H&P uses the LIMS system known as “ELEMENT” from Promium Inc. of Bothell, WA. The LIMS system maintains all the reportable data that is sent to the clients, including all QA/QC data.

The ELEMENT system is a comprehensive LIMS system whose complexity is beyond the scope of this document. The user is referred to the ELEMENT user manual available on the individual computers and also H&P’s separate SOP describing use of the ELEMENT LIMS.

7.2.1 Project Names and Work Orders

Each project will be assigned a unique ID number, called project #, upon receipt (See section 7.1.1.1.). This project number is entered in the LIMS. This is where custom analyses can be created which will allow the data to be reported with special analyte lists or units. After the project is created in element, a work order is created which represents a COC. Each day of the project will be assigned a unique ID# by the LIMS called a work order #. The work order number is a sequential number as follow:

The general format is LYMMNNN where “E” = H&P lab designation name, “Y” = year sample received, “MM” is month and “NNN” is a consecutive number between “000” and “999”. For example, E211010 was the 10th work order received in the Escondido (Now Carlsbad) lab in the month of November 2012.

Every sample that is recorded on a COC should be entered into the ELEMENT data system. ~~regardless if they are to be analyzed or not.~~ They should be entered in the same order as they are on the COC. If both waters and/or soils are received the same day as vapors, they must be written on different COCs. Vapor samples are to be recorded onto Appendix 6A1 and water/soil samples are to be recorded onto Appendix 6A2. In this situation, different work order should to be created for each COC under the same project.

7.2.2 Filename Assignment

Raw data filenames for GC and GC/MS are assigned by the analyst acquiring data for a fraction at the time the data are acquired. These assignments are at the discretion of the analyst. It is usually desirable, though not necessary, to use a portion of the sample code in the data filename. At a minimum, the sample name must be saved in the data file and recorded on the sample run logs. e.g., A sample labeled MW-1 might have a filename EO MW1.D where EO is the client abbreviation. The data file name procedures for standards analyzed during calibration are the concentration followed by the date of calibration. For example, “5 ng 5-11-19” or “10 ppbv 3-2-19”.

Traceability of measurement is maintained by keeping all the sampling data, project notes, raw analytical data and final report and review notes in a single file. The information included will provide a thorough documentation of the following:

- A documentation of project set up notes, as needed, and/or confirmation sheets
- A documentation of all devices used in the sampling and analyses of the samples
- Procedures used in the sampling and analysis
- Names of personnel performing all work
- Reagents and standards used in the analysis of all samples Sampling and Chemist’s log sheets and run logs
- All chromatograms and manual integrations
- Data Review Documentation

7.3 Subcontracting of Sample Analysis and Field Sampling Work

7.3.1 Sample Analysis

H&P will not, under its DoD, NELAP and ELAP accreditation, subcontract work out without prior notification to the client. Analyses for which H&P is accredited under ELAP will be performed by H&P unless ELAP certification is not available for the specific method or if H&P does not have the capability to analyze the samples. Analysis for which H&P is not accredited, will be subcontracted with the client’s permission to a laboratory

with an acceptable accreditation. Approved subcontractors and vendors for laboratory analysis are listed in Appendix 7B1.

Samples, which are to be subcontracted for NELAP or DoD work will only go to NELAP or DoD, accredited laboratories. DoD samples must receive approval in writing from the client prior to subcontracting to an outside laboratory. In addition, the reporting of subcontracted results will be sent directly to the client.

7.3.2 Field Sampling

H&P will not, under any circumstances, subcontract any of the FSMO (Field Sampling and Measurement Organization) services for the purpose of collecting environment field samples.

8.0 QUALITY CONTROL, DATA REVIEW, & PERFORMANCE TESTING

The purpose of this section is to define guidelines for the quality control (QC) procedures and systems used by H&P. H&P is committed to providing the highest quality data possible to their clients. The following listed items are used to achieve H&P's quality objectives:

8.1 Sample Quality Control

These include blanks, method checks, matrix spikes, replicates, the use of matrix spikes and surrogate spikes and calibration check procedures. Corrective actions are addressed as appropriate. All Quality Control samples are to be processed in the same manner as the field or unknown samples.

8.1.1 Blanks

Blanks are analyzed to demonstrate that analytical results are representative of samples and not of contaminants inadvertently entering the samples. Because contamination can take place via a variety of mechanisms there are several types of blanks that may be analyzed to monitor the process. These include Client's Field Blanks, H&P's Field Blanks, Trip Blanks, Reagent Blanks, Method Blanks and Ambient Air Blanks. Each of these is discussed below.

8.1.1.1 Client Field Blanks

Client field blanks are generated by the client's field sampling team and shipped to H&P where they are analyzed. All client field blanks received are to be analyzed if they are requested to be analyzed on the COC. If these blanks show contamination, laboratory blanks must be analyzed to determine whether it is due to field or laboratory activities. If contamination is detected in the Client Field Blank but not detected in the Lab Blank, this indicates that potential contamination of the samples has resulted from some aspect of the field sampling activity. For the purpose of this evaluation a contamination is defined as the presence of any analyte at or above its reporting limit.

8.1.1.2 H&P Field Blanks

H&P's field blanks are generated by the sampling equipment and equipment used to collect field samples. All H&P's field blanks received are to be analyzed unless otherwise requested by the client. For soil vapor jobs, the client may specifically request or submit field blank samples. If these blanks show contamination, laboratory blanks must be analyzed to determine whether it is due to field or laboratory activities. If contamination is detected in the H&P's Field Blank but not detected in the Lab Blank, the H&P PM should discuss the potential contamination with the client. Further, as corrective action, an attempt should be made to determine what caused the contamination and the source should be eliminated. For the purpose of this evaluation a contamination is defined as the presence of any analyte at or above its reporting limit.

8.1.1.3 Trip Blanks

Trip blanks are prepared at the laboratory and provided to the client for use. The client will use trip blanks to track any contamination that has occurred during shipment or travel to the laboratory for analysis. Typically, water samples are transported to a laboratory in a cooler and a trip blank is placed in the cooler along with the client samples. Upon analysis, any hits in the trip blank may be assumed to be a result of being placed in the cooler and one of the client samples was heavily contaminated enough to cause cross-contamination. H&P does not recommend the use of a trip blank for air/soil vapor samples, but some regulators insist on using them.

8.1.1.4 Reagent Blanks

Reagent blanks are generated in the laboratory and analyzed to identify possible sample contamination by the reagents used in preparing the samples. For the purpose of this evaluation a contamination is defined as the presence of any analyte at or above its reporting limit. If a contamination is identified, corrective active consists of identifying its source and eliminating it; sample analyses are not to be carried out during this period of corrective action.

Reagent blanks are to be analyzed whenever a new lot of reagent is incorporated into the analytical procedure. This analysis is to be performed and the data are to be evaluated prior to using the reagent(s) on field samples. Results are to be recorded and filed with the reagent certifications.

8.1.1.5 Method Blanks

Method blanks are analyzed to demonstrate that the interaction of reagents and sample preparation and analysis procedures do not lead to the generation or incorporation of contaminants. For the purpose of this evaluation contamination is defined as the presence of any analyte at or above its reporting limit. If

contamination is identified, corrective action consists of locating and eliminating its source; sample analyses are not to be carried out during this period of corrective action. If the chemist is unable to eliminate the contamination problem, the client is to be informed that the data will be flagged for the specific target analytes that are reportable in the method blank.

Method blanks are to be analyzed for each analytical batch of 20 samples or less. The method blank is to contain all the reagents and materials that are used in the preparation of samples.

For DoD samples, the method blank will be considered contaminated if:

- The concentration of any analyte in the blank exceeds $\frac{1}{2}$ of the reporting limit or is greater than $\frac{1}{10}$ the amount in the samples;
- The concentration of any common laboratory contaminant exceeds the reporting limits or
- The blank result otherwise affects the sample results as per the test method or project specific objectives.

If the method blank is contaminated as described above, then the laboratory shall reprocess affected samples, except when the contamination is below the LOD. If insufficient sample volume remains for reprocessing, the results shall be reported with appropriate data qualifiers.

8.1.1.6 Ambient Air Blanks

Ambient air blanks apply to soil vapor jobs whereby an aliquot of the outside air at the site is collected and analyzed. For H&P's 8260 SV method, this ambient air blank is reported as the method blank for fieldwork. The blank requirements listed above shall apply to ambient air blanks for H&P 8260SV analyses. For EPA and/or H&P TO-15 jobs it will be analyzed per client request and will be a sample added to the COC.

8.1.2 Instrument Calibration

Prior to analyzing any samples instruments must be calibrated to ensure that a valid dose versus response curve is attained. All analytes are quantitated against calibration curves and not against daily one-point calibration. The requirements for calibration are usually prescribed in the published methods, however individual clients, regulators and agencies may have made changes to the procedures in the method as originally written. These changes should be known, discussed and plans made to include them prior to the actual work. If no specified calibration changes are made for a project, the analyst is required to follow the most current H&P SOP for the specific method they are performing.

8.1.2.1 Initial Calibration Curve and Verification

Once the number of standard points and their introduction technique is decided, the analyst analyzes the standards and prepares a response curve. For GC or GC/MS analysis this usually takes the form of a plot of response (e.g., area of a GC peak) as a function of amount (or concentration). The curve must meet various acceptance criteria in order to be deemed “valid”, depending on the project or data quality objectives that are being followed. For instance, the linearity of the curve must be assessed. The analyst (or computer) calculates the validity of the curve. There may be more than one or more acceptance tests performed on the Calibration curve.

For GC/MS analyses the number of points in an Initial Calibration Curve is no fewer than five points. For many GC analyses the number of points in an Initial Calibration Curve is no fewer than three points. TPH analysis by GC requires at least 5 points in an ICAL. A greater number of points may be used in the event that certain multipoint calibrations are used e.g., quadratic curve fitting which requires a minimum of 6 points. All targets and surrogates are included in the calibration curve. To achieve linearity, an analyst may choose to remove the lowest or highest calibration level, but may not remove the middle calibration levels.

It is also common for the lowest point on the curve to be assigned as the laboratory’s LOQ or reporting limit since it is easy to calculate precision and bias from one of the points on the curve. Likewise, the highest standard is usually defined as the high point of the curve. No data may be reported less than the LOQ or greater than the high standard without also noting that the data may have lowered certainty through the use of defined flags or in the report narrative.

For most (not SIM or TPH) GC/MS methods, once the Initial Calibration is created, it is verified with a mid-point standard from a second source, procured separately from the original solution, which was used to prepare the primary standard used in the calibration curve. The second source is called an Initial Calibration Verification (ICV) and is analyzed and quantified against the original (or primary) standard. This test ensures that a “bad” or degraded standard was not used for the original calibration. The ICV must meet criteria specified in the method or SOP in order to continue on to sample analysis. If no second source is available from a second supplier, a second lot number from a single manufacturer may suffice as a second source.

Most methods further ensure accuracy of the calibration curve by specifying the length of time (or number of samples) that can be analyzed on one initial calibration curve. All records from the initial calibration should be retained by the analyst and added to the project folder or computer record. All calibration curve packages are to be delivered to the QA/QC officer for approval.

8.1.2.2 Continuing Calibration

Calibration checks are carried out daily to verify that a previously established response relationship remains intact. It involves analyzing a calibration standard (usually corresponding to the middle point of the curve) for each target analyte reported and comparing the responses encountered with those of the previous calibration based on percent difference. This midpoint standard is called a Continuing Calibration Verification (CCV). When the average response deviations for an analyte become greater than method criteria, the system must be recalibrated. Compliance depends on the system and application involved and is defined in specific QAPs or hardware specific SOPs.

Corrective action for CCV %Rs which do not satisfy the acceptance criteria consists of the following:

Contact QAO/Lab Director to receive approval to proceed with CCV as is, or;

Re-analyze two additional consecutive CCVs. If the second analysis of a CCV passes and the method is a DoD approved method, the analyst should reanalyze another CCV to verify instrument performance before proceeding with method blank and sample analysis. If these fail, a senior chemist or the Lab Director should evaluate the method. If the CCV shows signs of degradation, the working stock may be compromised. In this situation, the 2nd source standard is to be analyzed to verify this. If the 2nd source results in acceptable recoveries, the QAO and/or Lab Director should be contacted to get approval to proceed with analysis. If the CCV is still unacceptable the Lab Director may decide to pull the instrument off line for recalibration. The Lab Director /QAO may decide to give approval to proceed depending on the analytes affected and if the recoveries are biased high or low. It may also be necessary to inform the client of the discrepancy as the client may not be concerned with that specific analyte. Regardless, if analyses proceed, the data will be flagged accordingly.

8.1.2.3 Quantitation of samples

Samples are quantitated using the initial calibration curve rather than a continuing calibration. When samples fall outside the high range of the calibration curve, they are diluted in order that the samples fall within the range of the curve. If they fall below the lowest point standard (RL or LOQ), they are reported as “non-detect” or can be “J” flagged to the MDL or LOD.

8.1.3 Method Checks

Method checks are to be carried out whenever a new analytical procedure is incorporated into the laboratory or whenever a previously used method is reactivated. Method checks are also required for each batch of soil, water, and vapor samples by spiking sample media with the analytes of interest and determining their recoveries. These recoveries are acceptable when they fall within control limits set based on values anticipated from

literature data or previous laboratory experience or control charts. The specific acceptable recovery values must be incorporated into the project QAP. Method check recoveries (%MCR) are calculated as:

$$\%MCR = \frac{SA - SR}{SA} \times 100 \quad (\text{eq 1})$$

where SA is Spike added and SR is Sample Result

Alternative method checks can be performed by analyzing single and/or double-blind performance testing samples, reference materials or by intra-laboratory studies and evaluating if they pass the control limits. In addition, the %MCR recoveries for each analyte can provide information as to whether the method is resulting in bias high or bias low results.

8.1.3.1 Laboratory Control Samples (LCS)

Lab Control Samples are checks carried out for each matrix (e.g., soil, water, vapor) to determine the expected recoveries that will occur under the most ideal conditions of the method. Matrix samples, which are free of target analytes and matrix interferences, are spiked with the targets (from a different source than calibration standards) and surrogates (if part of the method) followed by determination of spiked analyte recoveries. These recoveries are acceptable when they fall within set control limits based on values anticipated from literature data or previous laboratory experience. The specific acceptable recovery values must be incorporated into the project QAP. Spike recoveries (%R) are calculated as:

$$\%R = \frac{SR}{SA} \times 100 \quad (\text{eq 1})$$

where SR is the result and SA is the amount of spike added.

LCS spike analyses are to be carried out once for every batch of samples or type of matrix or 20 samples. For soil and water samples, the LCS is performed in duplicate.

Corrective Actions

Corrective action for LCS %Rs which do not satisfy the acceptance criteria consists of the following:

Re-analyze another LCS. If the second analysis of LCS fails, a senior chemist or Lab Director should evaluate the method. If there are less than 11 analytes spiked and/or reported in the LCS, re-analyze all samples performed under the particular LCS as this shows that the method is not functioning at this time.

Marginal Exceedances are not currently used to evaluate LCS data. However, it may be used in the future to determine whether a batch of samples requires reanalysis. Marginal exceedances will allow a batch of samples to be accepted if greater than 11 analytes are spiked and reported in LCSs as follows:

11-30 analytes in LCS, 1 analyte allowed in ME of the LCS control limit
 31-50 analytes in LCS, 2 analytes allowed in ME of the LCS control limit
 51-70 analytes in LCS, 3 analytes allowed in ME of the LCS control limit
 71-90 analytes in LCS, 4 analytes allowed in ME of the LCS control limit
 > 90 analytes in LCS, 5 analytes allowed in ME of the LCS control limit

The control limits for the LCS and LCSD are evaluated for each method and matrix by using 3 standard deviations around the mean recovery using control charts. All DoD certified methods are to use the DoD LCS/LCSD criteria if available, however control charts are evaluated quarterly and at the end of the year to determine if H&P meets these criteria and if corrective action must be taken to improve the methods performance. The limits of the marginal exceedances are determined for each method by using 4 standard deviations around the mean recovery for each analyte determined using control charts. The QAO is to monitor any failed LCS recoveries on an instrument basis to determine if the LCS failures are not random. A non-random event is one whereby an analyte fails 2 out of the last three LCS sets. Any non-random issues are to be brought to the attention of the Lab Director who may reschedule the instrument for recalibration or other corrective actions.

Any analyte failing the LCS criteria is to be flagged and the data qualified as biased high or biased low.

8.1.3.2 Matrix Spikes

Matrix spikes are checks carried out for soil and water samples by spiking target analytes into field samples followed by determination of spiked analyte recoveries. These recoveries are acceptable when they fall within set control limits based on values anticipated from literature data or previous laboratory experience. The specific acceptable recovery values must be incorporated into the project QAP. Matrix spike recoveries (%R) are calculated as:

$$\%R = \frac{SSR - SR}{SA} \times 100 \quad (\text{eq 2})$$

where SSR is the spiked sample result, SR is the sample result and SA is the amount of spike added.

Matrix spike analyses are to be carried out once for every batch of samples or type of matrix or 20 samples. Matrix spikes are always performed in duplicate.

Corrective Actions

Corrective action for matrix spike %Rs which do not satisfy the acceptance criteria consists of the following:

Reanalyze the sample to demonstrate that the problem is not related to instrument operation. If the %R is within limits after this second analysis, prepare a matrix spike duplicate and continue with other samples.

If the %R is still outside the limits, the effect is considered a matrix effect and a set of blank spikes (LCS & LCSD) are to be prepared and analyzed to indicate the unacceptable matrix spike recoveries are due to a matrix effect and not an instrumental problem. Matrix spike results are reported with a flag to indicate questionable quantitative results due to matrix effects.

8.1.3.3 Replicate Analyses

Replicate samples are analyzed to determine and monitor analytical or sampling precision. In order to generate a useful database of these data they should be performed using replicate matrix spiked samples (see Section 8.1.3.1 or 8.1.3.2). Precision may be evaluated in terms of % difference using duplicate samples or relative standard deviation when larger numbers or replicates are involved. Percent differences (RPD) are calculated as:

$$RPD = \frac{(C_1 - C_2)}{(C_1 + C_2)/2} \times 100 \quad (\text{eq 3})$$

Replicate analyses on samples are performed routinely on vapor samples for most field jobs at a frequency of one per day per mobile lab. Water and soil replicates are only performed if requested by a client for a project. If requested, replicate analyses for soils and waters are to be carried out once for every batch of samples or type of matrix or 20 samples.

Corrective Actions

Corrective action options for RPD are which do not satisfy the acceptance criteria consists of the following:

Reanalyze the sample to demonstrate that the problem is not related to instrument operation. If the RPD is within limits after this second analysis, continue with other samples. If the RPD is still outside the criteria, report the two results that are the closest to each other and results can be reported with a flag to indicate questionable quantitative results due to matrix effects or non-homogeneity of sample.

8.1.3.4 Surrogate Analyte Analyses

Surrogate analytes are added to samples to monitor recovery and precision on a per sample basis. H&P regularly only adds surrogates to GC/MS analyses. Surrogates are selected so as to mimic target analyte behavior during workup and measurement. Surrogates are monitored in terms of the % recovery (%R in eq 1). A range of acceptable %Rs (acceptance criteria) is established based on literature or laboratory data and the experimental results compared to these. Control limits are also evaluated using control charts each quarter and at the end of each year to determine if the surrogate criteria are to be changed or if corrective action is necessary to improve method performance.

Corrective Actions

When the surrogate %Rs for a sample are outside the acceptance criteria range, the following corrective actions are taken:

For soil and water samples, the sample is reanalyzed to establish that the unacceptable value(s) is not a result of equipment failure. If a single reanalysis solves the problem, the analyses may be continued. If the reanalysis confirms that there is matrix interference, the surrogate may be flagged accordingly. Additional samples from that project need not be reanalyzed if the same surrogate recovery fails. For vapor analysis by H&P 8260SV, only 3 of the 4 surrogates need to be reported. For the TO-15 method, 2 of the 3 surrogates need to be reported. That failing surrogate should be removed from the report or flagged appropriately. Only one surrogate can be removed per client project. Usually, a failed surrogate indicates that target analytes may be affected as well. The analyst should consider what effects these may be. Since the same surrogates are spiked into blank spikes, CCVs and method blanks, the analyst should review that surrogate recovery in these samples to help determine if it is true matrix interference.

If %Rs are outside of the range for acceptable data, and there is a significant matrix effect, typically internal standards, if used, will fail. When internal standards fail their recovery criteria, the sample should be reanalyzed at a higher dilution factor. (see section 8.1.3.5) This must be noted on the sample data report.

8.1.3.5 Internal Standards

When internal standards are included as part of the analytical protocol, they are spiked into the prepared sample just prior to analysis and their response and retention time is used as an indication that instrumentation is functioning acceptably. Acceptable internal standard data is defined as that which falls within acceptance criteria windows that have been established for the associated method.

Corrective Actions

When internal standard responses or retention times are outside the acceptable ranges, corrective action must be taken. This consists of the following steps:

The sample is reanalyzed to demonstrate that the unacceptable result is reproducible. If the problem is corrected on reanalysis, no further action is required. This is performed only if the sample is not contaminated.

If the unacceptable data are reproducible, the daily calibration check is reanalyzed if instrument malfunction is suspected. If the calibration check is acceptable, the problem is related to a matrix effect and the sample is to be reanalyzed diluted or the data report must be flagged to this effect. In either case this must be recorded in the analysts run log.

If the internal standard is out due to the high concentration of contaminants in the sample, dilute the sample accordingly and reanalyze or qualify appropriately.

If the daily check results are unacceptable, the instrument malfunction must be corrected (see the operator's manual), the problem and its solution recorded in the instrument log. Finally, the instrument must be recalibrated as per the method requirements.

8.2 Data Review

The purpose of this section is to describe the responsibilities and the process for data review.

8.2.1 Data Review Responsibility

It is the dual responsibility of the Laboratory Director and the QAO to see that data is reviewed and that any problems identified are solved through the application of appropriate corrective actions. The data reviewer and original analyst have secondary responsibility to assist in the data review process.

All data must receive a three-tiered approach in the review process. The analyst is logically the first level in the data review process. The analyst reviews 100% of his/her work on any project. The analyst reviews the data for completeness and to ensure that it meets the data quality objectives for the project as to method suitability, quality control checks, including calibrations and samples quality control. The analyst completes a Tier 1 Review Checklist (Appendix 8 B). The chemist may be instructed by the QAO or Lab Director to flag the data using the list of approved data qualifiers (Appendix 8A).

The second level is the QA/QC level. The Quality Assurance Officer or designated reviewer also reviews 100% of the data produced by the analyst. In addition to all that the analyst reviews the supervisor reviews the data for its impact and suitability for the particular project. The reviewer is to ensure that:

- Results meet lab specified QA/QC or project specified QA/QC, if appropriate.
- Data meets project specified objectives
- Samples were prepared and analyzed appropriately
- There is a complete explanation of any anomalies to put in the case narrative.

It may be necessary to add data qualifiers in order to flag out-of-control data. Appendix 8A has a list of approved data qualifiers.

Finally, the data is reviewed for project completeness and appropriateness by lab administration, who signs off on the final product. The Quality Assurance Officer and administrator complete a Tier 2 & 3 Review Checklist (Appendix 8 C).

8.2.2 Data Review Process

H&P's Report Review:

1. Folder

Project Number
Project Name (site)
Project date

2. Accounting Information

Lab confirmation form
Chemist Daily Project Summary
Report to information
Billing to information

3. Print report on plain paper or review electronically

4. From Chain of Custody Record confirm:

- a. Chain of custody sample names match report
- b. Any special instructions
- c. Vapor Collection - Yes No Incomplete

Page 1:

Client name & address
Project name & number
Client contact
Report to be copied to anyone
(Do not cc: without permission, note who gave permission in the report file)
Date, number, & matrix of samples
Enter H&P Mobile Geochemistry, Inc project number

Page 2:

Check off each sample number listed on the CoC
Check sampled and received date

5. From Raw Data:

Organize raw data in order of date

Go through the raw data page by page

Tier 1: Completed and accurate?

Run Log (analytical)- Is it complete?

Chemists' notes – Any problem(s) listed for flagging data or writing a narrative?

Date - is the correct date analyzed listed?

Blank - is it clean?

CCAL - is it acceptable?

Sample - identify each individual chromatogram does it belong in this report, if not where does it go

Put a check mark next to all confirmed results above the RL (MDL/LOD if J flags requested

QC - MS and/or LCS

Internal Standard Recoveries acceptable?

Internal Standard Summary Sheets – Are they included? For level 3 and 4 data deliverables only

6. From the Chain of custody

Re-read the CoC.

Are there any special instructions?

Have all analyses requested been performed?

Any instructions in the 'Comments' section?

7. Edits

Make all changes

Flag data if necessary and/or write narrative (see section 8.3)

Generate a final PDF and print out on letterhead, if requested.

Compare final to rough draft

8. EMail PDF

Prepare the report, CoC, chromatograms, sampling log (if needed)

Prepare data deliverables if requested

Make a complete copy for our file on server (electronic only)

8.2.3 Re-issuance of Reports

If a report is to be reissued or revised, it must be uniquely identified as being a separate report from the original or other reissued reports (i.e. SCS10011-10 Rev__). The ELEMENT LIMS system will identify each report by date and time. This, along with the element project number or work order is a unique identification for the report. The data reviewer must also make certain that the latest report contains a reference to the previous reports. This will be handled by addition of a narrative or to refer to this change in an email to the client. The reason for the revision must be provided in the narrative.

8.2.4 Data File Security

The data reviewer(s) will maintain a password protected computer folder. Access to the folder will only be supplied to technical personnel/data review personnel and management/QA personnel.

8.3 Performance Testing

As part of the ongoing process of maintaining Quality environmental test data, H&P participates in nationally accredited performance testing of its analytical procedures. Depending upon the type of accreditation, this is normally once per calendar year. For DoD and some out-of-state certifications, a PT sample must be analyzed twice per year for each matrix. If PT samples are not available, intralaboratory studies are to be performed. H&P uses ISO 17034 certified and ISO 9001 certified providers of PT samples whenever possible. PT samples should be processed under the identical conditions which ordinary samples are analyzed. **CA ELAP has specific requirements in the case of a “not acceptable” score for PTs.** See SOP for Performance Testing for CA ELAP requirements and a discussion of PT procedures.

Under the NELAC and DoD program, a score of more than 80% is a passing score for a given PT study. Also, any single analyte may not fail consecutive studies in order to be considered a passing score. Any failures for any analyte must be researched for the root cause of the failure. Corrective action is then taken to ensure the failure is not repeated. This corrective action must be documented onto a preventative/corrective action form (Appendix 11G). For DOD certifications, the auditor for the DOD must be informed if the same analyte fails two consecutive times for a specific analytical method. The PT results are entered onto the Compliance checker provided by PJLA to assist in tracking analyte performance.

If PT samples are not available for a specific method, intralaboratory studies are to be performed on the same schedule as PT samples. Intralaboratory studies are performed using a series of 4 replicates of the same spiked sample. The average for each analyte for each laboratory is to be calculated as $\bar{x}_i$. Then the true value for each analyte is to be defined as X_i . The percent error for each laboratory can then be calculated as:

$$\% \text{ Error} = 100 \frac{(X_i - \bar{x}_i)}{X_i}$$

The % Error for each analyte must meet the method requirements. If not, the result is considered a failure. Each analyst must achieve acceptable results for 80% of the analytes reported. The overall average for all labs for each analyte is to be calculated. The % Error for the total average is to be determined. The total laboratory average must also pass 80% of the analyte for the method to be considered a valid method. More detailed information regarding how PT studies and Intra-laboratory studies are evaluated are outlined in the Performance Studies SOP.

9.0 DATA HANDLING

The purpose of this section is to define the standard data handling procedures used by H&P.

9.1 General Laboratory Data

Technical employees are to use laboratory logs for the purpose of recording data and observations related to general laboratory procedures. H&P retains a master list of all log books used in the laboratory. These logs will be supplied by H&P and remain the property of H&P at all times. Logs are to be maintained legally in blue ink and are to contain all data and any notes describing any general laboratory related observations. The following are logs relating to general laboratory data:

9.1.1 Standard preparation logs –

These logbooks are bound notebooks that have pre-numbered pages and are maintained at the main Carlsbad facility. The preparation for all standards used for calibration purposes are documented in these notebooks. There is a separate standard preparation logbook for vapor standards and for liquid standards. The format for liquid standards is “LP” for stock standards, “LS” for secondary stock standards and “LSS” for working stock standards. The format for vapor standards is “AIS” for internal standard/surrogate standards and “ACC” for first and second source working standards. The information for any prepared standard must include:

- Date prepared
- Initials of chemist preparing standard
- Lot number, name, amount, concentration, and expiration of stock standard used
- Final volume of standard
- Solvent or diluent gas used and its lot number and expiration date (if provided)
- Lot number, name, concentration, and expiration date of standard prepared.
- For vapor standards, the summa canister used for its preparation.

After the standard preparation is recorded in the standard preparation logbook, if there is not enough room at the bottom of the page for an additional entry, the analyst must close out the page using a large “Z” at the bottom with their initials and the date that the page was closed out.

9.1.2 Refrigerator/Freezer logs –

These logbooks do not have to be bound but must be maintained for all refrigerators and freezers that are used to store samples or standards. This includes all the refrigerators in the bay at the Carlsbad facility and each refrigerator in the mobile labs. The attached forms can be used for this purpose. Appendix 9A (1&2) and 9B is to be used for documentation of the bay and in-house refrigerators/freezer and Appendix 9C, the

excursion log, is to be used by the mobile lab chemists to document the mobile job performed along with the refrigerator temperatures and the lab temperature for each day.

9.1.3 Instrument maintenance logs –

These logbooks are bound notebooks that have pre-numbered pages and are kept with the specific instrument. The chemist is to document any procedure they perform to the instrument including changes of operational gases and their lot numbers. Each event should be dated and the reason for the procedure and the outcome. The chemist is to initial each entry. After the maintenance/repair is recorded in the maintenance log book, if there is not enough room at the bottom of the page for an additional entry, the analyst must close out the page using a large “Z” at the bottom with their initials and the date that the page was closed out.

The name and instrument ID# along with the serial numbers should be documented on the inside cover of the notebook. The chemist can also use this book to document instrument settings and parameters. When logs are completed, they are to be filed for archival purposes in a central location designated by the quality assurance officer or laboratory director.

9.1.4 Analyst Notebooks for Training

When an analyst is hired by H&P and begins their training, they may want to take notes to record what they learn. These notes must be recorded in a bound notebook that has pre-numbered pages. This notebook will be issued by the lab director and returned to H&P when the analyst ends their employment with H&P.

9.2 Laboratory Sample Data Packages

When samples are received in the field or in the fixed base lab, they are assigned an element job number and a H&P project #. A project folder will be created by either the sample custodian or by the field chemist. This package is to contain all the data and documents necessary to complete the specific project. (See Section 8.2.1) Each project folder is to contain all pertinent information to complete the analysis and prepare final data reports.

Data Packages include the following documents:

- Tier 1 review form
- Tier 2 & 3 review form
- Sample extraction and run logs
- Sample Chromatograms
- Sampling log sheets (vapor collection logs, if chemist/technician had sampled)
- Chemist Project notes (Field Jobs only)
- Sample Chain-of-custody (COC)
- Job Confirmation Sheet (Field Jobs only)

9.2.1 Tier 1, 2 & 3 Review Forms –

As part of the data review process described in detail in section 8 of this QSM, the analyst must document the review of their data package by completing the Tier 1: Chemist/Analyst Review Checklist, Appendix 8B. The QAO and Administrator must also document the review of their data package by completing the Tier 2 & 3: QAO/Administrator Review Checklist, Appendix 8C.

9.2.2 Sample Extraction/Run Log –

This daily analytical run log sheet is to be included in each data package for every analysis type performed on the samples included. Attached in Appendix 9E-9M are H&P's analyses run log sheets. It has a tab for each analysis that is performed. It is formatted to enter via the computer or to print out and hand enter. These log sheets allow the chemist to document the standards used for initial and daily calibrations and spiking solutions used for matrix or blank spikes. This log is to be completed in full before submitted for data review. Please note that the "comment" column is meant as a tool to help track your analyses status and is completely optional (prep, run, rerun, post...). Do not make changes to the layout or appearance in order to have consistent log sheets company wide. A chemist may make extra tabs for multiple standards for calibrations. The original spreadsheets are to be maintained on the computer in each laboratory and copied for job files.

9.2.3 Sample Chromatograms –

For mass spec analyses, analytical runs should have "raw" (not reviewed) chromatograms included in the project file. Due to the necessity for many manual integrations by the TO-15 methods, it is acceptable to provide a "reviewed" chromatogram only as long as all manual integration documentation is provided. The chemist must document that the internal standards and surrogates are acceptable by using a check mark to indicate these were evaluated. Any false positives on the chromatogram are to be crossed out. If the false positive has acceptable retention times and qualifiers, a reason for the decision for a false positive must be provided i.e. "peak not real". For manual integration procedures see section 9.9. For TPH analysis, only correctly integrated chromatograms need be included. For all analyses, each run must be documented onto the sample run log (section 9.2.2) even if it is not used or reported.

If a chemist is analyzing samples for more than one project folder, copies of the sample extraction/run log and any relevant chromatograms must be made and included in each package.

9.2.4 Sampling Log sheet (Field Jobs only) –

This sampling log is to be completed by any technician or chemist who collects soil, water or vapor samples. Field technicians must fill out the appropriate log sheet for each type of sampling matrices collected. Typically, chemists only collect soil vapor samples. Therefore, a chemist will complete a soil vapor survey log sheet. This log sheet is to be completed by hand and should thoroughly document all samples that were collected. Any samples that were not able to be collected must also be indicated on this form and the

reason listed under “field notes”. This log sheet is also not to be altered in any way for consistency purposes. If corrections are required, the incorrect item is to be lined out with a single line and the correct information entered accompanied with the corrector's initials and dated as well as a reason for the correction (i.e. typo). See FMS 001 thru 012 for all sample log sheets.

9.2.5 Chemist project notes checklist (Field Jobs only) –

This daily log is used by the QAO/data reviewer and billing department and is filled out by a chemist and included in each data package. This log is used to document unusual circumstances, changes in scope, exceptions, overtime, equipment problems, billable items (Tedlars) and client field requests. The instrumental or analytical issues that occur in the field are to be documented in detail on this form as well as the corrective actions that were done to solve the issue. It should be clear as to how much downtime occurred and whether the job was reassigned to another lab or was rescheduled. (See Appendix 9D1 & 9D2)

9.2.6 Sample Chain-of-custody (COC) -

This is not a log but a legal document that is completed for all samples relinquished to H&P. Each COC may be several pages long depending on how many samples are submitted for analysis for a project. Each COC set represents one work order and is dependent on “date received by H&P”. For a project that involves a mobile lab being scheduled for several days, a COC set is to be completed and a new element work order generated for each day. Each page of the COC set must be signed as received by a H&P employee and signed relinquished by the client. There are two types of CoCs, one to be used for vapor samples, the other is to be used for water/soil samples. See section 7.1.1.1 for more instructions on COC completion. Appendix 6 A & B

9.2.7 Job Confirmation Sheet (Field Jobs only) –

This document is generated by the project manager and delivered to the field chemist and field technician prior to the job. It includes all information relevant to the successful completion of the project including analysis type, sample matrix, sample quantity, analyte lists and reporting limits, start time, client name, project location, etc. This is to be kept in the project folder to enable the data reviewer to determine if the project was completed as specified. (See Appendix 6N1 & 6N2)

9.3 QA/QC Data

Quality control data are generated at the bench level and used to control ongoing operations. See Section 8.0 for details. The operation controlled depends on data item in question. Instrument calibration data and daily calibration checks, for example, are used by the instrument operator to control the instrument and its operation. Once an instrument is calibrated, the calibration summary along with the raw data blank test results, LOQ confirmations must be sent to the QA/QC officer for approval. Additionally, the calibration parameters must be provided (electronically by email) to the QAO. An electronic copy of this calibration is also to be kept in the mobile laboratory for reference. When a final report is generated the Data Reviewer verifies that all

project data have been collected. These are inventoried and placed into the Project Data File for future reference.

Other QA/QC data such as Method Detection Limit (MDL) studies, LOD/LOQ verifications, Intralaboratory and Performance Testing (PT) study results are to be generated and then validated by the QA/QC officer or the laboratory director. The raw data for the MDL studies are maintained by the QA/QC officer or Lab Director. The PT studies, intralaboratory studies and LOQ/LOD data are maintained by the laboratory director.

9.4 Validation Data

Validation consists of independently cross-checking calculations to assure that errors are not being produced. All data are reviewed by hand prior to incorporation into Final Reports. Hand calculated data are verified at a level of 10% by a second individual. Automated data processing results are reviewed at a rate of 5% for all data generated using previously validated programs. An exception to this is data processed using spreadsheet programs; these are validated by hand at a rate of 10%. Any data processed using a new computer program or spreadsheet is validated at a rate of 100% until all aspects of the process have been checked for correct operation. The data reviewer will designate that a data set has been reviewed by checking the rough draft report.

9.5 Data Integrity

Data Integrity is maintained through the use of a multi-tiered approach. The levels can be stated as

- Maintaining confidentiality of data integrity issues
- Personal ethics training and data integrity training for the employees and annual review of the training.
- A policy to require field technicians and analysts to seek advice from management for out-of-control events or out of the normal results i.e., Analyst decision and/or sampling decisions.
- Data review by independent personnel
- Data review by upper management
- Continuous review of data and a lookout for potential data integrity issues by the QAO and/or Field Operations and QA/QC Manager. The Human Resource Manager is the designated integrity officer.

If the QAO or Field Services Manager or Field QA/QC Manager find any evidence of a data integrity issue, an initial audit is to be initiated to quickly determine root cause and to prevent re-occurrence. All data integrity issues are to be discussed at managerial review meetings.

9.5.1 Ethics training

Ethics training is given to employees within a few days of their start date and on an annual basis. This consists of a self-reading selection on ethics in the laboratory, a PowerPoint presentation and a group ethics meeting with discussion. When they have read the materials, they are asked to read and acknowledge understanding of several documents

dealing with ethics in the laboratory or with sample collection in the field. These documents are:

Company Data Policy

The use of an Ethics Hotline

Company Non-retaliation policy

The above documents are now included in the Employee handbook. Those documents need to be signed as received and are kept on file. The employee is also to sign a statement that they have had this training and understand the ethics policies (See Appendix 9R). The signed documents are kept in the employee's file.

Annual training shall include the following data integrity issues:

- A definition of improper or unethical actions
- A list of prohibited practices along with examples
- Consequences of unethical behavior or infractions of the laboratory data integrity procedures.
- All employees are to be encouraged to contact the assigned integrity officer if any unethical behavior is observed.
- Final report location and processes (for those approved to review data)

9.5.2 Analyst and Field Technician Decisions

Field chemists and field technicians, may make certain decisions regarding out of control situations. For example, running an additional 2 CCVs is permitted at the discretion of the analyst. If ANY parameter remains outside of acceptable limits, the analyst is required to contact the Lab Director or QAO for instructions on how to proceed. The Lab Director or QA Officer may require such responses as recalibration, reanalysis of samples etc., to correct out of control events.

9.5.3 Independent Data Review

Under no circumstances may a chemist perform a final review their own generated data. The only exception to this is the generation of "Preliminary data" either in the field or in-house. Data integrity is maintained if the review is done by an independent person.

9.5.4 Data Review by Management

Upper management will review and sign final reports independent of the peer level data reviewers.

9.6 Data and Field Sampling Integrity Issues

Data shall be produced according to the project specific requirements as specified in the final, approved project planning documents such as the approved QAPP, when these documents are provided to the laboratory.

Improper actions are intentional or unintentional deviations from contract specified or method specified analytical practices that have not been authorized by DOD or another accrediting agency. Unethical or illegal actions are the deliberate falsification of analytical or quality control results where failed method or contractual requirements are made to appear acceptable.

9.6.1 Initial evaluation

Any employee may bring issues of data integrity to the attention of the management. Questions concerning data integrity are encouraged prior to issuance of data to clients so that resolutions can be accomplished in the simplest manner possible. For the analysts and data reviewers the Laboratory Director or Quality Assurance Officer can be the first point of contact on such issues. For field sampling technicians or field chemists doing field sampling, the first point of contact can be the Field Services Manager or Field QA/QC Manager. The final decision as to whether or not corrective action or policy change is appropriate is the responsibility of the President.

9.6.2 Corrective Action

If the Laboratory Director, Field Services Manager or Field QA/QC Manager decides that corrective or disciplinary action is necessary, they will see that appropriate parties are informed of the action warranted. This may be limited only to a single employee, who may receive a memo as to the out of control event. It may involve a companywide policy change or it may reach any client affected. The Laboratory Director and QAO will document the issue as appropriate and keep records of such actions. Memos to employees are to be stored in the personnel file as well as a separate Data Integrity issues file. Records of these events will be kept on file for a minimum of ten years.

9.7 Electronic Transmission of Data

Once the analyst has completed sample analysis and reviewed the sample data, they may send preliminary data to the client. All data entered in the Element LIMS system is to be checked for RED flags which will indicate that there is a problem with the data. Any problems must be fixed before the data is locked and status changed to analyzed. The analyst can then generate a draft report which includes the cover page to the appendix page. The preliminary report is to be saved on the server under preliminary data and the specific laboratory. The analyst should always verify that the preliminary report has:

- Correct analyte list and reporting limits
- No false positives or false negatives
- The correct project name and project manager
- Acceptable QA/QC

Preliminary data is preferred to be sent by email. The preliminary email template is to be used to email clients. A copy of this email is to be sent to the H&P project manager; all other H&P project managers and the laboratory director are to be “blind” copied as well.

Final reports are to be sent by email. Final reports are kept on the server in a Final Report Folder (i.e. 2020 Finals) that has limited access. Access to this folder is provided by the IT Manager. For the purposes of generating, reviewing and saving data, the following personnel have access to the LIMS: Mobile Lab and Fixed Base Chemists, Laboratory Director and QAO. For the purposes of finalizing and transmitting data, the following personnel have access to the final reports directory: Laboratory Director, QAO, Project Managers, IT Manager and Data Reviewers. Any H&P personnel that review and/or finalize analytical data are trained to save final data to the final report directory. Additionally, all appropriate personnel are trained on the process of naming revisions and adding a statement, to the revised report, that indicates what has changed. Revised final reports will be named with a "Rev" in the final report folder. Once a final report has been provided to a client it is not to be altered, and if a revision is needed, the report and file should include "Rev". Documentation of this training is located in the employee's training file and is updated annually as part of H&P's lab ethics and training program. Email transmission of client data by electronic means should contain a statement similar to what is listed below:

"This message is only intended for the addressee. It contains information that is confidential and may be protected by copyright and/or attorney-client privilege. If you are not the intended recipient, please notify us immediately and destroy this message."

9.8 Data Levels

Our standard final report is considered a level 2 data deliverable. Many times, a client may request a higher data level to be submitted for a specific project. This information will be specified in the job confirmation sheet for field job and on the COC for in-house work. The following data must be included with the final report for the data deliverable level below.

All reports are to:

- Be paginated with all pages numbered
- Have client name, address and client project number
- Have H&P's name, address and title of signatory person
- Have a cover sheet with table of contents
- List of all samples submitted
- Have a narrative listing non-conformance(s), problems with data, and other out of the ordinary occurrences and/or qualified data. For DOD reports, if requested by the client, all manual integrations should be summarized
- Have a QA/QC section containing method blank and spike data including QA/QC limits
- Have sample results and units
- Show surrogate recoveries with QA/QC limits
- Have an Appendix that defines all data qualifiers used
- Have all emails and documented phone calls included in Appendix of report (For DoD reports only) if requested by the client
- Include the following statement, "H&P Mobile Geochemistry, Inc. is certified under the California ELAP and National Environmental Laboratory Accreditation Conference (NELAC) for the fields of proficiency and analytes listed on those certificates. H&P is approved as an Environmental Testing Laboratory in accordance with the DoD-ELAP

Program and ISO/IEC 17025:2005 programs for the fields of proficiency and analytes included in the certification process and to the extent offered by the accreditation agency. Unless otherwise noted, accreditation certificate numbers, expiration of certificates, and scope of accreditation can be found at: www.handpmg.com. Fields of services and analytes contained in this report that are not listed on the certificates should be considered uncertified or unavailable for certification.”

9.8.1 Data Deliverable Level 3-

- Summary of initial calibration
- Summary of daily CCV evaluation
- Analytical Run Log
- Internal Standard Summary sheet (8260/TO-15 only). This summary sheet is to be created on the Chemstation software by the chemist. See procedure in Appendix 9O.

9.8.2 Data Deliverable Level 4

- Summary of initial calibration and chromatograms
- Summary of daily CCV evaluation
- Tune summary
- Analytical Run Log
- Internal Standard Summary sheet (8260/TO-15 only). This summary sheet is to be created on the Chemstation software by the chemist. See procedure in Appendix 9O.
- Detailed Report Chromatograms (8260/TO-15 only) with all false positives Q-deleted for all samples, blanks, CCVs and QA/QC samples.

9.9 Manual Integration of data

9.9.1 Reasons for Manual Integration (GC/MS Methods)

It is the responsibility of the analyst to evaluate their data and thoroughly review the instrument-generated data before reporting it. When the software identifies a hit on the chromatogram, it is advised that the chemist investigate if the software was correct in the integration and identification of the analyte. Many times, the software will select the wrong peak or set the baseline incorrectly, or there are other peaks that interfere with proper integration. Manual Integration may be necessary and is defined as the process by which an analyst can reset the baseline of a peak during reprocessing and quantitation such that the baseline is different from the original automated process set by the run parameters. The following items are acceptable reasons for using manual integration:

- Peaks are split by chromatography software
- There are well-defined peaks on the shoulders of other peaks
- Baseline noise: Signal-to-noise ratio is less than 3:1

- There are negative spikes in the baseline
- There are rising or falling baselines
- The wrong peak is identified by the chromatographic software

9.9.2 Documentation of Manual Integration

Extreme caution is required when using manual integration, particularly when the integration affects method compliance. Every manual integration must be documented in the data package and the technical justification provided. Once a peak is integrated manually the software puts a “M” footnote next to the result which indicates that that peak was manually integrated. The analyst is to cross out the original concentration value of the analyte being manually integrated on the “raw” quantitation report and write next to it the revised manually integrated value. This report should state “Not Reviewed” on the top. (see Section 9.2.3 for TO-15 exception). The analyst is to attach the before and after EICP print out or a blow up of the integrated peak and attach it to the quantitation report. The “Reviewed” quant report need not be included unless the manual integration was performed on an internal standard compound. Sign, date, before and after chromatograms, and include a reason for performing the manual integration.

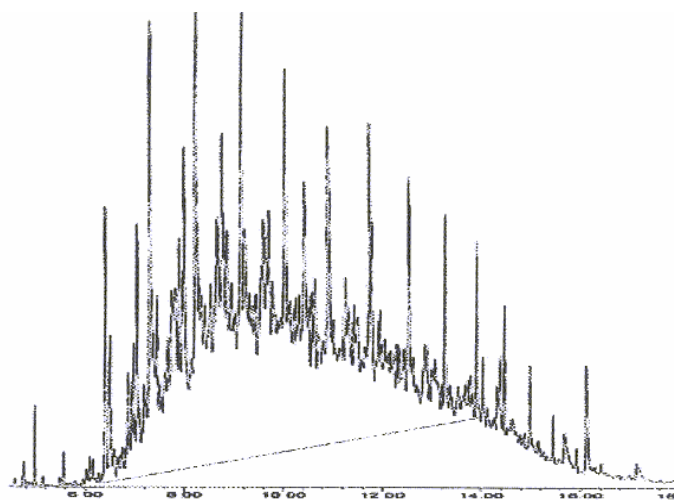
9.9.3 Manual Integration Procedures

To carry out a manual integration one must consider the chromatographic baseline and the start and stop points of the peak along the baseline. When manual integration is used, it is best to zoom in on the baseline and use a display window of less than 0.5 minutes. Determine the average noise level of the baseline. Set the start and stop points for the peak at the average noise level of the baseline. Manual integration should only be used when peaks are clearly resolved with a valley between the peaks.

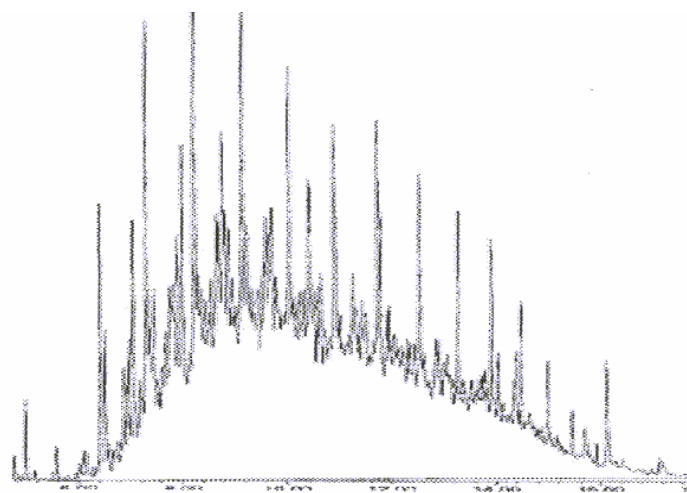
The analyst can also check on how problem peaks are integrated automatically during the calibration. They should attempt to perform the manual integration on sample chromatograms as similar as possible to way it was performed on the calibration chromatograms.

Examples of proper and improper integration:

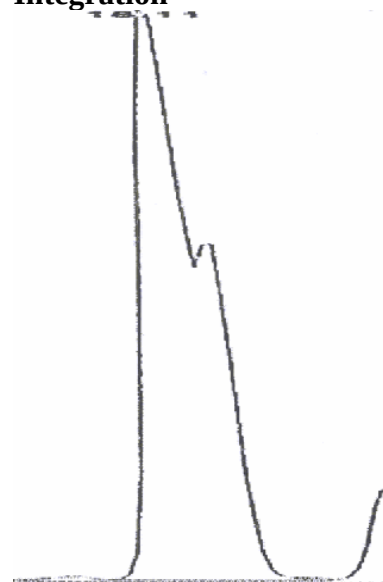
Incorrect Integration



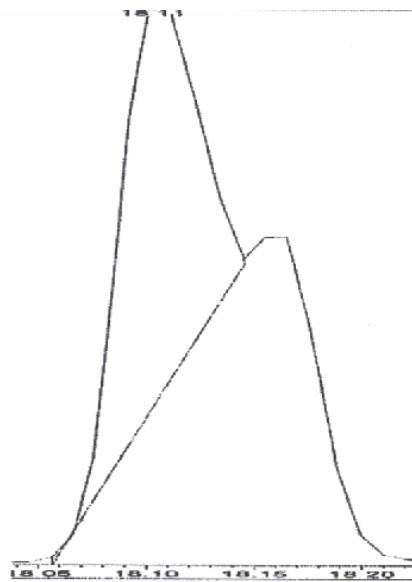
Correct Integration



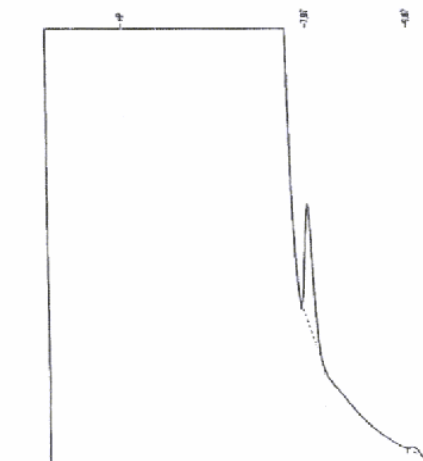
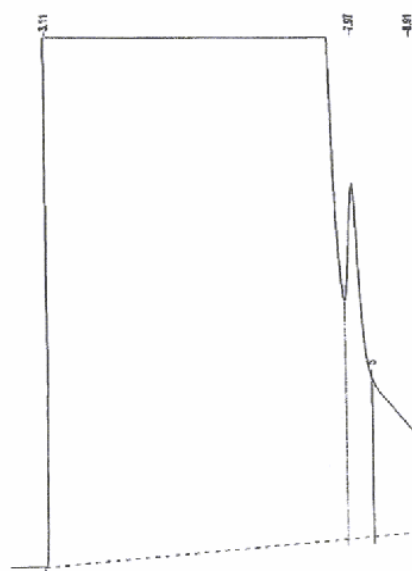
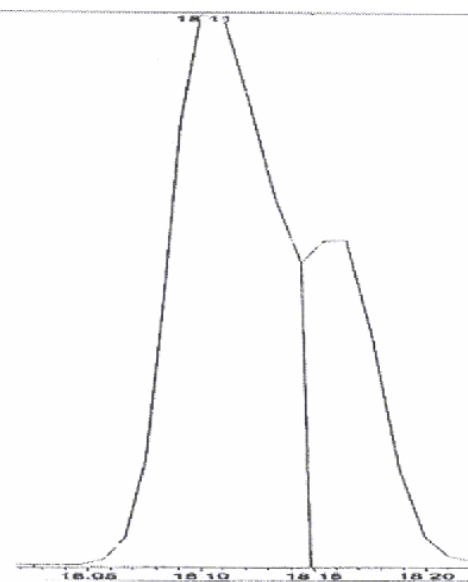
**Automatic Integration
Integration**



Incorrect Integration



Correct



10.0 Document Control

Document control is the process by which the documentation associated with samples and sample data are tracked and monitored. It also is the process of how the SOPs and the QSM, and its appendices, are modified, distributed and tracked. The process includes a document control procedure, assignment of a responsible individual to see that the system is being used properly. The various aspects of the document control system are described in detail in this section

10.1 Project Specific Document Control

The Document Control Officer maintains document files for each active and completed Task. A document file consists of all final documentation material connected with the samples in a Task including chromatograms, QC data and reports, final data sheets, billing, and ongoing standards analysis data. Also included are such things as chain-of-custody records, sample receipt logs, sample check-in/out logs, extraction logs, and GC/MS run logs. All emails are kept in electronic form only.

10.2 General Laboratory Documents

The Document Control Officer maintains general lab document files for general lab task and quality control. Document files consist of material connected with the samples in a peripheral manner including but not limited to refrigerator logs, extraction logs, field logs, blank studies, MDL studies, chromatograms, QC data and ongoing standards analysis data.

All entries in laboratory notebooks laboratory and field logs, and raw data are to be made in blue ink. If corrections are required, the incorrect item is to be lined out with a single line and the correct information entered accompanied with the corrector's initials, date and the reason for the correction (i.e. typo). Under no circumstances can "white-out" correction fluid be used to make a correction on any document. When a notebook has been completely filled in it is given to the Laboratory Director for filing.

All raw GC and GC/MS data are to be stored on the hard drives of the computers which control the instruments until reports are complete. They are then archived, along with all used laboratory notebooks, by the laboratory director for ten years. The raw data shall be archived using the archival method available on the computer that controls the instrument. All data and methods are to be saved onto DVDs

10.3 Quality Systems Manual (QSM), SOPs, and Associated Forms

H&P's QSM and SOPs shall be maintained in a format that records the effective date and revision date. The QAO, laboratory director and Field QA/QC Manager shall review them on a yearly basis at a minimum to ensure that QSM and SOPs are the most current and correct. They are also to be evaluated as to their suitability and compliance with all QA/QC requirements. The Lab Director and Field QA/QC Manager are to ensure that the SOP for the standard methods are based upon the most recent version of that method.

During the year, the QAO, Lab Director or Field QA/QC Manager may “hand-write” changes onto the original hard copies of a SOP or the QSM. These changes are to be signed and dated. Once a SOP or the QSM is finalized, it is to be reviewed and signed by both the QAO and Lab Director or the Field QA/QC Manager, as appropriate. All changes to the QSM and to method SOPs are to be clearly indicated. Additions are to be set to bold print and removed text is to be struck through. This does not apply to changes in the Table of Contents. All SOPs, log sheets, calculation sheets, appendices and the QSM must have the Revision #, revised date and effective date listed. All these documents must be paginated or otherwise suitably marked so that the end of the document is clear. The old electronic versions of the SOP and QSM will be transferred to an electronic folder labeled as “OLD SOPs” or “OLD QSM”. The revised, approved and signed versions will be kept in a “current” electronic folder labeled with annual date. All revised, approved and signed SOPs and QSM and appendices will be distributed electronically to all analysts, field technicians and laboratory personnel. The Lab Director or Field Operations and QA/QC Manager must obtain documentation from each person, to which the document was distributed to, that they read, understand and agree to follow or use the document. This distribution is recorded onto a Document Distribution List Appendix 10A. The QAO, Lab Director or Field Operations and QA/QC Manager will maintain a master list of all Quality documents and ensure that the most current documents are available for distribution. The most current versions of the SOPs and QSM are also made available to all laboratory and field personnel on the H&P server.

As part of the document control and security, H&P ensures that Excel spreadsheets are appropriately managed. Calculation spreadsheets, such as LOD/LOQ spreadsheets have columns that contain formulas, which are locked so that the formulas cannot be altered upon data entry by analytical personnel. Following submittal of Excel Spreadsheets, such as the quarterly LOD/LOQ sheets, the Lab Director or QAO *must write-protect the entire spreadsheet* to prevent inadvertent changes and will be saved appropriately. For example, quarterly LOD/LOQ verification spreadsheets will be locked and renamed “TO-15 SV LOD-LOQ-3rd QTR LOCKED.xls upon submittal and saved in a folder on the server with limited access. Locked spreadsheets must be saved in the Lab Director Folder located in the Management drive. Only the Lab Director and QAO have access to write protected spreadsheets. The IT Manager controls the access to the Management drive.

10.4 Document Records

H&P retains hardcopy reports, data and logs for a period of at least ten years. Electronic data files are backed up on a bi-annual basis. The Lab Director stores all the raw data files. Electronic data is currently kept indefinitely. In the event of transfer of ownership all data files will be transferred to the new owner. In the event that H&P goes out-of-business, all clients will be notified by email that the laboratory is closing and they may retrieve their project files within 30 days or they will be shredded.

10.5 Document Security

H&P considers all laboratory data associated with projects to be the property of H&P. The client is entitled to all forms of reports including but not limited to copies of everything produced during the project. H&P reserves the right to maintain original records of the projects. Toward that end client confidentiality is to be maintained. No data or information is supplied to third parties

without the consent of the client. The obvious exception is the subpoena of H&P' data by law enforcement and/or authorized representatives of accrediting government agencies.

All data associated with client projects and laboratory traceability are kept securely stored on-site. Document storage locations are to be locked with controlled access. Employees seeking access to these records must sign and date a Project Report Checkout Sheet (Appendix 10A). Once data has been finalized in LIMS, the data is locked and can only be unlocked by authorized H&P personnel. The IT manager provides access to lock (or unlock) electronic data in LIMS to specific H&P personnel. Any H&P personnel that review and/or finalize analytical data are trained to save final data to the final report directory. Documentation of this training is located in the employee's training file and is updated annually as part of H&P's lab ethics and training program. As mentioned previously, for the purposes of finalizing and transmitting data, the following personnel have access to the final reports directory: Laboratory Director, QAO, Project Managers, IT Manager and Data Reviewers. The security of all documents is the responsibility of the Document Control Officer.

Once data is released for destruction after 10 years, they are to be shredded

10.6 Confidential Handling

All information related to customers, their samples or the data associated with their samples is confidential. It is not to be discussed with anyone outside the lab other than the customer. Exceptions to this are acceptable only if the customer so specifies in writing.

10.7 Certifications

All documentation that pertains to the certifications held by H&P Mobile Geochemistry, Inc. from CA ELAP, DoD, NELAC and other states, are to be maintained by the laboratory director. The originals are to be displayed in the lobby of the Carlsbad facility. Copies of these certifications are held on the server and by the laboratory director. Each mobile laboratory will also post a copy of their certification on the wall.

10.8 Field Sample Collection Records

H&P considers all Field Sampling data associated with projects to be the property of H&P. The client is entitled to all forms of field log sheets generated, including but not limited to copies of everything produced during the project. Hard copies of field logs are not to be copied or duplicated in the field and are to be submitted to H&P headquarters for review upon completion of project. H&P reserves the right to maintain original records of the projects. Toward that end client confidentiality is to be maintained. No data or information is supplied to third parties without the consent of the client. No electronic or photographic records of field activities are permitted for field technicians except for draft data from any field analysis.

11.0 COMPLAINTS, AUDITS, MANAGEMENT REVIEWS, NON-CONFORMING WORK, PREVENTATIVE & CORRECTIVE ACTION

H&P is a company that is proactive at ensuring that they provide the highest quality data and services to their clients. The steps to being proactive are:

- Handling customer complaints immediately and effectively
- Taking steps to prevent problems by taking Preventative Action
- Fixing problems immediately and effectively by taking Corrective Action
- Auditing laboratories and data packages and taking Corrective/Preventative Action because of findings
- Auditing management and overall laboratory/sampling activities, quality systems and effectiveness of preventative/corrective actions

The following sections describe how H&P performs all these steps.

11.1 Customer Complaints

At all times, it is the policy of H&P is to be responsive to client wishes in terms of project requirements. H&P will do everything in its power to satisfy client requirements as long as they do not conflict with the company data policy, regulatory requirements or are in any way, unethical, deceptive, fraudulent or illegal.

If H&P receives a verbal, telephone or email complaint from a client, the individual, must immediately inform a supervisor or project manager of the complaint. The supervisor or project manager will make a decision to initiate action and may inform the QAO of the issue. Usually the project manager will immediately contact the client to determine the reason for the complaint and to discuss the possible resolution of the problem. The project manager may ask the Lab Director, Field Services Manager or Field QA/QC Manager or QAO for help in resolving the issue. It may be necessary to pull data, sampling or report records for investigation purposes. Once the problem is resolved, the reason for the problem may initiate a Corrective Action to prevent the problem from reoccurring. A Client Service Form (Appendix 11A) or similar form will be used to record the complaint, the resolution or corrective action taken, and client response with follow up.

11.2 Internal Audits

The purpose of this section is to describe one of the two types of audits/reviews that are performed at H&P. This section will also describe the responsibilities, the process, and corrective action procedures for internal QA audits.

11.2.1 Types of Internal Audits

There are two main types of audits that are performed at H&P: Performance Audit/Evaluation Audits and Quality Systems Audits. The first type is a Performance Audit/ Evaluation which checks the performance of technicians and/or chemists who perform either analytical or mechanical functions. The laboratory director, senior chemist,

the Field Services Manager, Field QA/QC Manager or senior technician may perform these audits. Another type of Performance Audit/ Evaluation audit is a data review audit, which is performed by the QAO to ensure that the data packages are acceptable and that the analytical protocols are followed.

The second type of internal audit is a Quality Systems Audit which is performed by the QAO and the laboratory director. This audit will verify that the requirements in the H&P's QSM are being met.

11.2.2 Internal Audit Responsibility

It is the responsibility of the President to see that internal audits are conducted and that any problems identified are solved through the application of appropriate corrective actions. Performance Audits/Evaluations and Quality Systems Audits are to be conducted no less than once per calendar quarter. The president is to be informed by the QAO if there is any evidence of data integrity issues. An internal audit will be performed as a result and these issues are to be discussed during the managerial reviews.

11.2.3 Internal Audit Process

The QAO, Field Services Manager, Field QA/QC Manager or the laboratory director may initiate a Performance Audit/Evaluation on an analyst or technician. An audit schedule is to be prepared at the beginning of each year that lists each analyst, mobile laboratory, drill rig and stationary laboratory and when the audit is planned to take place. Strict adherence to this schedule is not required but an attempt shall be made to follow the schedule as closely as possible.

The audits may include the actual review of their analytical or mechanical procedures, their knowledge of QA/QC criteria, inspection of their work areas or review of their documentation. The mobile laboratory or drill rig may also be inspected during an internal audit of a field analyst or technician. Documentation of this audit will be on either the Performance Audit/ Evaluation Forms (Appendix 11BIAF-11EIAF or 11I-K). The results of all internal audits are to be kept on file by the Laboratory Director or Field Services Manager or Field QA/QC Manager.

For the Quality Systems Audit, any documentation, procedures, corrective or preventative actions that were reviewed, modified, updated or finalized during the year may be placed into a Quality Systems Review File. These items can be discussed during the Quality Systems Audit. The findings resulting from this audit and any necessary corrective actions are to be documented on the Quality Systems Audit form, (Appendix 11H)

11.2.4 Preventative/Corrective Actions following Internal Audit

If the results of an internal audit should indicate that all evaluated areas are not satisfactory, preventative, or corrective action must be taken. These corrective actions are to be described in detail and should have an expected due date indicated.

For Internal Audits, the person completing the corrective action typically will be the analyst or technician being audited. However, the preventative or corrective action may be that the analyst or technician requires additional resources or training, which would indicate that the corrective action be a group effort between the analyst/tech and their supervisor. The performance and completion of any preventative or corrective actions must be recorded onto the original audit form used. If the result of an internal audit is found to effect client data, the client shall be notified immediately. The Laboratory Director, QAO or Field Services Manager, Field QA/QC Manager or Project Manager, is responsible for informing the client of the out-of-control event.

11.3 Managerial Reviews

The purpose of this section is to describe the responsibilities, the process, and corrective action procedures for Managerial Reviews. Management reviews are conducted to review the laboratories quality systems and environmental sampling techniques to determine if they are effective, accurate and still provide our clients with the highest quality data. A management review may be conducted to resolve a problem, update services, discuss safety issues, improve communications, to discuss training needs or to set company goals. Other items discussed may be:

- The suitability of policies and procedures
- The outcome of internal audits
- New sampling and analytical procedures
- Customer Complaints and feedback
- PT sample results
- Effectiveness of Preventative/Corrective Actions
- Services offered (Volume & Type)
- Assessments by external bodies
- Reports from supervisors/managers
- Internal Audits
- Performance testing
- Any ethics or data integrity issues

Any officer of H&P, or supervisor, may request a Management Review at any time but at least one Management Review must be performed annually. The final outcome of this meeting may result in a preventative or corrective action to be initiated, to set a goal or achieve a desired outcome that will ultimately improve the quality of the services offered by H&P. The documentation of this audit will be listed on the Management Review and Action Form (Appendix 11F). The person requesting the Management Review meeting is to document the details of the discussion and findings onto the Management Review and Action Form. The form is to be completed in full outlining the specific areas of discussion and the list of required preventative/corrective actions to be performed by whom and by what date. This documentation is to be filed with the Laboratory Director.

11.3.1 Managerial Review Responsibility

It is the responsibility of the President to see that managerial reviews of the Quality System are conducted and that any problems identified are solved through the application of appropriate corrective actions. Reviews are to be conducted on an as needed basis but no less frequently than once per calendar year.

11.3.2 Managerial Review Process

The predetermined time for Management Reviews are at the beginning and mid-point of each year. Managerial Reviews are requested by an H&P officer when the need to discuss items listed above are deemed necessary. A review will be conducted if there is evidence of inappropriate actions or procedures or vulnerabilities in respect to data or sampling quality. Each review must also discuss past Managerial Reviews and outcomes and whether the preventative/corrective actions taken were effective and/or completed. The company officer will enlist the assistance of the QAO for the Review.

11.3.3 Preventative/Corrective Action following Managerial Review

If problems or potential problems are identified it is the responsibility of the Lab Director, Field Services Manager, Field QA/QC Manager or the QAO to see that appropriate preventative/corrective action is taken and that the corrective is performed in a timely fashion. In general, the result of the managerial review will result in a revision of documents for the quality system including, but not limited to the QSM and all company SOPs. It is anticipated that all documents will be reviewed at the same time so that all changes may be incorporated into all documents and distributed to personnel simultaneously.

11.4 Control of Non-Conformances

During analysis, situations may arise that result in data being non-compliant to the standard operating procedures dictated in the QSM or in the method SOP. A non-conformance may also mean that the data generated will not meet the client requirements for the project. The same applies to sampling operations as well. The responsibility for identifying non-conformances starts with the sampling personnel and/or the analyst. Once a technician or analyst observes a non-conformance, they are to contact their immediate supervisor within 1 hour if the issue continues and cannot be resolved. For example: If the analyst is unable to maintain the laboratory temperature within the required limits, they are responsible for informing the Lab Director immediately. Once the supervisor is informed, the following information is to be assessed:

- Can the non-conformance be fixed or changed by corrective action?
- Is the data or sampling quality being affected and to what degree?
- Should the work be stopped and rescheduled?

The responsibility for obtaining this information lies with the laboratory director, Field Services Manager, and/or Field QA/QC Manager. It is ultimately up to the Lab Director, Field QA/QC Manager and project manager to make the decision whether work is to be stopped and

rescheduled. It may be necessary to inform the QAO as well depending on the circumstances. For some situations, it may be decided to inform the client at this time to allow them to make the decision to stop work, based upon the information collected. Regardless of the outcome, if the situation indicates that the non-conformance will continue, the job is to be rescheduled.

During the data review process, it may be determined that the data quality or sampling procedures did not meet data quality requirements or that sampling/analytical procedures were not followed. This may be noted in the chemist lab notes or sample collection logs. The problem may have been found during evaluation of QA/QC results for a project. This would be an instance where the analyst or tech did not realize that the situation was a problem or if approval was provided to them to proceed by their supervisor. The QAO, Field Services Manager, and/or the Field QA/QC manager will review the data and sampling logs to decide whether data quality was affected and to what degree. At this time, the laboratory director or Field QA/QC Manager may be consulted. If the data quality is not affected, the QAO may choose to document their findings only. If the data quality is affected, it is up to the QAO to decide whether the effects on the data quality are significant enough to bring this to the attention of the Lab Director and project manager. The following must be determined:

- How significant is the data result effected and to what degree?
- How relevant is the analyte that is in non-conformance?
- Could this impact decisions made in the field by the client?
- Should preventative/corrective action be initiated?

Depending on the findings, the QAO may choose to flag or qualify the data or if sampling related, the Field QA/QC Manager may choose to address the issue on the sampling log or with the client directly. If the situation indicates the analyst or tech requires retraining or further instruction a preventative/corrective action will be initiated. If the findings are significant and it could impact decisions that are made in the field, the client will be contacted within 5 working days and restitution made as soon as possible.

11.5 Preventive Action

Preventive action is any proactive methodology used to determine potential discrepancies before they occur and to ensure that they do not happen (thereby including, for example, preventive maintenance, management review or other common forms of risk aversion

To accomplish this, the following actions are performed on a regular basis.

- Continuous feedback from H&P project managers to analysts and technicians on our performance. Feedback is documented in personnel files.
- Regularly scheduled training sessions for chemists and technicians on new and improved procedures for sampling and analysis.
- Regularly scheduled safety meetings to prevent accidents, close calls and improve safety overall.
- Management meetings set to discuss future goals and potential new services.
- A team approach to solving problems whereby the input from all personnel is welcomed and encouraged.

- A team approach to solving quality issues whereby the QAO and Laboratory Director work closely together and involve the President in their decisions and actions.

All Preventive Actions are to be documented onto a Corrective/Preventative Action Form (See Appendix 11G).

11.6 Corrective Action

A corrective action is the action taken to eliminate the causes of an existing non-conformity, defect or other undesirable situation in order to prevent reoccurrence. Normally corrective actions are implemented in response to a customer complaint, abnormal levels of internal nonconformity, nonconformities identified during an internal audit or adverse or unstable trends in product and process monitoring.

It is the responsibility of the QAO to see that corrective actions are implemented. The Lab Director, Field Services Manager, analysts and data review personnel should make the QAO aware of any departure from method procedures or QC control parameters as soon as possible. The QAO, Lab Director or Field Services Manager (if sampling related) will then make any adjustments and inform the staff of the change or corrective action. If a problem is observed during drilling or sampling operations, a technician or the Field Services Manager may initiate the corrective action. In general, a corrective action can and should be initiated by any analyst, project manager, QAO or technician when a situation or an occurrence happens that will ultimately affect data quality, project deliverables or otherwise diminish the quality of service to the client. In summary, if a problem is observed, corrective action is to be initiated to solve it.

An analyst, technician, supervisor, or data reviewer upon noting a departure from method or QC parameters initiates corrective actions. The corrective action is initiated by filling out the corrective action form. See Appendix 11G – Corrective/Preventative Action Form. Each corrective action shall start with an investigation to determine the root cause (s) of the problem. The next person up the review chain (i.e. peer reviewer or supervisory review) will make a copy of the form and make the QAO and/or the Lab Director/ supervisor aware of the need for corrective action. The QAO will oversee ensuring that the corrective action is complete at which time the copy of the corrective action form is returned to the file with the solution. The higher the magnitude of the problem, the faster the corrective action is to be implemented. In this manner, a file will not be deemed complete unless a copy of the corrective action form is contained in the data file. The file will remain “open” until such time as a solution to the corrective action is in place. Once a corrective action has been completed, a follow-up is to be done within a year to determine if the corrective action has been effective. The follow-up findings are to be documented onto the original corrective action form.

The analyst has the authority to perform any changes that are allowed under the method (e.g. perform 2 additional CCVs under EPA/H&P Method 8260 if the first does not pass) or to place laboratory authorized data flags to data that is out of QC control limits (e.g., add an “E” flag to over calibration curve data). These should be documented in the raw data package and/or the run logs. Data that contains out of control QC should be reported to clients with “flags”.

Only the Lab Director or QAO has the authority to override method permitted changes to the data.

12.0 **SAFETY**

The purpose of this section is to outline H&P Mobile Geochemistry Inc.'s safety practices. It addresses general laboratory safety, safety requirements for equipment operation and for chemical handling and storage. For more details, refer to the following H&P resources: Company Health and Safety Program; Company Injury, Illness and Prevention Program; and The Company Employee Handbook.

12.1 General Laboratory Safety

12.1.1 Responsibility

Safety in all aspects of the H&P workplace is the responsibility of every employee. All personnel are to familiarize themselves with the contents of this section and police other employees to be sure the procedures are being followed. Authorized visitors and subcontractors in the laboratory are also expected to be aware of and follow the procedures.

12.1.2 Drugs

Under no circumstance are persons in the possession of or under the influence of mind-altering drugs or alcohol permitted in H&P or its laboratories. Being under the influence of or in the possession of such drugs and alcohol and/or the failure to report anyone under their influence or in their possession constitutes grounds for immediate dismissal. Details of this procedure are defined in the employee handbook.

12.1.3 Compliance

Drug and alcohol testing are required by client companies and as part of H&P's company policies. Employees are subject to the requirements and rules as discussed in the H&P employee handbook. These include but are not limited to pre-project drug testing, and post-accident investigation testing. Employees are expected to give full cooperation in conducting testing under their programs. Failure to cooperate with clients and/or H&P will be deemed as grounds for dismissal.

12.1.4 Dress

The purpose of this section is not to establish a dress code for employees. However, the proper choice of attire will enhance the effectiveness of safety equipment in the event of an accident. Shorts, skirts, and short-sleeved shirts are acceptable in the lab when work in process involves only instrumentation and inert solvents. They are acceptable under other circumstances when worn with lab coats. Bare feet or any form of open-topped shoes are not acceptable laboratory or field attire.

Mobile lab chemists and field technicians are required to have level D PPE with them at all project sites. These safety supplies are supplied by H&P.

12.1.5 Safety Glasses

The use of safety glasses is mandatory at all times in the laboratories when using solvents and when changing any cryogenic or high-pressure gas cylinder. Safety glasses will be provided for laboratory personnel and visitors entering the laboratories. Safety glasses are required when handling water samples as they contain acid for preservation.

12.1.6 Lab Coats

All laboratory personnel will be provided with coats and aprons if needed. These garments shall be made of a chemical resistant material and provide protection for the arms, legs and body. They should be worn any time an individual is in a space where liquid is being handled in sufficient quantities such that if spilled onto the individuals clothing, it would soak through to the skin. When personnel are sitting at a bench and handling chemicals or sample extracts, a laboratory coat or apron of sufficient size to cover the thighs should be worn. Solids even in small quantities, may pose a hazard if they work their way to the skin. Laboratory coats and aprons should not be laundered with personal clothing.

12.1.7 Respirators

Organic/Acid respirators will be provided for use by employees. Per H&P's Respirator Fitness Program, chemists and field technicians will be fit-tested yearly. They should be worn by personnel in the following cases:

- a. When handling potentially hazardous volatile organic compounds,
- b. When handling concentrated acids in open containers away from the hood,
- c. When working with materials that have the potential of off-gassing hazardous fumes either spontaneously or when mixed with other materials, and
- d. Any time there is any doubt with respect to the quality of the air in a work area.

Generally, if the work of an individual in an area requires a respirator, then all personnel in that area should wear a respirator.

12.1.8 Gloves

Personnel are required to wear gloves when handling open containers of chemicals or contaminated glassware, wiping down counter tops, washing glassware, dispensing chemicals or otherwise risking exposure to hazardous substances. Gloves should be washed with soap and water before removing to prevent contamination of the skin. H&P will provide gloves that can be used with the chemicals that are used. These are typically powder free nitrile gloves.

For drilling operations, employees must use leather gloves to prevent injury when handling heavy equipment. For sampling operations, nitrile gloves can be used unless the client requires cut resistant Kevlar gloves.

12.1.9 Housekeeping

The cleanliness of offices and laboratories is the responsibility of individuals working in those areas. Floors are to be kept free of filth and trash. The placement of supplies, equipment and personal items on the floor is to be avoided. Aisles shall be kept clear at all times. Electrical cables, when routed across an aisle, are to be covered or barricaded at all times. Access to emergency equipment such, as fire extinguishers, eyewashes, showers, etc., shall not be obstructed. Waste and scrap shall be discarded in the appropriate provided containers. No liquids or chemicals are to be placed in wastebaskets.

Mobile lab chemists are to follow Appendix 3C when assigned to clean their laboratory. To clean the outside of the laboratory, a carwash that has the clearance to accommodate the height of the lab without damaging the AC units on the roof is to be used. If such a carwash is not available, the chemist may get approval to have the lab washed by a RV repair center.

12.1.10 Personnel Access to Facilities

Routine access to Company facilities is limited to Company employees. All visitors to the facility are to be accompanied by a Company employee. Keys to the facility are not to be duplicated or loaned to others. There shall be a minimum of two persons present in the laboratory when potentially flammable, explosive, corrosive, toxic or hazardous materials are being handled.

12.1.11 Food and Drink in the Laboratory

All analysts are to avoid bringing food and drink into the laboratory areas. However, it is acceptable if the analyst keeps the food and beverages at the desk area of the laboratory where no chemicals are present. At no time is food or drink to be stored in laboratory refrigerators designated for samples or chemicals. Some refrigerators may be designated as food and drink refrigerators. Chemicals, samples or extracts are never to be placed into these special designated refrigerators.

12.1.12 High Pressure Cylinders

High pressure cylinders are used in the operation of the analytical instruments and in the field to purge tubing or in leak check procedures. Cylinders of compressed, liquefied or dissolved gases shall be stored in the laboratory with a firmly anchored protective strap to stabilize them in an upright position. Cylinders must be transported with the safety cap firmly attached. Regulators, valves and fittings must be selected in accordance with the manufacturer's recommendations. All fittings on oxygen and other oxidizing gases are to be kept free of oil and grease. The contents of all cylinders are to be clearly identified with appropriate markings and/or colors. Pressurized gas cylinders shall not be used without the appropriate regulators or pressure reducing valves.

All chemists and technicians are to use caution when handling these tanks. Safety glasses must be used at all times when installing or operating these tanks. When installing a

regulator on a tank, the secondary stage pressure control knob is to be set to fully closed position (fully counter clockwise). Ensure beforehand that the correct regulator is being used for the gas in the tank. Use the correct tool to tighten the regulator and open the main valve of the tank. NEVER stand directly in front of the regulator's diaphragm when opening the tank. Using the second stage pressure adjusting control knob, increase pressure to desired level. Use snoop or other means to ensure tank does not leak. To remove a regulator, close the tank's main valve and then fully close the second stage control knob. Using a wrench, slowly remove the regulator off the tank. Some compressed gas will be expelled after which the regulator can be safely removed.

12.1.13 Cryogenics

Cryogenics are used in the operation of TO-15 instrumentation. Cryogenic liquids can be dangerous due to their extremely low temperatures. Insulated gloves and safety glasses are to be worn while installing or handling cryogenic tanks or while transferring cryogenic liquids to alternative containers.

12.2 Equipment Operation

12.2.1 High Voltage Systems

The maintenance of high voltage circuits is limited to properly trained personnel who have been approved by Company Management. High voltage operating procedures will be as recommended by the equipment manufacturer and no equipment will be used in modes for which it was not intended. All high voltage equipment will be properly grounded at all times. Dangerous voltage or current configurations shall be protected by a substantial physical enclosure at all times.

12.2.2 Electrical Systems

Where electrical hazards exist first-line and back-up protection shall be provided to prevent personnel access to energized circuits. Periodic tests shall be established to verify that protective systems are operative. Whenever possible these protective systems shall be designed to be fail-safe. Proper warning signs shall be provided to indicate the nature of a hazard, its exact location and the proper actions necessary to avoid the hazard. Operating and maintenance personnel shall be made aware of all circuit breaker, cut-off switch and emergency de-energizing device locations. Fuses, circuit breaker and built-in system safety provisions shall not be by passed. Particular care shall be taken to insulate all circuitry correctly. Connection shall not be made or broken under load. When working on electrical circuits disconnect the source of power first. Secure temporary wiring so that it is not a trip hazard. Always assume that circuit sources are alive. Remember that any laboratory source may be energized at any time. All employees are responsible to be alert to existing hazards and report them to their supervisor immediately if action required is beyond the scope of the employee.

Electrical cords used to plug in instruments or mobile laboratories are to be inspected each time they are plugged in. Mobile lab cords are especially prone to wear and tear as they

are driven on and used at least twice daily. If the protective coating is pulling away from the plug head, or there is noticeable darkening of the plug head near the prongs or any exposed wiring, the cord is to be sent in for repair and a backup cord used until then. For labs that have hard wired cords, the Lab Director is to be informed immediately.

12.2.3 Engine Exhausts

During field operations and some in-house repair activities, engines may be operated that exhaust CO and other harmful vapors. It is critical that the chemist or technician be aware of this potential hazard and take steps to ensure proper ventilation and a safe work environment.

In the mobile laboratories, CO monitors are used to monitor for any issues with generator exhausts. The positioning of the lab is critical as the wind may be a culprit in bringing exhausts into the lab. The use of fans can assist in achieving and maintaining safe levels of CO inside the lab.

In drilling operations that require the use of the limited access rig, poor ventilation may be an issue. Steps must be taken to ensure good air flow and that all equipment exhausts are mitigated.

12.3 Chemical Handling and Storage

12.3.1 Routine Chemical Handling

Special handling instructions, specific hazards and emergency procedures are often written on chemical containers. These should be reviewed and understood prior to handling the material. The State of California requires manufacturers and distributors of chemicals to provide their customers with summaries of the hazardous, toxic and special properties of these substances. The ~~Company~~ Health and Safety Officer will maintain a file of Material Safety Data Sheets. The Safety Officer shall be provided with Material Safety Data Sheets by any individual requesting a new chemical. Chemicals are to be stored in designated laboratory locations and are to be returned there immediately after use. All secondary storage containers and solutions shall be clearly labeled as to their contents.

12.3.2 Flammable and Potentially Explosive Substances

Company Management and the Health and Safety Officer prior to commencement shall review any new operation involving potential fire or explosion risk. Copies of protocols and experimental procedures are to be provided to the Health and Safety Officer in order that a proper review can be carried out. Flammable substances are to be stored in designated cabinets and shall be maintained in the minimum quantities necessary for laboratory operation.

12.3.3 Hazardous Material Handling

Individuals handling hazardous materials shall acquire a thorough knowledge of these materials. Safe handling procedures include, but are not limited to, materials compatibility, storage properties, transfer procedures, disposal, decontamination procedures and system design specifications. Prior to initiating work with a potentially hazardous material, the following precautions shall be taken:

1. The physical and chemical characteristics of the material must be known and understood,
2. The proper protective materials and clothing must be available,
3. The facility (fume hoods, etc.) must be in proper working order, and
4. The operating procedures must be approved by Management and the Safety Officer.

12.4 Job Safety Analysis

A job safety analysis sheet for Strataprobe, mobile laboratories and hand drilling operations is required to be on hand and on site by most of H&P's oil company clients. This document is part of the QSM and is included.

13.0 ANALYTICAL TEST METHODS

LAB ID	METHOD	CERTIFICATION
FIXED BASE	EPA8260B ~~TPH LUFT~~ H&P8260SV EPA TO-15 TPHV APH (various methods) FIXED GASES HELIUM METHANE	CA ELAP CERT #2741 ~~CA ELAP CERT #2741~~ DoD CERT #L11-175 LA NELAP CERT 04138/DOD CERT #L11-175 NONE NONE NONE NONE NONE
LAB 1 (in process)	H&P8260SV TPHV BY GCMS	In Process None
LAB 3	H&P8260SV ~~TPHV BY GCMS~~	~~DoD CERT #L11-175~~ NONE
LAB 4	H&P8260SV TPHV BY GCMS	DoD CERT #L11-175 NONE
SB1	H&P8260SV TPHV BY GCMS ~~METHANE~~ ~~FIXED GASES~~	DoD CERT #L11-175 NONE ~~NONE~~ ~~NONE~~
SB2	EPA8260B H&P8260SV TPHV BY GCMS ~~METHANE~~ ~~FIXED GASES~~	CA ELAP CERT #2740/DoD CERT #L11-175 DoD CERT #L11-175 NONE ~~NONE~~ ~~NONE~~

14.0 ANALYTICAL INSTRUMENTATION

LABORATORY ID			
FIXED BASE	AUTOSAMPLERS	GAS CHROMATOGRAPHS	DETECTORS
8260	TEKMAR 3000/SOLATEK 72	AG6890 GC#4 SN US00027517	AG5973 MSD SN UD82311632
8260	ATOMX XYZ	AG6850A GC#5 SN US00002576	AG5973 MSD SN US10441742
TPH DHS LUFT	NONE	AG5890 GC#6 SN 3235A46654	FID
TO-15 SV & IA	ENTECH 7200A, 7032D, 7016D	AG6850 GC#9 SN GC#9 SN6313964	AG 5973N MSD SN US33246175
TO-15 IA	ENTECH 7100AR, 7032 AQ, 7016A	AG6850 GC#12 SN 7324508	AG 5975C MSD SN US74818075
TO-15 HYBRID	ENTECH 7032 A-L, 7016A	AG5850 GC#13 SN CN11012006	AG 5975 MSD SN US11020601
METHANE & FIXED GASSES	NONE	SHUMADZU 14A	FID, TCD
HELIUM	NONE	CARLE 311	TCD
TO-14	NONE	SRI	ECD, PID, TCD
LAB 1	ATOMX XYZ	AG 6890 GC#1 SN US00007247	AG 5973 MSD SN US72810840
LAB 3			
8260	TEKMAR 3000/SOLATEK 72	AG6890 GC#22 SN US00027182	AG 5973 MSD SN US63810185
LAB4			
8260	ATOMX XYZ-TEKMAR 3000/SOLATEK 72	AG6850A GC#7 US00002576SN 02-10442379	AG 5973N MSD US00002451US10442379
SB1			
8260	TEKMAR 3000/STRATUM SOLATEK 72	AG 6890 GC#3 SN US00024631	AG 5973 MSD SN US72810840
SB2			
8260	TEKMAR 3000/SOLATEK 72	AG6890 GC#22 SN US00027182	AG 5973 MSD SN US63810185
METHANE & FIXED GASES	NONE	SRI 8610	FID & TCD
OTHER PERIPHERAL EQUIPMENT			
TO-15 Cleaning Oven #1	SN 1203-8185		
TO-15 Cleaning Oven #2	SN O-021002-D		
TO-15 Cleaning Oven #3	SN B33ER-01731		

15.0 ANALYTICAL SOFTWARE

GCMS Software/Hardware

Lab	MS #	OS	Chem Station Version	Model #	
				MS	GC
L3	22	WIN XP	1701DA D.02.00.275 GPIB PCI Card (Agilent 82350-6511 Rev A)	5973	6890 Series Plus + MS GPIB-20 GC GPIB-15
SB2	1	WIN XP	1701DA D.01.02.16 (15-Jun-2004) GPIB PCI Card (Agilent 82350-65511 Rev A)	5973	6890 Series Plus + MS GPIB-20 GC GPIB-15
SB1	3	WIN XP	1701DA D.01.02.16 (15-Jun-2004) GPIB PCI Card (Agilent 82350-65511 Rev A)	5973A	6890 Series Plus + MS GPIB-20 GC GPIB-15
CARLSBAD 8260	4	WIN XP	1701DA D.02.00.275 GPIB PCI Card (Agilent 82350-65511 Rev A)	5973	6890 Series Plus + MS GPIB-20 GC GPIB-15
CARLSBAD 8260	5	WIN XP IP Address - 10.1.1.100 Subnet Mask - 255.255.255.0	1701DA D.02.00.275 BootP	5973N	6850 Mac Address - 00:60:b0:dd:17:24 MS IP Address - 10.1.1.101
L4	7	WIN XP IP Address - 10.1.1.100 Subnet Mask - 255.255.255.0	1701EA E.02.02.1431 BootP	5973N	6850 Mac Address - 00:30:d3:0e:9d:42 MS IP Address - 10.1.1.101
CARLSBAD TO-15 (Soil Vapor)	9	WIN XP IP Address - 10.1.1.100 Subnet Mask - 255.255.255.0	1701EA E.02.02.1431	5975C VL	6850N Mac Address - 00:30:d3:0e:bd:c7 MS IP Address - 10.1.1.102 GC IP Address – Blank

15.0 ANALYTICAL SOFTWARE

GCMS Software/Hardware

CARLSBAD TO-15 (Indoor Air)	12	WIN XP IP Address - 10.1.1.100 Subnet Mask - 255.255.255.0	1701EA E.02.02.1431	(Keyboard)	5975C VL 6850N Mac Address - 00:30:d3:10:67:01 MS IP Address - 10.1.1.102 GC IP Address - 10.1.1.101
CARLSBAD TO-15	13	Win 7 IP Address - 10.1.1.100 Subnet Mask - 255.255.255.0	1701EA E.02.02.1431	(Keyboard)	5975C VL 6850N Mac Address - 00:30:d3:18:78:81 MS IP Address - 10.1.1.102 GC IP Address - 10.1.1.101

QAPP Appendix B

Standard Operating Procedures (SOPs) and Field Forms

SOP 13 - Field Instrument Calibration

SOP 17 - Equipment Decontamination

SOP 20 - Sample Handling and Documentation

SOP E.0160 - Soil Sampling and Logging

SOP E.0464 - Sample Handling—Soil (Safety Level D)

SOP E.0472 - Groundwater Sampling - Bailer

SOP E.0552 - Field Headspace Screening – Soil/ Photoionization Detector

SOP E.100 - Surface & Near-Surface Bulk Sampling

SOP E.2128 - Standard Operating Procedures for Sub-slab & Shallow Soil Vapor Sampling

SOP 13

Field Instrument Calibration, December 11, 2025

Introduction

This SOP describes the procedures for the use and calibration of the most commonly used field instruments. The use and calibration procedures are provided for the following field instruments:

- Photoionization detector/organic vapor monitor (PID/OVM)
- X-Ray Fluorescence (XRF) Multi-element Analyzer

Photoionization Detector

- Photoionization detector meter and filter screen
- Isobutylene span gas (100 ppm) and gas sample bag

Calibration Procedures

Calibration procedures will be performed, as specified by the manufacturer, each day prior to use.

X-Ray Fluorescence (XRF) Multi-element Analyzer

XRF

Calibration Procedures

Calibration procedures will be performed, as specified by the manufacturer, each day prior to use. When the sampling work plan requires EPA Method 6200 sampling methods, the calibration requirement listed in EPA Method 6200 will be followed.

SOP 17

Equipment Decontamination, December 11, 2025

In order to reduce the risk of cross-contamination or transferring contaminants from areas of known contamination to known clean areas, decontamination of personnel and equipment is required. The decontamination procedures shall be established for each site based on the degree of hazard associated with the site and the amount of contact with hazardous materials resulting from site work. Final decontamination procedures shall be reviewed and approved by the Site Safety and Health Manager and included in the site-specific Health and Safety Plan (HASP). This procedure contains general decontamination protocols, suitable for most sites, although decontamination procedures will be reviewed on a site-by-site, contaminant-by-contaminant basis. Spent decontamination fluids will generally be considered non-hazardous waste and disposed accordingly, dependent on contaminant types present at a given site.

Decontamination Guidelines

Terracon uses a four-step decontamination procedure described below:

Step 1 Gross Contaminant Removal

This step consists of removing gross materials by gloved hand and then scrubbing using a detergent solution and water and a stiff brush. Scrubbing will continue until visible contaminants are removed. The water will be changed as necessary, daily at a minimum.

Step 2 Alconox Wash

An Alconox wash will be prepared by mixing 1 to 1-½ tablespoons of Alconox per gallon of warm water. The water will be changed as necessary, daily at a minimum.

Step 3 Clear Water Rinse

A rinse with clear potable water. This water will be changed as necessary to ensure its purity, daily at a minimum.

Step 4 Distilled Water Rinse

Unused distilled water will be used as a final rinse for all decontamination procedures. The water may be poured or sprayed.

Decontamination Blanks (Equipment Blanks) to document the decontamination procedures will be collected if required in the sampling work plan.

SOP 20

Sample Handling and Documentation, December 11, 2025

Introduction

This SOP describes procedures to follow once soil, sediment, or water samples are collected to ensure that the samples are handled properly, and that appropriate documentation is completed.

Sample Handling

Chemical resistant gloves will be worn during collection and initial handling of all samples. All samples will be promptly placed in an iced cooler. Typically, samples selected for chemical analysis are delivered at the end of each day to the analytical laboratory. If they are not submitted to the laboratory on the same day collected, they will be stored in a refrigerator in a locked sample storage room at Terracon's office until transport and delivery to the laboratory in an iced cooler. Upon receipt of the samples, the laboratory will record the internal temperature of the sample transport coolers on the chain of custody record.

Documentation

Sample Identification and Labeling

Samples will be labeled following the specific labeling requirements set forth in the sampling plan or using labeling methods that identify the area from which they were collected and the depth.

Each sample sleeve or sample container will be immediately labeled with the following information:

- Project number
- Sample identification
- Sample depth
- Date and time collected
- Analyses requested
- Filtered or unfiltered (for water samples)

This information will also be recorded in the field notebook. An example sample label is provided as an attachment to this SOP

Chain of Custody

Chain of custody documentation will begin in the field for each sample submitted to the laboratory and will be maintained by laboratory personnel. Samples will remain in the possession of the sampler at all times, or in a locked facility until delivery to the analytical laboratory. A chain of custody form will be completed and will accompany each sample cooler to the analytical laboratory. An example chain of custody form is provided as an attachment to this SOP.

Terracon field personnel will maintain a field logbook to record all field activities. All data generated during the project and any comments or other notes will be entered directly into the field logbook.

Terracon - SLC (TERRDUT)

Prepared by Pace Analytical National Center for Testing & Innovation

Project: _____

Project #: _____

Sample Loc./ID: _____

Analysis Reqd _____

Date: _____ Time: _____

[illegible]



Standard Operating Procedure E.0160

Title: Soil Sampling - General	SOP Number: SOP E.0160
Issue Date: Sept. 2024	
Prepared by: Andrew Turner	Approved by: SOP Review Committee
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1. OBJECTIVE

To provide standard procedure for collecting subsurface and near-surface soil samples appropriate to project conditions.

Sufficient sample will be collected for the analysis that will be performed as prescribed by the project documents. Soil descriptions will be completed for each collected soil sample using the general terminology of the unified soil classification system (ASTM D2487). Descriptions shall be recorded in field books and/or field logs.

2. BACKGROUND

This SOP is used for general surface and subsurface soil sampling using hand tooling as well as drilling using direct push, sonic, auger, and split barrel techniques. This document should be considered supplementary to applicable state/federal SOPs, as well as Terracon Safe Right Procedures (SRPs). Soil sampling techniques can vary between analytical methods and should be reviewed during Pre-Task Planning.

3. EQUIPMENT

- Surface Soil Sampling Equipment:
 - o Hand Augers (multiple size stainless steel buckets)
 - o Power Auger (if required for 2+ foot depth)
 - o Stainless steel trowels
 - o Shovels (to remove gravel and debris)
 - o Plastic sheeting and/or aluminum foil
 - o Decontamination equipment as required
 - o Hand tools (for equipment or other needs)
 - o Camera (Digital or film); or Cell Phone/Watch
 - o Field Screening Equipment (PID, FID, etc.)
 - o Labels
 - o Cooler
 - o Field log book
 - o Soils Data form, Daily QC form, etc.
 - o Site Safety and Health Plan
 - o Appropriate sample bottles
 - o Plastic bags (sealable)
 - o Compass
 - o Measuring tape or wheel



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- Subsurface Soil Sampling Equipment:
 - o Drill rig and equipment
 - o Stainless steel split spoon
 - o Shelby tubes
 - o Photoionization detector
 - o Indelible pens
 - o Cooler and ice
 - o Plastic sheeting and/or aluminum foil
 - o Measuring tape or measuring wheel
 - o Field screening equipment (PID, FID, etc.)
 - o Sample containers – chemical and geotechnical analysis
 - o Decontamination equipment (as necessary)
 - o Boring log form, etc.
 - o Ziploc® baggies
 - o Compass
 - o Watch
 - o Camera Phone

4. DOCUMENTATION

- Lithological Logging

The lithology of the sample along with any other pertinent information shall be logged by an environmental consultant. Particular consideration should be given to grain-size distribution (relative percentages of different size materials), presence of lamination or layering and soil consistency. Estimate the mineralogy for coarser grained material. Classify soil samples and enter onto the boring log using the Unified Soil Classification System (USCS), following methods outlined in ASTM standard D 2488 (American Society for Testing and Materials, 1984b). Prepare the final boring log using observations of the driller and on-site Geologist/Engineer/Environmental Scientist and from laboratory analysis.

Chain of Custody and other field notes requirements should be documented as referenced in applicable SOPs.

5. PERSONAL PROTECTIVE EQUIPMENT

- Wear and maintain Terracon-approved PPE at project sites and in laboratories as required by project, task, and/or work environment, except when in a PPE-Free Zone.
- Don't try to account for unusual or special health and safety situations. Unusual or special health and safety situations should be addressed by the Health and Safety Plan and the Project Manager.

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- Review SRPs specific to the task to be completed.

6. PROCEDURES

- Surface Soil Procedures

Select the location. Identify it with a unique designation for the project. Diagram, GPS, or otherwise describe the location on forms or in the logbook relative to a fixed benchmark that will allow the specific location to be re-visited in the future, if necessary. If appropriate, estimate the vertical elevation of the sample and record.

Surficial soil samples shall be collected as follows. Vegetation at the sample location is removed by cutting or scraping away with a stainless-steel trowel. While drilling the hole, remove gravel or other debris before obtaining the sample. Advance the auger or trowel to a depth of approximately six inches and then remove from the hole. Using pre-cleaned stainless-steel equipment, extrude the soil directly into the sampling containers. If dedicated sampling equipment is not used, sampling equipment must be decontaminated before collecting another sample. See appropriate SOPs for details on Sampling Equipment Decontamination.

Samples for VOC analysis must be collected first. Fill VOC sample containers as full as possible to minimize headspace losses. After mixing as required by project-specific quality documents, fill separate containers with enough soil for analyses of other required parameters. Immediately place the samples on ice. Enter all data into field log book. Describe soil samples as indicated below in Section 3.0, Lithologic Logging. See appropriate SOPs for details on Sample Preservation, Storage, Handling and Documentation.

- Subsurface Soil Procedures

Subsurface soil samples can be obtained by several methods depending on the type of samples required and the soil conditions. The usual method is to collect samples using a direct push (i.e. Geoprobe), Sonic, or 2.5 to 3-inch diameter, 2.5 to 5 feet long, continuous-drive, split-barrel sampler, which is advanced with the augers during drilling. These techniques have several advantages, the primary one being good sample recovery over a large interval, and accuracy in that cuttings are less likely to be included in the sample than in other methods. Disturbance to the soil is minimal so that subtle structures such as laminations or voids are less likely to be destroyed and geologic contacts are more readily observed and logged. In loose soil and/or where large debris or cobbles impede the progress of the sampler, sample recovery with a continuous sampler may be poor and a different sampling technique may be used.



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When continuous drive sampling is not practical, a 24-inch stainless steel split-barrel sampler can be driven a total of 24 inches into the undisturbed materials by dropping a 140-lb weight 30 inches. A 3-inch diameter split spoon may be used to increase the chances of sufficient volume recovery for sampling purposes. Record in 6-inch increments the number of blows required to drive the sampler, if required. Indicate these data along with the amount of sample recovery in the drilling log. In the event of poor sample recovery, the consultant may elect to offset to obtain the missing sample interval. Note on the boring log if the offset boring is unsuccessful.

At times where samples are required from shallow depths (less than 10 feet) it may be more feasible to collect samples using a hand auger. In this case a decontaminated hand auger shall be advanced to the top of the desired sample interval. Continue through the sample interval and collect the sample using the hand auger or using a stainless-steel trowel or sampling trier and place in a laboratory-cleaned glass container and labeled accordingly. Samples for VOC analysis must be collected first to minimize potential loss of volatiles. To minimize the potential for cross-contamination, use dedicated stainless-steel trowels or sampling triers at each location. Between each use, decontaminate sampling equipment in accordance with appropriate SOPs.

- Sample Collection Procedures

- o Field screening samples

Soil samples should be collected for field screening at regular intervals as specified in the project scoping document, at zones of obvious contamination, or at the water table. Perform the field screening in accordance with the applicable SOPs. Note the field screening results on the boring log.

- o Laboratory samples

After collecting the field screening samples, collect soil samples for laboratory analysis. Samples for VOC analysis must be collected first to minimize potential loss of volatiles. Place VOC soil samples in a suitable container. Fill sample containers as full as possible to prevent headspace degradation of VOC. Properly label the container and immediately place the sample into coolers packed with ice to maintain a temperature of less than 4°C. When the headspace screening is complete for each boring, the laboratory sample that corresponds to the highest headspace sample is selected for laboratory analysis. If field screening showed no elevated headspace readings, the sample collected as specified in the project scoping documents.

See appropriate SOPs for details on sample preservation, storage, handling, and documentation.



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7. REFERENCES

- **ASTM E1903-19** *Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process.*
- **ASTM D2487-17** *Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).*

8. TRAINING AND CERTIFICATION

- Training of new hires/less-experienced staff to be completed by skilled project staff, PM, APR or SME.
- Check Terracon University for training modules that may be available.



Standard Operating Procedure E.0464

Title: Sample Handling – Soil (Safety Level D)	SOP Number: SOP E.0464
Issue Date: April 2022	Approved by: Ken Olson/Kitty Hordahl
Prepared by: Daniel Schneider	Page 1 of 4

1. OBJECTIVE

To obtain a representative soil or sediment sample for chemical analysis. This includes the documentation of sampling methods, and protocols used for sample collection, processing, handling and shipment.

2. BACKGROUND

Soil and sediment sampling have been a common activity during environmental both assessment and response to address impacts to soil and will continue to be a routine activity during site investigation and remediation. Each analyte group often requires specific sampling protocols, sampling containers, preservation and hold times. The work plan should include a complete description of the sample locations, depths, media, purpose and use of sample results, sample container description, preservation and hold times that will direct actual collection and analysis to meet the project objectives.

3. EQUIPMENT

- a) Monitoring equipment (PID, FID, multi-gas meters, colormetric detector tubes) as specified by Project Manager;
- b) Sampling Device (split barrel sampler, hand auger, hand trowel, shovel, push probe sampler, or other appropriate sampling device);
- c) Decontamination Equipment;
- d) Laboratory prepared sample containers;
- e) Forms including soil boring form, chain-of-custody, etc;
- f) Indelible ink pen;
- g) Stainless steel bowl for composite sampling;
- h) Plastic sheeting;
- i) Site map;
- j) Measuring wheel;



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- k) Engineers tape marked in units of feet, tenths of a foot (0.1 ft.), and hundredths of a foot (0.01 ft.);
- l) Disposable chemical-resistant gloves; and
- m) Chem-wipes

4. DOCUMENTATION

- a) Complete the necessary documentation of site conditions and field data in accordance with SOP E.0018 Basic Recordkeeping and Field Documentation as appropriate. Complete chain of custody in accordance with E.0026 Chain of Custody Documentation as appropriate.
- b) Use Terracon forms or locally generated forms for data collection tabulation when collected via paper forms or collect electronically when using electronic forms such as Device Magic.
- c) IDENTIFY SPECIFIC FORM AS APPROPRIATE FOR ACTIVITY

5. PERSONAL PROTECTIVE EQUIPMENT

- a) Identify specific hazards associated with implementation of this SOP and include discussion and mitigation measures in project Health and Safety Plan (including discussion of requirement/need for utility clearance for SOP implementation). Discuss during Pre-task Planning/Kick-off Meetings.
- b) Wear and maintain Terracon-approved PPE at project sites and in laboratories as required by project, task, and/or work environment, except when in a PPE-Free Zone. This includes use of the Core PPE Kit.
- c) Reevaluate risks and necessary actions during initial site mobilization, each day and when conditions or activities change.

6. PROCEDURES

- a) Surficial soil/sampling
 - i. Determine sample location (set grid, if necessary)
 - ii. Determine the proper sampling device based on soil type, depth, sample type, etc.
 - iii. Collect each sample at the specified depth consistently for each sample.
- b) Direct Sampling



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- i. Transfer sample directly from the sampling device to the sample container.
 - ii. If evaluating for organic vapors, transfer the sample to plastic bag (zip top) for field screening. When appropriate, the sample should be split so as to obtain a sample for screening that is representative of the sample for testing. This can be accomplished by slicing the sample (if cohesive) lengthwise or by using other mechanical means. Care should be taken so as not to over-agitate the sample, especially if volatile organic compound testing is required.
 - iii. Document visual and physical characteristics
- c) Composite sampling (non-volatile only)
- i. Transfer equal volume/weight of sample from each location/depth to a stainless-steel mixing bowl
 - ii. Use a hand trowel or spoon to mix the soil sample
 - iii. If the sample size is very large, composite on a large sheet of clean plastic or stainless-steel sheet pan or mix equal volumes from numerous composite samples.
 - iv. If soils are cohesive, break up clumps.
 - v. Spread soil uniformly on plastic sheet or in bottom of stainless-steel bowl or stainless-steel tray and divide into quarters.
 - vi. Obtain equal quantity of soil from each sample for transfer to sample container (without mixing or break up).
- d) Decontamination
- i. Decontamination procedures should be specified by the project manager.
 - ii. Decontamination procedures for UST sites includes an Alconox® detergent scrub followed by a clean water rinse.
 - iii. Decontamination fluids are to be collected and replenished between sample locations (each boring) to reduce the potential for cross contamination.
- e) Sample preservation - store in cooler with ice. Use preservative as appropriate for the analytes tested.
- f) Sample documentation
- i. Complete field documentation and chain-of-custody form. Data to be recorded includes sampling location, methodology, depth, visual and physical characteristics, time and date.

7. REFERENCES

- a) Review operating manuals for all equipment used for this SOP.
- b) Review local/state specific requirements and modify field practices to conform to local/state requirements as appropriate.



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8. TRAINING

- a) Training of new hires and less-experienced staff to be completed by skilled project staff, PM, APR or SME.
- b) Check Terracon University for training modules that may be available.



Standard Operating Procedure E.0472

Title: Groundwater Sampling - Bailer	SOP Number: SOP E.0472
Issue Date: Sept. 2024	
Prepared by: Andrew Turner	Approved by: SOP Review Committee
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1. OBJECTIVE

To collect a representative groundwater sample from the sampling point for chemical analysis. This includes the documentation of sampling methods and supplies, and protocol to reduce potential for inaccurate representative sampling and or cross-contamination during the sampling event.

2. BACKGROUND AND REFERENCE

This SOP is used for general groundwater sampling using a bailer. This document should be considered supplementary to applicable state/federal SOPs as well as Terracon Safe Right Procedures (SRPs). Sampling techniques can vary between analytical methods and should be reviewed during Pre-Task Planning.

3. EQUIPMENT

- Monitoring equipment specified by the project manager.
- Electronic water level indicator, phase level indicator, etc.
- Decontamination equipment.
- Proper forms, labels and indelible ink pen.
- pH, temperature, and specific conductance meters.
- Sample containers and packing material, tape, and labels.
- Filtration device and filters (and fixing agents as appropriate).
- Cooler with ice pack and packing media.
- Bucket (calibrated in gallons or liters)
- Sampling device
- Bailers, pumps, etc.
- Keys for locking cap on well.
- Rope - steel, nylon, teflon, or polypropylene.
- De-ionized (DI) water.



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- Chemical-resistant gloves; and
- Site map.

4. DOCUMENTATION

- Complete the necessary documentation of site conditions and field data in accordance with SOP E.0018 Basic Recordkeeping and Field Documentation as appropriate. Complete the chain of custody in accordance with E.0026 Chain of Custody Documentation as appropriate.
- Use Terracon forms or locally generated forms for data collection tabulation when collected via paper forms or collect electronically when using electronic forms such as Device Magic.
- **IDENTIFY SPECIFIC FORM AS APPROPRIATE FOR ACTIVITY.**

5. PERSONAL PROTECTIVE EQUIPMENT

- Wear and maintain Terracon-approved PPE at project sites and in laboratories as required by project, task, and/or work environment, except when in a PPE-Free Zone.
- Don't try to account for unusual or special health and safety situations. Unusual or special health and safety situations should be addressed by the Health and Safety Plan and the Project Manager.
- Also note cautions (e.g., "Caution: the 40-milliliter vials contain acid").

6. PROCEDURES

a) Preparation

- Obtain the bottles and forms from analytical laboratory, and equipment necessary to complete the sampling event.
- Calibrate all field equipment i.e., pH and conductivity meters.
- Establish sampling well sequence (generally least impacted to most impacted).

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b) Field Activities

- Water levels - collect and record water levels
- Well depth – measure and document

c) Contamination minimization

- Use plastic sheets to prevent spillage onto existing ground surface
- Use proper bailing techniques (hand over hand) to prevent rope from touching the ground



d) Sample Collection

1) Preservation

- Use containers with proper preservative as prescribed by an analytical laboratory.

2) Filtration

- Metals only - (Samples for VOC analyses are not filtered).
- Field filter samples collected for dissolved metals analyses immediately after collecting the sample (if required and/or allowed by local or state regulations).
- Filter the sample prior to adding preservative or transferring to sample container containing a preservative (if required and/or allowed by local or state regulations).
- Discard the filter and tubing and dispose of in clean transfer container.

3) Collection

- Minimize disturbances that may aerate the sample (i.e., lower bailer slowly into water, pour slowly into sample container, use low flow sampling procedures, etc.).

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- Pour water from the top of the bailer or insert the bottom emptying device for sample transfer.
- Transfer the groundwater sample directly to the laboratory prepared sample container or the filter cup.
- Samples collected for VOCs should always be collected from a recently filled bailer full of water as soon as it is brought to the surface.
- Collect samples for VOCs by forming a positive meniscus on the sample vial and capping immediately.
- VOC samples must be free of air bubbles.
- Do not over-fill sample containers which contain a preservative.
- Place samples in cooler with ice.



4) Filtration Procedures

- Set up filtering apparatus according to the manufacturer's directions.
- Use a 0.45-micron membrane filter (may need a pre-filter to prevent clogging if the sample is turbid).
- Flush a minimum of 250 ml of D.I. water (or larger volume if recommended by manufacturer specifications) through the filtering apparatus and filter prior to filtering the sample.
- Pump the sample through the filter and discard the initial 100-200 ml (if you have sufficient volume).
- Collect and transfer the remaining sample volume to the sample container.

5) Data Documentation

- Record all pertinent sampling information on the sampling container label, sampling information form, chain-of-custody, and shipping form.
- Pertinent data will vary based on the parameter and the form; however, the following data must be recorded. Time, date, job



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number, project name, sampling location, samplers name, sampling methodology, parameters to be analyzed, stabilization data, and general observations.

- Make all entries in the chain-of-custody form prior to leaving the site. Ensure that the chain-of-custody protocol required for the project is maintained.
- If samples must be shipped, the chain-of-custody form must be enclosed with the samples and the container sealed with Terracon security labels. Obtain a post office receipt, bill of lading or similar document from the shipper to be included as part of the chain-of-custody documentation. Return one copy of the chain-of-custody documentation to the project manager.

6) Equipment Cleaning

- Clean all equipment used as specified by the Project Manager and according to cleaning/decontamination procedures prior to collecting a sample from the next sample location.

7) Sample Packaging and Shipment

- Carefully package the samples in a cooler with ice. Take care to wrap the sample containers in packing materials and place in sealed Ziploc type bags.
- Ship the samples via overnight courier as specified by the Project Manager. Be sure to secure all address labels with clear packing tape.

7. REFERENCES

- **ASTM D4448-85a** Standard Guide for Sampling Groundwater Monitoring Wells.



Standard Operating Procedure E.0552

Title: Field Headspace Screening – Soil / Photoionization Detector	SOP Number: SOP E.0552
Issue Date: Sept. 2024	
Prepared by: Chris Bartley	Approved by: SOP Review Committee
	Page 1 of 4

1. OBJECTIVE

To provide a qualitative and limited quantitative field screening of soil samples to aid in the evaluation of soil for the presence of volatile or semi-volatile organic chemicals.

2. BACKGROUND

The procedure is premised on the physical property of volatile compounds to move from the soil matrix of a freshly obtained soil sample (e.g., split spoon sample, grab sample, etc.) to the airborne state as vapor. The measurement of ambient air in close proximity to the surface of the soil or drilling core will produce an indication of contaminants moving from the soil matrix to air. The relative strength of contaminants in ambient air around the sample will be considered an indication of the relative concentration of chemicals in the soil sample. **Note that often, a sample aliquot may be maintained in a separate container, free from headspace, and store in an iced cooler for later fixed-laboratory analysis. Please refer to associated proposal/quality documents for the project.**

The procedure is semi-quantitative and valid only for the most preliminary qualitative decision-making. The procedure is highly susceptible to external air changes in wind velocity, ambient dilution by moving air and ambient influence by contaminants in moving air. The rate and degree of volatilization is susceptible to smearing of the exterior of the sample by the sampler wall in clay soils.

Measurements cannot be used as the sole indicator of soil contamination or in lieu of prescribed laboratory chemical testing for purposes of regulatory compliance. This procedure is only to be used for sites involving volatile or semi-volatile organic compounds. This procedure **is not** to be used for purposes of health and safety monitoring.



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3. EQUIPMENT

- Calibration gas from manufacturer
- Photoionization detector (PID) equipped with 10.0 eV lamp or greater (depending on the contaminants to be screened)
- Forms and indelible ink pen
- Disposable chemical-resistant gloves
- Test chamber, reusable or disposable, examples:
 - Mason jar with aluminum foil
 - Mason jar equipped with charcoal filter
- Ziploc® bags or other sealable containers of at least 500 cubic centimeters to provide a fixed headspace volume for constancy between tests
- Rigid, disposable concrete test cylinder mold with plastic cap

4. DOCUMENTATION

Record the highest reading in calibration gas equivalents on forms provided by the Project Manager or in the field logbook. Pertinent data will vary based on the parameter and the form; however, the following data must be recorded; date, job number, project name, sampling location, sample interval (if appropriate) sample identification, samplers name, and general observations.

5. PERSONAL PROTECTIVE EQUIPMENT

- Wear and maintain Terracon-approved PPE at project sites and in laboratories as required by project, task, and/or work environment, except when in a PPE-Free Zone.
- Don't try to account for unusual or special health and safety situations. Unusual or special health and safety situations should be addressed by the Health and Safety Plan and the Project Manager.
- Follow manufacturer's safety recommendations for the specific instrument you are using.



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6. PROCEDURES

Immediately prior to making a field measurement, the PID should be operated for approximately 1 minute and any background concentrations noted or "zero-ed out" relative to measurements.

Daily, the unit should be gas calibrated to a manufacturer's gas standard and the results recorded in the field logbook. If the unit does not calibrate, return it to the local Terracon equipment evaluation for evaluation and, if necessary, repair.

Prior to site testing an empty, unused test chamber should be sealed containing nothing but ambient air and allowed to stabilize for 1 minute. Test the chamber headspace to identify background contaminants contributed by the chamber itself. If anything is detected, change to another type of chamber which is inert relative to contributing ionizable materials to the headspace.

- Transfer soil sample representative of the condition to be measured from the sampling device to testing chamber (e.g., mason jar covered by aluminum foil, disposal concrete cylinder mold, Ziplock® bag, or other sealable container).
- Sample material should be representative of the vertical and horizontal cross-section of the sampled interval.
- The volume of soil should remain as constant as is practical for all site tests.
- The soil volume should not exceed 25% of the total volume of the air-filled testing chamber.
- Immediately seal the chamber after transfer and allow the sample to equilibrate for a minimum of 15 minutes at ambient temperatures above 50° F.



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- Insert probe into sealed container for reading for 1 minute for volatile compounds of concern and 3 minutes for semi-volatile compounds of concern to account for varied response times.

Record highest reading obtained as parts per million (ppm) calibration gas equivalents (i.e., TEI580 calibrated to isobutylene would be expressed as ppmi).

Sample Disposal

Soil Samples should be returned to the site and included in auger soil or excavation soil for proper disposal.

7. REFERENCES

- **Operating/User's Manual for the Equipment Being Used**

8. TRAINING AND CERTIFICATION

- Follow manufacturer's instructions for use in the User's Manual as well as any online instructional resources.



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8. TRAINING AND CERTIFICATION

- Training of new hires and less-experienced staff to be completed by skilled project staff, PM, APR or SME.
- Check Terracon University for training modules that may be available.



Standard Operating Procedure E.100

Title: Surface & Near-Surface Bulk Sampling	SOP Number: SOP E.100
Issue Date: Sept. 2024	
Prepared by: Andrew Turner	Approved by: SOP Review Committee
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1. OBJECTIVE

To provide standard procedure for collecting surface and near-surface soil samples of unconsolidated materials with hand tools as surface soils, tailings, spoils or other waste materials appropriate to project conditions.

Samples are generally collected from the surface to a depth of approximately four (~4) inches. Near-surface soil/tailings/spoils samples are generally collected from the surface to a depth of approximately four to twelve (~4-12) inches from the original surface. The original surface may be ground surface or the exposed horizontal or vertical surface of material excavated in mass from the subsurface.

Grab sampling is appropriate to conditions and projects where the end use of the sample is not overly sensitive to disturbance and handling during collection. Grab sampling should not be applied where the sample is used for field or laboratory measurements of low levels of readily volatile organic compounds. Grab sampling is appropriate for general field screening and as a field guide to directing environmental excavation, if compatible with the physical properties of the chemical(s) to be measured. Grab sampling should not be used for samples intended to represent in-situ, undisturbed subsurface conditions.

Sufficient samples will be collected for the analysis that will be performed as prescribed by the project documents. Soil descriptions will be completed for each collected soil sample using the general terminology of the unified soil classification system (ASTM D2487-17). Descriptions shall be recorded in field books.

2. BACKGROUND

This SOP is used for surface and near surface soil sampling using hand tools. This document should be considered supplementary to applicable state/federal SOPs as



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well as Terracon Safe Right Procedures (SRPs). Sampling techniques can vary between analytical methods and should be reviewed during Pre-Task Planning.

3. EQUIPMENT

- Rigid sampling equipment such as a trowel or shovel of inert material relative to the chemical(s) of concern and capable of reaching the depths prescribed for surface and near-surface soils.
- Disposable gloves.
- Nitrile/chemical-resistant gloves and work gloves (cut designation of 3 or greater).
- The laboratory prepared sample containers.
- Roll of plastic sheeting.
- Plastic trash bag for collecting expended supplies.
- Field documentation forms or project logbook.
- Chain-of-Custody forms for samples intended for laboratory analysis.
- Marking pencils or indelible markers that will not leave residues which can cause interference with laboratory testing procedures.

4. DOCUMENTATION

- Complete the necessary documentation of site conditions and field data in accordance with SOP E.0018 Basic Recordkeeping and Field Documentation as appropriate. Complete the chain of custody in accordance with E.0026 Chain of Custody Documentation as appropriate.
- Use Terracon forms or locally generated forms for data collection tabulation when collected via paper forms or collect electronically when using electronic forms such as Device Magic.
- Identify specific form as appropriate for activity.



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5. PERSONAL PROTECTIVE EQUIPMENT/SAFETY

- Identify specific hazards associated with implementation of this SOP and include discussion and mitigation measures in the project Health and Safety Plan (including discussion of requirement/need for utility clearance for SOP implementation). Discuss during Pre-task Planning/Kick-off Meetings.
- Wear and maintain Terracon-approved PPE at project sites and in laboratories as required by project, task, and/or work environment, except when in a PPE-Free Zone.
- Reevaluate risks and necessary actions during initial site mobilization, each day and when conditions or activities change.

6. PROCEDURES

Select the location. Identify it with a unique designation for the project. Diagram, GPS, or otherwise describe the location on field forms or in the logbook relative to a fixed benchmark that will allow the specific location to be re-visited in the future, if necessary. If appropriate, estimate the vertical elevation of the sample and record.

If the grab sample is constructed of multiple aliquots to represent averaging of conditions in soils/tailings/spoils, diagram, GPS, or otherwise describe the area represented by the constructed sample. Diagram or otherwise accurately describe sub-sample locations on forms or in the logbook relative to a fixed benchmark that will allow the specific sub-sample locations to be re-visited in the future, if necessary. If appropriate, estimate the vertical elevation of the sub-samples and record.

At each location before collecting the soil sample, put on a clean pair of disposable chemical-resistant gloves.

Collect each sample by hand using procedures and equipment/tools specified by the project manager and applicable SOPs.

Place the sample directly into the laboratory prepared sample container(s) and complete the sample label and Chain-of-Custody as instructed by the project manager.



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If intended for laboratory analysis, preserve the sample as required by project plans.

7. REFERENCES

- Review operating manuals for all equipment used for this SOP.
- Review local/state specific requirements and modify field practices to conform to local/state requirements as appropriate.
- **ASTM E1903-19** Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process.

8. TRAINING

- Training of new hires and less-experienced staff to be completed by skilled project staff, PM, APR or SME.
- Check Terracon University for training modules that may be available.



Standard Operating Procedure E.2128

Title: Standard Operating Procedures for Sub-slab & Shallow Soil Vapor Sampling	SOP Number: SOP E.2128
Issue Date: Sept. 2024	
Prepared by: Andrew Turner	Approved by: SOP Review Committee
	Page 1 of 9

1. OBJECTIVE

General procedure for collecting representative sub-slab & shallow soil vapor samples during an environmental investigation.

The purpose of this SOP is to provide general guidance and recommended standard practices for conducting sub-slab vapor sampling.

2. BACKGROUND AND REFERENCE

This SOP is used for both sub-slab and surface vapor sampling. This document should be considered supplementary to applicable state/federal SOPs as well as Terracon Safe Right Procedures (SRPs). Sampling techniques can vary between analytical methods and should be reviewed during Pre-Task Planning.

3. EQUIPMENT

- Level D PPE.
- Rotary Hammer Drill.
- 1/2-inch diameter hammer bit.
- 1 1/2-inch diameter hammer bit and flush mount cover (for flush mount applications).
- Wet/dry vacuum equipped with HEPA filtration unit.
- Power source, if needed for drill or vacuum.
- Bottle brush.



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- Vapor Pin®, new silicone sleeve, and protective cap (or stainless steel, Teflon, or other inert 1/4-inch tubing and grout, cement or other non-VOC containing and non-shrinking product to construct vapor sampling point and seal).
- Vapor Pin® installation/extraction tool.
- Mallet or drive hammer, if using Vapor Pin® system.
- 1 1/2 to 2-inch (height) piece of 2 1/2-inch diameter (or greater) PVC pipe and modeling clay (or similar – must be non-VOC containing), if using water dam for leak testing*.
- Distilled water, if using water dam for leak testing*.
- Concrete patching compound.
- Putty knife.
- New inert sample tubing [1/4-inch outside diameter (OD)] to connect to sampling canister: Teflon, Teflon-lined, Nyalflow or similar. The use of polyethylene tubing is commonly used for groundwater sampling or vinyl tubing.
- Laboratory-provided vacuum sampling canister with vacuum gauge and flow regulator (e.g., 200 milliliters per minute).
- 1/4-inch Swagelock nut.
- 1/4-inch Ferrule.
- 1/4-inch Spacer nut.
- Moisture filter.
- 3/8-inch OD inert tubing to construct sampling train.
- Fittings/valves (to be used with 3/8-inch OD inert tubing): Stainless steel or plastic ball or 3-way valves, tee connectors and/or couplers. Setting up will vary based on



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user preference and sampling train. Connections between tubing and fittings should be airtight. Fittings and valves should be properly decontaminated between sampling locations. Brass is not recommended, because of the potential for residual cutting oils to be present.

- Graduated syringe, peristaltic pump, or similar for purging.
- Vacuum gauge and pump or hand pump with gauge, if conducting vacuum shut-in testing on sampling train*.
- Shroud, tracer gas (e.g., helium) and portable tracer gas detector, if conducting tracer gas leak testing*.
- Field screening devices (PID, FID, etc.).
- Field Notebook/Soil Vapor Field Data Form.
- Chain of Custody.
- Decontamination supplies.

It is recommended that some form of leak detection be used during sub-slab vapor sampling events. The degree of the leak testing will depend on the project objectives. Vacuum shutting in testing is used to detect leaks in the connections in the sampling train, while both a water dam and tracer gas leak testing is used to detect potential short circuiting between the sub-slab and ambient air. Therefore, choosing either a water dam or trace gas leak testing rather than conducting both is generally appropriate.

4. DOCUMENTATION

Field Data Form: Sub-Slab Soil Gas Sampling (attached)

5. PERSONAL PROTECTIVE EQUIPMENT



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- Identify specific hazards associated with implementation of this SOP and include discussion and mitigation measures in the project Health and Safety Plan (including discussion of requirement/need for utility clearance for SOP implementation). Discuss during Pre-task Planning/Kick-off Meetings.
- Wear and maintain Terracon-approved PPE at project sites and in laboratories as required by project, task, and/or work environment, except when in a PPE-Free Zone.
- Reevaluate risks and necessary actions during initial site mobilization, each day and when conditions or activities change.

6. PROCEDURES

- Locate public and private utilities in the work area. Scanning the sampling location with ground penetrating radar (GPR) may be required.
- Put on appropriate PPE.
- If installing a permanent flush mount vapor sampling point, drill a 1 1/2-inch diameter hole at least 1 3/4 inch into the floor slab.
- Drill a 5/8-inch diameter hole through the floor slab (and in the middle of the 1 1/2-inch diameter hole, if installing a permanent sampling point) and about 1 to 2 inches into the underlying soil.
- Brush the hole with the bottle brush to remove concrete cuttings. Use a vacuum equipped with HEPA filter to remove loose cuttings and soil, if required.
- For Vapor Pin® installation, place the lower end of the Vapor Pin® with silicone sleeve in 5/8-inch hole and place the small hole located in the handle of the installation/extraction tool. Tap Vapor Pin® into place using mallet. Make sure installation/extraction tool is parallel to Vapor Pin® to avoid damaging barbs on Vapor Pin®. Silicone sleeve should bulge slightly between floor slab and Vapor Pin® shoulder. Place protective cap on Vapor Pin®.

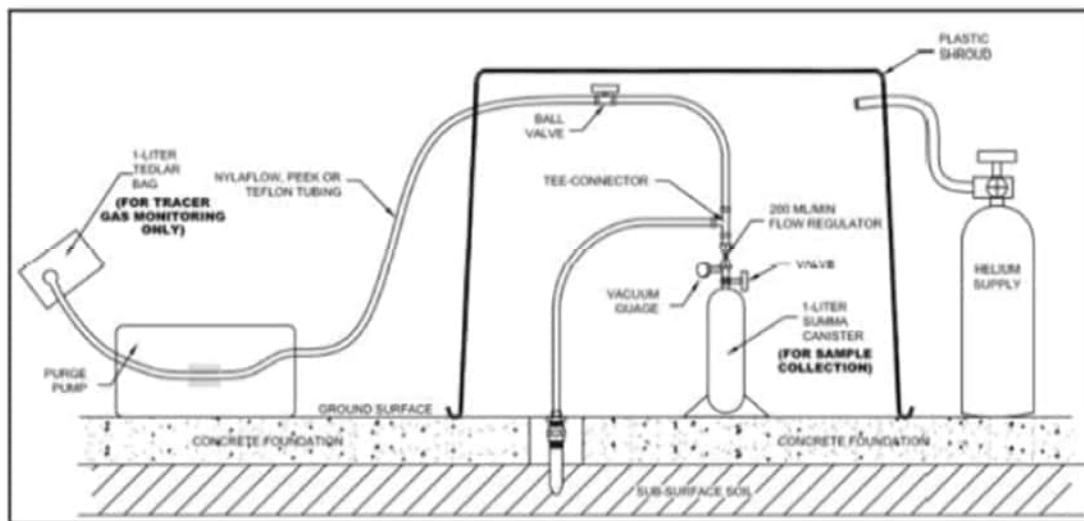
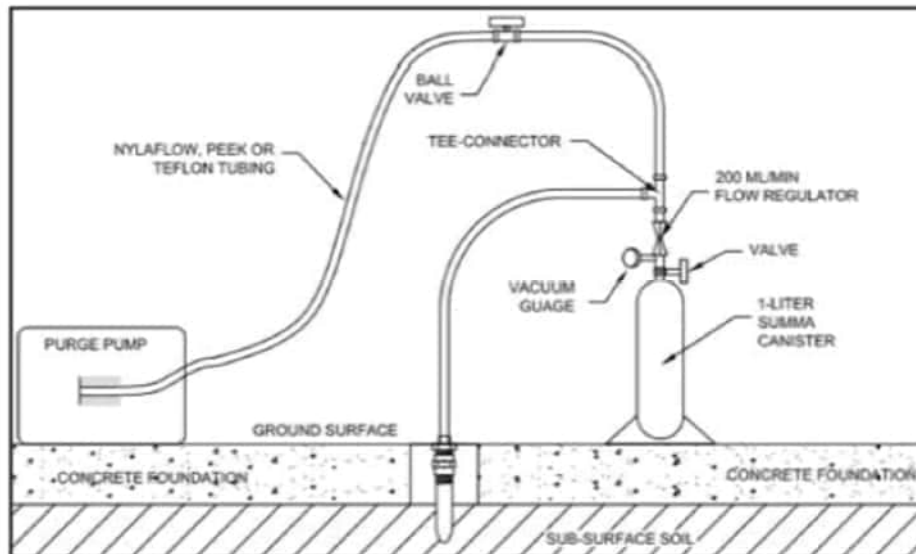


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- If constructing a vapor sampling point, cut the length of inert, 1/4-inch tubing long enough to extend through the slab into the open cavity below the slab. To avoid obstruction of the tubing, ensure that it does not extend into the sub-slab soil. Add coarse sand or glass beads to cover the tip of the tubing. Establish a seal between the tubing and top of the floor slab using grout, cement or other non-VOC containing and no-shrinking product. Cap the end of the tubing. Sampling should not occur until after the seal has properly set.
- Allow at least 20 minutes (or as required by oversight agency) for sub-slab conditions to equilibrate prior to sampling.
- **To construct a water dam**, which tests for short-circuiting leaks between sub-slab and ambient air, begin by placing PVC ring around vapor point. Secure PVC ring to floor surface using a bead of non-volatile molding clay. If a flush mount vapor point is being constructed, use of the PVC ring is not needed, and water can be placed within the 1 1/2-inch drilled hole.
- Remove the protective cap and attach 3/8-inch OD tubing to vapor sampling point. Attach fittings/valves and tee connections so a continuous connection can be maintained and isolated between the sampling point and the sampling canister and between the sampling point and an auxiliary connection onto which a PID, syringe, or pump can be connected. The use of fittings and tee connections in the sampling train allow the user to switch flow between tubing leading to the sampling canister and tubing leading to the syringe, pump, PID, etc. without introducing ambient air. A typical sampling train will include tubing with a tee connection between the vapor point and sampling canister. The second, auxiliary connection from the tee will have a valve downstream of the tee. **If conducting a shut-in test**, a valve should be installed between the vapor point and sampling canister so that the sampling train can be pressurized without drawing air through the Vapor Pin®. **If conducting a helium test**, the tubing between the vapor point and sampling canister should be placed through the shroud (e.g., plastic storage bin) – see example below.

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Examples of Sampling Trains:



- Connect sampling canister to sampling train using laboratory instructions, which generally involve removal of the brass cap from the top of the canister. Connect about 6 inches of 1/4-inch Teflon or similar tubing to top of sampling canister. Place ferrule on 1/4-inch Teflon tubing, followed by spacer nut and Swagelock nut. Hand-tighten nut to top of canister and then lightly tighten using a 9/16-inch wrench. Do



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not overtighten. Lightly tug on tubing to confirm connection has been made. Connect moisture filter to end of Teflon tubing and connect to 3/8-inch OD tubing on sampling train. Do not open the valve on the sampling canister until leak testing and purging has occurred.

- **If using a water dam**, pour distilled water into PVC ring taking care not to submerge the top of the vapor point. If a flush mount vapor point is being constructed, use of the PVC ring is not needed and water can be placed within the 1 1/2-inch drilled hole. During purging and sampling, the water level in the dam will be monitored. If water is lost, the Vapor Pin® will be reinstalled, or the seal otherwise re-established and sampling procedure will be repeated.
- **To conduct a vacuum shut-in test**, which tests for leaks in the sampling train, close the valve between vapor sampling point and the sampling canister. Attach a vacuum gauge and purge pump or hand pump with gauge to auxiliary line. Open valve downstream of tee connection, between pump and sampling canister. Pressurize line to demonstrate vacuum. Turn off pump. Monitor gauge for 2 to 3 minutes to ensure pressure in sampling train remains consistent. If pressure is lost, fittings should be checked and re-established before conducting shut-in test again. Close valve on auxiliary line.
- **To conduct a helium tracer test**, which tests for short-circuiting leaks between sub slab and ambient air, introduce helium gas into the shroud. Measure helium concentration in shroud with portable gas meter. Helium concentration should be between 15 to 20 percent (%) by volume.
- Open valve on auxiliary line and purge at least two volumes of “dead air” from the sampling train and vapor point using a graduated syringe, pump, or similar. The purging should be conducted at a low-flow rate (i.e., less than 200 ml/min). Close valve on auxiliary line.
- **If conducting a helium tracer test**, connect portable tracer gas detector to auxiliary line and open valve. If the detected tracer gas concentration is 5% or



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more of helium concentration within the shroud, the sampling point and sampling train should be examined for potential leaks and the tracer test reconducted.

- To begin sampling, ensure valve on auxiliary tubing is closed. Open valve on sampling canister and record canister vacuum. If canister is not under full vacuum, do not use canister for sample collection. Record time sample collection began.
- Close sampling canister valve when the vacuum on the sampling canister reaches near 2 to 3 inches of mercury of vacuum (or per laboratory's instructions) in the sampling canister after sample collection for comparison with the vacuum measured upon laboratory receipt to identify possible canister leaks during sample shipment. Record the time sampling was completed and the final vacuum reading.
- Disassemble sampling train. For temporary sampling points, remove sampling point and patch floor slab using patching compound and putty knife. If a permanent or flush mount sampling point is being used, place flush mount cover in the 1 1/2-inch diameter hole.
- Deliver/ship sampling canisters maintaining chain-of-custody. Sampling canisters are typically sent back to the laboratory in originally supplied box and packaging and do not require cooling/chilling.

7. REFERENCES

- No specific references for this procedure are required.

8. TRAINING AND CERTIFICATION

- Training of new hires and less-experienced staff to be completed by skilled project staff, PM, APR or SME.
- Check Terracon University for training modules that may be available.

Attachment: Field Data Form: Sub-Slab Soil Gas Sampling



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FIELD DATA FORM: SUB-SLAB SOIL GAS SAMPLING

PROJECT NAME: _____ Sample ID: _____

PROJECT NO.: _____ Sample Date: _____

Outside Temperature: _____ °F / °C Indoor Temperature: _____ °F / °C

Building Type/Use: _____ Occupant: _____

Description of Room/Sample Area: _____

HVAC Unit Operating? Term Prior to Sampling? _____ (48 hours recommended)

Floor Materials / Covering: _____

Subslab Utilities and Distance from Probe: _____

Potential VOC sources in the vicinity: _____ Distance from probe: _____ ft.

Drill/Corehole Details

Slab Coring/Drilling Equipment Used: _____

Outer Hole Thickness: _____ in. (Typical 1 inch, max recommended 1.5 inches)

Slab Thickness: _____ in. (Drilled as 3/8-inch pilot hole through slab)

Base Material Beneath Slab (circle one): sand gravel clay crushed rock other: _____

Apparent Moisture Content (circle one): dry moist wet (do not sample if saturated)

Gas Probe Details

Sample Tubing Length (in.): _____ Sample Tubing Diameter (in.): _____

Tubing Depth from Top of Slab (in.): _____ (Tubing should 'float' approx. 1/4-inch above hole bottom)

Anchoring Cement Type / Name: _____

Surface Completion / Protection: _____

IF VaporPin™ Used, Circle Type: brass stainless-steel Pressure Reading: _____

Sample Purging

Equilibration time between probe installation and purging: _____ hours / days (24 hours recommended)

Tubing Type: _____ Tubing Length: _____ ft. Tubing Diameter: _____ inch

Purging Method: _____ Pump Rate: _____ ml / min. Purging Duration: _____ min.

Volume Purged: _____ ml (Refer to Table 2 on page 13 of guidance for assistance with calculating volume purged)

PID / FID at Initial Purge: _____ ppm PID / FID at Sample Collection: _____ ppm

Leak Test Prior to Sample Collection? Yes No Method _____

Vacuum Shut-in Test

Pre: Start Time: _____ Vacuum: _____ "Hg Stop Time: _____ Vacuum: _____ "Hg

Post: Start Time: _____ Vacuum: _____ "Hg Stop Time: _____ Vacuum: _____ "Hg

Sample Collection

Sample Container (circle one): 1L 6L Cannister#: _____

Flow Controller (circle one): 100 ml/min 200 ml/min Flow Controller#: _____

Start Time: _____ Vacuum: _____ "Hg Stop Time: _____ Vacuum: _____ "Hg

LEL _____ % O2 _____ % H2S _____ ppm CO _____ ppm CO2 _____ % CH4 _____ ppm

Sample Point In-Situ Pressure Reading _____ pa

Split Sample? Yes No Describe Split Method: _____

Comments: _____

Form Completed By: _____ Date: _____

Project #
Sampler

Soil-Gas Sampling Log
Project Name
Sample Date



Sample ID	Date	Summa ID	Flow Controller ID	Shut-In Test (x1) pass/fail	Helium Test (x3)* pass/fail	Start Time	Start Pressure	End Time	End Pressure	Sample Time (= end time)

* Helium should be between 15-18%. Passing percent must be 10% or less of the starting helium concentration



**Groundwater Sample
Quality Control Log**
(Gallons/Casing Volumes)
Version Date 2010.01.01

Project #: _____ \ Project Name: _____ \
Sample ID: _____ Sample Location: _____
Sample Date: _____ Sample Time: _____ Sampler's Name: _____

Equipment Decontamination

Equipment	Decontaminated prior to use?	Decontamination Method
	Yes No	
	Yes No	
	Yes No	

Well Measurements

Casing Diameter (inches): _____ Casing Elevation Reference Point: _____
Depth to Product (DTP; ft): _____ Thickness of Product (DTW – DTP; ft): _____
Depth to Water (DTW; ft): _____ Length of Water in Well (TD – DTW; ft): _____
Total Depth of Well (TD; ft): _____

Casing Volume Calculations

Well casing volume (gal) = (Unit Casing Volume gal/ft) (length of water in well (ft)) = _____

Three Casing Volumes (gal) = (3)(Well Casing Volume (gal)) = _____

Casing Diameter (in)	1	1.5	2	4	6	8
Unit Casing Volume (gal/ft)	0.04	0.1	0.16	0.65	1.5	2.6

Conversions: 1 gallon = 3.8 L 1 L = 1.057 quarts
1 ft³ = 7.48 gallons 1 L = 1000 mL

Water Quality Parameters

Purging Start Time: _____ Purging End Time: _____ Total Purge Time: _____ Purged dry? _____ Y _____ N

Time	Purge Volume (L) or (gallons)	Temp. (°C) or (°F)	D.O. (mg/L)	Conductivity (mS/cm)	pH	ORP (mV)	Water Description (color, odor, sheen, etc.)

Sample Information

Container (type and volume)	Supplied by lab?	Preserved?	Field Filtered?	Analyses Requested
	Y N	Y N	Y N	
	Y N	Y N	Y N	
	Y N	Y N	Y N	
	Y N	Y N	Y N	



Project #: _____

Project Name: _____

Monitoring Well ID	Date	Time	Measurements			Calculations			Notes
			Depth to Product (DTP; ft)	Depth to Water (DTW; ft)	Total Depth of Well (TD; ft)	Product Thickness (DTW - DTP; ft)	Water Column Length (TD- DTW)	Purge Volume (Gal/Ltr)	Comments

Notes:

Project No. _____
 Project Name _____

Date _____
 Tech _____

Draw survey benchmark on map and describe Location below.

Benchmark should be the same location on all survey transits.

MUST have overlap of Benchmark and at least 1 MW; best practice to have 2 MWs overlap.

	Survey 1		Survey 2	
	TOC	GL	TOC	GL
MW-1				
MW-2				
MW-3				
MW-4				
MW-5				
Benchmark				

TOC Difference (Survey 1 - Survey 2)
0
0
0
0
0
0

These should be all
be the same

Relative Elevations (Adjust Survey 2 by the TOC difference)	
TOC	GL

Benchmark Location: _____

Appendix D
Draft of Public Notice

**Salt Lake City Corporation
Notice of Public Hearing
Regarding EPA Brownfield Grant Funds**

NOTICE IS HEREBY GIVEN that Salt Lake City Corporation will hold a **virtual public** hearing on **Month, day, 2026 at X:00 p.m. MDT** (**virtual meeting link or address**) to provide interested parties an opportunity to express their views on the federally funded Brownfield Cleanup Grant project.

On or about **Month, day, 2026**, Salt Lake City Corporation intends to commence implementation of an Environmental Protection Agency (EPA) Brownfields Cleanup grant and a Remedial Action Plan at a property located at 22 South Jeremy Street, Salt Lake City, Utah (site). The investigation and remediation activities are funded EPA Brownfield grants. Past uses of the property have resulted in releases of chlorinated and non-chlorinated volatile organic compounds (VOCs) and metals that have impacted portions of the property. The Salt Lake City Corporation proposes to repurpose the property for retail or light industrial use, utilizing the current building, to support rehabilitation of the Folsom Avenue corridor as a public space and development corridor. These funds are to be used for the investigation and cleanup of environmental impacts from the former commercial and industrial uses of the site, and other associated costs. Salt Lake City Corporation encourages citizens, business owners, and other interested stakeholders to attend the **Month, day, 2026 virtual** meeting to provide feedback and comments regarding the grant application and plans for cleanup and reuse of the property.

Information related to this project or the public hearing, including a copy of the **draft** Remedial Action Plan are available for review on Salt Lake City Corporation's website at **website link**.

Emails and mailed comments submitted to the email, website links, and physical address provided below must be received within the 30-day public comment period, which ends at **X:00 p.m. MDT** on **Month, day, 2026**, to ensure inclusion of such comments in the official record of the public hearing proceedings.

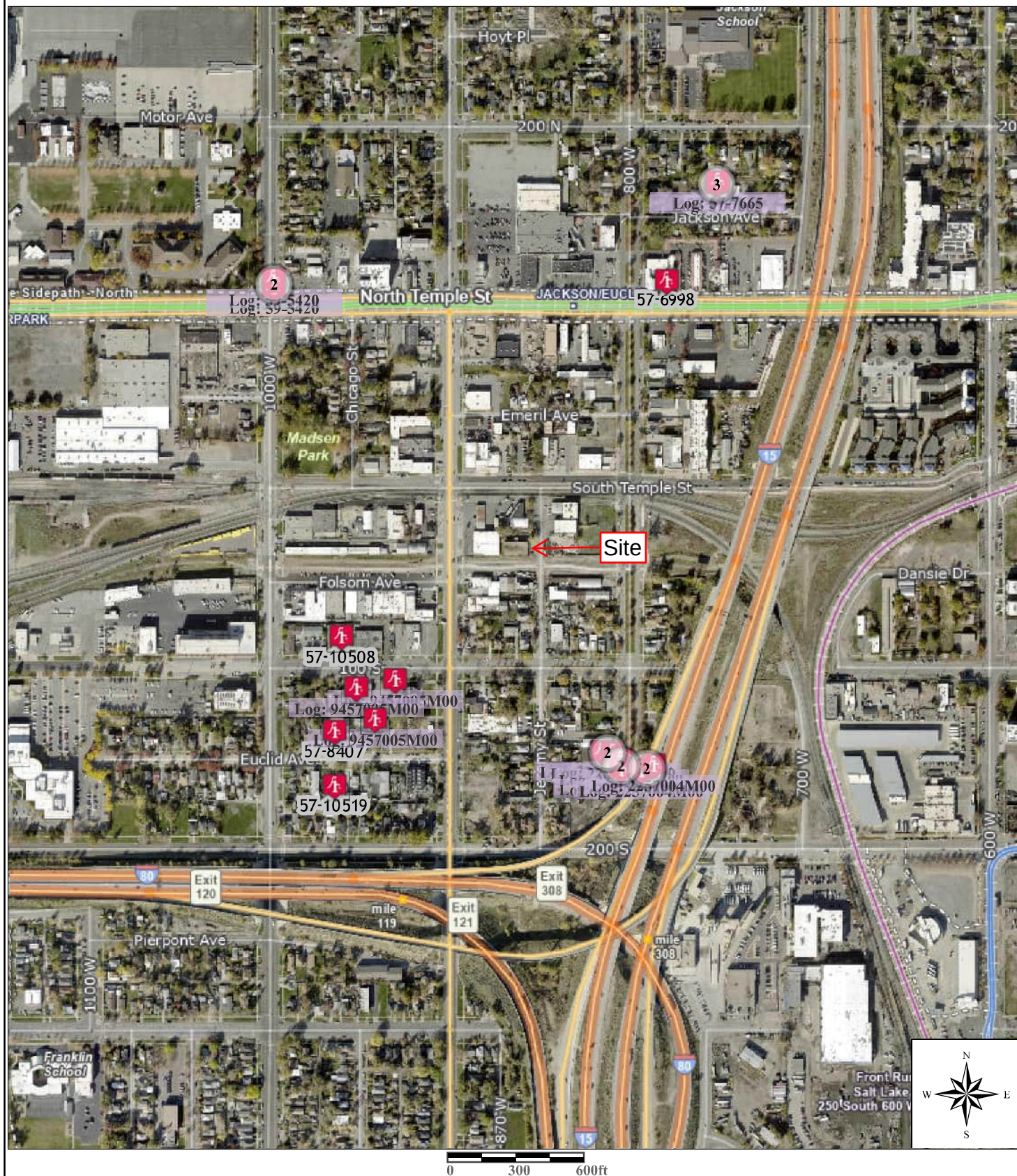
For non-English speaking persons, those without internet access, or those who otherwise need assistance to attend the virtual public hearing, please contact Mr. Austin Taylor no later than **X:00 p.m. MDT** on **Month, day, 2026**, at the contact information provided below. Every effort will be made to make reasonable accommodations for persons requesting assistance. For more information about the Public Hearing or Remedial Action Plan, please contact the following:

Austin Taylor
Project Manager, Community Reinvestment Agency
Salt Lake City Corporation
Website link
451 South State, Room 115
Salt Lake City, Utah 84111
(435) 705-3519
austin.taylor@slc.gov

Appendix E

Water Rights Points of Diversion

Water Rights Map



Water Right Details for 57-10508

Utah Division of Water Rights

12/9/2024 10:57 AM

(WARNING: Water Rights makes NO claims as to the accuracy of this data.)

Water Right: 57-10508

Application/Claim:

Certificate:

Owners:

Name: George T. Mattena
Address: 950 W 100 S
Salt Lake City UT 84104

Interest:

Remarks:

General:

Type of Right: Adjudication Decree
Quantity of Water: 0.4 ACFT

Source of Info.: Proposed Determination

Status:

Source: Underground Water Well
County: Salt Lake

Common Description: 57-7

Proposed Det. Book: 57-7

Map:

Pub. Date: 06/14/2018

Land Owned by Appl.: Yes

County Tax Id#: 1502202023

Dates:

Filing:

Filed: 11/03/2016

Priority: / /1904

Decree/Class:

Advertising:

Publication Began:

Publication End:

Newspaper:

Protest End Date:

Protested: Not Protested

Hearing Held:

Approval:

State Eng. Action:

Action Date:

Recon. Req. Date:

Recon. Req Type:

Certification:

Proof Due Date:

Extension Filed Date:

Election or Proof:

Election/Proof Date:

Cert./WUC Date:

Lapsed, Etc. Date:

Lap. Ltr. Date:

Wells:

Prov. Well Date:

Most Recent Well Renovate/Replace Date:

Points of Diversion:

Points of Diversion - Underground:

(1) S 680 ft. E 398 ft. from N4 corner, Sec 2 T 1S R 1W SLBM

Well Diameter: in.

Depth: to ft.

Year Drilled:

Well Log:

Well Id#:

Elevation:

UTM: 422477.29, 4513356.892 (NAD83)

Source/Cmnt:

Water Uses:

Water Uses - Group Number: 638835

Water Use Types:

Irrigation-Beneficial Use Amount: 0.08 acres Group Total: 0.08

Period of Use: 04/01 to 10/31

Place of Use (which includes all or part of the following legal subdivisions):

					North West				North East				South West				South East				Section		
					NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	Totals		
Sec	2	T	1S	R	1W	SLBM	Lot 2																0.08
Group Acreage Total :																			0.08				

Use Totals:

Irrigation sole-supply total: 0.08 acres

for a group total of: 0.08 acres

Segregation History:

This Right was Segregated from: none

as originally filed:	Flow in CFS	AND/ OR/ BLANK	Quantity in Acre-Feet	Water Uses						
				Irrigated Acreage	Stock (ELUs)	Domestic (EDUs)	Acre-Feet			
							Municipal	Mining	Power	Other
			0.65	0.13						

This Right as currently calculated:	Flow in CFS		Quantity in Acre-Feet	Water Uses						
				Irrigate Acreage	Stock (ELUs)	Domestic (EDUs)	Acre-Feet			
							Municipal	Mining	Power	Other
			0.65	0.13						

Appendix F
Background Threshold Value Calculation
Documentation

1				Background Statistics for Uncensored Full Data Sets								
2	User Selected Options											
3	Date/Time of Computation			ProUCL 5.2 1/13/2026 1:46:21 PM								
4	From File			N:\Projects\2023\61237386\Working Files\DRAFTS (Proposal-Reports-Communications)\Task 3.16 Schovaers B								
5	Full Precision			OFF								
6	Confidence Coefficient			95%								
7	Coverage			95%								
8	New or Future K Observations			1								
9	Number of Bootstrap Operations			2000								
10												
11	As-Subsurface											
12												
13	General Statistics											
14	Total Number of Observations			28	Number of Distinct Observations			27				
15	Minimum			1.6	First Quartile			5.838				
16	Second Largest			20.8	Median			8.775				
17	Maximum			21.4	Third Quartile			13.08				
18	Mean			9.978	SD			5.358				
19	Coefficient of Variation			0.537	Skewness			0.628				
20	Mean of logged Data			2.143	SD of logged Data			0.606				
21												
22	Critical Values for Background Threshold Values (BTVs)											
23	Tolerance Factor K (For UTL)			2.246	d2max (for USL)			2.714				
24												
25	Normal GOF Test											
26	Shapiro Wilk Test Statistic			0.94	Shapiro Wilk GOF Test							
27	1% Shapiro Wilk Critical Value			0.896	Data appear Normal at 1% Significance Level							
28	Lilliefors Test Statistic			0.134	Lilliefors GOF Test							
29	1% Lilliefors Critical Value			0.191	Data appear Normal at 1% Significance Level							
30	Data appear Normal at 1% Significance Level											
31												
32	Background Statistics Assuming Normal Distribution											
33	95% UTL with	95% Coverage	22.01	90% Percentile (z)			16.84					
34		95% UPL (t)	19.26	95% Percentile (z)			18.79					
35		95% USL	24.52	99% Percentile (z)			22.44					
36												
37	Gamma GOF Test											
38	A-D Test Statistic			0.206	Anderson-Darling Gamma GOF Test							
39	5% A-D Critical Value			0.752	Detected data appear Gamma Distributed at 5% Significance Level							
40	K-S Test Statistic			0.089	Kolmogorov-Smirnov Gamma GOF Test							
41	5% K-S Critical Value			0.166	Detected data appear Gamma Distributed at 5% Significance Level							
42	Detected data appear Gamma Distributed at 5% Significance Level											
43												
44	Gamma Statistics											
45	k hat (MLE)			3.341	k star (bias corrected MLE)			3.007				
46	Theta hat (MLE)			2.986	Theta star (bias corrected MLE)			3.318				
47	nu hat (MLE)			187.1	nu star (bias corrected)			168.4				
48	MLE Mean (bias corrected)			9.978	MLE Sd (bias corrected)			5.754				
49												
50	Background Statistics Assuming Gamma Distribution											
51	95% Wilson Hilferty (WH) Approx. Gamma UPL			21.34	90% Percentile			17.69				
52	95% Hawkins Wixley (HW) Approx. Gamma UPL			21.88	95% Percentile			20.92				

Arsenic Concentrations in the Subsurface - Background Threshold Value Input

Concentration (mg/kg)	Sample ID
4.62	SE-SB-01, 1- 2 FT
8.77	SE-SB-02, 1- 2 FT
8.47	SE-SB-03, 1.5- 2 FT
8.33	SE-SB-04, 1- 2 FT
17.5	SE-SB-05, 5-6.5 FT
10	SE-SB-06, 5-5.5 FT
16.5	SE-SB-07, 1- 2 FT
15.2	SE-SB-08, 0.5-1.5 FT
12.4	SE-SB-09, 1- 2 FT
15.1	SE-SB-10, 0.5-1 FT
11.8	SE-SB-11, 1-1.5 FT
10.1	SE-SB-12, 1-1.5 FT
7.1	SE-SB-13, 1- 2 FT
5.87	SE-SB-14, 1- 2 FT
5.05	SE-SB-15, 1- 2 FT
6.25	SE-SB-18 (3)
1.6	SE-SB-18 (8)
17.5	SE-SB-19 (4)
5.62	SE-SB-19 (8)
11.9	SE-SB-20 (3)
9.83	SE-SB-20 (11)
5.74	SE-SB-21 (3)
8.78	SE-SB-22 (3)
6.05	SE-SB-22 (7)
3.63	SE-SB-23 (3)
21.4	SE-SB-23 (10)
3.46	SE-SB-24 (3)
20.8	SE-SB-24 (7)

FT - feet

mg/kg - milligrams per kilogram

	A	B	C	D	E	F	G	H	I	J	K	L
1					Outlier Tests for Selected Uncensored Variables							
2	User Selected Options											
3	Date/Time of Computation			ProUCL 5.2 1/13/2026 2:11:46 PM								
4				From File	ProUCL_As.xls							
5				Full Precision	OFF							
6												
7												
8	Rosner's Outlier Test for As-Subsurface											
9												
10												
11	Mean			11.46								
12	Standard Deviation			9.55								
13	Number of data			29								
14	Number of suspected outliers			1								
15												
16				Potential	Obs.	Test	Critical	Critical				
17	#	Mean	sd	outlier	Number	value	value (5%)	value (1%)				
18	1	11.46	9.384	52.9	29	4.416	2.89	3.22				
19												
20	For 5% Significance Level, there is 1 Potential Outlier											
21	Potential outliers is: 52.9											
22												
23	For 1% Significance Level, there is 1 Potential Outlier											
24	Potential outliers is: 52.9											
25												