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Project Management Plan

Dewey Loeffel Landfill Superfund Site
Nassau, New York

May 15, 2012
Revised July 10, 2012
Revised July 25, 2012

Project Management Plan

Dewey Loeffel Landfill
Superfund Site
Nassau, New York

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Our Ref.:
B0031174

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1. Introduction

This Project Management Plan has been prepared to describe the management structure for implementation of each component of the Site Operating Plan (SOP) at the Dewey Loeffel Landfill Superfund Site located in the Town of Nassau, Rensselaer County, New York (site). The work described herein is being completed pursuant to the Administrative Settlement Agreement and Order on Consent for a Removal Action (CERCLA Index No. 02-2012-2005) (Consent Order) executed by the United States Environmental Protection Agency (USEPA), General Electric Company (GE), and SI Group, Inc. (SI Group), effective April 16, 2012. (GE and SI Group are referred to herein as Respondents.)

This Project Management Plan has been prepared to:

- Identify key project personnel;
- Identify the ARCADIS U.S., Inc. (ARCADIS) project team including associated subcontractors and their key personnel;
- Provide a summary of qualifications, including education and/or experience, for key ARCADIS personnel and subcontractors; and
- Provide Quality Management Plans (QMPs) for proposed subcontractors.

1.1 Site Location and Description

The Dewey Loeffel Landfill (landfill) is located along the south side at 350 Mead Road between Nassau-Averill Park Road and Central Nassau Road. A map showing the location of the landfill and surrounding area is presented on Figure 1. Key features are presented on Figure 2.

The capped area of the landfill is roughly triangular in shape and situated in a low-lying area between two wooded hills. The landfill is bound to the north by Mead Road, and to the south, west and east by undeveloped forested land. The rural area surrounding the landfill is sparsely populated and contains few residential properties and a bowhunter's club lodge.

Topography in the area generally slopes downward from east to west. Surface water at the landfill mostly drains to the west toward the Valatie Kill via Tributary T11A. The Valatie Kill flows in a southwesterly direction to Nassau Lake, located approximately three miles downstream. Surface water from a portion of the landfill flows to the south into a small unnamed tributary which discharges into Valley Stream and ultimately Nassau Lake.

The hydraulic gradient of groundwater in overburden soils in the vicinity of the landfill is generally to the west and/or southwest. The hydraulic gradient of groundwater in the bedrock is similar. However, based on the distribution of volatile organic compounds (VOCs) in a groundwater contaminant plume emanating from the landfill to the south, bedrock groundwater flows primarily to the south and is influenced by the presence of fractures within the bedrock.

1.2 Site History

As described in the Consent Order, from approximately 1952 to 1968, the landfill was owned and operated by several companies including the Loeffel Waste Oil and Removal Service Company (Loeffel Companies) as a waste disposal facility. During this time, the landfill consisted of two waste lagoons located in the western and central portions of the landfill, a 6-foot deep oil pit in the east central portion of the landfill, four 30,000 gallon aboveground storage tanks, and a drum disposal area located in the southeastern portion of the landfill.

Landfill disposal operations reportedly ceased in 1968 by order of the New York State Department of Environmental Conservation (NYSDEC). Between 1970 and 1975, remedial actions undertaken by the Loeffel Companies included covering and grading the drum disposal area, oil pit and lagoons, and constructing a system of drainage ditches around the landfill. From 1974 to 1980, the Loeffel Companies reportedly also operated a waste oil transfer station utilizing the four 30,000 gallon aboveground storage tanks.

On September 23, 1980, GE entered into an agreement with NYSDEC which required GE to perform field investigations, submit an engineering report which discussed the collected data, identify remedial alternatives, and recommend a remedial alternative. A remedy was subsequently selected by NYSDEC and involved the installation of soil-bentonite cutoff wall around the landfill, an overlying clay cap, and a landfill leachate collection system below the cap within the cutoff wall. The design of the remedy was performed by GE and approved by NYSDEC. The remedy was subsequently implemented by NYSDEC using funding provided by GE, Schenectady Chemicals, Inc. (now SI Group), and Bendix Corporation (now Honeywell International, Inc.). Beginning in 1983, NYSDEC and/or GE performed a variety of response actions at the site, some of which were performed in accordance with Records of Decision (RODs) issued by NYSDEC in January 2001 and January 2002. The response actions included, but were not limited to, the following:

- Installation and operation of a bedrock groundwater recovery well system involving three extraction wells located to the south of the landfill;

- Transportation of landfill leachate and extracted groundwater for off-site treatment;

- Installation, operation, maintenance and monitoring of point-of-use treatment systems for five residential wells (located on four properties) to remove VOCs;

- Routine VOC monitoring of other residential wells located near the landfill; and

- Routine monitoring of many groundwater monitoring wells located outside the landfill's perimeter fence.

The current groundwater extraction system was designed and constructed by NYSDEC, and is located along the approximate centerline of the VOC plume to the south of the landfill and includes three bedrock extraction wells (designated EW-1, EW-2 and EW-3, see Figure 2). Beginning in late March 2008 and through 2010, NYSDEC extracted groundwater from these three extraction wells on a seasonal basis, operating during the spring, summer, and fall months. Along with landfill leachate, extracted groundwater was transported for off-site treatment and disposal. NYSDEC transported landfill leachate for off-site treatment and disposal each year since 1991 with the exception of 1994. NYSDEC continued operation of the landfill leachate collection system through October 2011. Operation of the groundwater extraction system by NYSDEC did not resume after shutdown in the fall of 2010 until July 2011.

At the request of NYSDEC, USEPA proposed the site for inclusion on the National Priorities List (NPL) on March 4, 2010. The site was subsequently added to the NPL on March 10, 2011.

USEPA subsequently took over operation of the landfill leachate collection system and the groundwater extraction system to the south of the landfill on October 31, 2011. USEPA winterized the system, allowing groundwater extraction to continue during the winter months.

Pursuant to the Consent Order, Respondents will assume responsibility from USEPA for continued operation and maintenance of the landfill leachate collection system and the groundwater extraction system. The landfill leachate and extracted groundwater will be transported for off-site treatment and disposal until such time as the planned new treatment system is designed, constructed and approved for operation. Pursuant to the Consent Order, Respondents will design and construct a treatment system to treat landfill leachate and extracted groundwater. Upon USEPA approval that the treatment system discharges will meet the effluent discharge limits set under the Consent Order, transportation of landfill leachate and extracted groundwater for off-site treatment will cease.

1.3 Report Organization

This report is organized into the sections described below.

Section	Description
Section 1 – Introduction	Provides the objectives of this Project Management Plan, description and history of the landfill, and the Project Management Plan organization.
Section 2 – Overall Project Management	Describes the overall project management structure to be implemented including associated responsibilities and qualifications.
Section 3 – ARCADIS Project Management Structure	Describes the ARCADIS project management structure to be implemented including associated responsibilities and qualifications.
Section 4 – ARCADIS Subcontractors Project Management Structure	Describes the project management structures for ARCADIS subcontractors to be implemented including associated responsibilities, qualifications, and quality management plans.

2. Overall Project Management

The overall management structure for those involved with implementing the SOP is described in this section and shown on the Project Management Organizational Chart provided in Appendix A. USEPA's current On-Scene Coordinator is Ms. Margaret Alferman. USEPA's current Remedial Project Manager is Mr. Ben Conetta. USEPA's On-Scene Coordinator and Remedial Project Manager will be responsible for conducting oversight of the work performed under the Consent Order.

As specified and approved by USEPA in the Consent Order, Mr. Paul Wm. Hare, of GE's Corporate Environmental Programs, is Respondents' current Project Coordinator on behalf of GE and SI Group. Mr. Hare will be responsible on behalf of the Respondents for oversight of implementation of the Consent Order with the following duties:

- Maintain communication and correspondence with USEPA;
- Be knowledgeable about all matters relating to the work being performed under the Consent Order;
- Confirm that all work requiring certification by a professional engineer licensed in the State of New York is reviewed and certified by such;
- Notify USEPA of any proposed substantive changes to the approved SOP; and
- Be present on-site or readily available for USEPA to contact during implementation of work being performed under the Consent Order.

The Respondents' Technical Representatives include Mr. Hare for GE and Mr. Keith Cowan from Clough Harbour & Associates for SI Group.

3. ARCADIS Project Management Structure

As specified and approved by USEPA in the Consent Order, ARCADIS is Respondents' current contractor for the work to be performed under the Consent Order. ARCADIS' management structure is shown in the Project Management Organizational Chart provided in Appendix A. ARCADIS provides consultancy, design, engineering and management services in the fields of Infrastructure, Water, Environment and Buildings. ARCADIS will be responsible for conducting, documenting, and certifying all work activities associated with implementing the SOP. As discussed in Section 4, ARCADIS will retain the services of subcontractors to perform specific components of the SOP. This section discusses the ARCADIS management structure for implementing the SOP and the associated responsibilities for each person or entity. Resumes for key ARCADIS personnel are provided in Appendix B.

3.1 Project Manager/Engineer of Record

Mr. Donald Sauda, P.E. will serve as the Project Manager/ Engineer of Record for ARCADIS. Mr. Sauda will be responsible for overseeing all aspects of the SOP.

Mr. Sauda has more than 30 years of experience and specializes in facility planning, permitting, process selection, detailed design, construction, and operations for wastewater, groundwater, and stormwater collection and treatment facilities. He received a Bachelor of Science Degree in Chemical Engineering and a Master Degree in Business Administration. Mr. Sauda is also a Professional Engineer in New York State.

The Project Manager/Engineer of Record will have the following responsibilities:

- Serve as the primary contact person between ARCADIS and the Project Coordinator and the Respondents' Technical Representatives;
- Serve as the official representative of ARCADIS responsible for technical requirements of the project;
- Confirm that appropriate technical review is performed by qualified representatives of ARCADIS for implementing each component of the SOP;
- As a New York State licensed Professional Engineer, review and certify all work requiring certification;
- Provide overall coordination of work activities with ARCADIS personnel and subcontractors;

- Confirm ARCADIS and subcontractor personnel are following Health and Safety (H&S) and Quality Assurance/Quality Control (QA/QC) procedures; and

- Notify the Project Coordinator and the Respondents' Technical Representatives of any proposed substantive changes to the USEPA-approved SOP.

3.2 Pump and Treat Design/Build Task Manager

Mr. Timothy Miller, P.E. will serve as the Pump and Treat Design/Build Task Manager for ARCADIS and will report to the ARCADIS Project Manager. Mr. Miller will be responsible for coordinating and overseeing all design and construction aspects of the treatment system for landfill leachate and the groundwater extraction wells to the south of the landfill.

Mr. Miller has 16 years of experience with an extensive background in engineering design and process operations. He received a Bachelor of Science Degree in Chemical Engineering and is a Professional Engineer in New York State. Mr. Miller has worked on many projects involving soil and groundwater remediation along with water and wastewater treatment design/build and operation and maintenance (O&M).

The Pump and Treat Design/Build Task Manager will have the following responsibilities:

- Provide day-to-day management of the design and construction processes;

- Spearhead the preparation of the Preliminary Design Plan, Preliminary Design Data Report, and Final Design/Implementation Plan;

- Procure equipment and subcontractors for the treatment system; and

- Confirm construction and operation of the treatment system is completed in accordance with the Design Report/Implementation Plan (including the Quality Assurance Project Plan [QAPP]) and Health and Safety Plan (HASP), and Consent Order requirements.

3.3 Pump and Truck Task Manager/Pump and Treat Design Field Leader

Mr. James Schidzick will serve as the Pump and Truck Task Manager as well as the Pump and Treat Design Field Leader for ARCADIS and will report to the ARCADIS Project Manager. Mr. Schidzick will be responsible for coordinating and overseeing all aspects of the pump and truck operations and the field aspects of the pump and treat design.

Mr. Schidzick has more than eight years of professional experience providing field, technical, engineering, and project management support for a variety of projects under various regulatory programs (Voluntary Remediation, CERCLA, RCRA, and TSCA). His experience encompasses a wide variety of project sites, including both active and inactive hazardous waste sites and former manufactured gas plant sites. He has experience in preparing and implementing investigation and cleanup plans, technical specifications, environmental assessments, HASPs, and coordinating waste disposal. He received a Bachelor of Science Degree in Environmental Science.

As the Pump and Truck Task Manager, Mr. Schidzick will have the following responsibilities:

- Spearhead the preparation of the Pump and Truck Work Plan and Transportation and Disposal (T&D) Plan;
- Provide for O&M of the landfill leachate collection and groundwater extraction systems;
- Coordinate off-site transportation of landfill leachate and extracted groundwater to the USEPA-approved water treatment facility(ies);
- Coordinate off-site transportation and treatment/disposal of drummed hazardous waste;
- Confirm manifest paperwork is complete and signed;
- Coordinate water level collection at select landfill monitoring wells; and
- Confirm field activities are completed in accordance with the Pump and Truck Work Plan, T&D Plan, HASP, and QAPP.

As the Pump and Treat Design Field Leader, Mr. Schidzick will have the following responsibilities

- Collect all landfill leachate, extraction well, and monitoring well samples in accordance with the Preliminary Design Plan and QAPP;
- Coordinate shipment of all collected samples to analytical laboratories and the treatability test facility using chain-of-custody procedures;
- Coordinate survey and geotechnical boring activities; and
- Confirm field activities are completed in accordance with the Preliminary Design Plan, HASP, and QAPP.

3.4 QAPP Development/Data QA/QC Manager

Mr. Dennis Capria will serve as the QAPP Development/Data QA/QC Manager for ARCADIS and will report to the ARCADIS Project Manager. Mr. Capria will be responsible for coordinating and overseeing all aspects of the QAPP development, data management, and data QA/QC.

Mr. Capria has more than 16 years of analytical laboratory, data management, and data validation experience in the environmental field. Currently, he is involved in the data management, data validation, and QA/QC oversight of analytical data. Mr. Capria's responsibilities have ranged from overseeing the daily data management requirements for large industrial sites to O&M of volatile and semi-volatile organic analytical instruments. His analytical chemistry experience includes various sample preparations, wet chemistry techniques, data generation, and data interpretation. He received a Bachelor of Science Degree in Biology.

The QAPP Development/Data QA/QC Manager will have the following responsibilities:

- Prepare a QAPP to cover both the pump and truck operations and the pump and treat preliminary design activities;
- Confirm that data collection including sampling and analyses are performed in accordance with the QAPP; and
- Confirm that a Non-CLP Superfund Analytical Services Tracking System form for analytical work performed under the Consent Order is submitted to the USEPA within 30 days after acceptance of the analytical results.

3.5 HASP Development Manager/ H&S Coordinator

Mr. David Groff will serve as the HASP Development Manager/ H&S Coordinator for ARCADIS and will report to the ARCADIS Project Manager. Mr. Groff will be responsible for coordinating and overseeing all aspects of the HASP development. Mr. Groff will also provide H&S support the ARCADIS Project Manager and Site Safety Officer (SSO).

Mr. Groff has more than 13 years of experience in water/wastewater design, construction management, project management, and health and safety compliance. He wrote, implemented, and audited site-specific HASPs for large construction/demolition, environmental remediation, and site assessment projects. He received a Bachelor of Science Degree in Mechanical Engineering and a Master of Science Degree in Environmental and Resource Engineering.

The HASP Development Manager/ H&S Coordinator will have the following responsibilities:

- Prepare a HASP to cover both the pump and truck operations and the pump and treat preliminary design activities;
- Confirm that the HASP is prepared in accordance with the "EPA Standard Operating Safety Guide" (PUB 9285.1-03, PB 92-963414, June 1992);
- Confirm that the HASP complies with all currently applicable Occupational Safety and Health Administration (OSHA) regulations found at 29 C.F.R. Part 1910;
- Disseminate H&S documents to ARCADIS project staff; and
- Support the ARCADIS Project Manager and SSO during field activities.

4. ARCADIS Subcontractors Project Management Structure

ARCADIS subcontractors will be responsible for implementing specific components of the SOP. Subcontractors are organized as shown on the Project Management Organizational Chart provided in Appendix A while subcontractor company brochures and resumes for key personnel are provided in Appendix C. Each subcontractor proposed for this project is discussed below.

4.1 Analytical Laboratory

Pace Analytical Services, Inc. (Pace) is the proposed analytical laboratory. Pace will be responsible for conducting analytical analyses for samples obtained during implementation of the Preliminary Design Plan, Design Report/Implementation Plan, and T&D Plan. Pace will subcontract with TestAmerica, Inc. for analysis of water samples for available cyanide. Pace will also subcontract with Columbia Analytical Services, Inc. for analysis of water samples for low level mercury by USEPA Method 1631.

Pace has been a provider of analytical services in the environmental industry for more than 30 years. Pace is comprised of 19 environmental testing laboratories, two life sciences labs, and ten service centers nationwide. Pace laboratories provide project support and comprehensive testing services for consulting, engineering, energy and utility companies, municipalities, industry and government professionals, as well as for the pharmaceutical and medical device industries worldwide. Appropriate laboratory certifications are provided in the QAPP. For more information on Pace, visit www.pacelabs.com.

The designated contact for Pace is Mr. William Kotas, Client Service Manager. Mr. Kotas has more than 21 years of experience in laboratory services. He is responsible for management of client services section including supervisory oversight of all project managers and project coordinators, sample receipt department, and courier services. He received a Bachelor of Science Degree in Physics with a minor in Chemistry.

Pace's designated contact will have the following responsibilities:

- Review the QAPP to verify that Pace's analytical operations will meet project requirements;
- Coordinate sample container provision and analytical requirements with the ARCADIS Pump and Truck Task Manager/Pump and Treat Design Field Leader; Review receipt of all sample shipments and notify the ARCADIS Pump and Truck Task Manager/Pump and Treat Design Field Leader of any discrepancies in a timely fashion;

- Conduct internal laboratory audits to assess implementation of the QAPP; and

- Provide rapid notification to the ARCADIS Project Manager regarding laboratory nonconformance with the QAPP or analytical QA/QC problems affecting sample analyses.

4.2 Soil Borings

Parratt-Wolff, Inc. (Parratt-Wolff) is the proposed driller for soil borings. Paratt-Wolff, Inc. will be responsible for completing geotechnical borings in the treatment building area to confirm the foundation design. Boring locations will be drilled to a depth of 20 feet (or refusal, if shallower) and sampled at 5-foot intervals (i.e., 3-5 feet, 8-10 feet, 13-15 feet, and 18-20 feet). There will be two boring locations and each location will be sampled four times. In addition to the standard penetration test (American Society for Testing and Materials [ASTM] D1586), the soils will be classified in accordance with the Unified Soil Classification System (ASTM D2487).

Parratt–Wolff is an employee-owned, full-service environmental and geotechnical drilling firm with over 40 years of experience. With three offices, 55 employees and over 40 major pieces of field equipment, they offer a range of technical investigation services from Maine to Florida and as far west as Michigan. For more information on Parratt-Wolf, visit www.pwinc.com.

The designated contact for Parratt-Wolff is Mr. Sean Pepling. Mr. Pepling manages various aspects of jobs performed at Parratt-Wolff from the preparation of proposals to the scheduling and oversight of field crews. Mr. Pepling also reviews Parratt-Wolff test boring logs and samples for accuracy and completeness. He received a Bachelor of Science Degree in Geology.

Parratt-Wolff's designated contact will have the following responsibilities:

- Coordinate soil boring activities with the ARCADIS Pump and Treat Design Field Leader;

- Manage Parratt-Wolff field personnel; and

- Confirm H&S and QA/QC requirement are met by Parratt-Wolff field personnel.

4.3 Leachate and Groundwater Transportation and Off-Site Treatment

Clean Harbors Environmental Services (Clean Harbors) is the proposed leachate and groundwater transportation and off-site treatment subcontractor. Clean Harbors will be responsible for transportation of landfill leachate and groundwater extracted from wells to the south of the landfill for treatment initially at their facility in Baltimore, Maryland. In the future, treatment may occur at a different facility in Bristol, Connecticut.

USEPA's subcontractor is currently transporting landfill leachate and groundwater extracted from wells to the south of the landfill for treatment at Clean Harbors' Baltimore, Maryland facility.

Clean Harbors is a leading provider of environmental, energy, and industrial services throughout North America. Clean Harbors serves over 60,000 customers, including a majority of the Fortune 500 companies, thousands of smaller private entities and numerous federal, state, provincial and local governmental agencies. For more information on Clean Harbors, visit www.cleanharbors.com.

The designated contact for Clean Harbors is Mr. Robert Bihlmeyer. Mr. Bihlmeyer has more than 14 years of experience and is a Lead Customer Service Representative for Clean Harbor's Bristol Service Center. His responsibilities includes scheduling waste pick-ups, supporting account managers, managing data for all active customers, and providing transportation and disposal technical support to field service representatives. He received a Bachelor Degree in History.

Clean Harbors' designated contact will have the following responsibilities:

- Set up a waste profile for the landfill leachate and extracted groundwater;
- Provide the ARCADIS Pump and Truck Task Manager with pre-printed manifests;
- Coordinate transportation scheduling with the ARCADIS Pump and Truck Task Manager;
- Coordinate landfill leachate and extracted groundwater treatment with the Clean Harbor facility; and
- Provide the ARCADIS Pump and Truck Task Manager with copies of all completed manifests.

4.4 Drummed Waste Transportation and Off-Site Treatment/Disposal

Waste Management, Inc. (Waste Management) is the proposed drummed waste transportation and treatment/disposal subcontractor. Waste Management will be responsible for the transportation of drummed hazardous waste to its facility in Model City, New York for subsequent treatment/disposal. In the future, treatment/disposal of drummed hazardous waste may occur at a different facility.

Waste Management has been in business for more than 44 years and operates more than 300 active landfill disposal sites and transfer stations, approximately 85 landfill gas-to-energy and waste-to-energy facilities, nearly 200 recycling plants and more than 450 hauling companies. The company offers its full range of environmental services to more than two million commercial and 25 million residential customers company wide. For more information on Waste Management, visit www.wm.com.

The designated contact for Waste Management is Mr. Christopher Lowe, Senior Industrial Account Manager. Mr. Lowe is responsible for pricing and coordinating approval for non-hazardous and hazardous waste disposal. Mr. Lowe has over 26 years of experience in the environmental remediation field. He received his Bachelor Degree in Manufacturing Technology Information.

Waste Management's designated contact will have the following responsibilities:

- Set up a waste profile for the drummed hazardous waste;
- Provide the ARCADIS Pump and Truck Task Manager with pre-printed manifests; Coordinate transportation scheduling with the ARCADIS Pump and Truck Task Manager;
- Coordinate treatment/disposal of the drummed hazardous waste by Waste Management; and
- Provide the ARCADIS Pump and Truck Task Manager with copies of all completed manifests.

4.5 Field Operations Support

Precision Environmental Services, Inc. (PES) is the proposed field operations support subcontractor. PES will provide O&M support services as requested by the ARCADIS Pump and Truck Task Manager. As a contractor to USEPA and NYSDEC, PES was involved in construction, operation and maintenance of the landfill leachate collection system and the groundwater extraction wells to the south of the landfill.

PES is a New York State certified woman-owned business enterprise that was established in December of 1991. Since its inception, PES has maintained a staff of professionals providing hydrogeological, engineering and contracting services. PES personnel have been involved with the successful completion of numerous site assessments, subsurface investigations and design/implementation of associated remedial response work scopes involving both petroleum and hazardous substances. For more information on PES, visit www.precisionenvironmentalny.com.

The designated contact for PES is Mr. Stephen Phelps, Operations Manager. Mr. Phelps' current duties are to plan, direct and oversee the day to day operations of the organization. This includes technical field staff as well as project management and professional staff for the environmental department. Mr. Phelps has more than 10 years of experience in the field. He received his Bachelor of Arts Degree in Environmental Science.

PES does not currently have any specific responsibilities but will provide O&M support for the landfill leachate collection and groundwater extraction systems along with the tanker truck loading operations as requested by the ARCADIS Pump and Truck Task Manager.

4.6 Field Sampling Support

Tetra Tech GEO is the proposed field sampling support subcontractor. Tetra Tech GEO will be responsible for field sampling support services as requested by the ARCADIS Pump and Treat Design Field Leader during implementation of the Preliminary Design Plan.

Tetra Tech GEO, formerly GeoTrans, Inc. (GeoTrans), was founded in 1979 as a firm specializing in groundwater flow and transport modeling. Today, Tetra Tech GEO is a leading provider of consulting, engineering, program management, construction management, and technical services. Tetra Tech GEO supports government and commercial clients by providing solutions to complex problems focused on water, environment, energy, infrastructure, and natural resources. For more information on Tetra Tech GEO, visit www.geotransinc.com.

The designated contact for Tetra Tech GEO is Mr. Christopher Tallon, Senior Project Scientist. Mr. Tallon manages hazardous waste management activities at former manufacturing sites and inactive landfills, including hazardous waste shipments, inspections, record keeping, training, and reporting. He also manages wastewater treatment and remedial operations at former manufacturing sites. Mr. Tallon has more than 15 years of experience in hydrogeologic investigations, hazardous waste disposal programs, and environmental site assessments at industrial facilities and communication tower siting locations in the United States and Canada. He received his Bachelor of Arts Degree in Environmental Science.

Tetra Tech GEO does not currently have any specific responsibilities but will provide field sampling support services as requested by the ARCADIS Pump and Treat Design Field Leader during implementation of the Preliminary Design Plan.

4.7 Pump and Treat Construction Contractor

The Pump and Treat Construction Contractor has not yet been selected. Following completion of the Design Report/Implementation Plan, a contractor will be selected to construct the treatment system.

4.8 Pump and Treat System Operator

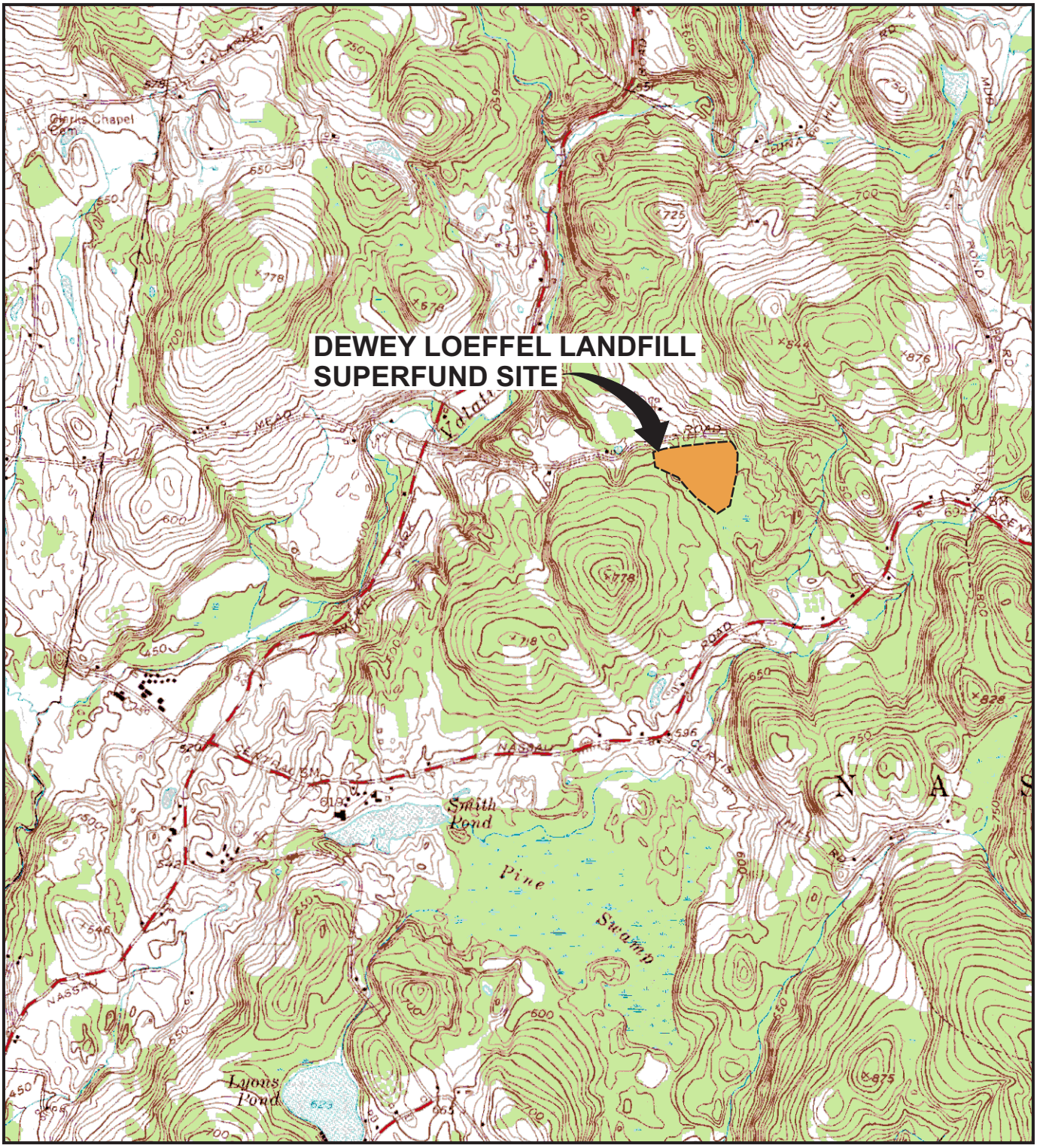
The Pump and Treat System Operator has not yet been selected. Following completion of the Design Report/Implementation Plan, a contractor will be selected to operate the treatment system.

4.9 Subcontractor Quality Management Plans

Quality Management Plans are provided in Appendix D for the subcontractors identified in this section.

ARCADIS

Figures



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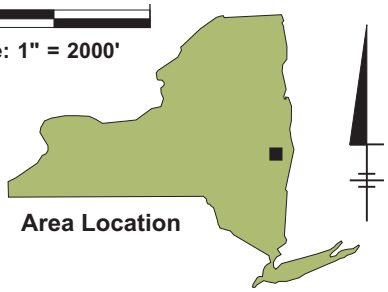
2000' 0 2000'

Approximate Scale: 1" = 2000'



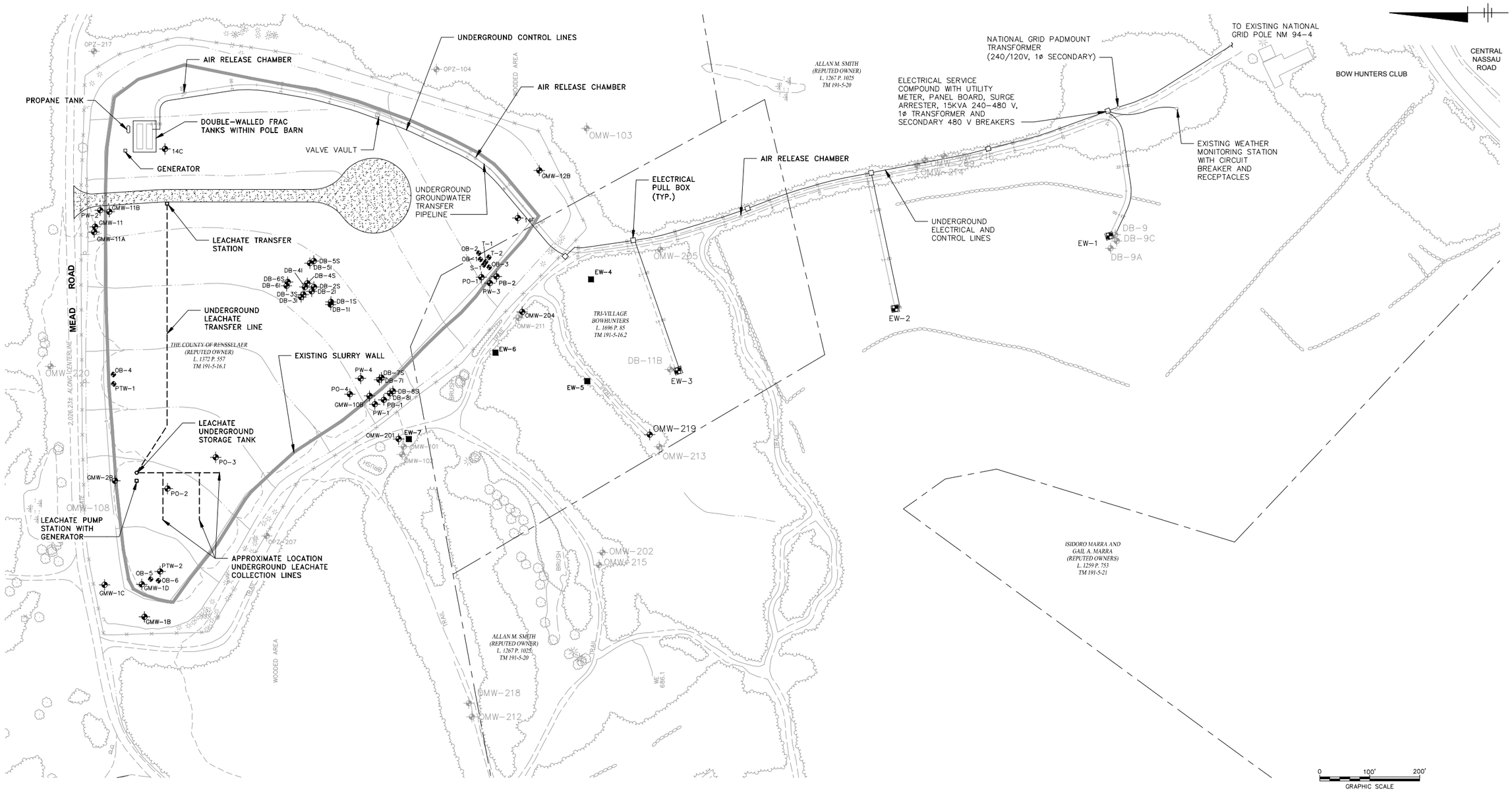
DEWEY LOEFFEL LANDFILL SUPERFUND SITE
NASSAU, NEW YORK

SITE LOCATION MAP

ARCADIS

FIGURE
1

04/116/2012 SYRACUSE, NY-ENV/CAD-141, DJHOWES
B0031174/0000/00001/CDR/31174N01.CDR



LEGEND

- FENCE
- PROPERTY LINES
- EXISTING ROADWAY
- STONE WALL
- 640 CONTOUR LINE
- SWALE
- EXISTING ROAD
- TREE LINE
- EXISTING EXTRACTION WELL
- PROPOSED EXTRACTION WELL
- OR EXISTING MONITORING WELL

DEWEY LOEFFEL LANDFILL SUPERFUND SITE
NASSAU, NEW YORK

SITE PLAN

ARCADIS

FIGURE 2

CITY:SYRACUSE-NY DIV/GROUP:ENVCAD DB:G.STEINBERGER LD:G.STEINBERGER PIC:P.FARR PM/TM: D.SAUDA LYR:ON=*;OFF=*REF*
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31174X01
31174X00

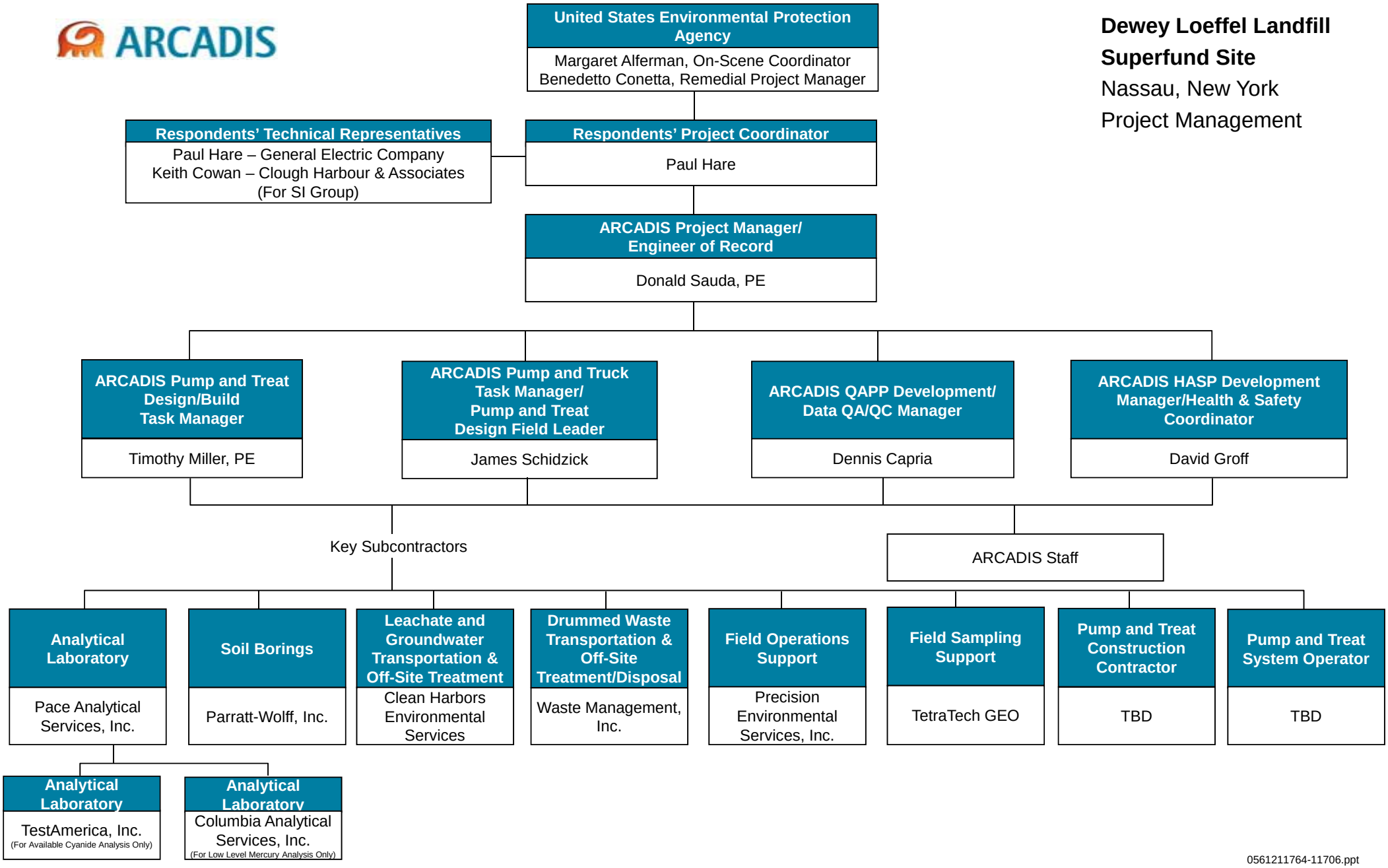
ARCADIS

Appendices

Appendix A

Project Management
Organizational Chart

Dewey Loeffel Landfill
Superfund Site
Nassau, New York
Project Management



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Appendix B

ARCADIS Resumes

ARCADIS

Education
MBA, Syracuse University, Syracuse, NY, 1989
BS, Chemical Engineering, Clarkson University, Potsdam, NY, 1981

Years of Experience
Total - 30
With ARCADIS - 23

Professional Registrations
Professional Engineer, NY

Donald F. Sauda, PE

Client Director

Mr. Sauda has more than 30 years of experience and specializes in facility planning, permitting, process selection, detailed design, construction, and operations for wastewater, groundwater, and stormwater collection and treatment facilities. He has extensive experience with SPDES permit application preparation and permit condition negotiations in New York State. Previously, Mr. Sauda was employed for more than 8 years in both production and engineering areas in the chemical industry.

Select Project Experience

Interim Remedial Measure
Chicago Pneumatic, Central New York

Managed the design and construction for the IRM to address VOCs in the surface water from an industrial facility. Design included the evaluation of four streams that discharged into a SPDES-permitted outfall during wet and dry weather. Treatment system consisted of a low-profile air stripper to treat influent pumped from two separate sources.

Storm Sewer Investigation
National Grid, New York

Managed the investigation at an active service center that was the site of a former manufactured gas plant (MGP). The purpose of the investigation was to identify the presence of MGP residual compounds in the storm sewer system and to determine the most appropriate corrective action. Dye testing was used to develop accurate mapping of the storm sewer system, and a sampling and analysis program was conducted to identify potential source areas. Based on these data, evaluated alternatives and recommended installation of a settling basin at the discharge of the storm sewer to collect MGP-residual-impacted sediments prior to discharge to an adjacent creek. Received NYSDEC approval of this recommendation, and managed preparation of the settling basin design.

Design and Construction of Groundwater Containment and Treatment System
Confidential Client, New England

Managed the design, permitting, and construction of the containment and treatment system at a Superfund site. The containment system included 15 vertical recovery wells and a hydraulic barrier consisting of a steel sheetpile wall. The steel sheetpile wall extended approximately 35 feet into bedrock and utilized water-tight interlocking joints. Treatment system included a 100 gpm metals pretreatment system, enhanced (UV/ peroxide) oxidation treatment system, liquid-phase GAC treatment system, and an air treatment system. The treatment system and all associated equipment are housed in a 7,000-square-foot building.

Process Evaluation for Wastewater Treatment System
Revere Copper and Brass, Central New York

Managed and was key team member of the process evaluation for a 200 gpm metals wastewater treatment system that was required as a special condition to a large manufacturing facility's SPDES permit. Evaluation included review of existing process information, interviews with treatment system operating personnel, and field observations. Prepared evaluation report describing the treatment system in detail and recommending 65 process improvements to be phased in over a three-year period.

Design of Groundwater Treatment System
Confidential Client, Central New York

Managed design of the 100 gpm groundwater treatment system at an inactive hazardous waste site where groundwater had been impacted by VOCs and metals. Treatment process included pH adjustment, chemical addition, clarification, air stripping, carbon absorption, and sludge dewatering. Groundwater is withdrawn using horizontal collection wells and is reinjected at the site through vertical reinjection wells.

Stormwater Pollution Prevention Plan (SWPPP)
Confidential Client, Central New York

Developed the SWPPP for a large manufacturing facility. Development included the preparation of a Best Management Practices (BMP) Plan to satisfy the requirements of a special condition in the facility's SPDES permit. Project also involved satisfying federal regulations that require that the SWPPP designate a pollution prevention team within the facility to develop and implement the SWPPP. SWPPP preparation included assessment of sources of potential pollutants to stormwater discharges, and use of the findings to prepare an inventory of BMPs for each identified source. As an outgrowth of the SWPPP, providing ongoing consulting services during negotiation of a modified SPDES permit with the NYSDEC.

Investigation of TCE and Phenols Contamination
Confidential Client, New York

Managed an investigation into contamination of a storm sewer system for a 175-acre industrial complex. Investigation included sewer reconnaissance and sampling program. Based on this investigation, developed technical language in consent order with the NYSDEC to bring the facility into compliance with SPDES permit. Evaluated the TCE limit in the facility's SPDES permit, conducted a hydrogeologic evaluation to determine the direction and velocity of groundwater flow, and consolidated all outfalls to two discharge points through the installation of 3,000 feet of storm sewers. Storm sewer system was designed for total flow of 225 mgd. Developed rainfall, flow, and TCE-sampling data collection programs, and used USEPA's stormwater management model to determine size of a TCE stormwater treatment facility. An 11,000-square-foot building was designed to house the 0.75 mgd TCE treatment plant.

Design/Build Turnkey of Stormwater Treatment System
Confidential Client, Upstate New York

Member of design team for design/build turnkey of the system at an industrial site. Manufacturing operations on this site had historically used PCBs in the manufacture of specialty metal products for the aerospace industry. The treatment system was designed to address periodic exceedances of the site stormwater discharge permit resulting from these historical PCB uses. The treatment system was designed and constructed to treat site-wide stormwater runoff up to the 25-year, 24-hour storm event for removal of PCBs to non-detect levels. The treatment system included a wet well pumping station, a 292,000-gallon water storage tank, and a 100 gpm treatment system consisting of sand filtration followed by carbon adsorption.

Design of Groundwater Treatment Facility
Confidential Client, Western Massachusetts

Contributed to the design of a groundwater treatment facility with a capacity of 1 million gallons per day (mgd). Conducted a metals treatability study to select the most effective chemical treatment and to provide a basis of chemical addition systems. Treatment processes included oil separation, equalization, pH adjustment, chemical addition, clarification, sand filtration, and carbon adsorption. Design activities involved the incorporation of existing groundwater extraction systems and a sludge-dewatering system in an adjacent treatment facility.

Two-Phase Project to Address Mercury-Contaminated Wastewater
Confidential Client, Cleveland, Ohio

Managed the design and provided construction observation for the two-phase project to address mercury-contaminated wastewater in an industrial and sanitary sewer system at an active industrial facility. The first phase involved installation of 1,500 feet of pipe, repiping of the main locker room, and the consolidation of the industrial and sanitary sewer systems. The second phase involved installation of 1,000 feet of pipe and abandonment or rerouting of 25 discharge points at the facility. Each phase was completed during 3-week shutdown periods in successive years and resulting in full compliance with the facility's discharge permit.

Storm Sewer Corrective Measures
Confidential Client, New York

Managed investigation, design, and implementation of corrective measures for PCB-impacted soils. The project included collecting 1,850 samples, cleaning and/or video inspecting 7,300 feet of storm sewer line, installing 8 manholes/catch basins, replacing 700 feet of storm sewer pipe, and excavation and offsite disposal of 13,000 tons of soil/sediment/debris/water. This work was conducted on 12 properties in a residential neighborhood.

Storm Sewer Corrective Measures
Confidential Client, New York

Managed investigation, design, and implementation of corrective measures for PCB-impacted soils and storm sewer at an industrial site. The project included collecting 500 samples, cleaning and/or video inspecting 8,000 feet of storm sewer line, installing nine manholes/catch basins, replacing or lining 1,500 feet of storm sewer pipe, and excavation and offsite disposal of 3,300 tons of soil/debris/water.

CERCLA Remedial Action Program
Confidential Client, North Carolina

Member of design team for the remedial action program at an active chemical manufacturing facility that required design and construction of a groundwater pre-treatment system for removal of VOCs (primarily 1,2-DCA). The project involved demolition of existing groundwater pretreatment equipment and construction of a new groundwater extraction trench and wells, more than 3,000 feet of aboveground pipe rack, and a 50 gpm treatment system consisting of a low-profile tray-type air stripper followed by catalytic oxidation (CatOx system with a caustic scrubber) of the vapor stream prior to discharge to atmosphere. This project was performed on a turnkey, design/build basis.

Design and Construction of In-Situ Air Stripper
Confidential Client, New York

Managed the design and construction of the air stripper at an inactive industrial facility. Following replacement of selected sections of storm sewer at the facility, low levels of VOCs remained in the discharge from the storm sewer. The source was traced to sections of the storm sewer beneath the plant building that could not be easily replaced or sealed. The in situ air stripper was installed in the last catch basin prior to the storm sewer discharge in order to remove VOCs via aeration.

Design/Build Turnkey Project
Confidential Client, Kentucky

Project manager for the project at a former die-cast facility that had PCB-impacted area groundwater and surface waters resulting from past operations at the site. The project involved design and construction of a new groundwater treatment system. Groundwater was collected in three caissons adjacent to the receiving stream and pumped to the new treatment system through 3,200 feet of 6-inch force main. The 70 gpm (250 gpm peak) treatment system was designed to upgrade an existing groundwater treatment system by removing PCBs via sand filtration followed by granular activated carbon adsorption. The treatment system included a 36-foot by 40-foot building addition, four 5,500-gallon polyethylene equalization tanks, two 2,500-gallon steel backwash recovery tanks, a pump station skid with four pumps, one sand filter skip unit with two 5,600-pound vessels, and two carbon adsorption skid units each with two 5,000-pound vessels.

Design/Build Turnkey Soil Remediation Project
Confidential Client, California

Member of design team for the remediation project at an active industrial facility that manufactures a variety of fasteners for the aerospace industry. Portions of the site soil and groundwater were impacted by VOCs, primarily TCE and PCE. The project included design and construction of an SVE system to remediate the site shallow soil zone (0 to 90 feet in depth). The SVE system includes 10 extraction wells, 13 passive vent wells, more than 700 linear feet of piping, a 350 scfm positive displacement blower, and five 2,000-pound carbon adsorption units operated under vacuum.

Stormwater Interim Corrective Measure
Confidential Client, New York

Managed the design and construction of the interim corrective measure at an active manufacturing facility. Following identification of the highest sources of VOCs, a section of the onsite storm sewer system was replaced with a water-tight HDPE sewer system. Following replacement of the sampling manhole, the stormwater discharge from the facility complied with the anticipated discharge limitations.

OMM Project Management
Confidential Client, New York

Providing OMM project management for two groundwater treatment systems. Duties include interfacing with operator, reviewing weekly/monthly reports, troubleshooting operating problems, submitting discharge monitoring reports, and overall financial management to the client.

Improvements to Leachate Treatment Systems
Confidential Client, New York

Managed design and construction of improvements to leachate treatment systems at three inactive hazardous sites. Improvements at the first site included replacement of the level-control system, addition of two flow meters, and addition of process piping to facilitate operations. At the second site, a 550-foot-long gravel access road was installed. Improvements at the third site included relocation and replacement of entire treatment system. Project included granular activated carbon (GAC) units, an ion exchange unit, a 10-foot by 12-foot building, and associated process pumps, piping, and controls. Design drawings for all improvements were submitted to and approved by the NYSDEC. Assisted in preparation of comment packages for draft SPDES permits at all three sites.

Air and Wastewater Environmental Compliance Services
Confidential Client, New Jersey

Provided onsite environmental compliance services at a large manufacturing facility. Responsible for identifying and verifying permit compliance status for all air emissions and wastewater discharges. Completed six air permit applications for air emissions that were discovered to be unpermitted. Provided day-to-day coordination with plant management, operations, and maintenance personnel.

Air and Wastewater Environmental Compliance Services
Confidential Client, New York

Provided onsite air and wastewater environmental compliance services at a large manufacturing facility. Responsible for administering both air and wastewater programs, including analytical testing, DMR submittals, and all other recordkeeping and reporting requirements. Also participated in negotiation of SPDES permit renewal with the NYSDEC.

Design of Sludge-Dewatering Facility
Confidential Client, New York

Managed the design of the sludge-dewatering facility at a RCRA-permitted TSDF. The facility included a plate-and-frame filter press, sludge dryer, and associated sludge-conditioning process. The filter press was located over the sludge dryer to minimize material handling.

Design of Groundwater Collection Trenches and SVE System
Confidential Client, New York

Managed design of the collection trenches and SVE system at a New York State listed inactive hazardous waste site to remediate VOC- and PCB-impacted site soils and groundwater at a former industrial manufacturing facility. This project included the design of multiple remedial tasks including the following: excavation of more than 2,500 cy of impacted soil and sediment and placement in an onsite containment cell, construction of two groundwater collection trenches totaling 800 feet in length, a leachate collection and storage system, and an SVE system. The SVE system consisted of a 30 hp, 250 scfm blower used to induce a vacuum through the vapor extraction piping located within the treatment cell. Extracted soil vapors were routed through a 1,000-pound carbon canister prior to release to the atmosphere or discharge back into the treatment cell.

Groundwater Investigation
Confidential Client, New York

Managed a groundwater investigation at a large industrial complex under the supervision of the NYSDEC. Project included installation of borings and monitoring wells to determine vertical and horizontal extent of contamination (primarily VOCs) and development and implementation of a storm sewer sampling program. Interim remedial measures (IRMs) for soil and/or groundwater were also evaluated based on the results of the field investigations. Each work element required a work plan submittal to NYSDEC for approval. The project also included negotiations with the NYSDEC for a new SPDES permit. As part of these negotiations, prepared three sets of comments to draft permits issued by the NYSDEC.

Water Supply System Design
Confidential Client, New York

Provided preliminary design services for water supply system to town. Services included evaluation of numerous source, transmission, distribution, and storage scenarios. For each scenario, necessary equipment (e.g., pipelines, valves) were sized, laid out, and priced. A number of financing and population growth assumptions were factored into the evaluation.

Remediation System Design
Confidential Client, New York

Designed remediation systems for BTEX contamination at more than 10 gasoline stations for a major oil company. System designs included free-product recovery, soil vapor extraction, and groundwater pump-and-treat systems.

Air and Wastewater Compliance Services
Confidential Client, New York

Plant engineer responsible for air and wastewater compliance at chemical manufacturing facilities. Duties included completing permit applications, discharge monitoring reports, and all other documentation. Also responsible for operation of wastewater treatment facility and RCRA compliance.

Improvements to Stormwater/Groundwater Treatment System
Confidential Client, New York

Managed design of improvements to an existing 250 gpm treatment system. The main parameters in the treatment system influent included VOCs and arsenic. The treatment processes include filtration, carbon adsorption, air stripping, chemical precipitation, clarification, sludge dewatering and ion exchange.

Soil Excavation Project
Confidential Client, Maryland

Managed design and implementation of the excavation at an inactive manufacturing facility. Based on previous investigations, a 215-cubic-yard area in the vicinity of a former oil vault was identified as being impacted by low levels of VOCs. To facilitate sale of this property by the owner, approximately 275 tons of soil were excavated and transported to a Subtitle D landfill for use as soil cover material.

Design of Temporary Leachate Treatment System
Confidential Client, New York

Managed design and provided construction administration for the temporary 30 gpm leachate treatment system at an inactive hazardous waste site, where the constituents of concern included VOCs and PCBs. Design included an air stripper and associated pumps, piping, and controls for an onsite treatment facility and a loading area for transfer of leachate to tank trucks for offsite disposal at a nearby facility. Contingencies for oil/water separation, ion exchange, and activated carbon treatment systems were also incorporated into the design. Project included preparation of detailed plans for construction, startup, and operation of the treatment system. Prepared several related plans, including a construction quality assurance (CQA) plan, sampling and analysis plan (SAMP), transportation plan, demobilization plan, and preparedness, prevention, and contingency (PPC) plans.

Field Treatability Study
Confidential Client, New York

Designed and performed the treatability study for pond water containing PCBs and algae particles. Successful removal of the algae particles was required to allow for the PCB limit of 65 parts per trillion to be achieved in effluent. The treatability study was the basis of a 400 gpm pond dewatering treatment system that included clarification, sand filtration, and carbon filtration.

Treatment System Design
Confidential Client, New York

Designed the system to remove lead from wastewater. Using a spare tank at the facility, a clarifier was designed to consistently meet the discharge limit for lead.

Remedial Engineering Evaluation
Confidential Client, New York

Managed preparation of the evaluation at a large industrial complex where constituents of concern included organic and inorganic compounds. Prepared a report evaluating the technical and economical feasibility of various groundwater treatment systems, including air stripping, activated carbon, biological, and steam stripping, and soil treatment systems, including excavation and in-situ vapor extraction.

Design/Build Water Treatment Plant Upgrade Project
Confidential Client, New York

Technical advisor for the project to support the upgrade of an existing groundwater and surface water treatment facility at an active pesticide and herbicide formulating facility. The objectives of the design upgrades were to increase the treatment system throughput rate from 150 gpm to 250 gpm and automate operations. The treatment system was designed to remove VOCs, pesticides, and arsenic. Upgrades included designing and installing a new low-profile air stripper, ferric chloride addition system, lime addition system, multi-media filter system, new instrumentation, and a central PLC-based control system. Responsibilities included treatability study development and implementation, final treatment system design and specification, development of construction documents and subcontractor bid packages, and engineering support services during turnkey construction activities.

Design of Groundwater Collection and Treatment System
Confidential Client, New York

Technical advisor for the design of two pumping manholes, a groundwater treatment system, and a pre-engineered building. The groundwater treatment system was designed to treat 50 gpm of groundwater and consisted of one 3,000 gallon solids/DNAPL settling tank, an oil-water separator, bag filter system, organoclay system, granular activated carbon system, and anion resin system. Responsibilities included final treatment system design and specification, basis of design document preparation, and engineering support services during construction activities.

Process Wastewater Treatment System Upgrade
Confidential Client, New York

Technical advisor for the upgrade of the wastewater treatment system at an active industrial plating facility. Wastewater treatment system upgrades included replacing a single-stage cyanide destruction system with a two-stage cyanide destruction system and installing a new chrome reduction system. Upgraded cyanide destruction system designed for an instantaneous flow rate of 30 gpm and included two 550 gallon tanks with mixers, sodium hydroxide metering pump, sulfuric acid metering pump, two sodium hypochlorite metering pumps, two pH controllers and two ORP controllers. Upgraded chrome reduction system designed for an instantaneous flow rate of 30 gpm and included one 550 gallon tank with mixer, sulfuric acid metering pump, sodium metabisulfite metering pump, and on pH/ORP controller. Responsibilities included treatability study development and implementation, final treatment system design and specification, and construction oversight support.

Lead Sampling Program
Confidential Client, Illinois

Developed the sampling program for wastewater sources at manufacturing facility. Following receipt of analytical results, completed evaluation of applicable treatment options. Two alternatives were selected for bench-scale treatability studies; an ultrafiltration treatment system was recommended as most appropriate. Completed design for installation of ultrafiltration treatment system.

Management and Disposal of Remediation Operations
Confidential Client, New York

Plant engineer responsible for management and disposal of remediation operations involving mercury-contaminated waste. Wastes included a wide range of materials, including brine sludges, dirt, stone, and concrete.

Improvements to Landfill Leachate Treatment System
Confidential Client, New York

Managed the design and served as lead process engineer for improvements to the system to remove PCBs, VOCs, and iron. The project included construction of an 1,800-square-foot building, with associated utilities. The process equipment included a flocculation tank with paddle-mixer, clarifier sludge pump and settling tanks, solid and carbon filtration systems, and a recycle system to return treated water to the landfill. Prepared operating manuals for landfill maintenance and leachate system.

Management and Disposal of Mercury-Containing Solid Waste
Confidential Client, New York

Plant engineer responsible for management and disposal of the waste. Duties included daily inspection of a less-than-90-day storage area, labeling, in-house training of personnel, manifesting, selection of waste transportation and disposal contractors, and recordkeeping. Facility generated approximately 150 tons of mercury-containing solid waste per year.

Air and Wastewater Permitting
Confidential Client, New York

Successfully completed five air permits to construct and water-discharge permits for expansion at a wire manufacturing facility. Additionally, researched and prepared report to successfully allow facility to be assigned effluent limits from the local POTW instead of the more stringent USEPA pretreatment limits.

Capital Program
Confidential Client, New York

Managed installation of the capital program negotiated through a consent order to improve environmental reliability at a chemical facility. Program included a plant audit to improve equipment reliability followed by development of a BMP program for the plant. The BMP program focused on conditions that could result in the discharge of a significant amount of pollutants. Proposed preventative programs included installing a chlorinated condensate treatment system, community and plant perimeter warning system, two emergency absorption systems for stack discharges, and an emergency power generator.

Process Wastewater Treatment System Upgrade
Confidential Client, North Carolina

Served as project manager for the system upgrade at an active industrial specialty wire manufacturing plant where pretreated process wastewater was dumped from batch dipforming, annealing, and electroplating operations. Wastewater pretreatment consisted of pH adjustment and clarification for metals removal prior to discharge to the sanitary sewer. Periodic permit violations led to the initiation of a wastewater treatment study to identify potential treatment system modifications to provide for full discharge permit compliance. Based on the study results, it was determined that acid and caustic bath dumps should be removed from the waste stream and disposed of offsite and/or metered slowly into the 25,000 gpd treatment system to avoid system upset. A treatment system upgrade design was completed that included an addition to the existing wastewater treatment plant to house a 5,000-gallon caustic storage tank and a 5,000-gallon acid storage tank for storage of bath dumps, pumps, controls, and other related equipment. In addition, a pre-engineered multimedia filter was installed after the existing clarifier to provide final polishing.

Wastewater Management
Confidential Client, Ohio

Provided onsite wastewater management at an active industrial facility for a three-month period. First developed an action plan of more than 100 items that included wastewater characterization, elimination of selected discharges, comprehensive review of the basis of categorical discharge limits, and calculation of more appropriate discharge limits. Among the accomplishments were relocation of a compliance sample point to obtain a more representative sample, segregation of a rinse step from a production process to eliminate contamination of the entire wastewater discharge, and modification of a metal cleaning process to eliminate fluoride contamination of the rinse water discharge.

Design of Groundwater Collection and Treatment System
Confidential Client, Michigan

Technical advisor for the design of the system. The project included design of four extraction wells (50 to 100 gpm each) and associated pumps and piping, a groundwater treatment system, a pre-engineered building, and two re-injection fields. The groundwater treatment system was designed to treat 300 gpm of groundwater and consisted of two 10,000 gallon equalization tanks, a sequesterant addition system, a multi-media filter, one low-profile air stripper system, and a solids handling system. Responsibilities included final treatment system design and specification, treatability study development and implementation, basis of design document preparation, and engineering support services during construction activities.

VOC-Contaminated Sediment Excavation
Confidential Client, New York

Managed design and implementation of the excavation from a stormwater drainage ditch at an inactive manufacturing facility. This excavation was conducted in conjunction with the installation of a water-tight storm sewer system in the ditch to eliminate the infiltration of groundwater. In total, approximately 140 cubic yards of sediment was excavated from varying depths to 12 inches and shipped offsite as hazardous waste. This project also included the removal and offsite disposal of an additional 120 cubic yards of hazardous debris generated from excavation of existing sewer manholes/pipes, tank foundations, and oil storage facilities.

Improvements to Municipal Potable Water Supply System
Confidential Client, New York

Managed design and provided construction administration for improvements to the water supply system. Installed and provided start-up services for a 500 gpm well water supply system. Additional improvements included design and installation of a 600,000-gallon concrete reservoir, 20 spring water collection manholes, and automation of well water-supply and treatment system. Project included design and implementation of a pilot study for various treatment options for hydrogen sulfide found in well water.

Membrane Ultrafiltration Mercury Wastewater Treatment Pilot Study
Confidential Client, New York

Plant engineer responsible for designing and maintaining the pilot study, which was initiated to recover mercury in metallic form to minimize the volume of hazardous waste generated.

Design of Air Stripper Treatment System
Confidential Client, New York

Managed design and provided construction administration for a 250-gallon air stripper treatment system for VOCs at an industrial complex. Design features included 100% online backup equipment for automatic switchover with minimal operator attention.

Design, Construction, and Start-Up of Mercury Wastewater Treatment System
Confidential Client, New York

Plant engineer responsible for design, construction, and startup of the system, which included equalization, pH adjustment, chemical addition, clarification, filtration, and associated sludge/solids handling systems.

Phosphorus and Ammonia Removal Processes
Confidential Client, New York

Managed electrical and process control designs for the removal processes at a publicly owned treatment works. The processes were designed for a peak flow of 80 million gallons per day.

Installation of Potable Water Transmission and Distribution System
Confidential Client, New York

Provided construction administration for installation of potable water transmission and distribution system to 120 homes and trailers. Project included installation of metering facility, more than 4 miles of pipeline, and connections to homes.

Select Publications

DeCarr, W.K., P.W. Hare, and D.F. Sauda. 1998. In-line sparging - cost-effective system reduces VOCs in storm water to permissible levels. Industrial Wastewater, July/August.

ARCADIS

Education
BS, Chemical Engineering,
Clarkson University,
Potsdam, NY, 1995

Years of Experience
Total - 16
With ARCADIS - 14

Professional Registrations
Professional Engineer, NY

Timothy E. Miller, PE

Senior Engineer I

Mr. Miller has an extensive 16 year background in engineering design and process operations. Mr. Miller has worked on a number of soil and groundwater remediation, water and wastewater treatment design/build projects, and operation and maintenance (O&M) sites.

Select Project Experience

Water Treatment Plant Upgrades
Confidential Client, New York

Project manager for the project to support the design/build upgrade of an existing groundwater and surface water treatment facility at an active pesticide and herbicide formulating facility. The objectives of the design upgrades were to increase the treatment system throughput rate from 150 gpm to 250 gpm and automate operations. The treatment system was designed to remove VOCs, pesticides, and arsenic. Upgrades included designing and installing a new low-profile air stripper, ferric chloride addition system, lime addition system, multi-media filter system, new instrumentation, and a central PLC-based control system. Responsibilities included treatability study development and implementation, final treatment system design and specification, development of construction documents and subcontractor bid packages, and engineering support services during turnkey construction activities.

Migration Control Trenches Upgrades
Confidential Client, New York

Project manager for the construction of migration control trench upgrades at an operating pesticide/herbicide formulating facility. The migration control trench upgrades consisted of installation of approximately 1,000 linear feet of blasted bedrock trenches, seven new extraction wells and pump houses, and approximately 2,000 linear feet of forcemain piping to the existing water treatment facility. Responsibilities included final contract drawing preparation, subcontract management, construction oversight, and system start-up.

O&M of Remedial Treatment System
Confidential Client, New Jersey

Serves as operation, maintenance and monitoring manager for three remedial treatment systems, which include multi-phase extraction and treatment via catalytic oxidation, air stripping and granular activated carbon adsorption; soil-vapor extraction and treatment via vapor-phase granular activated carbon; and groundwater extraction and treatment via a fixed-bed biological reactor. Onsite O&M activities include daily treatment system operation, monitoring and alarm response, permit-required sampling and reporting, and quarterly report preparation.

Sediment Handling and Dewatering Facility Design
Confidential Client, New York

Lead design engineer responsible for the design of a sediment handling and dewatering facility. The facility was designed to handle process up to 5,100 cubic yards per day of sediment mechanically off-loaded from barges. Processing facility consisted of an unloading wharf, trammel screen, hydrocyclone systems, gravity thickener, plate and frame filter presses, water treatment facility, sediment storage facility and rail yard sediment loading station. Responsibilities included basis of design preparation, contract drawing and technical specification preparation, construction bid support, and shop drawing review during construction.

Water Treatment Plant Upgrades
National Grid, Gloversville, New York

Lead design engineer for the design of two pumping manholes, a groundwater treatment system, and a pre-engineered building. The groundwater treatment system was designed to treat 50 gpm of groundwater and consisted of one 3,000 gallon solids/DNAPL settling tank, an oil-water separator, bag filter system, organoclay system, granular activated carbon system, and anion resin system. Responsibilities included final treatment system design and specification, basis of design document preparation, and engineering support services during construction activities.

Landfill Corrective Actions
Confidential Client, Illinois

Project manager for the construction of industrial landfill cover repairs and a leachate collection system at an operating chemical plant. The leachate collection system included 42 new extraction wells equipped with pumps, six double contained high-density polyethylene (HDPE) manholes with pump stations, 20,000 linear feet of double-contained HDPE pipe, neutralization system, and 2,000,000 gallon double-contained collection tank. Responsibilities included constructability review, subcontract management, construction oversight, and system start-up.

CERCLA Remedial Action Program
National Starch & Chemical Company, North Carolina

Lead design engineer for the program at an active chemical manufacturing facility that required design and construction of a groundwater pretreatment system for removal of VOCs (primarily 1,2-DCA). The project involved demolition of existing groundwater pretreatment equipment and construction of new groundwater extraction trenches and wells, more than 3,000 feet of aboveground pipe rack, a 50-gpm treatment system consisting of a low-profile tray-type air stripper, followed by catalytic oxidation (CatOx system with a caustic scrubber) of the vapor stream prior to discharge to atmosphere. This project was performed on a turnkey, design/build basis. Responsibilities included conceptual design and budgetary estimates, basis of design document preparation and agency submittal, final design submittal for agency review, development of construction documents and subcontractor bid packages, construction-phase engineering support services including shop drawing review, O&M manual preparation, and engineering support during system startup.

Design of Groundwater Collection Trenches and SVE System
Confidential Client, New York

Served as a project engineer for the design at a New York State-listed inactive hazardous waste site to remediate VOC- and PCB-impacted site soils and groundwater at a former industrial manufacturing facility. This project included the design of multiple remedial tasks including the following: excavation of more than 2,500 cy of impacted soil and sediment and placement in an onsite containment cell, construction of two groundwater collection trenches, a leachate collection and storage system, and an SVE system. The SVE system consisted of a 30-hp, 250-scfm blower used to induce a vacuum through the vapor extraction piping located within the treatment cell. Extracted soil vapors were routed through a 1,000-pound carbon canister prior to release to the atmosphere or discharge back into the treatment cell.

Design and Construction of Stormwater Treatment System
Special Metals, Upstate New York

Served as a design engineer for the design and construction of the system at an industrial site. Manufacturing operations on this site had historically used PCBs in the manufacture of specialty metal products for the aerospace industry. The treatment system was designed to address periodic exceedances of the site stormwater discharge permit resulting from these historic PCB uses. The treatment system was designed and constructed to treat sitewide stormwater runoff up to the 25-year, 24-hour storm event for removal of PCBs to nondetect levels. The treatment system included a wet well pumping station, a 292,000-gallon water storage tank, and a 100-gpm treatment system consisting of sand filtration followed by carbon adsorption. Activities included final treatment system design and specification, treatability study development and implementation, and engineering support services during turnkey construction activities.

Design of Groundwater Collection and Treatment System Enhancement
Confidential Client, New York

Lead design engineer for the design of the enhancement to adequately collect and treat impacted groundwater. The project included installation of two bedrock extraction wells (5 to 10 gpm each), associated pumps and piping, and upgrades to the existing low-profile air stripper treatment system. Responsibilities included conceptual design, construction phase engineering support services including shop drawing review, and O&M manual preparation.

Wastewater Engineering
Anoplate, Syracuse, New York

Project manager and design engineer for the upgrade of the wastewater treatment system at an active industrial plating facility. Wastewater treatment system upgrades included replacing a single-stage cyanide destruction system with a two-stage cyanide destruction system and installing a new chrome reduction system. Upgraded cyanide destruction system designed for an instantaneous flow rate of 30 gpm and included two 550 gallon tanks with mixers, sodium hydroxide metering pump, sulfuric acid metering pump, two sodium hypochlorite metering pumps, two pH controllers and two ORP controllers. Upgraded chrome reduction system designed for an instantaneous flow rate of 30 gpm and included one 550 gallon tank with mixer, sulfuric acid metering pump, sodium metabisulfite metering pump, and on pH/ORP controller. Responsibilities included treatability study development and implementation, final treatment system design and specification, and construction oversight support.

Design/Build Turnkey Soil Remediation Project
Hi-Shear, California

Lead design engineer for the project at an active industrial facility that manufactures a variety of fasteners for the aerospace industry. Portions of the site soil and groundwater were impacted by VOCs, primarily TCE and PCE. The project includes design and construction of an SVE system to remediate the site shallow soil zone (0 to 70 feet in depth). The SVE system includes 10 extraction wells, 13 passive vent wells, more than 700 linear feet of piping, a 350-scfm positive displacement blower, and five 2,000-pound carbon adsorption units operated under vacuum. The shallow SVE system was later redesigned to include deep soil zone (70 to 120 in depth) by adding four new deep SVE wells and replacing the carbon adsorption units with a catalytic oxidizer unit. Activities included final treatment system design and specification, bid document preparation and bid administration, construction-phase engineering support services including shop drawing review, O&M manual preparation, and engineering support during system startup.

Design of Groundwater Collection and Treatment Systems
National Grid, New York

Lead design engineer for the design of both temporary and permanent systems for a former manufactured gas plant (MGP) site. The project included installation of two 4-inch extraction wells (5 gpm each) and associated pumps and piping and specifying treatment system components such as pre-engineered metal building, equalization tank, oil/water separator, chemical pretreatment system, multimedia filtration system, and carbon adsorption system. Responsibilities included final treatment system design and specification, treatability study development and implementation, and development of construction documents and subcontractor bid packages.

Design of Groundwater Collection and Treatment System
Confidential Client, Michigan

Lead design engineer for the design of the system . The project included design of four extraction wells (50 to 100 gpm each) and associated pumps and piping, a groundwater treatment system, a pre-engineered building, and two re-injection fields. The groundwater treatment system was designed to treat 300 gpm of groundwater and consisted of two 10,000 gallon equalization tanks, a sequesterant addition system, a multi-media filter, one low-profile air stripper system, and a solids handling system. Responsibilities included final treatment system design and specification, treatability study development and implementation, basis of design document preparation, and engineering support services during construction activities.

Design/Build Industrial Wastewater Treatment Project
International Diesel of Alabama, Huntsville, Alabama

Lead design engineer for the project to support the expansion of an automotive engine manufacturing plant. The new treatment plant was designed to accept a highly variable oily wastewater with a maximum influent flow rate of 300 gpm and a treatment system throughput rate of 50 gpm. The treatment system design included an API oil-water separator, 60,000 gallons of equalization storage, chemical addition, dissolved-air flotation, and pH adjustment. Construction of the treatment plant included provisions for operation of a temporary treatment system to support ongoing production, a complete demolition of the existing treatment plant, a new building expansion and pressure wash station, and a new automated PLC-based control system. Responsibilities included final treatment system design and specification, treatability study development and implementation, development of construction documents and subcontractor bid packages, engineering support services during turnkey construction activities, preparation of a comprehensive operation and maintenance manual, and engineering support during startup and daily operation.

Design of Groundwater Collection and Treatment System Enhancement
Confidential Client, Georgia

Lead design engineer for the design of the system enhancement to adequately collect and treat impacted groundwater at a former manufacturing facility. The project included installation/upgrade of seven 4-inch extraction wells (5 to 10 gpm each) and associated pumps and piping, specifying a new oil/water separator, low-profile air stripper, and vapor-phase treatment, and upgrading the existing groundwater treatment system operation and controls. Responsibilities included final treatment system design and specification, basis of design document preparation for agency review, and engineering support services during construction activities.

O&M of Groundwater Collection and Treatment System
Confidential Client, New York

Serves as project manager for O&M of the system at a New York State-listed hazardous waste site. The remedial system includes groundwater collection trenches for control/remediation of VOC-impacted groundwater via carbon adsorption. Onsite O&M activities include daily treatment system operation, monitoring and alarm response, permit-required sampling and reporting, and annual report preparation.

Process Wastewater Treatment System Upgrade
Confidential Client, North Carolina

Design engineer for the upgrade at an active industrial specialty wire manufacturing plant. Pretreated process wastewater was dumped from batch dipforming, annealing, and electroplating operations. Wastewater pretreatment consisted of pH adjustment and clarification for metals removal prior to discharge to the sanitary sewer. Periodic permit violations led to the initiation of a wastewater treatment study to identify potential treatment system modifications to ensure full discharge permit compliance. Based on the study results, it was determined that acid and caustic bath dumps should be removed from the waste stream and disposed of offsite and/or metered slowly into the 25,000-gpd treatment system to avoid system upset. A treatment system upgrade design was completed that included an addition to the existing wastewater treatment plant to house a 5,000-gallon caustic storage tank and a 5,000-gallon acid storage tank for storage of bath dumps, pumps, controls, and other related equipment. In addition, a pre-engineered multimedia filter was installed after the existing clarifier to provide final polishing. For this project, responsibilities included final treatment system upgrade design, bid administration, construction observation services, and engineering support during construction.

Systems Design
Confidential Client, Georgia

Lead design engineer for the design of a landfill cover system, high vacuum extraction (HVE) system, vapor treatment system, and leachate collection system at an industrial landfill at a former manufacturing facility. The objectives of the design were to reduce volatile organic compounds (VOCs) in the landfill; minimize infiltration and surface water into the landfill; and minimize the potential for migration of constituents from the landfill. The landfill cover consisted of a grading layer and low-permeability final cover; the HVE system included 38 extraction wells, three extraction blowers capable of 2,500 scfm, building enclosure, and associated instrumentation; the vapor treatment system included a catalytic oxidizer and an acid scrubber; and the leachate collection system included 38 pneumatic pumps and associated appurtenances. Responsibilities included final treatment system design and specification, basis of design document preparation for agency review, and engineering cost estimate preparation.

Design/Build Turnkey Wastewater Remediation Project
Confidential Client, Kentucky

Lead design engineer for the project at an active die-cast facility. Manufacturing operations on this site had historically used PCBs in the manufacture of aluminum die-cast products for the automotive industry. The wastewater treatment system was designed to treat PCB-impacted wastewater generated at the facility. The project involved the design and construction of a treatment building addition, a new piping plan that rerouted all nonsanitary wastewater to the new treatment system without disturbing ongoing plant operations, a new factory locker room facility (needed to isolate nonsanitary wastewater), several pump stations, and a treatment system. The treatment system consisted of equalization, dissolved air floatation with chemical pretreatment for suspended solids and oil and grease removal, multimedia filtration for final solids removal, carbon adsorption for PCB removal, and a filter press for sludge handling. Responsibilities included final treatment system design and specification, treatability study development and implementation, development of construction documents and subcontractor bid packages, engineering support services during turnkey construction activities, and engineering support during start up and daily operation.

Comprehensive Environmental Sampling and Analysis Program
Confidential Client, New York

Served as a project engineer for the program for a large industrial client. The program involved collection and analysis of all environmental samples at the facility (more than 6,000 samples per year). Performed related program tasks including database management of all analytical data and preparation of monthly SPDES discharge monitoring reports and related documentation.

ARCADIS

Education
BS, Environmental Science; Minor in Geology, Atmospheric Science, University at Albany, Albany, NY

Years of Experience
Total - 8
With ARCADIS - 6

Current Training
OSHA 40-hr HAZWOPER
OSHA 8-hr. Refresher
NYSDOT HAZMAT Shipping #1
NYSDOT Materials of Trade
Loss Prevention System
First-Aid/CPR
Smith System Defensive Driving
NYS Boater Safety

James S. Schidzick Jr.

Project Scientist

Mr. Schidzick has more than 8 years of professional experience providing field, technical, engineering, and project management support for a variety of projects under various regulatory programs (Voluntary Remediation, CERCLA, RCRA, and TSCA) encompassing a wide variety of project sites, including both active and inactive hazardous waste sites and former manufactured gas plant sites. He has also experience in preparing and implementing investigation and cleanup plans, technical specifications, environmental assessments, project Health and Safety Plans, and coordinating waste disposal.

Mr. Schidzick has provided field supervision and management of sampling crews during various soil, sediment, and groundwater investigations to ensure that these activities were completed in accordance with EPA and NYSDEC-approved sampling plans, and has coordinated those efforts with the respective regulatory agency, client representatives, and property owners.

Select Project Experience

Construction Observation
Confidential Client, New York

Mr. Schidzick provided construction observation for a long-term construction project involving removal and replacement of a dam located at the outlet of a lake in New York, in accordance with the NYSDEC-approved design. Mr. Schidzick's primary role on this project was to document daily construction activities and progress to ensure the dam was constructed in accordance with the NYSDEC-approved design. While performing construction observation, Mr. Schidzick reported the daily field activities to the Engineer and Client and performed oversight of quality control testing for construction materials. Mr. Schidzick also coordinated waste disposal activities. As part of the dam reconstruction, materials were placed within approximately 0.4 acres of identified wetlands. Mr. Schidzick also provided construction oversight of the wetland construction/mitigation activities that were required under the USACE Nationwide Permit No. 38. Upon completion of the construction activities, Mr. Schidzick prepared a documentation report for submittal to the client to supplement the Final Engineering Report issued by the Engineer.

Construction Observation – Keuka Lake Maintenance Dredging Project
Iberdrola, USA. Wayne, New York

Mr. Schidzick provided construction observation during the construction of support areas to be used during the maintenance dredging of a former power canal. The construction activities included clearing trees and low-lying vegetation along the canal, constructing material staging areas, bermed sediment dewatering pads, and construction access roads. During the construction, Mr. Schidzick reviewed material submittals provided by the contractor for conformance with the project Technical Specifications, and made recommendations to the Engineer of Record and Client to accept/reject the submittals. During the construction, he also documented the daily activities in field log books, reported daily activities to the Engineer/Client, prepared for and participated in weekly construction progress meetings, and coordinated waste disposal.

Interim Remedial Measures – Source Removal
Confidential Client, Dolomite, Alabama

Mr. Schidzick provided engineering support during source removal activities at an approximately 45-acre former tar plant in Dolomite, Alabama. The IRM activities included the removal of approximately 10,000 cubic yards of tar-impacted materials to mitigate further impacts to groundwater at the Site. As part of the IRM activities, Mr. Schidzick provided office-based support to the Engineer and on-site representatives by reviewing project submittals provided by the contractor for conformance with the Technical Specifications contained in the ADEM-approved design. In addition, Mr. Schidzick coordinated and facilitated weekly project status meetings between the subcontractor, Client, and property owner to discuss the project status.

As part of the IRM, Mr. Schidzick prepared a Site Wide Construction Best Management Practices Plan in accordance with the Alabama Department of Environmental Management (ADEM) standards to address storm water runoff associated with the site activities. Mr. Schidzick was also responsible for preparing and submittal of the necessary notifications and permits to state and local regulatory agencies, including ADEM, Jefferson County, and the City of Hueytown, AL. He also coordinated efforts with other consultants and subcontractors in the development of USACE Nationwide Permit No. 38 application.

At the completion of the IRM activities, Mr. Schidzick prepared a Certification Report to document to ADEM and the USEPA the Closure of a RCRA Regulated Unit, in accordance with the Post-Closure Care Permit requirements.

Subsequent to the completion of the IRM activities, Mr. Schidzick assisted the project team in the development of a Site-Wide Corrective Action Plan (CAP) to address remaining Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) at the site which were targeted for corrective actions.

Sediment Investigation
Consolidated Edison Company of New York, Inc., Bronx, NY

Mr. Schidzick provided technical support during a sediment investigation to determine the nature and extent of potential sediment impacts associated with a former MGP facility located in Bronx, New York. The investigation included a Site reconnaissance to identify potential migration pathways, evaluate and document the water surface conditions adjacent to the Site, and to identify and select background sample locations; sediment probing to observe sediment consistency and potentially sheen-generating sediments; and surface sediment sample collection.

During the investigation activities a total of 58 sediment samples were collected from 40 sample locations for analysis for various chemical and physical parameters, in accordance with the NYSDEC-approved sampling plan. Mr. Schidzick was also responsible for coordinating IDW disposal activities on behalf of the client. Following receipt of the analytical data from the laboratory, Mr. Schidzick was prepared a Sediment Investigation Report to present the results of the Sediment investigation activities for submittal to the NYSDEC.

Corrective Action Activities
Confidential client, Kentucky

Mr. Schidzick serves as the task manager for the corrective action monitoring and maintenance activities associated with the Corrective Action Plan for the Site. The project involves a long-term monitoring program which includes an annual groundwater monitoring and gauging, DNAPL monitoring and recovery, surface water sampling, and annual land use and engineering and institutional controls monitoring. In addition, Mr. Schidzick is the task manager for planning and coordination in connection with the planned remediation activities for three residential properties and one commercial property involving excavation and off-site transportation and disposal of PCB-impacted soils from three residential properties, and filling a warehouse basement to mitigate the potential for exposure to PCB-impacted groundwater.

EE/CA Work Plan for Phase II of Non-Time-Critical Removal Action
Confidential Client, River in the Northeast

Prepared an Engineering Evaluation/Cost Analysis (EE/CA) Work Plan for the second phase of a two phase removal action on an undisclosed river in the Northeast. For Phase I, ARCADIS's responsibilities include preparation of an EE/CA, preparation of associated work plans and technical reports, and the remedial design for the removal action, with similar Phase II work to proceed on a schedule yet to be determined by the USEPA.

Floodplain Investigation
Confidential Client, New York

Mr. Schidzick served as the field team leader and task manager for a multi-year investigation to assess and characterize floodplain soils in New York in accordance with the EPA-approved Field Sampling Plan and subsequent addenda thereto. The investigation activities included collecting floodplain soil samples from both private and public properties using a macro-core sampling device. The investigation has encompassed approximately 800 residential, industrial, and commercial properties. Since his involvement in the project, Mr. Schidzick has been responsible for coordinating the sampling efforts with client representatives, property owners, regulatory agencies, and analytical laboratories; planning and scheduling the sampling efforts with the EPA and Client representatives; coordinating IDW disposal, and the associated reporting.

Interim Remedial Measures
Confidential Client, New York

Mr. Schidzick assisted the Project Team in the development and submittal of a Short-Term Response Action Work Plan to the USEPA. The purpose of the Work Plan was to develop a cost effective approach to minimize the potential for human exposure to PCB-impacted soils. Following EPA approval of the Work Plan, Mr. Schidzick prepared an Implementation Plan and subsequent addenda thereto, which included Project Specifications and Contract Drawings, Erosion and Sediment Control Plan, and a Site-Specific Health and Safety Plan. The purpose of the Implementation Plan and subsequent addenda were to present the scope of work for short-term response actions, provide details and schedule for implementing the response actions on a property specific basis, and outline project monitoring, maintenance, and reporting requirements.

Following EPA approval of the Implementation Plans, Mr. Schidzick was responsible for developing project budgets, coordinating with Clients, Subcontractors, Property Owners, and EPA to implement the work. During the construction phase, Mr. Schidzick provided engineering support and oversight of the work to ensure it was completed in accordance with the approved design, including coordination of waste disposal. For each construction year, Mr. Schidzick prepared a Documentation Report, including record drawings, for submittal to the EPA.

Remedial Investigation/Feasibility Study former Manufactured Gas Plant Site
National Grid, Hudson, New York

Mr. Schidzick served as task manager to complete a multi-phase remedial investigation to characterize MGP-impacted sediments within the Hudson River adjacent to the Site. The site investigation activities included implementation of a 3-year sediment monitoring program to assess the natural recovery of PAH-impacted sediments, non-aqueous phase liquid (NAPL) delineation using TarGost technology, and a demonstration project to assess Bioavailability of PAH-impacted sediment and sediment toxicity. At the conclusion of the investigation activities, Mr. Schidzick assisted in the development of a Comprehensive Sediment Investigation Report to present the results of the investigation activities.

Following NYSDEC approval of the CSIR, Mr. Schidzick assisted the Project Team in developing a Feasibility Study for the Site. Throughout the FS process, he worked with the client and project team to develop Remedial Action Objectives and cost-effective remedial alternatives to be presented in the FS for consideration. Mr. Schidzick also assisted with the screening of remedial technologies and identification of ARARS and SCGs.

ARCADIS

Education
BS, Biology, State University College at Plattsburgh, Plattsburgh, NY, 1988

Years of Experience
Total - 24
With ARCADIS - 14

Dennis K. Capria

Principal Scientist

Mr. Capria has more than 16 years of analytical laboratory, data management and data validation experience in the environmental field. Currently, he is involved in the data management, data validation and QA/QC oversight of analytical data. Mr. Capria's responsibilities have ranged from overseeing the daily data management requirements for large industrial sites to the operation and maintenance of volatile and semivolatile organic (GC, GC/MS instruments). His analytical chemistry experience includes various sample preparations, wet chemistry techniques, data generation and interpretation. His supervisory experience includes managing a team of data validators as well as overseeing a QA/QC department at a laboratory.

Managerial/ Technical Expertise

In addition to serving as the leader of ARCADIS' Data Services Group, Mr. Capria has served as the quality assurance officer (QAO) for investigations of multiple hazardous waste sites. Sites include impacted aquatic systems, industrial facilities, landfills, and wastewater effluent discharges. As QAO, Mr. Capria serves as the primary communication link between analytical subcontractors and ARCADIS , and is responsible for managing coordinating field managers and analytical subcontractors, and the direction of the DSG personnel. Current responsibilities include developing quality assurance project plans (QAPPs) that are consistent with project data quality objectives (DQOs), and federal and state guidelines.

On a project-specific basis, he has been involved in developing analytical approaches to solve specific project requirements and regulatory needs; developing and reviewing bid documents for analytical services; and evaluating and auditing laboratory performance. Mr. Capria provides a wealth of data quality services for some of the largest industrial sites in the United States.

Data Quality Services

Mr. Capria is responsible for developing and reviewing project quality assurance documentation including project-specific (DQOs), (QAPPs), and field sampling plans (FSPs). He oversees the validation of mixed media (soil, sediment, water, biota, wipes, building material and air) data from investigations of multiple hazardous waste sites, including data validation pursuant to U.S. Environmental Protection Agency (USEPA) Functional Guidelines, and provides guidance on data usability. He manages and performs data validation efforts pursuant to USEPA regional and individual state guidelines, and is proficient in USEPA-CLP, USEPA-Regional, USEPA SW-846, 40 CFR Part 136, New Jersey Department of Environmental Protection (NJDEP), and New York State Department of Environmental Conservation (NYSDEC) ASP procedures.

Mr. Capria has been instrumental in the success of planning and implementing data management tools for the generation of hundreds of analytical presentation tables, which are utilized by ARCADIS and its clients in evaluating data for multiple projects.

Other Related Experience

Prior to joining ARCADIS , Mr. Capria held the positions of GC/MS chemist and analytical quality assurance/quality control coordinator at laboratories in the Northeast. His prior responsibilities included client contact for industrial and consulting firms regarding analytical services for a major ASP laboratory. He was responsible for the daily operation of the GC/MS department for an analytical laboratory. There, gaining extensive knowledge of USEPA acceptable methodologies, Mr. Capria worked to establish and implement the analytical guidelines for compliance with regulatory agency specifications. His responsibilities included: conducting sample analyses utilizing gas chromatography/ mass spectrometers; maintaining analytical instrumentation; scheduling analysis; reviewing and organizing data packages; writing standard operating procedures; training technicians; and streamlining the electronic data collection between lab instrumentation and QA/QC department, accelerating client results.

Mr. Capria's other accomplishments included maintaining laboratory certifications (such as New York State Department of Health [NYSDOH], NYSDEC, NJDEP, and Pennsylvania Department of Environmental Resources [PADER]), preparing monthly control limits for QA/QC sample data, and providing a wealth of client services related to analytical program management.

Short Bio

With more than 16 years of experience, Mr. Capria specializes in overseeing the daily data management requirements for large industrial sites and the operation and maintenance of volatile and semi-volatile organic instruments. His supervisory experience includes managing a team of data validators as well as overseeing a quality assurance/quality control (QA/QC) department at a laboratory.

Select Project Experience

QA/QC Coordinator and Data Validator

Confidential Client, Massachusetts

Served as the QA/QC coordinator and data validator for a major industrial site. Was responsible for the day-to-day management of data for thousands of samples collected on a regular basis in support of various investigation and remediation programs. In this role, provided daily technical support to the client, managed the entire analytical program, supervised the data management for the project and performed data validation for the numerous samples per year. In addition, performed laboratory audits in support of the pre-design investigation (PDI) program for this industrial facility.

Data Management/Validation
Confidential Client, New York

Data management/validation in support of the RI at Industrial Park pursuant to USEPA Region 2 guidelines.

Data Management/Validation
Confidential Client, Massachusetts

Data management/validation in support of the off-site property investigations pursuant to USEPA Region 1 guidelines.

Data Management/Validation
Confidential Client, Michigan

Data management/validation in support of the RFI at automotive plant complex in accordance with USEPA National Functional and Region 3 guidelines.

Data Validation
Confidential Client, Michigan

Served as the validator for this large automotive site, where responsibilities included coordinating with client and project personnel, validating the data from the numerous samples collected each year, supervising and approving the input validation, and updating the database for the project. Also performed laboratory audits in support of the RFI completed at this site.

Data Management/Validation
CBS, Springfield, Massachusetts

Serves as the validator for the CBS site, where responsibilities included data management for the project and performance of data validation for complete investigation.

Data Management/Validation
Confidential Client, Massachusetts

Data management/validation in support of the Consent Decree (CD) pre-design investigations and on-site National Pollutant Discharge Elimination System (NPDES) program at a large industrial facility, pursuant to USEPA Region 1 guidelines. Managed and validated more than 30,000 samples collected at the facility

ARCADIS

Education
MS, Environmental and Resource Engineering, SUNY ESF, Syracuse, NY, 2003
BS, Mechanical Engineering Technology, SUNY Institute of Technology at Utica/Rome, Utica, NY, 1993

Years of Experience
Total - 17
With ARCADIS - 9

Professional Associations
New York Water Environment Association

David F. Groff

Staff Environmental Engineer

Mr. Groff has more than 13 years of experience in water/wastewater design, construction management, project management, and health and safety compliance. He wrote, implemented, and audited site-specific health and safety plans (HASPs) for large construction/demolition projects, environmental remediation projects, and site assessment projects.

As a safety officer for a large commercial developer, Mr. Groff developed a contractor safety program to be utilized by all contracting firms working under an owner-controlled insurance program, assisted in the development of an OSHA Strategic Partnership Agreement to be utilized during construction of a planned multi-billion dollar expansion of an existing facility, and assisted local authorities during routine life safety inspections of the existing facility.

As a safety manager for a large commercial construction company, Mr. Groff developed and implemented the company's safety program, successfully challenged every proposed OSHA citation and was successful in having them either rescinded or reduced in severity or penalty, monitored and investigated work-related injuries and illnesses and ensured that corrective measures were taken to prevent recurrences, and developed safety training programs and conducted safety training for personnel. Safety training included general construction safety, fall protection, ladders, scaffolding, hazard communication, forklift, aerial lift, confined space entry, and powder-actuated tool training.

While serving as a member of the Joint Labor/Management Committee for the Construction Employers Association, he worked on the development of safety training programs associated with a grant from the New York State Hazard Abatement Board.

Select Project Experience

Construction of Leachate Collection System
Honeywell, Syracuse, New York

Provided health and safety oversight at a landfill during construction of a leachate collection system. Responsibilities included providing contractor safety orientations, conducting safety audits, and monitoring contractor's operations for compliance with applicable requirements.

Installation of a Water-Line Extension and Remediation Project
National Grid, Cobleskill, New York

Primary constituents of concern were PCBs and lead. Responsibilities as field project manager included serving as a liaison between the client, owner of the site, the village, regulatory agencies, and the general contractor; collecting samples for waste characterization; completing the required hazardous waste manifests; conducting perimeter and personal air monitoring; reviewing requests for payment and extra work orders; and preparing the final report for submittal to the New York State Department of Environmental Conservation (NYSDEC).

Demolition of Abandoned Chemical Plant
Honeywell, Solvay, New York

Provided health and safety oversight. Responsibilities included providing contractor safety orientations, conducting safety audits, monitoring contractor's operations for compliance with applicable requirements, providing onsite safety training for personnel, and conducting quantitative respirator fit testing.

Demolition of Abandoned Chemical Plant
Honeywell, Solvay, New York

Primary constituents of concern were mercury and caustic soda. Responsibilities as field project manager included serving as a liaison between the owner and the general contractor, serving as the site contact for regulatory agencies, reviewing demolition work plans for compliance with the approved site work plan, coordinating and participating in the sampling of demolition debris and the characterization of hazardous waste, coordinating and scheduling the disposal of hazardous waste and completing the required manifests, coordinating the work of subcontractors, reviewing requests for payment and extra work orders, and preparing the final report for submittal to the NYSDEC.

Phase I Baseliner
Waste Management, Upstate New York

Conducted facility audits for a national waste disposal corporation. Audits focused on safety of facility personnel and contractor safety during a landfill expansion project.

Remediation of River
Confidential Client, New York

Provided construction oversight during the remediation of the project. Additional responsibilities included total dust and PCB air monitoring, collection of confirmatory soil samples, and turbidity monitoring during work activities in or adjacent to the river.

Selective Demolition of Automobile Manufacturing Facility
Confidential Client, Indiana

Responsibilities as field project manager included serving as a liaison between the client, owner of the site, union representatives, regulatory agencies, and the general contractor; collecting samples for waste characterization; and construction oversight and documentation. Primary constituents of concern at the site were asbestos and mercury.

Indoor Air Quality Sampling
Upstate New York

Conducted air monitoring at construction, demolition, and hazardous waste sites that had contained lead, mercury, PCBs, and PAHs. Conducted high-volume indoor air quality sampling at a large retirement community. Familiar with the operation and use of several instruments, pumps, and procedures used for environmental sampling.

Air Monitoring
Various Locations

Conducted air monitoring at construction, demolition, and hazardous waste sites that had contained lead, mercury, PCBs, and PAHs. Conducted air monitoring for mercury and total dust during the demolition of a mercury-impacted structure in New Jersey. Familiar with the operation and use of several instruments, pumps, and procedures used for environmental sampling.

Metropolitan Syracuse WWTP Grit Removal Facilities
Onondaga County Department of Water Environment Protection, Syracuse, New York

Project designer for an evaluation of the existing grit removal facilities and preliminary design of recommended improvements, including installation of longitudinal baffling, addition of fluidizing water connections, modifying baffles and diffused air piping, new grit separators and dewatering units, and grit piping improvements.

Temporary Relocation of Raw Water Intake
Brookfield Power, Cohoes, New York

Served as a designer on a project that required the installation of a temporary relocation of a raw water (5 MGD) intake for a small upstate New York City. Responsibilities included preparing the engineering design report, preparing contract drawings and specifications for pumping equipment, pipe, and appurtenances; preparing construction cost estimates; and reviewing contractor submittals.

Midland Avenue Combined Sewer Outflow (CSO) Regional Treatment Facility (RTF)
Onondaga County Department of Water Environment Protection, Syracuse, New York

Served as a designer and assisted other project team members. Responsibilities included management and oversight of subcontractor that conducted an exploratory utility location program that was necessary to determine the position of the existing main interceptor sewer and other utilities located adjacent to the proposed site; design of a new 800-foot-long, 54-inch-diameter main interceptor sewer; preparation of contract drawings and specifications for mechanical equipment and general site work; review of contract drawings and specifications prepared by others; and preparation of construction cost estimates. During the construction phase, responsibilities included the review of contractor's submittals.

Wilmuth Pump Station Screen Replacement
Erie County Department of Environment and Planning, Buffalo, New York

Served as a designer and assistant project manager requiring the removal and replacement of mechanical screen rakes at a 15 mgd pump station. Responsibilities included preparing the engineering design report; preparing contract drawings and specifications for the mechanical screen rakes and related equipment; hydraulic analysis of existing conditions and evaluating manufacturer's equipment; evaluating alternative mechanical screen rake designs; preparing construction cost estimates; attending project meetings; and preparing meeting minutes and other project correspondence.

Storm Sewer IRM
National Grid, Gloversville, New York

Served as a designer on a project that required the relocation/installation of storm sewer and groundwater collection system at the site of a former manufactured gas plant (MGP). Responsibilities included preparing contract drawings and specifications for general site work, pipe, and appurtenances; preparing construction cost estimates; and reviewing contractor submittals.

Roof Replacement Project
Newark Public Schools, Newark, New Jersey

Served as an assistant project manager for a roof replacement project that included 10 separate schools during a 2-month period.

Screen Machine Replacement
Onondaga County Department of Water Environment Protection, Syracuse, New York

Served as a designer and assistant project manager requiring the removal and replacement of 11 mechanical screen rakes for 8 separate facilities. Facilities ranged in size from large wastewater treatment plants (175 mgd) to pump stations (6 to 30 mgd). Responsibilities included preparing contract drawings and specifications for the mechanical screen rakes and related equipment; preparing roof system contract drawings and specifications; hydraulic analysis of existing conditions and evaluating manufacturer's equipment; preparing construction cost estimates; attending project meetings; preparing meeting minutes and other project correspondence; coordinating the work of consultants; reviewing contract drawings and specifications prepared by others; and field management and observation of contractors.

Pipeline Relocation Project
NYSEG, Oneonta, New York

Served as a designer and assistant project manager requiring the relocation of 1,200 feet of storm sewer, sanitary sewer, and water main at the site of a former manufactured gas plant (MGP). Responsibilities included preparing the engineering design report; preparing contract drawings and specifications for general site work, pipe, and appurtenances; preparing construction cost estimates; and preparing meeting minutes and other project correspondence.

Large Sediment Dewatering Project
Confidential Client, Northeastern United States

Served as a designer and assisted other project team members during the design phase of the project on a major waterway, for an industrial client. Responsibilities included developing contract drawings and specifications for large horizontal centrifugal slurry pumps, progressing cavity slurry pumps, polymer storage and feed system, and solidification/stabilization process equipment; and attending project meetings.

Municipal Combined Sewer Outflow (CSO) Regional Treatment Facility
Onondaga County Department of Water Environment Protection, Syracuse, New York

Served as a designer and assisted other project team members. Responsibilities included management and oversight of subcontractor that conducted an exploratory utility location program that was necessary to determine the position of the existing main interceptor sewer and other utilities located adjacent to the proposed site; design of a new 800-foot-long, 54-inch-diameter main interceptor sewer; preparation of contract drawings and specifications for mechanical equipment and general site work; review of contract drawings and specifications prepared by others; and preparation of construction cost estimates. During the construction phase, responsibilities included the review of contractor's submittals.

Site Sampling
Confidential Client, San Jose, California

Conducted sampling at the site of an explosion at a rocket fuel production facility to determine the presence of ammonium perchlorate. Results from field tests were utilized to determine if hazardous materials were present and required removal prior to demolition activities. Assisted in the collection and cataloging of debris to be used in an accident investigation.

Preliminary Designs
Syracuse, New York

While working as a mechanical engineer for a large commercial developer, prepared preliminary designs for equipment to be utilized in a tri-generation facility and for the production of "green energy," generated construction cost estimates, reviewed contract drawings and specifications prepared by others, and coordinated subcontractors.

Appendix C

ARCADIS Subcontractor
Brochures and Resumes

Pace Analytical®

NEW YORK LABORATORY

New York / Schenectady, N

NEW YORK LABORATORY SERVICES

PROVIDING ENVIRONMENTAL AND SPECIALTY ANALYTICAL TESTING FOR THE EAST-NORTHEAST REGION

(AP Photo/Mark Lennih

NEA was the lead laboratory for the 2009 Hudson River dredge program and was the testing lab for the USEPA WTC test and clean program after 9/

Pace Analytical's New York Laboratory, formerly operating as Northeast Analytical Laboratory (NEA), is a 15,000 square feet facility located in Schenectady, New York. The laboratory is one of only a few certified laboratories that can provide this advanced level of expertise in the area of high resolution PCB congener identification and analysis.

For the past two decades, the New York lab has built a distinguished national reputation for uncompromising data quality, service and technical expertise in dealing with low level detection limits for sediments, waters and biota (fish) matrices. As NEA, they completed a wide range of high profile projects on behalf of Fortune 500 companies – *both commercial and industrial* – and various government agencies.

The new Pace New York lab will now provide enhanced specialty service offerings through its nationwide laboratory network. Clients will have access to a much broader capability to support their environmental testing needs including the analysis of air samples, biological tissue, radiological, dioxin/furan and dioxin-like compounds.

Although the laboratory has expanded its services, it still remains at the forefront of PCB measurement and research. The lab has developed congener specific PCB analytical methodology that has supported many programs investigating PCB problems and issues related to several major river systems in the United States.

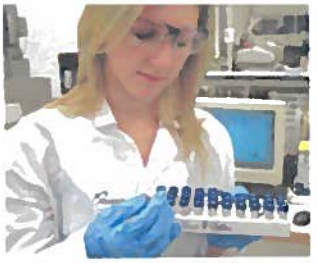
Pace Analytical New York lab provides the following services:

- Organic and Inorganic Analyses
- Air Analysis for PCBs by TO-10A & TO-4A
- PCB Congener Analysis utilizing HRGC/ECD by modified Green Bay or PCB Congener Analysis by CQCS 8082 (all 209 congeners)
  [Congener Lists: 12 WHO Coplanars, NOAA, USACE, USFWS and USEPA SW846 8082]
- Low Level PCB Water Analysis by Aroclors Detection Limit 50 ng/L (PPT) or PCB Congeners Detection Limit 9 ng/L (PPT) total PCBs
- PCB Congener Blood/Serum Analysis
- PCB Homolog Analysis by USEPA 680 GC/MS
- AVS/SEM
- Biota Analysis
- Dioxin/Furan Analysis

For convenience, consistency and quality control, we assign a dedicated point of contact to each client or program

Pace Analytical®

NEW YORK LABORATORY



Certifications:

- NELAP Accredited
- New York State Department of Health ELAP
- Pennsylvania DEPR
- Massachusetts DEP
- Connecticut DPH
- New Jersey DEP
- North Carolina DENR

Matrices Analyzed:

- Air
- Water
- Soil and Sediments
- Sludge
- Oil
- Fish
- Plants
- Mammals
- Invertebrates
- Building Materials (Caulk, Paint, Tiles)

Major Instrumentation:

- 14-Gas Chromatography Systems (GC/ECD)
- 3-Gas Chromatography Systems (GC/PID/FID)
- 5-GC/MS Systems
- 1-Mercury Analyzer
- 1-Automatic Absorption Spectrometer,
- 3-Total Organic Carbon Analyzer
- 1-Coupled Plasma (ICP) Atomic Emission Spectrometer
- 1-Milestone Ethos EX Microwave Extraction System (MES)
- 5-Dionex ASE 200 Accelerated Solvent Extractor
- 16-units Horizon SPE-DEX 4790 Series Automated Solid Phase Extractor
- 72-units Soxhlet Extraction Apparatus

Laboratory Capabilities:

- Full Organic & Inorganic Analyses
- Drinking Water Analyses
- Tissue Analyses
- Volatiles
- Semivolatiles
- Pesticides
- PCBs
- Metals
- Inorganics
- Petroleum Hydrocarbons
- Toxaphene
- Low Level Mercury (1631E)
- Methyl Mercury (1630)

Commitment to Customer Satisfaction

The Pace New York laboratory has exceeded clients' expectations by providing sound environmental science and unsurpassed test data quality to our clients – *on time* – and in response to our clients' changing needs. We continue our commitment to provide exceptional customer service and reliable project management support.

Courier Service

Courier service is provided for sample pickups or container deliveries. Depending on project scope, arrangements can be made for courier services beyond the regular route.

We offer the following services:

- Sample pickup
- Customized bottle orders
- Data packages
- Online data management (PacePort)
- Preprinted labels
- Preprinted Chain of Custody

For more information:

New York Laboratory

2190 Technology Drive
Schenectady, NY 12308
Phone: (518) 346-4592
Fax: (518) 381-6055
www.pacelabs.com

Pace Analytical Services, Inc.
Minnesota Laboratory / Corporate Offi
1700 Elm Street
Minneapolis, MN 55414
(612) 607-1700
www.pacelabs.com

WILLIAM A. KOTAS:
PROFESSIONAL EXPERIENCE RESUME:

2010- CURRENT: CLIENT SERVICES MANAGER
PACE ANALYTICAL SERVICES INC
2190 Technology Drive
Schenectady, New York 12308

Responsible for management of client services section including supervisory oversight of all Project Managers and Project Coordinators, Sample Receipt department and Courier services. Provides technical direction for non-routine projects. Client point of contact for legacy site programs. Responsible for financial management of department. Responsible for development of lab literature and promotional guides. Responsible for technical training of Sales Account Representatives.

2007-2010: SENIOR TECHNICAL LABORATORY REPRESENTATIVE
Northeast Analytical, Inc.
2190 Technology Drive
Schenectady, New York 12308

Coordinates data analysis, project management, and planning for new method development, client relations, and technical data review. Responsible for marketing, advertising and bid evaluations. Interface with government, academic, industry officials, consultants, attorneys, and directors from other laboratories on a regular basis.

1997-2007: QUALITY ASSURANCE OFFICER/TECHNICAL SPECIALIST
Northeast Analytical, Inc.
2190 Technology Drive
Schenectady, New York 12308
Responsible for review of analytical reports and data summary packages generated by organics and inorganics sections. Review of analytical procedures for compliance with US EPA, New York State ELAP and other regulations for environmental analysis. Responsible for scheduling and performing QA operations including internal audits and spot checks. Maintains Quality Assurance/Quality Control records for the laboratory. Assists current & prospective clients in selection of test methods, sampling requirements and interpretation of test results. Responsible for maintenance of Chemical Hygiene Plan and instruction of laboratory personnel on OSHA required safety procedures

1991-1997: QUALITY ASSURANCE OFFICER/ COMPUTER SYSTEMS (IT) MANAGER
Northeast Analytical, Inc.
301 Nott Street
Schenectady, New York 12305
Reviews analytical reports and data summary packages generated by organics and inorganics sections. Reviews analytical procedures for compliance with US EPA, New York State ELAP and other regulations for environmental analysis. Maintains Quality Assurance/Quality Control records for the laboratory. Responsible for installation and maintenance of Laboratory Information Management System (LIMS), Novell Local Area Network (LAN) and all workstations and associated peripherals.

1990-1991: MICROSCOPIST/ ANALYST
Entek Environmental & Technical Services
1724 5th Avenue
Troy, New York 12180
Performed analysis of air and bulk materials for the presence of asbestos fibers by Phase Contrast and Polarized Light Microscopy. Contributed to the development of a comprehensive training examination for new analysts.

1988-1990: ENVIRON. ANALYST/ QUALITY CONTROL COORDINATOR

Pittsburgh Testing Lab Division
Albany, New York 12203
Analyzed air and bulk samples for asbestos. Collected and compiled quality control data generated by each analyst. Assisted laboratory manager in lab operations and client relations.

EDUCATION:

1990: B.S. Physics
Minor: Chemistry
State University of New York at Albany
Albany, New York

1985: A.S. Mathematics/Science
Hudson Valley Community College
Troy, NY

1999-2003 Continuing Education – Web Development, ASP and Java Programming, Server Side Data Dase programming.
Schenectady County Community College
Schenectady, NY

PROFESSIONAL AFFILIATIONS:

American Society of Physics-Sigma Pi Sigma Physics Honors Society
Hudson Mohawk Professional Geologist Society

CERTIFICATION:

NYS-DEC Organic and Inorganic Data Validation Certificate

PUBLICATIONS:
Contributing editor to *Guide to Environmental Analytical Methods* 4th ed. A summary of Quality Assurance requirements and other pertinent information for select analytical methodologies. Published by Genium Publishing Corp. Schenectady, NY,1998.

parratt wolff inc

- About Us
- Office Locations/Contact Us
- Management Team
- Careers

"To be honest, I never thought I'd meet drillers I actually enjoy being around... until last week! The drillers from Parratt -Wolff answered my numerous questions about well installation and I truly felt like I learned more in one week with them than in months of reading or hearing about what happens during a well installation." - *Allison Fang, Geologist*

About Us

Parratt-Wolff is now in its second generation of management. Having grown, matured and evolved into an employee-owned company, we are proudly continuing the service and know-how that has been our trademark since our founding.

Our technical expertise allows us to provide services unimagined when the firm was launched in 1969. Since that time, our company has evolved into a well-known, highly respected provider of specialty contract drilling services. All of our geotechnical drilling is performed under strict compliance with ASTM Standards.

We have grown to a company of three offices, 55 employees and we now own over 40 major pieces of field equipment. We service clients from Maine to Florida and as far west as Michigan. Our growth is the result of solid management, dedicated field professionals and the repeat business of our many, satisfied clients.

Despite all the changes some things remain the same at Parratt-Wolff....an unwavering commitment to delivering consistently high quality work, on schedule and at a competitive price.

» **East Syracuse, New York:**
5879 Fisher Road, P.O. Box 56, East Syracuse, New York 13057 P: 800-782-7260 or 315-437-1429 Email: info@pwinc.com
» **Hillsborough, North Carolina:**
501 Millstone Drive, P.O. Box 1029, Hillsborough, North Carolina 27278 P: 800-627-7920 or 919-644-2814 Email: info@pwnc.com
» **Lewisburg, Pennsylvania:**
PO Bx 608, Suite 230, 4650 Westbranch Highway, Lewisburg, Pennsylvania 17837 P: 570-523-8913

INTRODUCTION

Parratt-Wolff, Inc. (PWI) was founded in 1969 to provide drilling services to the Northeast. Since then we have grown to a company of two offices, 45 employees and 35 major pieces of field equipment. Our growth is the result of solid management, dedicated field professionals and the repeat business of our many satisfied clients. Our current service area stretches from Maine to Georgia and as far west as Michigan and Mississippi. As an introduction to PWI, we have prepared this statement of qualifications. Included in the qualifications are the following:

- capabilities summary
- equipment list
- description of our direct push-sampling system
- quality assurance plan
- resumes of managers
- list of drillers and years of service
- partial client list
- office locations

This statement is just a brief summary of our company. If you require additional information, documentation or project references please contact us or visit our website at www.pwinc.com.

We look forward to working with you.

CAPABILITIES SUMMARY

Direct-push (Geoprobe) soil, groundwater and soil gas sampling

Hollow stem auger 2-1/4" I.D. to 10-1/4" I.D.

Fluid rotary 3" to 14" O.D.

Flush joint steel casing, 2-1/2" I.D. to 8" I.D.

Wireline coring in rock, NQ through PQ-sizes

Air hammer drilling, 4" O.D. to 8" O.D.

Depths reached by any of these methods are governed by soil and rock conditions at a particular site

Well installations, 3/4" I.D. to 12" I.D.

Packer pressure testing in rock or overburden including discrete water sampling

Well development and pumping tests

Machine dug test pits

Injection of ORC, HRC and similar products

Side and Bottom-view down-hole TV camera to 120'

Installation of pumps and remediation systems

CURRENT EQUIPMENT LIST

Drilling Equipment

2 Four-wheel drive tractor-mounted direct-push sampling rigs

1 Geoprobe 7822DT ATV mounted direct push/rotary drill rig

1 Geoprobe 6620DT ATV mounted direct push/rotary drill rig

5 Ingersoll-Rand A300 truck-mounted combination direct-push/rotary drill rigs

1 Ingersoll-Rand A200 truck-mounted combination direct-push/rotary drill rig

4 CME 55 truck-mounted combination rotary drill rigs

3 CME 75 truck-mounted rotary drill rigs

2 CME 850 crawler-mounted rotary drill rigs

1 CME 55 crawler-mounted rotary drill rig

1 CME 850X crawler-mounted direct-push/rotary drill rig

1 Diedrich D-90 all-terrain carrier-mounted combination direct-push/rotary drill rig

2 Diedrich D-50 truck/skid-mounted rotary drill rig

1 Acker ACE skid-mounted rotary drill rig

1 Beaver hydraulic portable rotary drill rig

2 tripod-mounted drills

1 monopod drill

1 pipe-mounted drill

Vacuum Excavation Equipment

2 each Vacmaster 4000 vac-trucks

Pacific Tec vac-trailer

Support Vehicles

Stake rack trucks – 1 ton to 2-1/2 ton

Pickups/service trucks

Support trailers – 1-1/2 ton to 40 ton

Pumps and Packers

200 GPM pumps and less

Packers for 8” wells or less

Transducers for monitoring

Various air compressors, pumping stations, grout mixers, generators, steam cleaners, floats, boats, outboard motors, tools, ATV material transporters, down-hole video camera and accessories

THE PARRATT-WOLFF DIRECT-PUSH SYSTEM

When conducting a direct-push sampling project, Parratt-Wolff, Inc. (PWI) uses proven tools and methods. Currently, we have available two Geoprobe combination rigs with the 66-series hammers, six combination rotary/probe rigs mounted on trucks, two 4-wheel drive tractor-mounted probe units and two full-size ATV rotary drills equipped for direct-push sampling. Since 1994, these rigs have been used on numerous direct-push sampling jobs and have also installed hundreds of monitoring wells. The dual capability of the combination rigs gives PWI the flexibility to drill with several different methods, all in one mobilization. Also, with multiple carriers Parratt-Wolff can reach just about any drilling location.

The Benefits of the PWI System:

1. Our combination direct-push/hydraulic drill rigs are multi-purpose. If field conditions preclude the use of direct-push drilling methods, other drilling methods are available in the same mobilization. Each rig is equipped with the drilling capabilities one would expect from a fully tooled drill rig. These rigs have been used to advance 10-1/4" ID augers, drill a 12" diameter fluid rotary bore hole, advance an 8" diameter down hole hammer, or to core rock.

2. Multiple field tasks can be performed in one mobilization without any delays and under one contract. For example, once a free product plume is delineated with direct-push methods, large diameter recovery wells can be immediately installed.

3. The availability of multiple types of direct-push capable rigs allows us to mobilize the right type of rig for your project. Whether you are inside or outside, on pavement or off-road, Parratt Wolff has a rig for the job.

Our Geoprobe and 4-wheel drive tractor-mounted rigs are small enough to fit in constricted areas and have a tight turning radius, making these the ideal rigs for indoor work where access is limited. In addition, the off-road capabilities of the vehicles make them the perfect choice for rugged outdoor conditions when rotary drilling is not required.

Our six truck-mounted combination rigs are fully tooled to complete direct-push sampling and rotary drilling on the same job in one mobilization. Rotary drilling techniques available include hollow stem auger, down-hole hammer drilling, drive and wash casing or fluid rotary methods.

The ATV rigs gives Parratt-Wolff a third option when it comes to direct push sampling. These rigs have been used to probe to 90’ and then drill a 6” diameter borehole 150-foot deep … all in the same day!

Soil Sampling

Soil samples are typically collected with conventional 2" diameter split-spoons (with or without liners) that are driven with a direct-push hammer in 2' increments. Should field conditions prevent us from using conventional split-spoons, Geoprobe's Large Bore or Macro-Core® discrete interval soil samplers could be used to collect soil cores. In the event direct-push methods fail, other drilling methods such as hollow stem augers, fluid rotary or down-hole hammers can be used to advance the bore hole.

Groundwater Sampling

Groundwater samples can be collected from either discrete intervals or from temporary wells. For discrete sampling, PWI uses either the HydroPunch II sampler or Geoprobe's Screen Point 15 discrete sampler. As an alternative, various diameter temporary wells, including Geoprobe's Mill Slotted Well Point can be installed. PWI can also install micro wells with a sand pack and seal. Groundwater samples are typically collected with a bailer, peristaltic or inertial lift pump.

DRILLER'S EXPERIENCE

Placing an experienced driller on your site is as important to us as it is to you. This translates into a productive job for us and a project completed on schedule and on budget for you. On average, our drillers have over 23 years experience.

Driller	Number of Years Experience	Number of Years with Parratt-Wolff
Arnold Chapel*	1985 – Present	1989 – Present
Mark Eaves	1991 – Present	1991 – Present
Gary Ellingworth	2002 – Present	2002 – Present
Ian Grassie*	1992 – Present	1995 – Present
Glenn Lansing *	1986 – Present	1986 – Present
Jim Lansing	1988 – Present	1988 – Present
Lewis LeFever*	1988 – Present	1995 – Present
Mickey Marshall	1985 – Present	1993 – Present
Richard Navatka*	1987 – Present	1987 – Present
Brad Palmer*	1985 – Present	1985 – Present
Layne Pech*	1981 – Present	1995 – Present
Lee Penrod*	1983 – Present	1994 – Present
Joe Percy*	1986 – Present	1993 – Present
Bill Rice*	1978 – Present	1978 – Present
Doug Richmond*	1988 – Present	1988 – Present
Kevin White	1987 – present	1987 – Present

*Certified Water Well Driller with Monitoring Well Endorsement by the NGWA

All drillers listed above are annually respirator fit tested, medically monitored and have completed the OSHA 40 hour training program and subsequent 8-hour refresher classes. Certifications of these tests and training are available upon request.

REPRESENTATIVE CLIENT LIST

BP / Atlantic Richfield
Abscope Environmental, Inc.
Allied-Signal Corporation
ARCADIS
Bechtel Environmental, Inc.
Beechnut Foods
Black & Veatch
C & S Engineers, Inc.
Camp, Dresser & McKee, Inc.
Carrier Corporation
CH2M Hill
Clean Harbors, Inc.
Clough Harbour Associates
CSX
Cornell University
Corning Glass Works
Earth Tech, Inc.
EA Engineering, Science & Technology, Inc.
ENSR
Environmental Resources Management Group
General Electric Company
Geotrans
Groundwater & Environmental Services
Groundwater Sciences Corporation
Haley and Aldrich, Inc.
MACTEC
Honeywell International, Inc.
I.B.M.
Jersey Central Power and Light
Malcolm Pirnie, Inc.
Michael Baker, Inc.
ExxonMobil Oil Company
N.J. Dept. of Environmental Protection
N.Y.S. Dept. of Environmental Conservation
N.Y.S. Department of Transportation
N.Y.S. Electric and Gas Corporation
National Grid / Niagara Mohawk Power Corporation
O'Brien and Gere Engineers, Inc.
Parsons Engineering Science
Roux Associates
Schnabel Engineering Associates
The Shaw Group
Stearns and Wheler, LLC
John P. Stopen Engineering Partnership
Syracuse University
Tetra Tech, Inc.
T.R.W.
U.S. Air Force
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
U.S. Marine Corps
Union Carbide
URS, Inc.
Verizon
Weston Solutions
Xerox

OFFICE LOCATIONS

Main Office:
P.O. Box 56
5879 Fisher Road
East Syracuse, New York 13057
Phone: 800-782-7260
Phone: 315-437-1429
Fax: 315-437-1770
Contacts: Bill Morrow, Joel Parratt
Email: info@pwinc.com

Branch Office:
P.O. Box 1029
501 Millstone Drive
Hillsborough, North Carolina 27278
Phone: 800-627-7920
Phone: 919-644-2814
Fax: 919-644-2817
Contacts: Robert Stevens, Todd Muench
Email: bstevens@pwinc.com

Branch Office:
PO Box 608
4650 Westbranch Highway
Lewisburg, PA 17837
Phone:570-523-8913
Contacts: Bill Morrow
Email: wmorrow@pwinc.com

PWI employs approximately fifty five people full time. We are classified as a small, employee-owned business.

We are currently licensed and performing work in Connecticut, Delaware, Georgia, Maryland, Massachusetts, Michigan, Mississippi, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Vermont, Virginia, Washington D.C. and West Virginia.

SEAN PEPLING
Project Manager

EDUCATION:

B.S. - Geology, SUNY College at Cortland, 1987

REGISTRATIONS AND/OR AFFILIATIONS:

- Licensed Professional Geologist, State of Tennessee: TN2333
- Association of Ground Water Scientists and Engineers
- Central New York Association of Professional Geologists

SPECIAL TRAINING:

- 40-hour OSHA Health and Safety Training
- 8-hour OSHA Health and Safety Refresher Course
- 8-hour OSHA Health and Safety Manager Training
- API WorkSafe Safety Key Training
- Loss Prevention System Training

QUALIFICATIONS:

As a Project Manager with Parratt-Wolff, Mr. Pepling manages various aspects of our jobs from the preparation of proposals to the scheduling and oversight of our field crews. Mr. Pepling also reviews Parratt-Wolff test boring logs and samples for accuracy and completeness.

Prior to Parratt-Wolff, Mr. Pepling had over 14 years of experience managing and performing remedial investigations, site assessments and landfill closure investigations. He has been responsible for managing hydrogeologic investigations and preparing reports that have undergone regulatory review and resulted in the issuance of several permits. He has planned, supervised and interpreted monitoring well drilling programs, geophysical surveys and groundwater sampling programs. He has also performed groundwater modeling on various sized groundwater flow systems ranging from an entire county to individual sites.

EXPERIENCE:

2007 – Present	Project Manager, Parratt-Wolff, Inc.
2001-2007	Associate/Project Manager, Dvirka and Bartilucci Consulting Engineers
1993-2001	Project Geologist/Project Manager, ERM-Northeast, Inc.
1991-1993	Project Geologist, PEER Consultants, PC
1990-1991	Project Geologist, Empire Soils Investigations, Inc.

People and Technology Creating a Better Environment

Your First Choice for Environmental, Energy & Industrial Services

CleanHarbors®

Who We

The Confidence of Working with a Leader

Since 1980, Clean Harbors has grown to be North America's leading and most trusted provider of energy and industrial, environmental, and hazardous waste management services. We offer a wide range of Environmental Services such as waste recycling and disposal, chemical packing, household hazardous waste management services, materials and supplies sales, field services, emergency response, and transformer services. Our Energy & Industrial Services include in-plant specialty industrial services, exploration services, directional boring, lodging services, filtration and treatment services, health and safety services, and rental services.

By delivering comprehensive services, we simplify and significantly enhance the success of your business operation. Our unparalleled combination of services and solutions, talented people and valuable assets enable Clean Harbors to serve as your sole source provider.

In addition to providing superior service, Clean Harbors has earned a reputation for keeping customers' needs first. Our clients include a majority of the Fortune 500 companies; numerous utilities, oil, pharmaceutical and chemical companies; the high-tech and biotech industries; and numerous local, state, provincial and federal government agencies. While our customers come from different backgrounds and industries, they all share one thing: the confidence knowing that their energy and industrial, environmental, and waste disposal needs are being managed with the utmost care, timeliness and efficiency.

As an innovative leader, Clean Harbors is committed to preserving our natural environment and adhering to strict government regulations. We invite you to learn more about Clean Harbors.

First Things First: Your Health & Safety

At Clean Harbors, we understand that hiring a company to work in your location or in the field can mean liability exposure, a risk you simply cannot afford to take. SafetyFirst!, our company's comprehensive and industry-leading safety and health program, is employee-driven with a firm management commitment to meet the safety requirements for service providers. SafetyFirst! encompasses numerous worker protection programs in place at Clean Harbors and demonstrates the company's corporate-wide commitment to safety.

The trend in achieving excellent health and safety results throughout the company sets us apart from other environmental and industrial services companies. All recordable injuries, whether they occur in the U.S., Canada or Puerto Rico, are included in Clean Harbors' injury and illness rate calculations. Total Recordable Incident Rate (TRIR) and Days Away, Restricted Activity and Transfer Rate (DART) are two of the primary health and safety statistical measures defined by the U.S. Occupational Safety and Health Administration (OSHA), and we continuously track our performance in these two areas. The numerous safety related programs that Clean Harbors has in place also contribute to our overall health & safety performance.

OSHA Voluntary Protection Program (VPP)

With safety at the forefront of all its activities, it stands to reason that Clean Harbors actively participates in VPP, a comprehensive health and safety process that requires employee involvement, management support, and cooperation with OSHA. Numerous Clean Harbors facilities have earned the prestigious VPP “Star” designation, OSHA's highest level of recognition for exemplary health and safety records, hazard prevention and control programs, routine work site analysis, health and safety training, and high level of management and employee involvement in all safety programs.

VPP Resident Contractors Program

Clean Harbors extends the VPP philosophy to employees who work on customer sites through the VPP Resident Contractors Program. By participating in the Resident Contractors Program, Clean Harbors combines its safety programs with the customer's safety programs to build a stronger health and safety environment on the customer's site.

Complete Confidence from Beginning to End

Environmental Services

Waste Disposal

- Bulk waste disposal
- Drum waste disposal
- Incineration
- Wastewater treatment
- Landfill
- Fuel blending
- PCB disposal
- Explosives management
- Medical waste management & destruction
- Consumer product disposal
- Shredding services
- Large-scale waste removal & disposal projects
- Container management
- Transportation services

Recycling Services

- Chemical & solvent recycling
- Reuse, recycling & reclamation
- Chemical distribution & product sales
- Used oil & oil products recycling
- Electronic & obsolete equipment recycling & disposal
- Light bulb recycling

Chemical Packing

- CleanPack® laboratory chemical packing
- Reactive material services
- Cylinder & compressed gas management
- CustomPack® self-pack program
- Laboratory moves
- DEA controlled substance management
- Radioactive services & disposal

Field Services

- Vacuum services
- Tank cleaning
- Decontamination
- Product recovery & transfer
- Demolition & dismantling
- Scarifying & media-blasting
- Steam cleaning
- Excavation & removal
- Facility closures
- Rail-car cleaning & inspection
- Marine booming & line handling
- Maritime services
- Remediation services

Material & Supplies Sales

- Absorbents, drums, safety equipment, & more

Apollo Onsite Services

- Customized on-site environmental & industrial services

Transformer Services

- Electrical equipment recycling & disposal
- Electrical equipment field services

Household Hazardous Waste

- Temporary one-day collections
- Agricultural & pesticide collections
- Permanent collection facilities & depots
- Mobile collection programs
- Door-to-door collection programs
- Universal waste programs
- Special waste events
- Small quantity generator programs
- Consulting services

Emergency Response

- Oil spill response
- Chemical & hazardous material spill response
- Biological & infectious agent response
- Natural disaster response
- Emergency pump-outs
- Emergency lab packing
- Emergency waste disposal
- Standby emergency response coverage
- National response coverage programs

A Proven Record of Reliability

Energy & Industrial Services

Energy & Industrial Services

- Catalyst technologies
- Decoking / pigging services
- Chemical cleaning
- High-pressure services
- Industrial services
- On-site material processing
- Outage & turnaround services
- Mechanical services
- Flush-by services
- Hot oiling
- Coil tubing
- Continuous rod services
- Pressure trucks
- Fluid handling, transportation & disposal
- Solids handling, transportation & disposal
- Hydro-excavation

Exploration Services

- Land & aerial surveying
- Line locating
- Line clearing
- Mulching & hand cutting
- Shot hole & diamond drilling
- Land development
- Civil water & sewer infrastructure construction
- Seismic line cutting
- Heliportable drilling

Directional Boring

- Drilling (conventional, mudmotor & air drilling)
- Directional punching
- Pipe ramming / pipe extraction
- Fusing services (licensed to fuse c900 pvc pipe)
- RG-O5 rock shield pipe protection
- Dewatering services
- Soil testing & storage tank cathodic protection

Lodging Services

- Permanent & temporary camps
- Client & open lodges
- Drill camps
- Wastewater treatment plants

Filtration & Treatment Services

- Rental equipment & systems
- Portable systems 5 gpm to 12k gpm
- Carbon change out & disposal services
- Treatment of contaminated water
- Filter products, bags, vessels
- Dewatering systems
- Consulting support for treatment system design & engineering
- Complete turnkey remediation packages for water, wastewater, air, vapor & soil
- Turnkey operations & maintenance of systems

Health & Safety Services

- Drug & alcohol testing
- Occupational health testing
- Mobile testing
- Respiratory testing
- Audiometry testing
- Education sessions

Rental Services

- Access & rig matting
- Portable access bridges
- Combustion
- Production equipment
- Mobile washroom facilities
- Fluid rentals
- Shoring
- Winch tractors

Customizing an On-Site Program Right for You

Apollo Onsite Services

Apollo Onsite Services

Clean Harbors' Apollo Onsite Services offer custom designed on-location staffing programs that place select, experienced and cross-trained employees at your business to support your industrial and environmental service needs. Apollo teams handle routine and non-routine projects. This industry-leading on-site solution allows you to focus on your production (what you do best) as we make your entire on-site services and environmental program safer, more cost-effective and self-sufficient (what we do best).

Bringing our expertise and resources right to the customer, Clean Harbors' Apollo Program is the premier on-site solution that serves the dual purpose of not only improving your industrial services and waste stream management, but making your entire in-plant services and environmental programs safer, more cost-effective and self-sufficient.

Clean Harbors' skilled technicians work on-site in tandem with customers to deliver proper waste transportation and disposal, lab chemical packing (CleanPack®), industrial cleaning and maintenance, and more. Whether you require a single field technician or a 20-person team of diversified talent, Clean Harbors can design the right program to satisfy your specific needs.

We continually evaluate and track all program goals and provide regular feedback and evaluation via a proven metrics system to ensure customer satisfaction. As your needs change, we seamlessly and cost-effectively adapt to meet those changes.

We utilize a hand-in-hand, team approach that leverages our extensive resources and infrastructure, including our Web-enhanced technology and online services.

Apollo Service Offerings

Clean Harbors' exclusive Apollo Program brings the most extensive range of environmental and industrial services to your site:

- Full-time on-site services including in-plant industrial maintenance; routine and specialty industrial services; product recovery and transfer; tank cleaning, including confined-space entry; vacuum services; and emergency response
- Trained on-site management and specialty labor resources such as lab pack chemists, environmental technicians, drivers, wastewater-treatment operators and incinerator operators
- Waste profiling, coordination, tracking (on-site/off-site), and beneficial reuse analysis, inventory and off-site shipping management
- Efficient waste treatment and processing capabilities to Clean Harbors-owned and operated facilities
- Apollo Teams use Clean Harbors' proprietary software to quickly produce inventory lists, manifests, LDR forms and labels that comply with all local, state, provincial and federal regulations
- Web-enabled systems utilize electronic profiling

Clean Harbors' Vision

To be the premier provider of environmental services and solutions.

Why Clean Harbors

Reduced Risk. We understand that hiring a company to work on your site can mean liability exposure. Clean Harbors' training protocols and health and safety procedures are unsurpassed. Our Experience Modification Rates (EMRs), DART, TRIR, and our training programs and overall approach to business keep your plant in compliance with OSHA and HRSDC, while limiting your liability exposure.

Always in Compliance. EPA, DOT, TDG and Environment Canada regulations are complex, and even a minor infraction can cost you time and money. Clean Harbors provides the expert service and advice to ensure your waste-management program is always up to code, while still keeping an eye on your bottom line.

Reducing Liabilities. All of our disposal facilities uphold rigorous quality assurance programs to meet the highest standards of both internal and external audits. We maintain constant vigilance over all facilities to identify and minimize long-term liabilities. The result: Your exposure to risk is minimized.

Controlling Costs. Clean Harbors will address your situation and identify the most appropriate and cost-effective solution for you.

All-in-One Service. Regardless of the waste type your company generates or the services you require, Clean Harbors is your single source provider for environmental, and energy and industrial services.

Leveraging Technology. Our Internet-based online services provide customers with instant access to key records related to transactions and help us better track shipments from pickup to disposal. You can monitor every aspect of your waste stream and maintain complete process control.

Fast Turnaround. Each week, Clean Harbors crews from service centers across North America perform hundreds of planned jobs ranging from routine confined-space entry for storage tank cleaning, to elaborate cleaning during a plant turnaround. Clean Harbors has the capabilities and resources to complete any size job, quickly and efficiently.

Rapid Emergency Response. When time is critical, Clean Harbors is ready to respond swiftly and effectively to any emergency, including spills of all sizes on land or water, chemical, oil, and biohazards, including bloodborne pathogens.

Equipment and Extensive Resources. Whether it's manpower, equipment, supplies, specialized equipment or technology, we will provide a complete solution to your situation with our vast array of resources.

Manpower, Experience and Sound Management. Clean Harbors attracts and employs the finest, most talented people in the industry. Our training standards are second to none, and each job is performed using strict protocols and health and safety procedures. You're always in good hands.

Environmental Services

For Technical Services
Call 800.444.4244
For Field Services
Call 800.OIL.TANK
(800.645.8265)

Energy & Industrial Services

Call 877.215.9730 (U.S.)
Call 800.661.6689 (Canada)

Or visit the Web at

www.cleanharbors.com

Corporate Headquarters
42 Longwater Drive
P.O. Box 9149
Norwell, MA 02061-9149
781.792.5000
800.282.0058

Clean Harbors

Commitment. Leadership. Confidence.

Clean Harbors is North America's leading provider of environmental, energy and industrial services serving over 50,000 customers, including a majority of Fortune 500 companies, thousands of smaller private entities and numerous federal, state, provincial and local governmental agencies.

Within Clean Harbors Environmental Services, the Company offers a broad range of hazardous material management and disposal services, including the collection, packaging, recycling, treatment and disposal of hazardous and non-hazardous waste. We also provide a wide variety of environmental cleanup services on customer sites or other locations on a scheduled or emergency response basis.

Within Clean Harbors Energy and Industrial Services, the Company provides industrial and specialty services, such as high-pressure and chemical cleaning, catalyst handling, decoking, material processing and industrial lodging services to refineries, chemical plants, pulp and paper mills, and other industrial facilities. We also provide exploration and directional boring services to the energy sector serving oil and gas exploration, production, and power generation.

Clean Harbors has more than 175 locations, including over 50 waste management facilities throughout North America in 37 U.S. states, seven Canadian provinces, Mexico and Puerto Rico. The Company also operates international locations in Bulgaria, China, Sweden, Singapore, Thailand and the United Kingdom.

Founded in 1980, Clean Harbors has grown to be the leading and most trusted environmental, energy and industrial services, and waste management company, fully committed to preserving natural resources, serving local communities, and adhering to strict government regulations.

Look to Clean Harbors to handle every aspect of your environmental, energy and industrial services management program.

Environmental Services

- Waste Disposal
- Chemical Packing
- Transformer Services
- Material & Supplies Sales
- Emergency Response
- Recycling Services
- Field Services
- Apollo Onsite Services
- Household Hazardous Waste

Energy & Industrial Services

- Industrial Services
- Directional Boring
- Filtration and Treatment Services
- Rental Services
- Exploration Services
- Lodging Services
- Health and Safety Services

CleanHarbors®

Robert M Bihlmeyer
Lead Customer Service Representative

a.	**Name, Title & Local Company Address:**				
	Robert M Bihlmeyer Lead Customer Service Representative Clean Harbors Env. Services 761 Middle Street Bristol, CT 06010				
b.	**Corporate Address:**				
	Clean Harbors Environmental Services, Inc. 42 Longwater Drive Norwell, Massachusetts 02061				
c.	**Years Experience – With This Firm:**	14	**With Other Firms:**	0	
d.	**Education: Degree(s) / Year / Specialization & Licenses / Registrations**				
	Bachelors in History. 1979				
e.	**Other Experience and Qualifications:**				
	Mr. Bihlmeyer is a Lead Customer Service Representative for Clean Harbor's Bristol Service Center. His responsibilities include: Cut sales orders and schedule waste pick-ups for all "local" customers. Complete waste profiles and enter in Clean Harbors computer system referred to as WIN. Support Account Managers and Clean Pack Specialists in servicing "local accounts". Manage the data in WIN for all reactive customers; Milk Run Maintenance, Customer Master File, CPS, Profile System and Quote System. Handle local call-ins and network call properly. Provide T&D technical support to Field Service Reps. Preview and resolve any invoicing issue.				
f.	**Environmental & Health and Safety Training:**				
	• **40 Hour OSHA** • **Clean Harbors Winweb training** • **Clean Harbors Beacon training** • **RCRA training** • **DOT training** • **Hepatitis B vaccination** • **Sample shipping Fedex Ground**				

Expert solutions for managing industrial materials.

WASTE MANAGEMENT

THINK GREEN®

Your reliable partner for materials management.

Maximizing Resources Step by Step

As North America's leading environmental solutions company, we at Waste Management spend a lot of time thinking about the raw materials and products used in manufacturing. As our planet's natural and man-made resources grow scarcer, process residuals become far too valuable simply to discard.

Across the country, industries like yours are relying on our expert Sustainability Services team to help them reduce process residuals, minimize risk, and achieve environmental compliance, even as we guide them in cutting costs and streamlining operations.

We are seasoned professionals who undergo annual industry and regulatory training so we can anticipate changes that will impact you and your business. We understand the chemicals, materials, and products you use and are proficient in DOT and EPA regulations. Many of us hold degrees in science and engineering.

As experts in sustainability, we're adept at helping you extract value from materials you may be throwing away. In fact, in the past six years, we've helped other highly regulated industries realize more than $75 million in savings.

And, we are far more than consultants. We can work side by side with you, assisting with implementation to drive real savings to your bottom line. We can collaborate with you in several ways:

- If you need us on site, we can be there to offer expert advice and help you identify and implement sustainable business practices.
- We can help you divert material from landfills, or perhaps use it to generate power through our landfill-waste-to-energy initiatives.
- We can help you reclaim valuable resources, such as mercury.
- In some cases, we can help eliminate your need for a specific material altogether.
- And we can help you repurpose your industrial by-products for other beneficial uses.

When you're a Waste Management customer, your options are varied and continually expanding.

TAKING YOU THROUGH THE PROCESS

Expert Guidance
We can lead you to processes that streamline your operations and tread lightly on the environment at every stage of your supply chain.

Implementation
We can be at your side, helping you lower production costs, boost your bottom line, and achieve your sustainability objectives.

Operations
Our Sustainability team can analyze your industry and organizational dynamics to create an end-to-end, unique solution and plan of action.

Results
We can help you reduce – or even eliminate – by-products to make a positive difference in the environment and in your organization.

Environmental Solutions for Industry

Our mission is to assist you in your pursuit of cost savings while also achieving your environmental sustainability goals. Using our comprehensive network of treatment and recycling facilities, Waste Management is prepared to be your sole service provider in meeting all your environmental needs.

Using a single point of contact, our service professionals are committed to providing comprehensive solutions at your facility or across your enterprise. Whether the recycling or treatment solution is managed in-house or through Waste Management's vast network of strategic alliances, our in-field execution is comprehensive, convenient, timely, professional – and competitively priced.

Among the solutions available to you are:

Industrial Recycling: Driving diversion of common industrial materials, including plastics, woods, metals, and materials from industrial processes.

Mercury Retort: Recovering mercury from contaminated products, devices, and debris, then reprocessing it for reuse.

Bioremediation: Treating organic materials with microorganisms to make them less toxic or non-toxic.

Bulk Treatment: Reducing the toxicity of large-volume streams, ranging from oilfield liquids, to on-site or off-site treatment of coal combustion products. The ultimate goal for beneficial reuse and recycling of these process residuals is to provide them a second life.

Thermal Desorption: Treating dry soils or sludges to remove organics, which can then be recycled.

Container and Logistics Management: Collecting, staging and transporting drums, totes, and gaylords, whether the materials are hazardous or non-hazardous, liquid or solid, debris or soil. Whether it's one drum or a pallet of small containers, Waste Management can devise a cost-effective materials management plan.

Macro/Microencapsulation: Managing toxic materials with sealing agents or placing them in impermeable containers to prevent them from interacting chemically with the environment.

Deep Well Injection: Liquid by-products are pumped under pressure into porous rock formations deep underground for secure management.

PCB Management: Secure management of manufactured items containing polychlorinated biphenyls, including articles, soil, sediment, and debris in full compliance with TSCA regulations.

Comprehensive Solutions

As North America's leading provider of environmental services, Waste Management has the capabilities and experience to manage every category of by-products and to serve customers across a variety of industries. We look at your resource use in a holistic way, using advanced evaluation techniques and alternative materials management solutions before recommending strategies to help you operate more sustainably.

With our vast infrastructure and expert sustainability teams, we are well equipped to deal with the compliance issues that generators and manufacturers face every day.

In addition to our vast internal infrastructure, we maintain a large network of affiliates who adhere to our high standards of excellence. As a result, our customers have access to the nation's most comprehensive portfolio of environmental solutions.

Rely on Waste Management for everything from fuels blending, bioremediation, mercury and battery recovery, incineration, and spill response to a host of other adaptable solutions, each ideally responsive to the needs of industry – from small-quantity generators to mega-industrial complexes.

For more information about how we can develop solutions to meet the needs of your plant or company facilities, contact your Waste Management Manufacturing & Industrial representative at 1-800-963-4776 or visit WMSolutions.com.

WMMANUF-443B

WASTE MANAGEMENT

THINK GREEN.®

Expert solutions for transporting industrial materials.

WASTE MANAGEMENT

THINK GREEN.®

The one source for handling all your industrial materials.

As North America's leading provider of environmental services, Waste Management is well prepared with the experience, equipment, and logistics infrastructure to transport your industrial by-products safely, reliably and responsibly. We can also work with you to minimize the process residuals you generate and maximize the material value of your operations.

Expert Source for Your Transportation Needs

Rely on Waste Management for a matchless array of solutions for managing and transporting your industrial by-products. We can also help you reconsider the nature and value of those materials and recommend strategies for making the decisions most advantageous to you, geographically and economically.

Whether you have a single drum or a trainload of materials to be managed, we can identify the environmental and economic issues associated with those materials, provide a host of solutions, and recommend those most appropriate to your situation.

Rely on us for well-maintained, up-to-date vehicles and equipment operated by trained, dependable industry professionals. Our competitively priced services are available throughout the United States and Canada to meet your transportation requirements – from ordinary to unusual, from simple to complex. Our extensive industrial services include roll-off containers, bulk hauling, small-quantity collection, and many other offerings. (See list of services at right.)

Let us apply our knowledge, experience and nationwide capabilities to your challenges, helping you achieve your sustainability objectives while driving bottom-line growth for your organization.

Transportation Service Excellence

At Waste Management, we view every business transaction as an opportunity to build a long-term relationship with our customers. We will work closely with you to understand your business today and anticipate your materials transportation needs tomorrow. Our services can include:

- Logistics and transportation design
- Quality control and follow-up
- Strict safety monitoring and enforcement
- Assistance with DOT, EPA and NESHAP recordkeeping requirements
- Drivers trained in safety and emergency response
- Assistance with preparation of shipping papers
- Ongoing consultative services to adopt as your business evolves

INDUSTRIAL TRANSPORTATION SERVICES

BULK HAULING

Bulk tankers
Pneumatic trailers
Pumper trucks
Vacuum trucks

ROLL-OFF CONTAINERS

Covered containers
Custom-designed containers
Demolition containers
Sealed sludge containers
Soil containers
Specialty containers
Water-tight containers

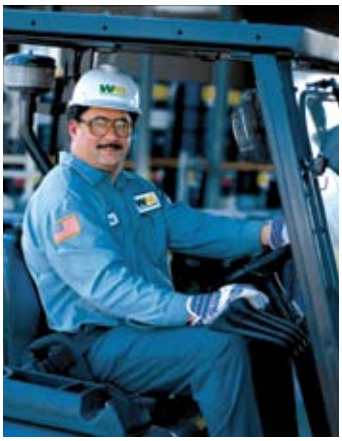
OTHER SERVICES

Bulk liquid storage
Dewatering boxes
Dump trailers
Rock dumps
Flatbed trailers
Rail transport
Short-body trucks with lift gates
Vacuum boxes
Van trailers
Walking floor trailers

SMALL-QUANTITY COLLECTION

Bagster® Dumpster in a Bag®
Dock pickup
Drums
Gaylord shipping boxes
Less Than Truck Load (LTL)
Totes

*Check with your representative for available services in your area.



Industrial Roll-Off Services

At Waste Management, we focus on providing superior service and value to each customer. We maintain every roll-off container to ensure safety and environmental compliance. We train our drivers to deliver your roll-off containers on time and place them in the most convenient and accessible locations available. And we service the containers in accordance with the highest professional standards. By attending to these details – and so many others – we set the standard for excellence for permanent and temporary roll-off services.

In most locations, Waste Management remains on call to make emergency pickups when the volume of materials generated is higher than anticipated. In most areas, we also offer same-day service.

LARGE AND SMALL.

Waste Management provides industry-preferred transportation services for solid and liquid materials.

Container Management Services

Waste Management provides safe, dependable and affordable transportation and materials management of drum containers bearing both hazardous and non-hazardous materials, for businesses large and small. In addition, we strive to provide superior customer service, including professional account set-ups, routine on-time deliveries and collections and solutions-oriented customer support.

Because the cost of handling and transporting drums can frequently surpass the costs of their actual materials management, Waste Management is committed to helping customers develop a collection and materials management plan that keeps these costs to a minimum.

Drum management services can be arranged on an on-call or scheduled basis. "LTL" (less than truck load) services for single drums, and full-truck-load management services are also available.

TRAINED DRIVERS AND STATE-OF-THE-ART EQUIPMENT

Waste Management ensures that your containers will be delivered when and where you need them.

Vacuum Trucks

Whether the job site requires a supersucker or a fleet of vacuum tankers, Waste Management can harness the neccessary resources and talent to keep your project on schedule and on budget. Both drivers and laborers are fully trained and current with their Hazwoper certifications. You can have confidence that the job's safety is our utmost priority.

Specialized Trucking

To be economically feasible, large-scale construction and remediation projects often require the use of specialized trucks. Our wide-ranging network of transportation specialists can quickly and affordably obtain any type or quantity of transportation equipment, including end dumps, demolition trailers, and tandem and pup trailers. We can seamlessly dovetail the importing of backfill with soil export and arrange for the soil to be delivered and professionally applied in preparation for landscaping, paving or construction.

Rail Services

Waste Management provides rail services to customers with rail access and those in proximity to a spur. Our service utilizes the nation's vast rail network to provide affordable access directly to sites that may be hundreds, or even thousands, of miles away.

Beyond transportation services, rely on Waste Management's Sustainable Services team to help you reduce, or even eliminate, by-products. In the process, we can guide you to ways to streamline operations and drive bottom-line growth.

Our far-reaching solutions enable us to look at your resource use in a holistic way and apply efficiencies learned in other industries to your specific situation. We can evaluate every aspect of your business and recommend strategies for operating more sustainably at every level of your operations.

For us, by-products are no longer something to get rid of – they are resources. We're adept at finding value in the materials our customers are used to throwing away. Give us a call and let's discuss how we can help your business recover part of that value.

For more information about the transportation solutions available in your area, contact your Waste Management Manufacturing & Industrial sales representative at 1-800-963-4776 or visit WMSolutions.com.

WMMANUF-443A

WASTE MANAGEMENT

THINK GREEN®

Christopher A. Lowe

South Hadley, Massachusetts 01075
413.544.1932
Clowe2@wm.com

Work Experience

Senior Industrial Account Manager

September 2010 -present: Waste Management, Inc.

Waste Management East Group industrial, special and hazardous waste sales for Connecticut and Eastern New York. Responsible for pricing and coordinating approval into (6) Massachusetts, (1) New Hampshire, (3) New York Sub-Title D Landfills for non-hazardous waste and hazardous waste disposal at CWM Chemical Waste Services Sub-Title C Landfill located in New York.

Business Development, Estimator & Project Manager

2009- September 2010: McConnell Enterprises, Inc.

Provide estimating, project management and lead marketing effort for McConnell Enterprises, Inc. McConnell is a privately owned demolition, environmental remediation and scrap metal recycling contractor located in Massachusetts. My focus has been to market McConnell's services in the private sector, get invites for bid opportunities, network and establish open communication with firms associated in the demolition / environmental & waste management markets and expand geographic market sector and promote scrap steel processing & recycling. Through my efforts McConnell has been invited and participated on Federal Environmental Procurement solicitations, Major & Private Petroleum Company RFQ's and Consulting & Engineering Company demolition and remediation opportunities. These opportunities have included building & structure demolition, asbestos & hazardous material surveys, contaminated soil excavation, T&D (hazardous & non-hazardous waste), site restoration, clearing & grubbing, fuel supply pipe line decommissioning, shoring dewatering and dredging.

Business Development Manager

2008-2009: MHF Logistical Solutions

MHF Logistical Solutions (MHF) was an asset based rail road logistics waste disposal transporter (company dissolved). BDM sales efforts were focused on Major Accounts (Federal Service Contractors, Landfill Owners & Hazardous Waste Disposal Facilities) on large scale event remediation projects and management of recurring waste streams. Waste streams varied to included hazardous, radioactive and non-regulated.

Director of Business Development

2000-2008: Charter Environmental, Inc. & AmeriTech Environmental Services, Inc.

Provided business development and sales marketing for the environmental site services of Charter Environmental, Inc (CEI) to include T&D of various regulated debris & soil wastes and environmental site restoration to municipal, state and federal government agencies, as well as, environmental consultants, general contractors and waste disposal facilities. Concentrated marketing and sales effort between CEI and AmeriTech Environmental Services, Inc (ATech) a division of CEI. Diversified and expanded core business capability and market sector to include C&D, ACM, radiological debris, ash (msw & coal) & municipal solid waste. Increased the geographic influence of service to include sites in New England & New York. Servicing facilities located in New York, Ohio, Pennsylvania, Michigan, Tennessee, Texas, Utah and Province of Quebec.

Work Experience

Since 1984

- 26 years experience in the Environmental Remediation field. My employment tenure has included Private Oil Company, State Environmental Agency, Self-Employed Broker, Environmental Recycling Facility, Environmental Remediation Contractor, Hazardous Waste Transporter and includes the positions listed above.
- Performed and marketed environmental services to the Federal & State Government, Property Owners, Major Oil Companies, Colleges & Universities, Insurance Companies, Construction Managers, Abatement Contractors, Demolition Companies, Power Producing Industry and Waste Management Industry.
- Environmental services that I have managed include UST closures, contaminated soil excavation, transportation & disposal of State Regulated, RCRA, TSCA & Radioactive debris/soil waste, C&D debris (ACM & TCLP Lead) transportation & disposal, dredge sediment management removal, transportation & disposal, demolition & debris separation/disposal projects, municipal solid waste (msw) transportation, sludge and ash (msw & coal) transportation & disposal, building and structure demolition.

- My duties as Director of Business Development included: Time management between event and annuity opportunities, provide detailed growth analysis to evaluate capital equipment purchases, maximize productivity of owned assets and establish relationships with similar subcontractor providers. Optimize traditional vendor relationships to become client & service provider. Continuous effort supporting the image as premier service provider.

Education

1980 – 1986

Norwich University

Bryant College

Worcester Sate College

Central New England College/Information Technology, Worcester, MA

- Bachelor's Degree - Manufacturing Technology Information

Additional Training

OSHA 40 hour

LPS trained

CONSTRUCTION / REMEDIAL SERVICES

Multi Phase Recovery

Also known as Total Fluid Extraction, this uses a high vacuum system to remove combinations of contaminated ground water, separate-phase petroleum product, and hydrocarbon vapor from the subsurface. It removes contaminants from both above and below the water table.

Soil Vapor Extraction / Air Sparging

Soil vapor extraction is often employed by PES for treatment of contaminated soil. SVE essentially removes contaminants from the soil in vapor form by applying a vacuum through a system of underground wells. Air injection wells are often installed to increase air flow and improve removal efficiency.

SVE alone cannot remove contaminants from soil below the water table. Here the air sparging process is included, which pumps air into the saturated zone to push contaminants above the water table where the SVE extraction wells remove them.

Point of Entry Treatment Systems

PES staff can assist property owners with water source evaluation as well as source protection plans. We will provide sampling and testing services in connection with home purchases and development.

If groundwater contamination is identified, carbon canister systems are often required at the point of entry to the facility. Continuous monitoring and change-outs are scheduled and implemented to maintain proper water quality.

Precision Environmental Services, Inc., a New York State certified woman-owned business enterprise established in 1991, includes professionals, hydrogeologists, and technicians providing environmental investigation and contracting services. PES personnel have completed numerous site assessments, subsurface investigations, and design/implementation of remedial response projects.

KEY SERVICES

- Subsurface drilling and probing;
- Underground storage tank management and closure;
- Phase I, II and III environmental audits/assessments;
- Remedial corrective action design and implementation;
- Construction dewatering and soil/fluid transport and disposal;
- Indoor air quality testing and vapor impact mitigation.

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Main Office:
831 NYS Route 67 38A,
Ballston Spa, New York 12020
Tel: 518.885.4399

Central New York Office:
756 C.R. 21
Hannibal, New York 13074
Tel: 315.564.3222#

www.precisionenvironmentalny.com

PES

PRECISION ENVIRONMENTAL SERVICES, INC.

- ***Consulting***
- ***Assessment***
- ***Remediation***

20 YEARS
1991 - 2011

~Certified Women-Owned Business Enterprise~

Investigative Services

Site Assessment

Utilizes "due diligence" environmental guidelines to identify environmental concerns which could pose a potential liability for the Property.

Subsurface Investigation

If a site is known to contain environmental contamination or requires further investigation, a Phase II assessment is conducted. This entails any of the following:

- Excavate test pits
- Install soil borings using direct-push Geoprobe®, fitted with a soil sampler
- Install groundwater monitoring wells using Geoprobe or a hollow-stem auger drill rig
- Monitor and field screen the soil with field instrumentation
- Maintain monitoring well or soil program to analyze for constituents of concern
- Ground penetrating radar survey.

PES equipment includes geoprobes and excavation equipment configured to allow for rough terrain and/or limited access.

Investigative Services

Groundwater Investigation

Groundwater monitoring wells can be installed as part of the subsurface investigation in order to assess groundwater quality. This is accomplished using a conventional hollow-stem auger drill rig or our Bobcat mounted Geoprobe.

Groundwater sampling and reporting is then provided to further assess environmental impacts.

Soil Vapor Intrusion

Soil vapor, contaminated by leaking petroleum products or hazardous substances, has become a serious concern. The vapor can enter a building through cracks or perforations in slabs or walls.

Only when thorough analysis of building operations and systems is completed, above-slab and sub-slab air sampling is done. Corrective action can be as simple as wind driven negative air ventilation or large scale power ventilation.

Construction / Remedial Services

Underground Storage Tanks

Due to the inherent risk of contaminant release, buried storage tanks and piping are potential significant liability. PES technical staff have successfully completed hundreds of UST removals and associated remediation projects, such as:

- Sampling and monitoring;
- Tank removal;
- Closure reports;
- Mass soil excavation and disposal;
- Associated construction dewatering.

Groundwater Treatment

Groundwater extraction and treatment is not just removal of contaminants, it provides containment of contaminated ground water to prevent migration. Typical alternatives include:

- Conventional pump and treat
- Total Fluid (Multi Phase) Extraction
- Air stripper tray and packed Towers
- Granular Activated Carbon Treatment
- Advanced Oxidation
- Chemical Augmentation
- Free product Recovery

STEPHEN M. PHELPS

PROFESSIONAL PROFILE

Mr. Phelps is manager of operations with Precision Environmental Services, Inc. His current duties are to plan, direct and oversee the day to day operations of the organization. This includes technical field staff as well as project management and professional staff for the environmental department. He is responsible for ensuring and improving the performance, productivity, efficiency and profitability of organizational operations through the provision of effective methods and strategies. He is a direct liaison with principles and top managers to assist in the development, implementation and management of strategic operational plans.

Mr. Phelps also serves as senior project manager as intramural or project specific needs dictate. He possess greater than ten years of experience in the field. He is capable of managing all facets of environmental projects including coordinating with clients and regulatory officials, cost estimating, budget analysis, scheduling of personnel, equipment allocation, contract management with subcontractors, health and safety aspects, and overall project coordination to ensure work is completed in a comprehensive, efficient and timely manner. Mr. Phelps has managed numerous projects from inception to completion for work assignments ranging from several thousand to several million dollars. He oversees and performs environmental investigations including oversight of drilling activities and groundwater monitoring well installations, management of soil vapor intrusion studies, soil gas surveys, and indoor air assessments in accordance with the latest regulatory guidelines. He also has experience in the field of environmental remediation. He facilitates remedial design efforts and directs operation and maintenance for various remedial technologies. Additionally he performs field and laboratory data interpretation for site assessment, generates technical regulatory reports to document site conditions, potential threats to sensitive receptors, and recommendations for the mitigation of petroleum, hazardous wastes, or other substances.

EMPLOYMENT HISTORY

2004-Present, Operations Manager/Senior Project Manager, Precision Environmental Services, Inc., Ballston Spa, NY

- Coordinate, manage and monitor the workings of technical field staff, project management and professional staff
- Improve processes and policies in support of organizational goals
- Formulate and implement organizational policies and procedures to maximize output
- Organize, recruitment and placement of required staff
- Establish work schedules
- Supervise staff, monitor and evaluate performance
- Provide consultation and senior project management duties for both private and public sector environmental projects to identify and assess contaminant exposure, migration and mitigation
- Perform subsurface investigations and remedial actions that include oversight of field work and the interpretation of collected data

2001-2004, Environmental Scientist 2, The Tyree Organization, Ltd., Latham, NY

- Supervised and participated in the successful completion of numerous environmental projects in a timely and efficient manner
- Conducted soil, groundwater and air sampling in conformance with standard regulatory guidelines to assess impact levels, exposure pathways and the degradation of contaminants
- Performed operation and maintenance on various remedial systems including groundwater pump and treat, high vacuum extraction, and air sparge and soil vapor extraction systems

2000-2001, Project Manager/Environmental Field Technician, Hillmann Environmental Group, Chatham, NY

- Performed environmental site assessments including site reconnaissance, record review, interviews and a compilation of site data to determine past and present land use and potential environmental threats
- Provided project monitoring for large and small asbestos abatement projects to identify and limit human exposure and document adherence to regulatory guidelines
- Developed skills necessary to implement work in accordance with environmental laws and regulations and execute specialized training in the field

EDUCATION/AFFILIATIONS

B.A., Environmental Science, State University of New York, Plattsburgh, 1999
OSHA 40-Hour Hazardous Materials and Site Investigations Training Course
Annual OSHA 8-hour refresher
OSHA 10-Hour Construction Training
Railroad Worker Safety Training
Confined Space Entry Training
Certified CPR and First Aid

TETRA TECH GEO

ASSESS
[SITE CHARACTERIZATION]

SITE CHARACTERIZATION SERVICES

Tetra Tech GEO provides clients with "best in class" professional services to link site investigation and analysis with engineering and design to ensure that potential and existing environmental liabilities are characterized and remediated in the most technically efficient and cost-effective manner.

- **Site Investigation.** Our site characterization services meet the needs of the business and real estate communities by applying nearly 40 years of practical experience gained at Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), and state-lead projects. Tetra Tech GEO has completed more than 6,000 Phase I and Phase II environmental site assessments and National Environmental Policy Act (NEPA) assessments for raw land and industrial and Brownfield sites.

- **Soil and Groundwater Investigation.** Our technical expertise includes dense non-aqueous phase liquid and light non-aqueous phase liquid (DNAPL/LNAPL) characterization, radiological contaminant assessments, and polychlorinated biphenyls (PCB) specialty analyses. In addition, our experience includes fractured rock characterization, natural attenuation evaluation, potable water resource assessments, dose and facility reconstruction, and forensic geology.

- **Innovation.** Tetra Tech GEO is a leader in the use of innovative approaches to streamline site characterization activities by applying in-the-field data analysis and decision making (the Triad approach) to site work to identify contaminant sources, using passive diffusion bag (PDB) samplers in water and completing feasibility studies for biological and natural attenuation solutions.

- **Publications/Guidance Documents.** Tetra Tech GEO staff includes recognized experts in the field of site characterization and groundwater remediation who have authored dozens of U.S. Environmental Protection Agency (EPA) publications and guidance documents on subjects including DNAPL evaluation, capture zone analysis, multi-phase extraction processes, and pump and treat optimization.

Site Characterization Services Provided by Tetra Tech GEO:

- Soil, air, and groundwater investigations
- Permitting assistance
- Hydrogeologic studies
- GIS models and graphics
- LNAPL recovery
- Treatability studies
- Tidal influence studies
- Aquifer resource evaluation
- Fractured rock characterization
- Pneumatic fracturing
- Groundwater/surface-water interaction
- Bedrock coring
- Discrete-interval packer testing
- Interconnectivity testing
- Air sampling and exposure assessments
- Radionuclides investigations
- Database/GIS model integration
- Human health exposure assessments
- Forensic site reconstruction
- Expert witness testimony
- Third-party oversight
- Underground storage tank remediation
- Water resource assessments

TETRA TECH GEO

ACT
[PERMITTING SUPPORT]

PERMITTING SUPPORT

Tetra Tech GEO has significant experience in compliance and permitting for all types of facilities. Our staff of scientists and engineers assist clients in preparing multimedia environmental permits and associated documentation—from the development of the application to the final negotiation of permit conditions. Project highlights include:

- **Underground injection control (UIC) permitting.** Since the 1980s, Tetra Tech GEO has assisted numerous clients in UIC permitting, performing flow and transport modeling to demonstrate no-migration, waste containment, and protection of underground sources of drinking water. Clients we have assisted include: DuPont, BASF, Monsanto, Texaco, and Occidental Petroleum, as well as municipalities for which underground injection of treated wastewater is being used as a disposal method. In addition, we have expertise in Carbon Capture and Storage (CCS) permitting.

- **Landfill permit compliance.** Tetra Tech GEO has extensive experience working at municipal solid waste landfills providing permit and permit modification assistance. This includes performing Groundwater Impact Assessments, developed monitoring plans, and delineating Management Zones in compliance of regulatory requirements. Our clients include Waste Management, the City of Ann Arbor, and Beazer.

- **Water use and discharge permitting.** We have extensive experience in surface water discharge permitting at both the federal (NPDES) and state level, helping clients obtain groundwater discharge, water appropriation, and use permits. Tetra Tech GEO technical activities have included: the design of treatment and water systems, collection/analysis of field data, completion of applications, meeting with/testifying before regulatory agencies, and participating in public meetings.

Permitting Services Provided by Tetra Tech GEO:

- Underground injection control (UIC) for Class I, II, III and V wells
- Landfill permit compliance
- RCRA/Solid and hazardous waste
- Surface water discharge (NPDES) permitting
- Groundwater discharge permitting
- Water appropriation and use permitting
- Air (e.g., Title V)
- Industrial and solid waste
- Carbon sequestration

TETRA TECH GEO

ACT
[REMEDIAL ENGINEERING]

SOIL AND GROUNDWATER REMEDIATION

Tetra Tech GEO selects and implements the most appropriate remedial technologies based on the contaminants of concern, site characteristics, and client objectives. Our design capabilities are enhanced by our experience with groundwater modeling, biochemistry, and geochemistry. We routinely compare the costs and benefits of traditional technologies (e.g., pump and treat) with new and innovative technologies and have the expertise to design and implement the best option.

Examples of innovative remedial technologies successfully implemented by Tetra Tech GEO include:

- **Connersville, Indiana.** Tetra Tech GEO designed, implemented, and monitors a large scale biobarrier to cost-effectively treat TCE migrating from a source area. The biobarrier is over 1,000 feet long and was created through injection of emulsified vegetable oil and inoculation of an appropriate microbial culture. The biobarrier is part of an overall strategy for site remediation addressing soils, source-area groundwater, and groundwater plume.

- **Central New Jersey.** Tetra Tech GEO designed, installed, and operates an aerobic bioreactor that uses injected water and air to enhance bioremediation of contaminant sources in a landfill. This remedy is coupled with groundwater extraction that provides hydraulic capture during source area remediation. Injecting the extracted water into the bioreactor reduces disposal/treatment costs while treating the source area.

- **Colorado.** Tetra Tech GEO designed, implemented, and monitors in-situ biogeochemical stabilization to address PAHs in saturated soils at a former wood-treating facility. The technology takes advantage of the relative immobility of PAHs and enhances in-place stabilization, mitigating migration and potential exposure.

Remediation Services Provided by Tetra Tech GEO:

Some of the Contaminants of Concern Routinely Addressed by Tetra Tech GEO.

- Hydrocarbons
- Chlorinated solvents
- Polyaromatic hydrocarbons (PAHs)
- Heavy metals (e.g., chromium)
- Acid mine drainage
- LNAPL and DNAPL
- Radionuclides

Traditional Remedial Technologies Successfully Implemented by Tetra Tech GEO

- Pump and treat
- Air sparging and soil vapor extraction
- Dual-phase extraction
- Total fluids recovery
- In-situ chemical oxidation
- Bioremediation
- Permeable and impermeable barriers
- Monitored natural attenuation
- Dig and haul

Innovative Technologies Successfully Implemented by Tetra Tech GEO

- Bioaugmentation
- In-situ biogeochemical stabilization
- Landfill bioreactors

TETRA TECH GEO

ASSESS
[DNAPL CHARACTERIZATION AND REMEDIATION]

DNAPL CHARACTERIZATION AND REMEDIATION

Tetra Tech GEO has more than 27 years of experience in characterizing and remediating DNAPL sites. Our staff is recognized as the technical experts who have "written the book" on DNAPL (i.e., authors of over 10 USEPA guidance documents, including the publication DNAPL Site Evaluation). In addition, Tetra Tech GEO staff have taught DNAPL classes in all ten USEPA Regions and to the U.S. Navy as part of the Remediation Innovative Technology Seminar (RITS) series.

- **Site Characterization.** Tetra Tech GEO implements a proven investigative approach to DNAPL site investigations using tools ranging from direct-push technology to multiple cased wells with multiple ports. Our approach leads to collecting information cost-effectively for source control/removal and evaluating monitored natural attenuation remediation.

- **Remediation.** Our firm has extensive experience with remedial technologies for sites impacted by DNAPL. We use a "tool-box" approach, fitting the technology to site conditions. Technologies we use include pump and treat, DNAPL extraction enhanced by barrier walls, in-situ chemical oxidation, surfactant flushing, and thermally-enhanced extraction.

- **DNAPL research efforts.** Tetra Tech GEO supports the Technology Assessment Branch/OSRTI/OSWER USEPA on DNAPL issues, having conducted Remediation Site Evaluations and Independent Design Reviews at numerous sites.

- **Short Courses.** Tetra Tech GEO has presented seminars regarding DNAPL site investigation and remediation to each of the ten USEPA Regions, more than ten US Navy installations across the country, and to private companies and universities.

- **Internet Seminars.** Tetra Tech GEO is routinely asked to prepare and present internet seminars on advanced topics. Many of these short courses have been sponsored by USEPA as part of the CLU-IN series of seminars and have been attended by hundreds of participants.

DNAPL Services Provided by Tetra Tech GEO:

- Site characterization of source area and downgradient dissolved plume
- Multiphase flow modeling
- Geochemistry and biogeochemistry interpretation
- Database/GIS integration
- Data visualization
- Expert witness testimony
- Training & peer review
- DNAPL source zone & plume remediation
- Long-term monitoring
- Regulatory negotiations

TETRA TECH GEO

ASSESS
[SITE CHARACTERIZATION]

INDUSTRIAL HYGIENE AND IN-BUILDING SERVICES

Tetra Tech GEO provides professional environmental, industrial hygiene and engineering services to developers, real estate owners, and tenants to successfully resolve heath and safety concerns related to property activities. We put the expertise and experience of our health and safety professionals to work to ensure that environmental conditions are properly recognized and assessed. For industrial workers and building occupants, we identify health and safety hazards, exposure pathways, levels of risk, and appropriate control measures. For environmental hazards, we identify contaiminants of conern, determine mobility and fate, and evaluate existing and predicted environments.

Our experience with in-building services includes:

- **Indoor Air/Subsurface Vapor Intrusion Concerns.** Tetra Tech GEO has conducted a wide variety of services for building owners and lessees that have resolved vapor intrusion, odor, biological, and indoor air quality concerns in a cost and time-effective manner.

- **Fuel System Design and Remediation.** Fuel releases from emergency generator or heating systems can result in in-building contamination and environmental impacts. Indoor releases can result in building vacancies, health damage claims and fire code violations. Tetra Tech GEO is highly experienced in providing an immediate response to deal with health and safety issues and clean up environmental impairment

- **Building Water Supply System Remediation.** Unhealthy water quality is a concern to building owners and occupants especially buildings with lead piping, and a private water supply source. Tetra Tech GEO engineers and industrial hygienists have the practical experience needed to quickly resolve health and safety issues. Our responsive approach and unique solutions have saved our clients both time and cost in dealing with building and employee related heath and safety concerns.

In-Building and Industrial Hygiene Services Provided by Tetra Tech GEO:

- Building condition surveys
- Indoor air quality investigation
- Mold, asbestos, lead-based paint, and radon investigation and abatement
- Subsurface vapor intrusion studies and turnkey remediation
- Building water supply testing and analysis
- Design and installation of water quality remedial systems.
- Hazard assessment
- OSHA compliance assistance
- Worker exposure monitoring
- Sick building syndrome evaluations
- Noise surveys
- Fuel system release investigation and remediation
- Fuel system design and installation
- SPCC plan preparation and certification
- Expert witness testimony
- Training

TETRA TECH GEO

ASSESS
[SITE ASSESSMENT]

SITE ASSESSMENT SERVICES

Tetra Tech GEO prepares Phase I and Phase II Environmental Site Assessments (ESAs) in accordance with procedures defined by the 2005 ASTM International Standard E 1527-05, the U.S. Environmental Protection Agency's (EPA's) All Appropriate Inquiry (AAI) guidance, and local and state guidance.

Our experience in Phase I and Phase II ESAs is extensive, ranging from single-parcel assessments of undeveloped land to multi-parcel developed properties that support a variety of retail, commercial, or manufacturing operations. We have conducted hundreds of ESAs across the country. Clients include: residential and commercial developers, school districts, lending institutions, and industrial clients.

Our support services include:

- Phase I/II/III programs
- Regulatory compliance
- Asbestos and lead paint surveys
- Vapor intrusion evaluations
- School site preliminary environmental assessments
- Liability assessments

Tetra Tech GEO is routinely involved in redevelopment projects with our residential and commercial clients and has extensive experience with Brownfields projects. Often, we prepare quick-turnaround Phase I and Phase II ESAs to assess the property in terms of potential on-site sources of contamination, as well as impacts from off-site sources. It is not uncommon to find contamination beneath properties that originated from an off-site source (such as large groundwater plumes that migrate long distances beneath otherwise "clean" properties). In these cases, Tetra Tech GEO works with regulatory agencies to obtain letters to confirm that contamination originated from an off-site source; these letters help ease environmental concerns related to the real estate transaction.

Site Assessment Services Provided by Tetra Tech GEO:

- Phase I ESAs
- Phase II ESAs – including collection and analysis of soil, groundwater, and soil vapor samples
- Preliminary environmental assessments (PEAs)
- Vapor intrusion assessments
- Design and installation of sub-slab vapor barriers and venting systems
- Underground storage tank removal and closure
- Soil excavation and disposal
- Human health risk assessments
- Asbestos surveys
- Lead paint surveys
- Agency negotiation support
- Soil management plans
- Public participation notices

TETRA TECH GEO

INNOVATE
[RESOURCE DEVELOPMENT]

WATER RESOURCE ENGINEERING

Tetra Tech GEO provides water resources engineering services for a variety of domestic and international clients:

- **Water supply evaluation.** For both government and private clients, Tetra Tech GEO uses hydrogeological tools and techniques to determine groundwater supply potential in diverse environments. For example, we evaluated and provided positive input to a mining company on the potential of developing a water supply in the Atacama Desert in Chile—known as "the driest place on earth". The tools we employ include literature reviews, fracture trace analysis, lithologic/geophysical logging, aquifer testing, GIS overlays, and groundwater modeling.

- **Development of local water supplies.** Tetra Tech GEO is responsible for locating, drilling wells, permitting, and verifying the viability of water supplies for over 75 subdivisions in the Piedmont of Northern Virginia. Our firm routinely develops water supplies in other complex geological settings.

- **Water use permitting.** Tetra Tech GEO's scientists and engineers conduct technical and administrative work to obtain permits to develop/operate water supplies. Our experience ranges from permitting domestic water supplies to a 30 mgd public water supply wellfield.

- **Litigation support.** For water supply disputes, Tetra Tech GEO provides technical support and expert testimony. We have successfully defended our findings for cases involving water rights, impact assessments, water use restrictions, and permitting issues. We work with counsel for water suppliers, agriculture, private industry, and regulatory agencies.

- **Wellfield operations support.** Tetra Tech GEO experience includes developing wellfield operations plans for municipalities and private industry. These plans describe optimal sequencing of wells, routine maintenance, monitoring, and reporting. We have also developed water conservation plans.

Water Resource Engineering Services Provided by Tetra Tech GEO:

- Fracture trace analysis
- Assessment of water resource development potential
- Water use permitting
- Technical support for litigation and arbitration
- Optimization of wellfield operation
- Oversight of well drilling
- Regulatory support
- Aquifer storage and recovery
- Assessment of saltwater intrusion and upconing
- Lake and reservoir modeling
- EM terrain conductivity surveys
- Aquifer testing
- Groundwater/surface-water interaction
- Wetland impacts

TETRA TECH GEO

Christopher D. Tallon

Senior Project Scientist

Mr. Tallon is a project manager with 15 years experience in hydrogeologic investigations, hazardous waste disposal programs, and Phase 1 Environmental Site Assessments at industrial facilities and communication tower siting locations in the United States, and Canada.

He has extensive experience conducting data collection activities in support of RI/FS and monitoring of groundwater remedies at a large former manufacturing facilities. His activities include: hydrogeologic data interpretation and analyses for RI reports; preparing reports and work plans for submittal to regulatory agencies; preparing project Health and Safety Plans; preparing project Integrated Contingency Plans, conducting groundwater and surface water level monitoring; groundwater, surface water, DNAPL, soil, and rock sampling for chemical analyses; pumping tests; and oversight of monitoring well and multi-level monitoring device installations in bedrock and unconsolidated deposits. He has experience with various groundwater sampling methods including low-flow, bailer, and various types of pumps.

Mr. Tallon manages hazardous waste management activities in compliance with RCRA and TSCA at former manufacturing sites and inactive landfills, including hazardous waste shipments, inspections, record keeping, training, and reporting.

He manages waste water treatment and remedial operations and is responsible for treatment system compliance at former manufacturing sites.

He has completed soil vapor intrusion investigations in accordance with the New York State Department of Health (NYSDOH) Soil Vapor Intrusion Guidance and performs soil vapor, sub-slab vapor, indoor air, and outdoor air sampling using Summa canisters. He is familiar with NYSDOH air guideline values.

PREVIOUS WORK HISTORY

Dames & Moore, Latham, New York, (1996-1999), *Environmental Technician,*

Specialized Environmental Monitoring, Wilton, New York, (1996) *Environmental Technician*

SSB Environmental, Albany, New York, (1995-1996), *Field Technician*

Education:

B.A., Environmental Science, State University of NY at Plattsburgh, 1994

Registrations/Certifications:

40 Hour OSHA Hazardous Waste Operations Training and 8 Hour Refresher

8 Hour OSHA Supervisor Training

Confined Space Entry and Rescue

American Red Cross Advanced First Aid, Adult CPR

Respirator Fit Test and Protection Training

Certified Fork-Lift Truck Operator

Lock Out/Tag Out Certified

Basic Water Rescue Training

Bloodborne Pathogens Training

Fire Extinguisher/Hot Work Training

Advanced Hazardous Waste Management Training

Hazardous Materials Transportation Training

Hazardous Waste in New York State Training

Office:

Schuylerville, NY

Years of Experience:

15

Years with Tetra Tech:

12

Appendix D

ARCADIS Subcontractor
Quality Management Plans

QUALITY ASSURANCE MANUAL

Quality Assurance/Quality Control Policies and Procedures

Pace Analytical Services – New York

2190 Technology Drive; Schenectady, NY 12308; (518)346-4592

CORPORATE APPROVAL

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Date

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LOCAL APPROVAL

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4/17/2012
Date

Christina L. Braidwood
Laboratory Quality Manager
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03/29/2012
Date

Dan Pfalzer
Laboratory Technical Director
(518)346-4592 Ext. 40

4/2/2012
Date

Effective Date is the date of the last signature.

Table of Contents

1.0. INTRODUCTION AND ORGANIZATIONAL STRUCTURE

"Working together to protect our environment and improve our health"
Pace Analytical Services Inc. - Mission Statement

1.1. Introduction to PASI

1.1.1. Pace Analytical Services, Inc. (PASI) is a privately held, full-service analytical testing firm operating a nationwide system of laboratories. PASI offers extensive services beyond standard analytical testing, including: bioassay for aquatic toxicity, air toxics, industrial hygiene testing, explosives, dioxins and coplanar PCB's by high resolution mass spectroscopy , radiochemical analyses, product testing, pharmaceutical testing, field services and mobile laboratory capabilities. PASI has implemented a consistent Quality System in each of its laboratories and service centers. In addition, the company utilizes an advanced data management system that is highly efficient and allows for flexible data reporting. Together, these systems ensure data reliability and superior on-time performance. This document defines the Quality System and QA/QC protocols.

1.1.2. Our goal is to combine our expertise in laboratory operations with customized solutions to meet the specific needs of our customers.

1.2. Statement of Purpose

1.2.1. To meet the business needs of our customers for high quality, cost-effective analytical measurements and services.

1.3. Quality Policy Statement and Goals of the Quality System

1.3.1. PASI management is committed to maintaining the highest possible standard of service for our customers by following a documented quality system. The overall objective of this quality system is to provide reliable data of known quality through adherence to rigorous quality assurance policies and quality control procedures as documented in this Quality Assurance Manual.

1.3.2. All personnel within the PASI network are required to be familiar with all facets of the quality system relevant to their position and implement these policies and procedures in their daily work. This daily focus on quality is applied with initial project planning, continued through all field and laboratory activities, and is ultimately included in the final report generation.

1.3.3. PASI management demonstrates its commitment to quality by providing the resources, including facilities, equipment, and personnel to ensure the adherence to these documented policies and procedures and to promote the continuous improvement of the quality system. All PASI personnel must comply with all current applicable state, federal, and industry standards, and are required to perform all tests in accordance with stated methods and customer requirements.

1.4. Core Values

1.4.1. **Integrity-** Pace personnel are required to abide by the PASI Code of Ethics and all Pace employees must go through Data Integrity/Ethics training upon initial orientation and as an annual refresher.

1.4.2. **Value Employees-** Pace management views employees as our most important asset and communicates to them the relevance and importance of their activities within their job functions and how they contribute to the achievement of the objectives of the quality management system.

1.4.3. **Know Our Customers-** Pace makes every effort to know our customers and address their sampling and analytical needs. More information on this item can be found in section 2.0.

1.4.4. **Honor Commitments-** Pace labs focus on making solid commitments with regards to quality, capacity, and agreed upon turnaround time to our customers.

1.4.5. **Flexible Response To Demand-** Pace labs are equipped with both the material and personnel resources to enable them to be responsive to the demands of customers when situations or projects need change.

1.4.6. **Pursue Opportunities-** Pace is committed to pursuing opportunities for the growth of the company by constantly exploring markets and areas where we can expand.

1.4.7. **Continuously Improve-** Pace has committed much time and effort into establishing a continuous improvement program where company personnel meet on a regular basis to share ideas in cost reduction, production improvement and standardization in order to develop best practices. This information, as well as company financial and production metrics, are tracked, evaluated, and shared with each Pace facility.

1.5. Code of Ethics

1.5.1. PASI's fundamental ethical principles are as follows:

1.5.1.1. Each PASI employee is responsible for the propriety and consequences of his or her actions;

1.5.1.2. Each PASI employee must conduct all aspects of Company business in an ethical and strictly legal manner, and must obey the laws of the United States and of all localities, states and nations where PASI does business or seeks to do business;

1.5.1.3. Each PASI employee must reflect the highest standards of honesty, integrity and fairness on behalf of the Company with customers, suppliers, the public, and one another.

1.5.1.4. Each PASI employee must recognize and understand that our daily activities in environmental laboratories affect public health as well as the environment and that environmental laboratory analysts are a critical part of the system society depends upon to improve and guard our natural resources:

1.5.2. Strict adherence by each PASI employee to this Code of Ethics and to the Standards of Conduct is essential to the continued vitality of PASI and to continue the pursuit of our common mission to protect our environment and improve our health.

1.5.3. Failure to comply with the Code of Ethics and Standards of Conduct will result in disciplinary action up to and including termination and referral for civil or criminal prosecution where appropriate. An employee will be notified of an infraction and given an opportunity to explain, as prescribed under current disciplinary procedures.

1.5.4. Any Pace employee can contact corporate management to report an ethical concern by calling the anonymous hotline at 612-607-6431.

1.6. Standards of Conduct

1.6.1. **Data Integrity**

1.6.1.1. The accuracy and integrity of the analytical results and its supporting documentation produced at PASI are the cornerstones of the company. Lack of data integrity is an assault on our most basic values putting PASI and its employees at grave financial and legal risk and will not be tolerated. Therefore, employees are to accurately prepare and maintain all technical records, scientific notebooks, calculations, and databases. Employees are prohibited from making false entries or misrepresentations of data for any reason.

1.6.1.2. Managerial staff must make every effort to ensure that personnel are free from any undue pressures that may affect the quality or integrity of their work including commercial, financial, over-scheduling, and working condition pressures.

1.6.2. **Confidentiality**

1.6.2.1. PASI employees must not use or disclose confidential or proprietary information except when in connection with their duties at PASI. This is effective over the course of employment and for an additional period of two years thereafter.

1.6.2.2. Confidential or proprietary information, belonging to either PASI and/or its customers, includes but is not limited to test results, trade secrets, research and development matters, procedures, methods, processes and standards, company-specific techniques and equipment, marketing and customer information, inventions, materials composition, etc.

1.6.3. **Conflict of Interest**

1.6.3.1. PASI employees must avoid situations that might involve a conflict of interest or could appear questionable to others. The employee must be careful in two general areas:

1.6.3.1.1. Participation in activities that conflict or appear to conflict with the employees' PASI responsibilities.

1.6.3.1.2. Offering or accepting anything that might influence the recipient or cause another person to believe that the recipient may be influenced to behave or in a different manner than he would normally. This includes bribes, gifts, kickbacks, or illegal payments.

1.6.3.2. Employees are not to engage in outside business or economic activity relating to a sale or purchase by the Company. Other problematic activities include service on the Board of Directors of a competing or supplier company, significant ownership in a competing or supplier company, employment for a competing or supplier company, or participation in any outside business during the employee's work hours.

1.6.4. **Compliance**

1.6.4.1. All employees are required to read, understand, and comply with the various components of the standards listed in this document. As confirmation that they understand their responsibility, each employee is required to sign an acknowledgment form annually that then becomes part of the employee's permanent record. Employees will be held accountable for complying with the Quality Systems as summarized in the Quality Assurance Manual.

1.7. Laboratory Organization

1.7.1. The PASI Corporate Office centralizes company-wide accounting, business development, financial management, human resources development, information systems, marketing, quality,

safety, and training activities. PASI's Director of Quality is responsible for assisting the development, implementation and monitoring of quality programs for the company. See Attachment IIB for the Corporate Organizational structure.

1.7.2. Each laboratory within the system operates with local management, but all labs share common systems and receive support from the Corporate Office.

1.7.3. A Senior General Manager (SGM) oversees all laboratories and service centers in their assigned region. Each laboratory or facility in the company is then directly managed by an SGM, a General Manager (GM), an Assistant General Manager (AGM), or an Operations Manager (OM). Quality Managers (QM) or Senior Quality Managers (SQM) at each laboratory report directly to the highest level of local laboratory management, however named, that routinely makes day-to-day decisions regarding that facility's operations. The QMs and SQMs will also receive guidance and direction from the corporate Director of Quality.

1.7.4. The SGM, GM, AGM or OM, or equivalent functionality in each facility, bears the responsibility for the laboratory operations and serves as the final, local authority in all matters. In the absence of these managers, the SQM/QM serves as the next in command. He or she assumes the responsibilities of the manager, however named, until the manager is available to resume the duties of their position. In the absence of both the manager and the SQM/QM, management responsibility of the laboratory is passed to the Technical Director, provided such a position is identified, and then to the most senior department manager until the return of the lab manager or SQM/QM. The most senior department manager in charge may include the Client Services Manager or the Administrative Business Manager at the discretion of the SGM/GM/AGM/OM.

1.7.5. A Technical Director who is absent for a period of time exceeding 15 consecutive calendar days shall designate another full-time staff member meeting the qualifications of the technical director to temporarily perform this function. The laboratory SGM/GM/AGM/OM or SQM/QM has the authority to make this designation in the event the existing Technical Director is unable to do so. If this absence exceeds 35 consecutive calendar days, the primary accrediting authority shall be notified in writing.

1.7.6. The SQM/QM has the responsibility and authority to ensure the Quality System is implemented and followed at all times. In circumstances where a laboratory is not meeting the established level of quality or following the policies set forth in this Quality Assurance Manual, the SQM/QM has the authority to halt laboratory operations should he or she deem such an action necessary. The SQM/QM will immediately communicate the halting of operations to the SGM/GM/AGM/OM and keep them posted on the progress of corrective actions. In the event the SGM/GM/AGM/OM and the SQM/QM are not in agreement as to the need for the suspension, the Chief Operating Officer and Director of Quality will be called in to mediate the situation.

1.7.7. The technical staff of the laboratory is generally organized into the following functional groups:

- Organic Sample Preparation
- Wet Chemistry Analysis
- Metals Analysis
- Volatiles Analysis
- Semi-volatiles Analysis
- Radiochemical Analysis
- Microbiology

1.7.8. Appropriate support groups are present in each laboratory. The actual organizational structure for PASI – New York is listed in Attachment IIA. In the event of a change in SGM/GM/AGM/OM, SQM/QM, or any Technical Director, the laboratory will notify its accrediting authorities and revise the organizational chart in the Quality Assurance Manual (QAM) within 30 days. For changes in Department Managers or Supervisors or other laboratory personnel, no notifications will be sent to the laboratory's accrediting agencies; changes to the organizational chart will be updated during or prior to the annual review process. Changes or additions in these key personnel will also be noted by additional signatures on the QAM, as applicable. In any case, the QAM will remain in effect until the next scheduled revision.

1.8. Laboratory Job Descriptions

1.8.1. Senior General Manager

- Oversees all functions of all the operations within their designated region;
- Oversees the development of local GMs/AGMs/OMs within their designated region;
- Oversees and authorizes personnel development including staffing, recruiting, training, workload scheduling, employee retention and motivation;
- Oversees the preparation of budgets and staffing plans for all operations within their designated region;
- Ensures compliance with all applicable state, federal and industry standards;
- Works closely with Regional Sales Management.

1.8.2. General Manager

- Oversees all functions of their assigned operations;
- Authorizes personnel development including staffing, recruiting, training, workload scheduling, employee retention and motivation;
- Prepares budgets and staffing plans;
- Monitors the Quality Systems of the laboratory and advises the SQM/QM accordingly;
- Ensures compliance with all applicable state, federal and industry standards.

1.8.3. Assistant General Manager / Operations Manager

- In the absence of the SGM/GM, performs all duties as listed above for the SGM or GM;
- Oversees the daily production and quality activities of all departments;
- Manages all departments and works with staff to ensure department objectives are met;
- Works with all departments to ensure capacity and customer expectations are accurately understood and met;
- Works with SGM/GM to prepare appropriate budget and staffing plans for all departments;
- Responsible for prioritizing personnel and production activities within all departments;
- Performs formal and informal performance reviews of departmental staff.

1.8.4. Senior Quality Manager

- Provides quality oversight for multiple laboratories where there is not a local quality manager or for labs where there are multiple and separately distinct quality systems in the same facility;

- Responsible for implementing, maintaining and improving the quality system while functioning independently from laboratory operations. Reports directly to the highest level of local laboratory facility management, however named, that routinely makes day-to-day decisions regarding laboratory operations, but receives direction and assistance from the Corporate Director of Quality;
- Ensures that communication takes place at all levels within the lab regarding the effectiveness of the quality system and that all personnel understand their contributions to the quality system;
- Monitors Quality Assurance/Quality Control activities to ensure that the laboratory achieves established standards of quality (as set forth by the Corporate Quality office). The Quality Manager is responsible for reporting the lab's level of compliance to these standards to the Corporate Director of Quality on a quarterly basis;
- Maintains records of quality control data and evaluates data quality;
- Conducts periodic internal audits and coordinates external audits performed by regulatory agencies or customer representatives;
- Reviews and maintains records of proficiency testing results;
- Maintains the document control system;
- Assists in development and implementation of appropriate training programs;
- Provides technical support to laboratory operations regarding methodology and project QA/QC requirements;
- Maintains certifications from federal and state programs;
- Ensures compliance with all applicable state, federal and industry standards;
- Maintains the laboratory training records, including those in the Learning Management System (LMS), and evaluates the effectiveness of training;
- Monitors correctives actions;
- Maintains the currency of the Quality Manual.

1.8.5. Quality Manager

- Responsible for implementing, maintaining and improving the quality system while functioning independently from laboratory operations. Reports directly to the highest level of local laboratory facility management, however named, that routinely makes day-to-day decisions regarding laboratory operations, but receives direction and assistance from the Corporate Director of Quality. They may also report to a Senior Quality Manager within the same facility;
- Ensures that communication takes place at all levels within the lab regarding the effectiveness of the quality system and that all personnel understand their contributions to the quality system;
- Monitors Quality Assurance/Quality Control activities to ensure that the laboratory achieves established standards of quality (as set forth by the Corporate Quality office). The Quality Manager is responsible for reporting the lab's level of compliance to these standards to the Corporate Director of Quality on a quarterly basis;
- Maintains records of quality control data and evaluates data quality;
- Conducts periodic internal audits and coordinates external audits performed by regulatory agencies or customer representatives;
- Reviews and maintains records of proficiency testing results;
- Maintains the document control system;
- Assists in development and implementation of appropriate training programs;

- Provides technical support to laboratory operations regarding methodology and project QA/QC requirements;
- Maintains certifications from federal and state programs;
- Ensures compliance with all applicable state, federal and industry standards;
- Maintains the laboratory training records, including those in the Learning Management System (LMS), and evaluates the effectiveness of training;
- Monitors correctives actions;
- Maintains the currency of the Quality Manual.

1.8.6. Quality Analyst

- Assists the SQM/QM in the performance of quality department responsibilities as delegated by the SQM/QM;
- Assists in monitoring QA/QC data;
- Assists in internal audits;
- Assists in maintaining training records;
- Assists in maintaining the document control system;

1.8.7. Technical Director

- Monitors the standards of performance in quality assurance and quality control data;
- Monitors the validity of analyses performed and data generated;
- Reviews tenders, contracts and QAPPs to ensure the laboratory can meet the data quality objectives for any given project;
- Serves as the manager of the laboratory in the absence of the SGM/GM/AGM/OM and SQM/QM;
- Provides technical guidance in the review, development, and validation of new methodologies.

1.8.8. Administrative Business Manager

- Responsible for financial and administrative management for the entire facility;
- Provides input relative to tactical and strategic planning activities;
- Organizes financial information so that the facility is run as a fiscally responsible business;
- Works with staff to confirm that appropriate processes are put in place to track revenues and expenses;
- Provide ongoing financial information to the SGM/GM/AGM/OM and the management team so they can better manage their business;
- Utilizes historical information and trends to accurately forecast future financial positions;
- Works with management to ensure that key measurements are put in place to be utilized for trend analysis—this will include personnel and supply expenses, and key revenue and expense ratios;
- Works with SGM/GM/AGM/OM to develop accurate budget and track on an ongoing basis;
- Works with entire management team to submit complete and justified capital budget requests and to balance requests across departments;
- Works with project management team and administrative support staff to ensure timely and accurate invoicing.

1.8.9. Client Services Manager

- Oversees all the day to day activities of the Client Services Department which includes Project Management and, possibly, Sample Control;
- Responsible for staffing and all personnel management related issues for Client Services;
- Serves as the primary senior consultant to customers on all project related issues such as set up, initiation, execution and closure;
- Performs or is capable of performing all duties listed for that of Project Manager.

1.8.10. Project Manager

- Coordinates daily activities including taking orders, reporting data and analytical results;
- Serves as the primary technical and administrative liaison between customers and PASI;
- Communicates with operations staff to update and set project priorities;
- Provides results to customers in the requested format (verbal, hardcopy, electronic, etc.);
- Works with customers, laboratory staff, and other appropriate PASI staff to develop project statements of work or resolve problems of data quality;
- Responsible for solicitation of work requests, assisting with proposal preparation and project initiation with customers and maintain customer records;
- Mediation of project schedules and scope of work through communication with internal resources and management;
- Responsible for preparing routine and non-routine quotations, reports and technical papers;
- Interfaces between customers and management personnel to achieve customer satisfaction;
- Manages large-scale complex projects;
- Supervises less experienced project managers and provide guidance on management of complex projects;
- Arranges bottle orders and shipment of sample kits to customers;
- Verifies login information relative to project requirements and field sample Chains-of-Custody.

1.8.11. Project Coordinator

- Responsible for preparation of project specifications and provides technical/project support;
- Coordinates project needs with other department sections and assists with proposal preparation;
- Prepares routine proposals and invoicing;
- Responsible for scanning, copying, assembling and binding final reports;
- Other duties include filing, maintaining forms, process outgoing mail, maintaining training database and data entry.

1.8.12. Department Manager/Supervisor

- Oversees the day-to-day production and quality activities of their assigned department;
- Ensures that quality assurance and quality control criteria of analytical methods and projects are satisfied;
- Assesses data quality and takes corrective action when necessary;

- Approves and releases technical and data management reports;
- Ensures compliance with all applicable state, federal and industry standards.

1.8.13. Group Supervisor/Leader

- Trains analysts in laboratory operations and analytical procedures;
- Organizes and schedules analyses with consideration for sample holding times;
- Implements data verification procedures by assigning data verification duties to appropriate personnel;
- Evaluates instrument performance and supervises instrument calibration and preventive maintenance programs;
- Reports non-compliance situations to laboratory management including the SQM/QM.

1.8.14. Laboratory Analyst

- Performs detailed preparation and analysis of samples according to published methods and laboratory procedures;
- Processes and evaluates raw data obtained from preparation and analysis steps;
- Generates final results from raw data, performing primary review against method criteria;
- Monitors quality control data associated with analysis and preparation. This includes examination of raw data such as chromatograms as well as an inspection of reduced data, calibration curves, and laboratory notebooks;
- Reports data in LIMS, authorizing for release pending secondary approval;
- Conducts routine and non-routine maintenance of equipment as required;
- Performs or is capable of performing all duties associated with that of Laboratory Technician.

1.8.15. Laboratory Technician

- Prepares standards and reagents according to published methods or in house procedures;
- Performs preparation and analytical steps for basic laboratory methods;
- Works under the direction of a Laboratory Analyst on complex methodologies;
- Assists Laboratory Analysts on preparation, analytical or data reduction steps for complex methodologies;
- Monitors quality control data as required or directed. This includes examination of raw data such as chromatograms as well as an inspection of reduced data, calibration curves, and laboratory notebooks.

1.8.16. Field Technician

- Prepares and samples according to published methods, PASI Quality Assurance Manual and/or customer directed sampling objectives;
- Capable of the collection of representative environmental or process related air samples;
- Use computer software to compile, organize, create tables, create graphics and write test reports;
- Reviews project documentation for completeness, method compliance and contract fulfillment;

- Train less experienced environmental technicians and provide guidance on sampling and analysis;
- Responsible for project initiation and contact follow-up;
- Develop sampling plans and prepare test plan documents.

1.8.17. Field Analyst

- Analyzes field samples according to published methods, PASI Quality Assurance Manual and/or customer directed sampling objectives,
- Capable of the collection and analysis of representative environmental or process related air samples,
- Proficient in a variety of analytical tests; specifically on-site gas-phase organic and inorganic compounds by extractive fourier transform infrared spectroscopy (FTIR),
- Train less experienced staff and provide guidance on FTIR sampling and analysis,
- Assist in reporting tasks and project management responsibilities, and
- Perform back-up support for manager tasks such as reporting needs and customer concerns.

1.8.18. Sample Management Personnel

- Signs for incoming samples and verifies the data entered on the Chain of custody forms;
- Enters the sample information into the Laboratory Information Management System (LIMS) for tracking and reporting;
- Stages samples according to EPA requirements;
- Assists Project Managers and Coordinators in filling bottle orders and sample shipments.

1.8.19. Systems Administrator or Systems Manager

- Assists with the creation and maintenance of electronic data deliverables (EDDs);
- Coordinates the installation and use of all hardware, software and operating systems;
- Performs troubleshooting on all aforementioned systems;
- Trains new and existing users on systems and system upgrades;
- Maintains all system security passwords;
- Maintains the electronic backups of all computer systems.

1.8.20. Safety/Chemical Hygiene Officer

- Maintains the laboratory Chemical Hygiene Plan;
- Plans and implements safety policies and procedures;
- Maintains safety records;
- Organizes and/or performs safety training;
- Performs safety inspections and provides corrective/preventative actions;
- Assists personnel with safety issues.

1.8.21. Program Director/Hazardous Waste Coordinator (or otherwise named)

- Evaluates waste streams and helps to select appropriate waste transportation and disposal companies;

- Maintains complete records of waste disposal including waste manifests and state reports;
- Assists in training personnel on waste-related issues such as waste handling and storage, waste container labeling, proper satellite accumulation, secondary containment, etc.;
- Conducts a weekly inspection of the waste storage areas of the laboratory.

1.9. Training and Orientation

1.9.1. Training for Pace employees is managed through a web-based Learning Management System. After a new employee has been instructed in matters of human resources, they are given instructional materials for the LMS and a password for access.

1.9.2. A new hire training checklist is provided to the new employee that lists training items for the employee to work through either independently on LMS or with their supervisor or trainer. The training items that can be completed independently include:

- Reading through applicable Standard Operating Procedures;
- Reviewing the Quality Manual and Chemical Hygiene Plan;
- Core training modules such as quality control indicators, basic laboratory skills, etc.;
- Quality Systems training including traceability of measurements, method calibration, calibration verification, accuracy, precision and uncertainty of measurements, corrective actions, documentation, and root cause analysis;
- Data Integrity/Ethics training.

1.9.3. The new employee's Department Supervisor provides the employee with a basic understanding of the role of the laboratory within the structure of PASI and the basic elements of that individual's position. Supervised training uses the following techniques:

- Hands-on training
- Training checklists/worksheets
- Lectures and training sessions
- Method-specific training
- Conferences and seminars
- Short courses
- Specialized training by instrument manufacturers
- Proficiency testing programs.
- On-line courses

1.9.4. Group Supervisors/Leaders are responsible for providing documentation of training and proficiency for each employee under their supervision. The employee's training file indicates what procedures an analyst or a technician is capable of performing, either independently or with supervision. The files also include documentation of continuing capability, which are fully detailed in Section 3.4. Training documentation files for each person are maintained by the Quality Office either in hardcopy format or within the LMS.

1.9.5. All procedures and training records are maintained and available for review during laboratory audits. These procedures are reviewed/updated periodically by laboratory management. Additional information can be found in SOP S-NY-Q-274-rev.01 **Training and Employee Orientation** or its equivalent revision or replacement.

1.10. Data Integrity System

1.10.1. The data integrity system at PASI provides assurances to management that a highly ethical approach is being applied to all planning, training and implementation of methods. Data integrity is crucial to the success of our company and Pace Analytical is committed to creating and maintaining a culture of quality throughout the organization. To accomplish this goal, PASI has implemented a data integrity system that encompasses the following four requirements:

1.10.1.1. A data integrity training program: standardized training is given to each new employee and a yearly refresher is presented to all employees. Key topics addressed by this training include:

1.10.1.1.1. Need for honesty and transparency in analytical reporting
1.10.1.1.2. Process for reporting data integrity issues
1.10.1.1.3. Specific examples of unethical behavior and improper practices
1.10.1.1.4. Documentation of non-conforming data that is still useful to the data user
1.10.1.1.5. Consequences and punishments for unethical behavior
1.10.1.1.6. Examples of monitoring devices used by management to review data and systems

1.10.1.2. Signed data integrity documentation for all employees: this includes a written quiz following the Ethics training session and written agreement to abide by the Code of Ethics and Standards of Conduct explained in the employee manual.

1.10.1.3. In-depth, periodic monitoring of data integrity including peer data review and validation, internal raw data audits, proficiency testing studies, etc.

1.10.1.4. Documentation of any review or investigation into possible data integrity infractions. This documentation, including any disciplinary actions involved, corrective actions taken, and notifications to customers must be retained for a minimum of five years.

1.10.2. PASI management makes every effort to ensure that personnel are free from any undue pressures that affect the quality of their work including commercial, financial, over scheduling, and working condition pressures.

1.10.3. Corporate management also provides all PASI facilities a mechanism for confidential reporting of data integrity issues that ensures confidentiality and a receptive environment in which all employees are comfortable discussing items of ethical concern. The anonymous message line is monitored by the Corporate Director of Quality who will ensure that all concerns are evaluated and, where necessary, brought to the attention of executive management and investigated. Any Pace employee can contact corporate management to report an ethical concern by calling the anonymous hotline at 612-607-6431.

1.11. Laboratory Safety

1.11.1. It is the policy of PASI to make safety and health an integral part of daily operations and to ensure that all employees are provided with safe working conditions, personal protective equipment, and requisite training to do their work without injury. Each employee is responsible for his/her own safety as well as those working in the immediate area by complying with established company rules and procedures. These rules and procedures as well as a more detailed description of the employees' responsibilities are contained in the corporate Safety Manual and Chemical Hygiene Plan.

1.12. Security and Confidentiality

1.12.1. Security is maintained by controlled access to laboratory buildings. Exterior doors to laboratory buildings remain either locked or continuously monitored by PASI staff. Keyless door lock are controlled with key cards and computer access codes/logins are changed every six months. Posted signs direct visitors to the reception office and mark all other areas as off limits to unauthorized personnel. All visitors, including PASI staff from other facilities, must sign the Visitor's Logbook maintained by the receptionist. A staff member will accompany them during the duration of their stay on the premises unless the SGM/GM/AGM/OM, SQM/QM, or Technical Director specify otherwise. In this instance, the staff member will escort the visitor back to the reception area at the end of his/her visit where he/she signs out. The last staff member to leave their department for the day should ensure that all outside access points to that area are secure.

1.12.2. Additional security is provided where necessary, (e.g., specific secure areas for sample, data, and customer report storage), as requested by customers, or cases where national security is of concern. These areas are lockable within the facilities, or are securely offsite. Access is limited to specific individuals or their designees. Security of sample storage areas is the responsibility of the Sample Custodian. Security of samples and data during analysis and data reduction is the responsibility of Group Supervisors. Security of customer report archives is the responsibility of the Client Services Manager. These secure areas are locked whenever these individuals or their designees are not present in the facility.

1.12.3. Access to designated laboratory sample storage locations is limited to authorized personnel only. Provisions for lock and key access are provided. No samples are to be removed without proper authorization. If requested by customer or contract, samples are not to be removed from secure storage areas without filling out an associated internal chain of custody.

1.12.4. Standard business practices of confidentiality are applied to all documents and information regarding customer analyses. Specific protocols for handling confidential documents are described in PASI SOPs. Additional protocols for sample identification by internal laboratory identification numbers only are implemented as required under contract specific Quality Assurance Project Plans (QAPPs).

1.12.5. All information pertaining to a particular customer, including national security concerns will remain confidential. Data will be released to outside agencies only with written authorization from the customer or where federal or state law requires the company to do so.

1.13. Communications

1.13.1. Management within each lab bears the responsibility of ensuring that appropriate communication processes are established and that communication takes place regarding the effectiveness of the management/quality system. These communication processes may include email, regular staff meetings, senior management meetings, etc.

1.13.2. Corporate management bears the responsibility of ensuring that appropriate communication processes are established within the network of facilities and that communication takes place at a company-wide level regarding the effectiveness of the management/quality systems of all Pace facilities. These communication processes may include email, quarterly continuous improvement conference calls for all lab departments, and annual continuous improvement meetings for all department supervisors, quality managers, client services managers, and other support positions.

2.0. SAMPLE CUSTODY

2.1. Sampling Support

2.1.1. Each individual PASI laboratory provides shipping containers, properly preserved sample containers, custody documents, and field quality control samples to support field-sampling events. Guidelines for sample container types, preservatives, and holding times for a variety of methods are listed in Attachment VIII. Note that all analyses listed are not necessarily performed at all PASI laboratories and there may be additional laboratory analyses performed that are not included in these tables. PASI – New York may provide pick-up and delivery services to their customers when needed.

2.2. Field Services

2.2.1. Pace Analytical has a large Field Services Division which is based in their Minneapolis facility as well as limited field service capabilities in some of our other facilities. Field Services provides comprehensive nationwide service offerings including:

- Stack Testing
- Ambient Air
- CEM Certification Testing
- Air Quality Monitoring
- Onsite Analytical Services- FTIR and GC
- Real-time Process Diagnostic/Optimization Testing
- Wastewater, Groundwater and Drinking Water Monitoring
- Storm Water and Surface Water Monitoring
- Soil and Waste Sampling
- Mobile Laboratory Services

2.2.2. Field Services operates under the PASI Corporate Quality System, with applicable and necessary provisions to address the activities, methods, and goals specific to Field Services. All procedures and methods used by Field Services are documented in Standard Operating Procedures and Procedure Manuals.

2.3. Project Initiation

2.3.1. Prior to accepting new work, the laboratory reviews its performance capability. The laboratory confirms that sufficient personnel, equipment capacity, analytical method capability, etc., are available to complete the required work. Customer needs, certification requirements, and data quality objectives are defined and the appropriate sampling and analysis plan is developed to meet the project requirements by project managers or sales representatives. Members of the management staff review current instrument capacity, personnel availability and training, analytical procedures capability, and projected sample load. Management then informs the sales and client services personnel whether or not the laboratory can accept the new project via written correspondence, email, and/or daily operations meetings.

2.3.2. The laboratory maintains records of all such reviews, including discussions with customers. Routine analytical project documentation of quotes, notes, dates, initials, and/or recordings is maintained in a project folder by project management. Conditions for new and more complex contracts are determined by the SGM/GM/AGM/OM and sales representatives. Quality Management is consulted on technical requirements and operations staff provides input on volume capacities. Evidence of these reviews is maintained in the form of awarded Request for Proposals (RFPs), signed quotes or contracts, and a Customer Relationship Management (CRM) database. If a review identifies a potential mismatch between customer requirements and laboratory capabilities and/or capacities, Pace will specify its level of commitment by listing these exceptions to the requirements within the RFP, quote or contract.

2.3.3. Additional information regarding specific procedures for reviewing new work requests can be found in SOP S-NY-Q-220-rev.02 **Review of Analytical Requests, Tenders, and Contracts Review** or its equivalent revision or replacement.

2.4. Chain of Custody

2.4.1. A chain of custody (COC) provides the legal documentation of samples from time of collection to completion of analysis. PASI has implemented Standard Operating Procedures to ensure that sample custody traceability and responsibility objectives are achieved for every project.

2.4.2. Field personnel or client representatives must complete a chain of custody for all samples that are received by the laboratory. The importance of completeness of COCs is stressed to the samplers and is critical to efficient sample receipt and to insure the requested methods are used to analyze the correct samples.

2.4.3. If sample shipments are not accompanied by the correct documentation, the Sample Receiving department notifies a Project Manager. The Project Manager then obtains the correct documentation/information from the customer in order for analysis of samples to proceed.

2.4.4. The sampler is responsible for providing the following information on the chain of custody form:

- Customer project name
- Project location or number
- Field sample number/identification
- Date and time sampled
- Sample matrix
- Preservative
- Requested analyses
- Sampler signature
- Relinquishing signature
- Date and time relinquished
- Sampler remarks as needed
- Custody Seal Number if present
- Regulatory Program Designation
- The state where the samples were collected to ensure all applicable state requirements are met
- Turnaround time requested
- Purchase order number

2.4.5. The COC is filled out completely and legibly with indelible ink. Errors are corrected by drawing a single line through the initial entry and initialing and dating the change. All transfers of samples are recorded on the chain of custody in the "relinquished" and "received by" sections. All information except signatures is printed.

2.4.6. Additional information can be found in S-NY-C-227-rev.06 **Sample Receipt, Sample Storage, and Sample Security** or its equivalent revision or replacement.

2.5. Sample Acceptance Policy

2.5.1. In accordance with regulatory guidelines, PASI complies with the following sample acceptance policy for all samples received.

2.5.2. If the samples do not meet the sample receipt acceptance criteria outlined below, the laboratory is required to document all non-compliances, contact the customer, and either reject the samples or fully document any decisions to proceed with analyses of samples which do not meet the criteria. Any results reported from samples not meeting these criteria are appropriately qualified on the final report.

2.5.3. All samples must:

- Have unique customer identification that is clearly marked on durable waterproof labels affixed to the sample containers that match the chain of custody.
- Have clear documentation on the chain of custody related to the location of the sampling site with the time and date of sample collection.
- Have the sampler's name and signature.
- Have all requested analyses clearly designated on the COC.
- Have clear documentation of any special analytical or data reporting requirements.
- Be in appropriate sample containers with clear documentation of the preservatives used.
- Be correctly preserved unless the method allows for laboratory preservation.
- Be received within holding time. Any samples with hold times that are exceeded 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.
- Be received within appropriate temperature ranges - not frozen but ≤6°C (See Note 1), unless program requirements or customer contractual obligations mandate otherwise (see Note 2). The cooler temperature is recorded directly on the COC and the SCUR. Samples that are delivered to the laboratory 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.

Note 1: Temperature will be read and recorded based on the precision of the measuring device. For example, temperatures obtained from a thermometer graduated to 0.1°C will be read and recorded to

±0.1°C. Measurements obtained from a thermometer graduate to 0.5°C will be read to ±0.5°C. Measurements read at the specified precision are not to be rounded down to meet the ≤6°C limit

Note 2: Some microbiology methods allow sample receipt temperatures of up to 10°C. Consult the specific method for microbiology samples received above 6°C prior to initiating corrective action for out of temperature preservation conditions.

Note 3: Biological Tissue Samples must be received frozen at ≤10°C.

2.5.4. Upon sample receipt, the following items are also checked and recorded:

- Presence of custody seals or tapes on the shipping containers;
- Sample condition: Intact, broken/leaking, bubbles in VOA samples;
- Sample holding time;
- Sample pH and residual chlorine when required;
- Appropriate containers.

2.5.5. Samples for drinking water analysis that are improperly preserved, or are received past holding time, are rejected at the time of receipt, with the exception of VOA samples that are tested for pH at the time of analysis.

2.5.6. Additional information can be found in S-NY-C-227-rev.06 **Sample Receipt, Sample Storage, and Sample Security** or its equivalent revision or replacement.

2.6. Sample Log-in

2.6.1. After sample inspection, all sample information on the chain of custody is entered into the Laboratory Information Management System. This permanent record documents receipt of all sample containers including:

- Customer name and contact
- Customer number
- Pace Analytical project number
- Pace Analytical Project Manager
- Sample descriptions
- Due dates
- List of analyses requested
- Date and time of laboratory receipt
- Field ID code
- Date and time of collection
- Any comments resulting from inspection for sample rejection

2.6.2. All samples received are logged into the LIMS within one working day of receipt. Sample login may be delayed due to customer clarification of analysis needed, corrective actions for sample receipt non-conformance, or other unusual circumstances.

2.6.3. The Laboratory Information Management System automatically generates a unique identification number for each sample created in the system. The LIMS sample number follows the general convention of LLXXXXX-Where LL represents, in letters, the year (e.g. AP = 2012) and

XXXXX represents a sequential number (AP00001, AP00002,…) This unique identification number is placed on the sample container as a durable label and becomes the link between the laboratory's sample management system and the customer's field identification; it will be a permanent reference number for all future interactions.

2.6.4. Current division codes are noted below. These division codes are used primarily for accounting purposes and LIMS sample identifications. More division codes may be added without updating this document.

10 = Minnesota; Montana; Virginia, MN	35 = Florida
92 = Asheville and Charlotte	20 = Gulf Coast
60 = Kansas	30 = Pittsburgh
50 = Indianapolis	40 = Green Bay
25 = Seattle	17 = Pace Life Sciences
51 = Columbus	65 = Schenectady, NY
75 = Dallas	36 = South Florida

2.6.5. Sample labels are printed from the LIMS and affixed to each sample container.

2.6.6. Samples with hold times that are near expiration date/time may be sent directly to the laboratory for analysis at the discretion of the Project Manager and/or SGM/GM/AGM/OM.

2.6.7. Additional information can be found in S-NY-C-227-rev.06 **Sample Receipt, Sample Storage, and Sample Security** or its equivalent revision or replacement.

2.7. Sample Storage

2.7.1. Storage Conditions

2.7.1.1. Samples are stored away from all standards, reagents, or other potential sources of contamination. Samples are 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.

2.7.1.2. Storage blanks, consisting of two 40mL aliquots of reagent water, are stored with volatile samples and are used to measure cross-contamination acquired during storage. If applicable, laboratories must have documented procedures and criteria for evaluating storage blanks, appropriate to the types of samples being stored.

2.7.1.3. Sample Custodians will record the temperature of the cooler through a temperature blank. The temperature requirement is 0-6.0 degrees Celsius. If the temperature is outside these acceptance criteria, a note is indicated within a Case Narrative for the client.

2.7.2. Temperature Monitoring

2.7.2.1. Samples are taken to the appropriate storage location immediately after sample receipt and check-in procedures are completed. All sample storage areas are located in limited access areas and are monitored to ensure sample integrity.

2.7.2.2. The temperature of each refrigerated storage area is maintained at $\leq 6^{\circ}C$ unless state or program requirements differ. The temperature of each freezer storage area is maintained at $<-10^{o}C$ unless state or program requirements differ. The temperature of each storage area is

checked and documented each day of use (each calendar day). If the temperature falls outside the acceptable limits, the following corrective actions are taken and appropriately documented:

- The temperature is rechecked after two hours to verify temperature exceedance. Corrective action is initiated and documented if necessary.
- The SQM/QM and/or laboratory management are notified if the problem persists.
- The samples are relocated to a proper environment if the temperature cannot be maintained after corrective actions are implemented.
- The affected customers are notified.
- Documentation is provided on analytical report.

2.7.3. **Hazardous Materials**

2.7.3.1. Pure product or potentially heavily contaminated samples must be tagged as "hazardous" and stored separately from other samples.

2.7.4. **Foreign/Quarantined Soils**

2.7.4.1. Depending on the soil disposal practices of the laboratory, foreign soils and soils from USDA regulated areas are adequately segregated to enable proper sample disposal. The USDA requires these samples to be incinerated or sterilized by an approved treatment procedure. Additional information regarding USDA regulations and sample handling can be found in applicable local laboratory SOPs.

2.7.4.2. Additional information on sample storage can be found in S-NY-C-227-rev.06 **Sample Receipt, Sample Storage, and Sample Security** or its equivalent revision or replacement and in S-NY-W-054-rev.09 **Classification and Disposal of Laboratory Waste**.

2.8. Sample Protection

2.8.1. PASI laboratory facilities are operated under controlled access protocols to ensure sample and data integrity. Visitors must register at the front desk and be properly escorted at all times.

2.8.2. Samples are removed from storage areas by designated personnel and returned to the storage areas, if necessary, immediately after the required sample quantity has been taken.

2.8.3. Upon customer request, additional and more rigorous chain of custody protocols for samples and data can be implemented. For example, some projects may require internal chain-of-custody protocols.

2.8.4. Additional information can be found in S-NY-C-227-rev.06 **Sample Receipt, Sample Storage, and Sample Security** or its equivalent revision or replacement.

2.9. Subcontracting Analytical Services

2.9.1. Every effort is made to perform all analyses for PASI customers within the laboratory that receives the samples. When subcontracting to a laboratory other than the receiving laboratory, whether inside or outside the PASI network, becomes necessary, a preliminary verbal communication with that laboratory is undertaken. Customers are notified in writing of the laboratory's intention to subcontract any portion of the testing to another laboratory. Work performed under specific protocols may involve special considerations.

2.9.2. Prior to subcontracting samples to a laboratory outside Pace Analytical, the potential sub-contract laboratory will be pre-qualified by verifying that the subcontractor meets the following criteria:

- All certifications required for the proposed subcontract are in effect,
- Sufficient professional liability and other required insurance coverage is in effect, and
- Is not involved in legal action by any federal, state, or local government agency for data integrity issues and has not been convicted in such investigation at any time during the past 5 years.

2.9.3. The contact and preliminary arrangements are made between the PASI Project Manager and the appropriate subcontract laboratory personnel. The specific terms of the subcontract laboratory agreement include:

- Method of analysis
- Number and type of samples expected
- Project specific QA/QC requirements
- Deliverables required
- Laboratory certification requirement
- Price per analysis
- Turn-around time requirements

2.9.4. Chain of custody forms are generated for samples requiring subcontracting to other laboratories. Sample receiving personnel re-package the samples for shipment, create a transfer chain of custody form and record the following information:

- Pace Analytical Laboratory Number
- Matrix
- Requested analysis
- Special instructions regarding turnaround, required detection or reporting limits, or any unusual information known about the samples or analytical procedure.
- Signature in "Relinquished By"

2.9.5. All subcontracted sample data reports are sent to the PASI Project Manager. Pace will provide a copy of the subcontractor's report to the client when requested.

2.9.6. Any Pace Analytical work sent to other labs within the PASI network is handled as subcontracted work and all final reports are labeled clearly with the name of the laboratory performing the work. Any non-TNI work is clearly identified. PASI will not be responsible for analytical data if the subcontract laboratory was designated by the customer.

2.9.7. Additional information can be found in S-NY-C-044-rev.07 **Subcontracting Samples** or its equivalent revision or replacement.

2.10. Sample Retention and Disposal

2.10.1. Samples, extracts, digestates, and leachates must be retained by the laboratory for the period of time necessary to protect the interests of the laboratory and the customer.

2.10.2. Unused portions of samples are retained by each laboratory based on program or customer requirements for sample retention and storage. The sample retention time is a minimum of 45 days from receipt of the samples. Samples requiring storage beyond this time due to special requests or contractual obligations may not be stored under temperature controlled conditions unless the laboratory has sufficient capacity and their presence does not compromise the integrity of other samples.

2.10.3. 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. If it is not feasible to return samples, or the customer requires PASI to dispose of excess samples, proper arrangements will be made for disposal by an approved contractor.

2.10.4. Additional information can be found in S-NY-W-054-rev.09 **Classification and Disposal of Laboratory Waste** and S-NY-C-227-rev.06 **Sample Receipt, Sample Storage, and Sample Security** or their equivalent revisions or replacements.

3.0. ANALYTICAL CAPABILITIES

3.1. Analytical Method Sources

3.1.1. PASI laboratories are capable of analyzing a full range of environmental samples from a variety of matrices, including air, surface water, wastewater, groundwater, soil, sediment, biota, and other waste products. The latest valid editions of methodologies are applied from regulatory and professional sources including but not necessarily limited to EPA, ASTM, USGS, NIOSH, Standard Methods, and State Agencies. Section 11 is a representative listing of general analytical protocol references. PASI discloses in writing to its customers and regulatory agencies any instances in which modified methods are being used in the analysis of samples.

3.1.2. In the event of a customer-specific need, instrumentation constraint or regulatory requirement, PASI laboratories reserve the right to use valid versions of methods that may not be the most recent edition available.

3.2. Analytical Method Documentation

3.2.1. The primary form of PASI laboratory documentation of analytical methods is the Standard Operating Procedure (SOP). SOPs contain pertinent information as to what steps are required by an analyst to successfully perform a procedure. The required contents for the SOPs are specified in the company-wide SOP for Preparation of SOPs (S-ALL-Q-001).

3.2.2. The SOPs may be supplemented by other training materials that further detail how methods are specifically performed. This training material will undergo periodic, documented review along with the other Quality System documentation.

3.3. Analytical Method Validation

3.3.1. In some situations, PASI develops and validates methodologies that may be more applicable to a specific problem or objective. When non-standard methods are required for specific projects or analytes of interest, or when the laboratory develops or modifies a method, the laboratory validates the method prior to applying it to customer samples. Method validity is established by meeting criteria for precision and accuracy as established by the data quality objectives specified by the end user of the data. The laboratory records the validation procedure, the results obtained and a statement as to the usability of the method. The minimum requirements for method validation include evaluation of sensitivity, quantitation, precision, bias, and selectivity of each analyte of interest.

3.3.2. All method validation of raw data reports will be kept on file in the QA Office.

3.4. Demonstration of Capability (DOC)

3.4.1. Analysts complete an initial demonstration of capability (IDOC) study prior to performing a method or when there is a change in instrument type, personnel, or test method, or at any time that a method has not been performed by the laboratory or analyst in a 12-month period. The mean recovery and standard deviation of each analyte, taken from 4 replicates of a quality control standard is calculated and compared to method criteria (if available) or established laboratory criteria for evaluation of acceptance. Each laboratory maintains copies of all demonstrations of capability, including those that fail acceptance criteria and corresponding raw data for future reference and must

document the acceptance criteria prior to the analysis of the DOC. Demonstrations of capability are verified on an annual basis.

3.4.2. For Continuing Demonstrations of Capability, the laboratories may use Performance Testing (PT) samples in lieu of the 4-replicate approach listed above. For methods or procedures that do not lend themselves to the "4-replicate" approach, the demonstration of capability requirements will be specified in Section 13 – Method Performance of the applicable SOP. Drinking Water DOCs must be done at or below the MCL.

3.4.3. Additional information can be found in SOP S-NY-Q-274-rev.01 **Training and Employee Orientation** or its equivalent revision or replacement.

3.5. Regulatory and Method Compliance

3.5.1. PASI understands that expectations of our customers commonly include the assumption that laboratory data will satisfy specific regulatory requirements. Therefore PASI attempts to ascertain, prior to beginning a project, what applicable regulatory jurisdiction, agency, or protocols apply to that project. This information is also required on the chain of custody submitted with samples.

3.5.2. PASI makes every effort to detect regulatory or project plan inconsistencies, based upon information from the customer, and communicate them immediately to the customer in order to aid in the decision making process. PASI will not be liable if the customer chooses not to follow PASI recommendations.

3.5.3. It is PASI policy to disclose in a forthright manner any detected noncompliance affecting the usability of data produced by our laboratories. The laboratory will notify customers within 30 days of fully characterizing the nature of the nonconformance, the scope of the nonconformance and the impact it may have on data usability.

4.0. QUALITY CONTROL PROCEDURES

Quality control data is analyzed and where they are found to be outside pre-defined criteria, planned action is taken to correct the problem in order to prevent incorrect results from being reported. Quality control samples are to be processed in the same manner as client samples.

4.1. Method Blank

4.1.1. A method blank is used to evaluate contamination in the preparation/analysis system and is processed through all preparation and analytical steps with its associated samples.

4.1.2. A method blank is processed at a minimum frequency of one per preparation batch. In the case of a method that has no separate preparation step, a method blank is processed with no more than 20 samples of a specific matrix performed by the same analyst, using the same method, standards, and reagents.

4.1.3. The method blank consists of a matrix similar to the associated samples that is known to be free of analytes of interest. Laboratories will characterize a representative matrix as "clean" if the matrix contains contaminants at less than ½ the laboratory's reporting limit.

4.1.4. Method blanks are not applicable for certain analyses, such as pH, conductivity, flash point and temperature.

4.1.5. Each method blank is evaluated for contamination. The source of any contamination is investigated and documented corrective action is taken when the concentration of any target analyte is detected above the reporting limit and is greater than 1/10 of the amount of that analyte found in any associated sample. Corrective actions include the re-preparation and re-analysis of all the samples (where possible) along with the full set of required quality control samples. Data qualifiers must be applied to any result reported that is associated with a contaminated method blank.

4.1.6. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.2. Laboratory Control Sample

4.2.1. The Laboratory Control Sample (LCS) is used to evaluate the performance of the entire analytical system including preparation and analysis.

4.2.2. An LCS is processed at a minimum frequency of one per preparation batch. In the case of a method that has no separate preparation step, an LCS will be processed with no more than 20 samples of a specific matrix performed by the same analyst, using the same method, standards, and reagents.

4.2.3. The LCS consists of a matrix similar to the associated samples that is known to be free of the analytes of interest that is then spiked with known concentrations of target analytes.

4.2.4. The LCS contains all analytes specified by a specific method or by the customer or regulatory agency, which may include full list of target compounds, with certain exceptions. These exceptions may include analyzing only specific Aroclors when PCB analysis is requested or not spiking with all EPA Appendix IX compounds when a full Appendix IX list of compounds is requested. However, the lab must ensure that all target components in its scope of accreditation are included in the spike

mixture for the LCS over a two (2) year period. In the absence of specified components, the laboratory will spike the LCS with the following compounds:

- For multi-peak analytes (e.g. PCBs, technical chlordane, toxaphene), a representative standard will be processed.
- For methods with long lists of analytes, a representative number of target analytes may be chosen. The following criteria is used to determine the number of LCS compounds used:
  - For methods with 1-10 target compounds, the laboratory will spike with all compounds
  - For methods with 11-20 target compounds, the laboratory will spike with at least 10 compounds or 80%, whichever is greater
  - For methods with greater than 20 compounds, the laboratory will spike with at least 16 compounds.

4.2.5. The LCS is evaluated against the method default or laboratory-derived acceptance criteria. For those methods that require laboratory-derived limits, method default control limits may be used until the laboratory has a minimum of 20, but preferably greater than 30, data points from which to derive internal acceptance criteria. Any compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Any associated sample containing an 'out-of-control' compound must either be re-analyzed with a successful LCS or reported with the appropriate data qualifier. When the acceptance criteria for the LCS are exceeded high, and there are associated samples that are non-detects, then those non-detects can be reported with data qualifiers, or when the acceptance criteria are exceeded low, those associated sample results may be reported if they exceed the maximum regulatory limit/decision level with data qualifiers.

4.2.6. For LCSs containing a large number of analytes, it is statistically likely that a few recoveries will be outside of control limits. This does not necessarily mean that the system is out of control, and therefore no corrective action would be necessary (except for proper documentation). TNI has allowed for a minimum number of marginal exceedances, defined as recoveries that are beyond the LCS control limits (3X the standard deviation) but less than the marginal exceedance limits (4X the standard deviation). The number of allowable exceedances depends on the number of compounds in the LCS. If more analyte recoveries exceed the LCS control limits than is allowed (see below) or if any one analyte exceeds the marginal exceedance limits, then the LCS is considered non-compliant and corrective actions are necessary. The number of allowable exceedances is as follows:

- >90 analytes in the LCS- 5 analytes
- 71-90 analytes in the LCS- 4 analytes
- 51-70 analytes in the LCS- 3 analytes
- 31-50 analytes in the LCS- 2 analytes
- 11-30 analytes in the LCS- 1 analyte
- <11 analytes in the LCS- no analytes allowed out)

4.2.7. A matrix spike (MS) can be used in place of a non-compliant LCS in a batch as long as the MS passes the LCS acceptance criteria (this is a TNI allowance). When this happens, full documentation must be made available to the data user. If this is not allowed by a customer or regulatory body, the associated samples must be rerun with a compliant LCS (if possible) or reported with appropriate data qualifiers.

4.2.8. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.3. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

4.3.1. A matrix spike (MS) is used to determine the effect of the sample matrix on compound recovery for a particular method. The information from these spikes is sample or matrix specific and is not used to determine the acceptance of an entire batch unless the MS is actually used as the LCS.

4.3.2. A **Matrix Spike/Matrix Spike Duplicate** (MS/MSD) set is processed at a frequency specified in a particular method or as determined by a specific customer request. This frequency will be specified in the applicable method SOP or customer QAPP. In the absence of such requirements, an MS/MSD set is routinely analyzed once per every 20 samples per matrix per method.

4.3.3. The MS and MSD consist of the sample matrix that is then spiked with known concentrations of target analytes. Laboratory personnel spike customer samples that are specifically designated as MS/MSD samples or, when no designated samples are present in a batch, randomly select samples to spike that have adequate sample volume or weight. Spiked samples are prepared and analyzed in the same manner as the original samples and are selected from different customers if possible.

4.3.4. The MS and MSD contain all analytes specified by a specific method or by the customer or regulatory agency. In the absence of specified components, the laboratory will spike the MS/MSD with the same number of compounds as previously discussed in the LCS section. However, the lab must ensure that all targeted components in its scope of accreditation are included in the spike mixture for the MS/MSD over a two (2) year period.

4.3.5. The MS and MSD are evaluated against the method or laboratory derived criteria. Any compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Batch acceptance, however, is based on method blank and LCS performance, not on MS/MSD recoveries. The spike recoveries give the data user a better understanding of the final results based on their site specific information.

4.3.6. A matrix spike and sample duplicate will be performed instead of a matrix spike and matrix spike duplicate when specified by the customer or method.

4.3.7. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.4. Sample Duplicate

4.4.1. A sample duplicate is a second portion of sample that is prepared and analyzed in the laboratory along with the first portion. It is used to measure the precision associated with preparation and analysis. A sample duplicate is processed at a frequency specified by the particular method or as determined by a specific customer.

4.4.2. The sample and duplicate are evaluated against the method or laboratory derived criteria for relative percent difference (RPD). Any duplicate that is outside of these limits is considered to be 'out of control' and must be qualified appropriately.

4.4.3. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.5. Surrogates

4.5.1. Surrogates are compounds that reflect the chemistry of target analytes and are typically added to samples for organic analyses to monitor the effect of the sample matrix on compound recovery.

4.5.2. Surrogates are added to each customer sample (for organics), method blank, LCS, and MS prior to extraction or analysis. The surrogates are evaluated against the method or laboratory derived acceptance criteria or against project-specific acceptance criteria specified by the client, if applicable. Any surrogate compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Samples with surrogate failures are typically 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. An exception to this would be samples that have high surrogate values but no reportable hits for target compounds. These samples would be reported, with a qualifier, because the implied high bias would not affect the final results. For methods with multiple surrogates, documentation regarding acceptance and associated compounds will be found in the individual method SOPs.

4.5.3. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.6. Internal Standards

4.6.1. Internal Standards are method-specific analytes added to every standard, method blank, laboratory control sample, matrix spike, matrix spike duplicate, and sample at a known concentration, prior to analysis for the purpose of adjusting the response factor used in quantifying target analytes. At a minimum, the laboratory will follow method specific guidelines for the treatment of internal standard recoveries as they are related to the reporting of data.

4.6.2. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.7. Field Blanks

4.7.1. Field blanks are blanks prepared at the sampling site in order to monitor for contamination that may be present in the environment where samples are collected. These field quality control samples are often referenced as field blanks, rinsate blanks, or equipment blanks. The laboratory analyzes these field blanks as normal samples and informs the customer if there are any target compounds detected above the reporting limits.

4.8. Trip Blanks

4.8.1. Trip blanks are blanks that originate from the laboratory as part of the sampling event and are used to monitor for contamination of samples during transport. These blanks accompany the empty sample containers to the field and then accompany the collected samples back to the laboratory. These blanks are routinely analyzed for volatile methods where ambient background contamination is likely to occur.

4.9. Limit of Detection (LOD)

4.9.1. PASI laboratories are required to use a documented procedure to determine a limit of detection for each analyte of concern in each matrix reported. All sample processing steps of the preparation and analytical methods are included in this determination including any clean ups. For any test that does not have a valid LOD, sample results below the limit of quantitation (LOQ) cannot be reported.

4.9.2. The LOD is initially established for the compounds of interest for each method in a clean matrix with no target analytes present and no interferences at a concentration that would impact the results. The LOD is then determined every time there is a change in the test method that affects how the test is performed or when there has been a change in the instrument that affects the sensitivity. If required by customer, method or accreditation body, the LOD will be re-established annually for all applicable methods.

4.9.3. Unless otherwise noted, the method used by PASI laboratories to determine LODs is based on the Method Detection Limit (MDL) procedure outlined in 40 CFR Part 136, Appendix B. Where required by regulatory program or customer, the above referenced procedure will be followed.

4.9.4. Where specifically stated in the published method, LODs or MDLs will be performed at the listed frequency.

4.9.5. The validity of the LOD must be shown by detection (a value above zero) of the analytes in a QC sample in each quality system matrix. The QC sample must contain the analyte at no more than 3X the LOD for a single analyte test and 4X the LOD for multiple analyte tests. This verification must be performed on each instrument used for sample analysis and reporting of data. The validity of the LOD must be verified as part of the LOD determination process. This verification must be done prior to the use of the LOD for sample analysis.

4.9.6. An LOD study is not required for any analyte for which spiking solutions or quality control samples are not available such as temperature.

4.9.7. The LOD, if required, shall be verified annually for each quality system matrix, technology and analyte. In lieu of performing full LOD (MDL) studies annually, the laboratory can verify the LOD (MDL) on an annual basis, providing this verification is fully documented and does not contradict other customer or program requirements that the laboratory must follow. The requirements of this verification are:

- The spike concentration of the verification must be no more than 3X times the LOD for single analyte tests and 4X the LOD for multiple analyte tests.
- The laboratory must verify the LOD on each instrument used for the reporting of sample data.
- The laboratory must be able to identify all target analytes in the verification standard (distinguishable from noise).

4.9.8. Additional information can be found in SOP S-NY-Q-021-rev.07 **Determination & Verification of MDL/IDL/PQL** or its equivalent revision or replacement.

4.10. Limit of Quantitation (LOQ)

4.10.1. A limit of quantitation (LOQ) for every analyte of concern must be determined. For PASI laboratories, this LOQ is referred to as the RL, or Reporting Limit. This RL is based on the lowest calibration standard concentration that is used in each initial calibration. Results below this level are not allowed to be reported without qualification since the results would not be substantiated by a

calibration standard. For methods with a determined LOD, results can be reported out below the LOQ but above the LOD if they are properly qualified (e.g., J flag).

4.10.2. The LOQ must be higher than the LOD.

4.10.3. To verify the LOQ, the laboratory will prepare a sample in the same matrix used for the LCS. The sample will be spiked with target analytes at the concentration(s) equivalent to or less than the RL(s). This sample must undergo the routine sample preparation procedure including any routine sample cleanup steps. The sample is then analyzed and the recovery of each target analyte determined. The recovery for each target analyte must meet the laboratories current control limits for an LCS. The annual LOQ verification is not required if the LOD was determined or verified annually on that instrument.

4.10.4. Additional information can be found in SOP S-NY-Q-021-rev.07 **Determination & Verification of MDL/IDL/PQL** or its equivalent revision or replacement.

4.11. Estimate of Analytical Uncertainty

4.11.1. PASI laboratories can provide an estimation of uncertainty for results generated by the laboratory. The estimate quantifies the error associated with any given result at a 95% confidence interval. This estimate does not include bias that may be associated with sampling. The laboratory has a procedure in place for making this estimation. In the absence of a regulatory or customer-specific procedure, PASI laboratories base this estimation on the recovery data obtained from the Laboratory Control Spikes. The uncertainty is a function of the standard deviation of the recoveries multiplied by the appropriate Student's t Factor at 95% confidence.

4.11.2. The measurement of uncertainty is provided only on request by the customer, as required by specification or regulation and when the result is used to determine conformance within a specification limit.

4.12. Proficiency Testing (PT) Studies

4.12.1. PASI laboratories participate in the TNI defined proficiency testing program. PT samples are obtained from NIST approved providers and analyzed and reported at a minimum of two times per year for the relevant fields of testing per matrix.

4.12.2. PASI participates in ELAP PT samples for routine quarterly PT testing for NY certification. Since NY is the Primary AB, the results are sent to other certified states to maintain state certification. NY currently reports to MA-DEP, NJ-DEP, CT-DOH, and NC-DOH. When PTs cannot be used through ELAP, PASI-New York utilizes ERA for PT purchasing. Other PT testing from clients may be through other vendors, such as Wibby Environmental.

4.12.3. The laboratory initiates an investigation whenever PT results are deemed 'unacceptable' by the PT provider. All findings and corrective actions taken are reported to the SQM/QM or their designee. A corrective action plan is initiated and this report is sent to the appropriate state accreditation agencies for their review. Additional PTs will be analyzed and reported as needed for certification purposes.

4.12.4. PT samples are treated as typical customer samples, utilizing the same staff, methods, equipment, facilities, and frequency of analysis. PT samples are included in the laboratory's normal analytical processes and do not receive extraordinary attention due to their nature.

4.12.5. Comparison of analytical results with anyone participating in the same PT study is prohibited prior to the close of the study.

4.13. Rounding and Significant Figures

4.13.1. In general, the PASI laboratories report data to no more than three significant digits. Therefore, all measurements made in the analytical process must reflect this level of precision. In the event that a parameter that contributes to the final result has less than three significant figures of precision, the final result must be reported with no more significant figures than that of the parameter in question. The rounding rules listed below are descriptive of the LIMS and not necessarily of any supporting program such as Excel.

4.13.2. Data is compared to the reporting limits and MDLs to determine if qualifiers are needed before the rounding step occurs.

4.13.3. **Rounding:**

- If the figure following the one to be retained is less than five, that figure is dropped and the retained ones are not changed (with three significant figures, 2.544 is rounded to 2.54).
- If the figure following the ones to be retained is greater than five, that figure is dropped and the last retained one is rounded up (with three significant figures, 2.546 is rounded to 2.55).
- If the figure following the ones to be retained is five and if there are no figures other than zeros beyond that five, then the five is dropped and the last figure is rounded up (with three significant figures, 2.525 is rounded to 2.53).

4.13.4. **Significant Digits**

4.13.4.1. Unless specified by federal, state, or local requirements or on specific request by a customer, PASI-New York reports all analytical results to 3 significant digits, regardless of the magnitude of the value reported.

4.14. Retention Time Windows

4.14.1. When chromatographic conditions are changed, retention times and analytical separations are often affected. As a result, two critical aspects of any chromatographic method are the determination and verification of retention times and analyte separation. Retention time windows must be established for the identification of target analytes. The retention times of all target analytes in all calibration verification standards must fall within the retention time windows. If an analyte falls outside the retention time window in an ICV or CCV, new absolute retention time windows must be calculated, unless instrument maintenance fixes the problem. When a new column is installed, a new retention time window study must be performed.

4.14.2. One process for the production of retention time windows: Make 3 injections of all single component or multi-component analytes over a 72-hour period. Record the retention time in minutes for each analyte and surrogate to 3 decimal places. Calculate the mean and standard deviation of the three absolute retention times for each target analyte and surrogate. For multi-component analytes, choose 3-5 major peaks and calculate the mean and standard deviation for each of the peaks. If the standard deviation of the retention times of a target analyte is 0.000, the lab may use a default standard deviation of 0.01. The width of the retention time window for each analyte

and surrogate and major peak in a multi-component analyte is defined as +/- 3 times the standard deviation of the mean absolute retention time established during that 72-hour period or 0.03 minutes, whichever is greater.

4.14.3. The center of the retention time window is established for each analyte and surrogate by using the absolute retention times from the CCV at the beginning of the analytical shift. For samples run with an initial calibration, use the retention time of the mid-point standard of the initial calibration curve.

4.14.4. For more information, please reference the local facility's analytical SOPs.

5.0. DOCUMENT MANAGEMENT AND CHANGE CONTROL

5.1. Document Management

5.1.1. Additional information can be found in SOP S-NY-Q-224-rev.03 **Document Control for NELAC Compliance** or its equivalent revision or replacement. Information on Pace's policy for electronic signatures can also be found in this SOP.

5.1.2. Pace Analytical Services, Inc. has an established procedure for managing documents that are part of the quality system. The list of managed documents includes, but is not limited to, Standard Operating Procedures (both technical and non-technical), Quality Assurance Manuals, quality policy statements, training documents, work-processing documents, charts, posters, memoranda, notices, forms, software, and any other procedures, tables, plans, etc. that have a direct bearing on the quality system (including applicable data records and non-technical documents).

5.1.3. A master list of all managed documents is maintained at each facility identifying the current revision status and distribution of the controlled documents. This establishes that there are no invalid or obsolete documents in use in the facility. All documents are reviewed periodically and revised if necessary. Obsolete documents are systematically discarded or archived for audit or knowledge preservation purposes.

5.1.4. Each managed document is uniquely identified to include the date of issue, the revision identification, page numbers, the total number of pages and the issuing authorities. For complete information on document numbering, refer to SOP S-NY-Q-224-rev.03 **Document Control for NELAC Compliance**.

5.1.5. SOPs, specifically, are available to all laboratory staff via the Learning Management System (LMS) which is a secure repository that is accessed through an internet portal. As a local alternative to the hard copy system of controlled documents, secured electronic copies of controlled documents may be maintained on the laboratory's local server. These document files must be read-only for all personnel except the Quality Department and system administrator. Other requirements for this system are as follows:

- Electronic documents must be readily accessible to all facility employees.
- All hardcopy SOPs must be obtained from the Quality Department.

5.1.6. **Quality Assurance Manual (QAM):** The Quality Assurance Manual is the company-wide document that describes all aspects of the quality system for PASI. The base QAM template is distributed by the Corporate Quality Department to each of the SQMs/QMs. The local management personnel modify the necessary and permissible sections of the base template and submit those modifications to the Corporate Director of Quality for review. Once approved and signed by both the CEO and the Director of Quality; the SGM/GM/AGM/OM, the SQM/QM, and any Technical Directors sign the Quality Assurance Manual. Each SQM/QM is then in charge of distribution to employees, external customers or regulatory agencies and maintaining a distribution list of controlled document copies. The Quality Assurance Manual template is reviewed on an annual basis by all of the PASI SQMs/QMs and revised accordingly by the Director of Quality.

5.1.7. **Standard Operating Procedures (SOPs)**

5.1.7.1. SOPs fall into two categories: company-wide documents and facility specific documents. Company-wide SOPs start with the prefix S-ALL- and local SOPs start with the individual facility prefix.

5.1.7.2. The purpose of the company-wide SOPs is to establish policies and procedure that are common and applicable to all PASI facilities. Company-wide SOPs are document-controlled by the corporate quality office and signed copies are distributed to all of the SQMs/QMs. The local management personnel sign the company-wide SOPs. The SQM/QM is then in charge of distribution to employees, external customers, or regulatory agencies and maintaining a distribution list of controlled document copies.

5.1.7.3. Local PASI facilities are responsible for developing facility-specific SOPs applicable to their respective facility. The local facility develops these facility-specific SOPs based on the corporate-wide SOP template. This template is written to incorporate a set of minimum method requirements and PASI best practice requirements. The local facilities may add to or modify the corporate-wide SOP template provided there are no contradictions to the minimum method or best practice requirements. Facility-specific SOPs are controlled by the applicable SQM/QM according to the corporate document management policies.

5.1.7.4. SOPs are reviewed every two years at a minimum although a more frequent review may be required by some state or federal agencies or customers. If no revisions are made based on this review, documentation of the review itself is made by the addition of new signatures on the cover page. If revisions are made, documentation of the revisions is made in the revisions section of each SOP and a new revision number is applied to the SOP. This provides a historical record of all revisions.

5.1.7.5. All copies of superseded SOPs are removed from general use and the original copy of each SOP is archived for audit or knowledge preservation purposes. This ensures that all PASI employees use the most current version of each SOP and provides the SQM/QM with a historical record of each SOP.

5.1.7.6. Additional information can be found in SOP S-NY-Q-001-rev.04 **Preparation of SOPs** or its equivalent revision or replacement.

5.2. Document Change Control

5.2.1. Changes to managed documents are reviewed and approved in the same manner as the original review. Any revision to a document requires the approval of the applicable signatories. After revisions are approved, a revision number is assigned and the previous version of the document is officially retired. Copies may be kept for audit or knowledge preservation purposes.

5.2.2. All controlled copies of the previous document are replaced with controlled copies of the revised document and the superseded copies are destroyed or archived. All affected personnel are advised that there has been a revision and any necessary training is scheduled.

5.3. Management of Change

5.3.1. The process for documenting necessary changes within the laboratory network are not typically handled using the corrective or preventive action system as outlined in section 9.0. Management of Change is a proactive approach to dealing with change to minimize the potential

negative impact of systematic change in the laboratory and to ensure that each change has a positive desired outcome. This process will primarily be used for the implementation of large scale projects and information system changes as a means to apply consistent systems or procedures within the laboratory network. The request for change is submitted by the initiator and subsequently assigned to an individual or team for development and planning. The final completion of the process culminates in final approval and verification that the procedure was effectively implemented.

6.0. EQUIPMENT AND MEASUREMENT TRACEABILITY

Each PASI facility is equipped with sufficient instrumentation and support equipment to perform the relevant analytical testing or field procedures performed by each facility. Support equipment includes chemical standards, thermometers, balances, disposable and mechanical pipettes, etc. This section details some of the procedures necessary to maintain traceability and to perform proper calibration of instrumentation and support equipment. See Attachment III for a list of equipment currently used at the New York PASI facility.

6.1. Standards and Traceability

6.1.1. Each PASI facility retains all pertinent information for standards, reagents, and chemicals to assure traceability to a national standard. This includes documentation of purchase, receipt, preparation, and use.

6.1.2. Upon receipt, all purchased standard reference materials are recorded into a standard logbook or database and assigned a unique identification number. The entries include the facility's unique identification number, the chemical name, manufacturer name, manufacturer's identification numbers, receipt date, and expiration date. Vendor's certificates of analysis for all standards, reagents, or chemicals are retained for future reference.

6.1.3. Subsequent preparations of intermediate or working solutions are also documented in a standard logbook or database. These entries include the stock standard name and lot number, the manufacturer name, the solvents used for preparation, the solvent lot number and manufacturer, the preparation steps, preparation date, expiration dates, preparer's initials, and a unique PASI identification number. This number is used in any applicable sample preparation or analysis logbook so the standard can be traced back to the standard preparation record. This process ensures traceability back to the national standard.

6.1.4. All prepared standard or reagent containers include the PASI identification number, the standard or chemical name, the date of preparation, the date of expiration, the concentration with units, and the preparer's initials. This ensures traceability back to the standard preparation logbook.

6.1.5. For containers that are too small to accommodate labels that list all of the above information associated with a standard, the minimum required information will be PASI standard ID, concentration, and expiration date. This assures that no standard will be used past its assigned expiration date.

6.1.6. If a second source standard is required to verify an existing calibration or spiking standard, this standard should be obtained from a different manufacturer or from a different lot unless client specific QAPP requirements state otherwise.

6.1.7. Additional information concerning standards and reagent traceability can be found in the SOP S-NY-Q-264-rev.02 **Standard Identification, Traceability, and Storage Procedures** or its equivalent revision or replacement.

6.2. General Analytical Instrument Calibration Procedures

6.2.1. All support equipment and instrumentation are calibrated or checked before use to ensure proper functioning and verify that the laboratory's requirements are met. All calibrations are performed by, or under the supervision of, an experienced analyst at scheduled intervals against either certified standards

traceable to recognized national standards or reference standards whose values have been statistically validated.

6.2.2. Calibration standards for each parameter are chosen to establish the linear range of the instrument and must bracket the concentrations of those parameters measured in the samples. The lowest calibration standard is the lowest concentration for which quantitative data may be reported. Data reported below this level is considered to have less certainty and must be reported using appropriate data qualifiers or explained in a narrative. The highest calibration standard is the highest concentration for which quantitative data may be reported. Data reported above this level is considered to have less certainty and must be reported using appropriate data qualifiers or explained in the narrative. Any specific method requirement for number and type of calibration standards supersedes the general requirement. Instrument and method specific calibration criteria are explained within the specific analytical standard operating procedures for each facility.

6.2.3. Instrumentation or support equipment that cannot be calibrated to specification or is otherwise defective is clearly labeled as out-of-service until it has been repaired and tested to demonstrate it meets the laboratory's specifications. All repair and maintenance activities including service calls are documented in the maintenance log. Equipment sent off-site for calibration testing is packed and transported to prevent breakage and is in accordance with the calibration laboratory's recommendations.

6.2.4. In the event that recalibration of a piece of test equipment indicates the equipment may have been malfunctioning during the course of sample analysis, an investigation is performed. The results of the investigation along with a summary of the information reviewed are documented and maintained by the quality manager. If the investigation indicates sample results have been impacted, the customer is notified within 30 days. This allows for sufficient investigation and review of documentation to determine the impact on the analytical results. Instrumentation found to be consistently out of calibration is either repaired and positively verified or taken out of service and replaced.

6.2.5. Raw data records are retained to document equipment performance. Sufficient raw data is retained to reconstruct the instrument calibration and explicitly connect the continuing calibration verification to the initial calibration.

6.2.6. **General Organic Calibration Procedures**

6.2.6.1. Calibration standards are prepared at a minimum of five concentrations for organic analyses. Results from all calibration standards analyzed must be included in constructing the calibration curve with the following exceptions:

6.2.6.1.1. The lowest level calibration standard may be removed from the calibration as long as the remaining number of concentration levels meets the minimum established by the method and standard operating procedure. For multi-parameter methods, this may be done on an individual analyte basis. The reporting limit must be adjusted to the lowest concentration included in the calibration curve.

6.2.6.1.2. The highest level calibration standard may be removed from the calibration as long as the remaining number of concentration levels meets the minimum established by the method and standard operating procedure. For multi-parameter methods, this may be done an individual analyte basis. The upper limit of quantitation must be adjusted to the highest concentration included in the calibration curve.

6.2.6.1.3. Multiple points from either the high end or the low end of the calibration curve may be excluded as long as the remaining points are contiguous in nature and the minimum number

of levels remains as established by method or standard operating procedure. The reporting limit or quantitation range, whichever is appropriate, must be adjusted accordingly.

6.2.6.1.4. Results from a concentration level between the lowest and highest calibration levels can only be excluded from an initial calibration curve for a documentable and acceptable cause with approval from the responsible department supervisor and the local SQM/QM or their designee. An acceptable cause is defined as an obvious sample introduction issue that resulted in no response or a documented response that is less than the lowest standard used in the ICAL. A suspected incorrectly prepared standard is not considered to be an acceptable cause. The results for all analytes are to be excluded and the point must be replaced by re-analysis. Re-analysis of this interior standard must occur within the same 12-hour tune time period for GC/MS methodologies and within 8 hours of the initial analysis of that standard for non-GC/MS methodologies. All samples analyzed prior to the re-analyzed calibration curve point must be re-analyzed after the calibration curve is completed and re-processed against the final calibration curve.

6.2.6.2. Initial calibration curves are evaluated against appropriate statistical models as required by the analytical methods. Curves that do not meet the appropriate criteria require corrective action that may include re-running the initial calibration curve. Rounding to meet initial calibration criteria is not allowed, that is, 15.3 cannot be rounded down to meet a $\leq$ 15% RSD requirement. This also applies to linear and non-linear fit requirements. All initial calibrations are verified with an initial calibration verification standard (ICV) obtained from a second manufacturer or second lot from the same manufacturer if that lot can be demonstrated as prepared independently from other lots prior to the analysis of samples. Sample results are quantitated from the initial calibration unless otherwise required by regulation, method, or program.

6.2.6.3. The calibration curve is periodically verified by the analysis of a mid-level continuing calibration verification (CCV) standard during the course of sample analysis. Rounding to meet continuing calibration criteria is not allowed, that is, 15.3 cannot be rounded down to meet a $\leq$ 15% D requirement. Continuing calibration verification is performed at the beginning and end of each analytical batch except if an internal standard is used, then only one verification at the beginning of the batch is needed, whenever it is expected that the analytical system may be out of calibration, if the time period for calibration has expired, or for analytical systems that have specific calibration verification requirements. This verification standard must meet acceptance criteria in order for sample analysis to proceed.

6.2.6.4. In the event that the CCV does not meet the acceptance criteria, a second CCV may be injected as part of the diagnostic evaluation and corrective action investigation. If the second CCV is acceptable, the analytical sequence may be continued. If both CCVs fail, the analytical sequence is terminated and corrective action is initiated. Sample analysis cannot begin until after documented corrective action has been completed and two consecutive passing CCVs have been analyzed. If required by specific state, program, or customer specification, the instrument is re-calibrated after two consecutive CCV failures. All samples analyzed since the last compliant CCV are re-analyzed for methodologies utilizing external calibration.

6.2.6.5. When instruments are operating unattended, autosamplers may be programmed to inject consecutive CCVs as a preventative measure against CCV failure with no corrective action. In this case, both CCVs must be evaluated to determine potential impact to the results. A summary of the decision tree and necessary documentation are listed below:

- If both CCVs meet the acceptance criteria, the analytical sequence is allowed to continue without corrective action. The 12 hour clock begins with the injection of the second CCV.
- If the first CCV does not meet the acceptance criteria and the second CCV is acceptable, the analytical sequence is continued and the results are reported.
- If the first CCV meets the acceptance criteria and the second CCV is out of control, the samples after the out of control CCV must be re-analyzed in a compliant analytical sequence.
- If both CCVs are out of control, all samples since the last acceptable CCV must be re-analyzed in a compliant analytical sequence.

6.2.6.6. Some analytical methods require that samples be bracketed by passing CCVs analyzed both before and after the samples. This is specific to each method but, as a general rule, all external calibration methods require bracketing CCVs. Most internal standard calibrations do not require bracketing CCVs.

6.2.6.7. Some analytical methods require verification based on a time interval; some methods require a frequency based on an injection interval. The type and frequency of the calibration verifications is dependent on both the analytical method and possibly on the quality program associated with the samples. The type and frequency of calibration verification will be documented in the method specific SOP employed by each laboratory.

6.2.7. General Inorganic Calibration Procedures

6.2.7.1. The instrument is initially calibrated with standards at multiple concentrations to establish the linearity of the instrument's response. A calibration blank is also included. Initial calibration curves are evaluated against appropriate statistical models as required by the analytical methods. Rounding to meet initial calibration criteria is not allowed, that is, 15.3 cannot be rounded down to meet a $\leq$ 15% RSD requirement. This also applies to linear and non-linear fit requirements. The number of calibration standards used depends on the specific method criteria or customer project requirements, although normally a minimum of three standards is used.

6.2.7.2. The ICP and ICP/MS can be standardized with a zero point and a single point calibration if:

- Prior to analysis, the zero point and the single point calibration are analyzed and a linear range has been established,
- Zero point and single point calibration standards are analyzed with each batch
- A standard corresponding to the LOQ is analyzed with the batch and meets the established acceptance criteria
- The linearity is verified at the frequency established by the method or manufacturer.

6.2.7.3. All initial calibrations are verified with an initial calibration verification standard (ICV) obtained from a second manufacturer or second lot from the same manufacturer if the lot can be demonstrated as prepared independently from other lots prior to the analysis of samples. Sample results are quantitated from the initial calibration unless otherwise required by regulation, method, or program.

6.2.7.4. During the course of analysis, the calibration curve is periodically verified by the analysis of calibration verification standards (CCV). A calibration verification standard is analyzed within each analytical batch at method/program specific intervals to verify that the initial calibration is still valid. The CCV is also analyzed at the end of the analytical batch.

6.2.7.5. A calibration blank is also run with each calibration verification standard to verify the cleanliness of the system. All reported results must be bracketed by acceptable CCVs. Instrument and method specific calibration acceptance criteria are explained within the specific analytical standard operating procedures for each facility.

6.2.7.6. Interference check standards are also analyzed per method requirements and must meet acceptance criteria for metals analyses.

6.3. Support Equipment Calibration Procedures

6.3.1. All support equipment is calibrated or verified at least annually using NIST traceable references over the entire range of use. The results of calibrations or verifications must be within the specifications required or the equipment will be removed from service until repaired. The laboratory maintains records to demonstrate the correction factors applied to working thermometers.

6.3.2. On each day the equipment is used, balances, ovens, refrigerators (those used to keep samples and standards at required temperatures), freezers, and water baths are checked in the expected use range with NIST traceable references in order to ensure the equipment meets laboratory specifications and these checks are documented appropriately.

6.3.3. **Analytical Balances**

6.3.3.1. Each analytical balance is calibrated or verified at least annually by a qualified service technician. The calibration of each balance is verified each day of use with weights traceable to NIST bracketing the range of use. Calibration weights are ASTM Class 1 or other class weights that have been calibrated against a NIST standard weight and are re-certified every 5 years at a minimum against a NIST traceable reference. Some accrediting agencies may require more frequent checks. If balances are calibrated by an external agency, verification of their weights must be provided. All information pertaining to balance maintenance and calibration is recorded in the individual balance logbook and/or is maintained on file in the Quality department.

6.3.4. **Thermometers**

6.3.4.1. Certified, or reference, thermometers are maintained for checking calibration of working thermometers. Reference thermometers are provided with NIST traceability for initial calibration and are re-certified, at a minimum, every 3 years with equipment directly traceable to NIST.

6.3.4.2. Working thermometers are compared with the reference thermometers annually according to corporate metrology procedures. Each thermometer is individually numbered and assigned a correction factor based on the NIST reference source. In addition, working thermometers are visually inspected by laboratory personnel prior to use and temperatures are documented.

6.3.4.3. Laboratory thermometer inventory and calibration data are maintained in the Quality department.

6.3.5. **pH/Electrometers**

6.3.6. The meter is calibrated before use each day, using fresh buffer solutions. Please refer to the SOP S-NY-I-022-rev.08 **Determination of pH** or its equivalent revision or replacement for additional pH requirements.

6.3.7. **Spectrophotometers**

6.3.7.1. During use, spectrophotometer performance is checked at established frequencies in analysis sequences against initial calibration verification (ICV) and continuing calibration verification (CCV) standards.

6.3.8. **Mechanical Volumetric Dispensing Devices**

6.3.8.1. Mechanical volumetric dispensing devices including bottle top dispensers, pipettes, and burettes, excluding Class A volumetric glassware, are checked for accuracy on a quarterly basis. The accuracy of glass microliter syringes is verified and documented prior to initial use. Please refer to SOP S-NY-I-055-rev.06 **The Operation of Eppendorf and Ranin Pipettes.**

6.3.8.2. Additional information regarding calibration and maintenance of laboratory support equipment can be found in SOP S-NY-Q-008-rev.04 **Calibration of Bulb, Digital, and Immersion Thermometers** or its equivalent revision or replacement.

6.4. Instrument/Equipment Maintenance

6.4.1. The objectives of the Pace Analytical maintenance program are twofold: to establish a system of instrument care that maintains instrumentation and equipment at required levels of calibration and sensitivity, and to minimize loss of productivity due to repairs.

6.4.2. The Operations Manager and/or department manager/supervisors are responsible for providing technical leadership to evaluate new equipment, solve equipment problems, and coordinate instrument repair and maintenance. Analysts have the primary responsibility to perform routine maintenance.

6.4.3. To minimize downtime and interruption of analytical work, preventative maintenance is routinely performed on each analytical instrument. Up-to-date instructions on the use and maintenance of equipment are available to staff in the department where the equipment is used.

6.4.4. Department manager/supervisors are responsible for maintaining an adequate inventory of spare parts required to minimize equipment downtime. This inventory includes parts and supplies that are subject to frequent failure, have limited lifetimes, or cannot be obtained in a timely manner should a failure occur.

6.4.5. All major equipment and instrumentation items are uniquely identified to allow for traceability. Equipment/instrumentation is, unless otherwise stated, identified as a system and not as individual pieces. The laboratory maintains equipment records that include the following:

- The name of the equipment and its software
- The manufacturer's name, type, and serial number
- Approximate date received and date placed into service
- Current location in the laboratory
- Condition when received (new, used, etc.)
- Copy of any manufacturer's manuals or instructions
- Dates and results of calibrations and next scheduled calibration (if known)
- Details of past maintenance activities, both routine and non-routine
- Details of any damage, modification or major repairs

6.4.6. All instrument maintenance is documented in maintenance logbooks that are assigned to each particular instrument or system.

6.4.7. The maintenance log entry must include a summary of the results of that analysis and verification by the analyst that the instrument has been returned to an in-control status. In addition, each entry must include the initials of the analyst making the entry, the dates the maintenance actions were performed, and the date the entry was made in the maintenance logbook, if different from the date(s) of the maintenance.

6.4.8. Any equipment that has been subjected to overloading or mishandling, or that gives suspect results, or has been shown to be defective, is taken out of service and clearly identified. The equipment shall not be used to analyze customer samples until it has been repaired and shown to perform satisfactorily.

7.0. CONTROL OF DATA

Analytical results processing, verification, and reporting are procedures employed that result in the delivery of defensible data. These processes include, but are not limited to, calculation of raw data into final concentration values, review of results for accuracy, evaluation of quality control criteria and assembly of technical reports for delivery to the data user.

All analytical data undergo a well-defined, well-documented multi-tier review process prior to being reported to the customer. This section describes procedures used by PASI for translating raw analytical data into accurate final sample reports as well as PASI data storage policies.

7.1. Analytical Results Processing

7.1.1. When analytical, field, or product testing data is generated, it is either recorded in a bound laboratory logbook (e.g., Run log or Instrument log) or copies of computer-generated printouts that are appropriately labeled and filed. These logbooks and other laboratory records are kept in accordance with each facility's Standard Operating Procedure for documentation storage and archival. If the laboratory chooses to minimize or eliminate its paper usage, these records can be kept on electronic media. In this case, the laboratory must ensure that there are sufficient redundant electronic copies so no data is lost due to unforeseen computer issues.

7.1.2. The primary analyst is responsible for initial data reduction and review. This includes confirming compliance with required methodology, verifying calculations, evaluating quality control data, noting non-conformances in logbooks or as footnotes or narratives, and uploading analytical results into the LIMS. The primary analyst must be clearly identified in all applicable logbooks, spreadsheets and LIMS fields.

7.1.3. The primary analyst then compiles the initial data package for verification. This compilation must include sufficient documentation for data review. It may include standard calibrations, chromatograms, manual integration documentation, electronic printouts, chain of custody forms, and logbook copies.

7.1.4. Some agencies or customers require different levels of data reporting. For these special levels, the primary analyst may need to compile additional project information, such as initial calibration data or extensive spectral data, before the data package proceeds to the verification step.

7.1.5. The laboratory will establish acceptance limits for precision and accuracy and control charts are maintained for determining the limits required for each analyte as requested by the method. These limits will not be less stringent than those defined by the analytical method. Control limits are determined by following procedures indicated in SOP, S-NY-QA-300-rev.00, **Deriving Quality Control Limits.**

7.2. Data Verification

7.2.1. Data verification is the process of examining data and accepting or rejecting it based on pre-defined criteria. This review step is designed to ensure that reported data are free from calculation and transcription errors, that quality control parameters are evaluated, and that any non-conformances are properly documented.

7.2.2. Analysts performing the analysis and subsequent data reduction have primary responsibility for quality of the data produced. The primary analyst initiates the data verification process by reviewing and accepting the data, provided QC criteria have been met for the samples being reported. Data review checklists, either hardcopy or electronic, are used to document the data review process. The primary analyst is responsible for the initial input of the data into the LIMS. The primary analyst and reviewer must be clearly identified on all applicable data review checklists.

7.2.3. The completed data package is then sent to a designated qualified reviewer (this cannot be the primary analyst). The following criteria have been established to qualify someone as a data reviewer. To perform secondary data reviewer, the reviewer must:

7.2.3.1. Have a current Demonstration of Capability (DOC) study on file and have an SOP acknowledgement form on file for the method/procedure being reviewed; or, See Note

7.2.3.2. Have a DOC on file for a similar method/technology (i.e., GC/MS) and have an SOP acknowledgment form on file for the method/procedure being reviewed; or, See Note

7.2.3.3. Supervise or manage a Department and have an SOP acknowledgment form on file for the method/procedure being reviewed; or,

7.2.3.4. Have significant background in the department/methods being reviewed through education or experience and have an SOP acknowledgment form on file for the method/procedure being reviewed.

7.2.4. **Note:** Secondary reviewer status must be approved personally by the SQM/QM or SGM/GM/AGM/OM in the event that this person has no prior experience on the specific method or general technology.

7.2.5. This reviewer provides an independent technical assessment of the data package and technical review for accuracy according to methods employed and laboratory protocols. This assessment involves a quality control review for use of the proper methodology and detection limits, compliance to quality control protocol and criteria, presence and completeness of required deliverables, and accuracy of calculations and data quantitation. The reviewer also validates the data entered into the LIMS.

7.2.6. Once the data have been technically reviewed and approved, authorization for release of the data from the analytical section is indicated by initialing and dating the data review checklist or otherwise initialing and dating the data (or designating the review of data electronically). The Operations or Project Manager examines the report for method appropriateness, detection limits and QC acceptability. Any deviations from the referenced methods are checked for documentation and validity, and QC corrective actions are reviewed for successful resolution.

7.2.7. Additional information regarding data review procedures can be found in SOP S-NY-Q-219-rev.04 **Data Control, Data Review, and Manual Integrations** or its equivalent revision or replacement.

7.3. Data Reporting

7.3.1. Data for each analytical fraction pertaining to a particular PASI project number are delivered to the Project Manager for assembly into the final report. All points mentioned during technical and QC reviews are included in a case narrative if there is potential for data to be impacted.

7.3.2. Final reports are prepared according to the level of reporting required by the customer and can be transmitted to the customer via hardcopy or electronic deliverable. A standard PASI final report consists of the following components:

7.3.2.1. A title which designates the report as "Final Report", "Laboratory Results", "Certificate of Results", etc.;

7.3.2.2. Name and address of laboratory (or subcontracted laboratories, if used);

7.3.2.3. Phone number and name of laboratory contact to where questions can be referred;

7.3.2.4. A unique identification number for the report. The pages of the report shall be numbered and a total number of pages shall be indicated;

7.3.2.5. Name and address of customer and name of project;

7.3.2.6. Unique identification of samples analyzed as well as customer sample IDs;

7.3.2.7. Identification of any sample that did not meet acceptable sampling requirements of the relevant governing agency, such as improper sample containers, holding times missed, sample temperature, etc.;

7.3.2.8. Date and time of collection of samples, date of sample receipt by the laboratory, dates of sample preparation and analysis, and times of sample preparation and analysis when the holding time for either is 72 hours or less;

7.3.2.9. Identification of the test methods used;

7.3.2.10. Identification of sampling procedures if sampling was conducted by the laboratory;

7.3.2.11. Deviations from, additions to, or exclusions from the test methods. These can include failed quality control parameters, deviations caused by the matrix of the sample, etc., and can be shown as a case narrative or as defined footnotes to the analytical data;

7.3.2.12. Identification of whether calculations were performed on a dry or wet-weight basis;

7.3.2.13. Reporting limits used;

7.3.2.14. Final results or measurements, supported by appropriate chromatograms, charts, tables, spectra, etc.;

7.3.2.15. A signature and title, electronic or otherwise, of person accepting responsibility for the content of the report;

7.3.2.16. Date report was issued;

7.3.2.17. A statement clarifying that the results of the report relate only to the samples tested or to the samples as they were received by the laboratory;

7.3.2.18. If necessary, a statement indicating that the report must not be reproduced except in full, without the written approval of the laboratory;

7.3.2.19. Identification of all test results provided by a subcontracted laboratory or other outside source;

7.3.2.20. Identification of results obtained outside of quantitation levels.

7.3.3. The laboratory will follow the reporting requirements for Massachusetts as indicated in QA_MA_ReportingLimits_Requiremnts_031612_Rev01_03, **Reporting Requirements for Massachusetts.**

7.3.4.

In addition to the requirements listed above, final reports shall also contain the following items when necessary for the interpretation of results:

7.3.4.1. Deviations from, additions to, or exclusions from the test method, and information on specific test conditions, such as environmental conditions;

7.3.4.2. Where relevant, a statement of compliance/non-compliance with requirements and/or specifications (e.g., the TNI standard);

7.3.4.3. Where applicable, a statement on the estimated uncertainty of measurement; 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 the uncertainty affects compliance to a specification limit;

7.3.4.4. Where appropriate and needed, opinions and interpretations, which may include opinions on the compliance/non-compliance of the results with requirements, fulfillment of contractual requirements, recommendations on how to use the results, and guidance to be used for improvement;

7.3.5. Any changes made to a final report shall be designated as "Revised" or equivalent wording. The laboratory must keep sufficient archived records of all laboratory reports and revisions. For higher levels of data deliverables, a copy of all supporting raw data is sent to the customer along with a final report of results. When possible, the PASI facility will provide electronic data deliverables (EDD) as required by contracts or upon customer request.

7.3.6. Customer data that requires transmission by telephone, telex, facsimile or other electronic means undergoes appropriate steps to preserve confidentiality.

7.3.7. The following positions are the only approved signatories for PASI final reports:

- Senior General Manager
- General Manager
- Assistant General Manager
- Senior Quality Manager
- Quality Manager
- Client Services Manager
- Project Manager
- Project Coordinator

7.4. Data Security

7.4.1. All data including electronic files, logbooks, extraction/digestion/distillation worksheets, calculations, project files and reports, and any other information used to produce the technical report are maintained secured and retrievable by the PASI facility.

7.5. Data Archiving

7.5.1. All records compiled by PASI are maintained legible and retrievable and stored secured in a suitable environment to prevent loss, damage, or deterioration by fire, flood, vermin, theft, and/or environmental deterioration. Records are retained for a minimum of five years unless superseded by federal, state, contractual, and/or accreditation requirements. These records may include, but are not limited to, customer data reports, calibration and maintenance of equipment, raw data from instrumentation, quality control documents, observations, calculations, and logbooks. These records are retained in order to provide for possible historical reconstruction including sampling, receipt, preparation, analysis, and personnel involved. TNI-related records will be made readily available to accrediting authorities. Access to archived data is documented and controlled by the SQM/QM or a designated Data Archivist.

7.5.2. Records that are computer generated have either a hard copy or electronic write protected backup copy. Hardware and software necessary for the retrieval of electronic data is maintained with the applicable records. Archived electronic records are stored protected against electronic and/or magnetic sources.

7.5.3. In the event of a change in ownership, accountability or liability, reports of analyses performed pertaining to accreditation will be maintained by the acquiring entity for a minimum of five years. In the event of bankruptcy, laboratory reports and/or records will be transferred to the customer and/or the appropriate regulatory entity upon request.

7.5.4. For Massachusetts samples, the laboratory shall maintain copies of all analytical reports, logs, charts, and records created for a minimum of ten years or as otherwise specified by the department. Records related to performance on proficiency tests shall be maintained for a minimum of five years. Records shall include the results and supporting documentation of analyses of samples including proficiency test samples, reagent blanks, laboratory fortified blanks, laboratory fortified sample matrices and duplicates, and surrogate analyte recovery data.

7.6. Data Disposal

7.6.1. Data that has been archived for the facility's required storage time may be disposed of in a secure manner by shredding, returning to customer, or utilizing some other means that does not jeopardize data confidentiality. Records of data disposal will be archived for a minimum of five years unless superseded by federal, contractual, and/or accreditation requirements. Data disposal includes any preliminary or final reports that are disposed.

8.0. QUALITY SYSTEM AUDITS AND REVIEWS

8.1. Internal Audits

8.1.1. Responsibilities

8.1.1.1. The SQM/QM is responsible for designing and/or conducting internal audits in accordance with a predetermined schedule and procedure. Since internal audits represent an independent assessment of laboratory functions, the auditor must be functionally independent from laboratory operations to ensure objectivity. The auditor must be trained, qualified, and familiar enough with the objectives, principles, and procedures of laboratory operations to be able to perform a thorough and effective evaluation. The SQM/QM evaluates audit observations and verifies the completion of corrective actions. In addition, a periodic corporate audit will be conducted. The corporate audits will focus on the effectiveness of the Quality System as outlined in this manual but may also include other quality programs applicable to an individual laboratory.

8.1.2. Scope and Frequency of Internal Audits

8.1.2.1. The complete internal audit process consists of the following four sections:

- Raw Data Review audits- conducted according to a schedule per local SQM/QM. A certain number of these data review audits are conducted per quarter to accomplish this yearly schedule;
- Quality System audits- considered the traditional internal audit function and includes analyst interviews to help determine whether practice matches method requirements and SOP language;
- Final Report reviews;
- Corrective Action Effectiveness Follow-up.

8.1.2.2. Internal systems audits are conducted yearly at a minimum. The scope of these audits includes evaluation of specific analytical departments or a specific quality related system as applied throughout the laboratory.

8.1.2.3. Where the identification of non-conformities or departures cast doubt on the laboratory's compliance with its own policies and procedures, the lab must ensure that the appropriate areas of activity are audited as soon as possible. Examples of system-wide elements that can be audited include:

- Quality Systems documents, such as Standard Operating Procedures, training documents, Quality Assurance Manual, and all applicable addenda
- Data records and non-technical documents
- Personnel and training files.
- General laboratory safety protocols.
- Chemical handling practices, such as labeling of reagents, solutions, and standards as well as all associated documentation.
- Documentation concerning equipment and instrumentation, calibration/maintenance records, operating manuals.
- Sample receipt and management practices.
- Analytical documentation, including any discrepancies and corrective actions.

- General procedures for data security, review, documentation, reporting, and archiving.
- Data integrity issues such as proper manual integrations.

8.1.2.4. When the operations of a specific department are evaluated, a number of additional functions are reviewed including:

- Detection limit studies
- Internal chain of custody documentation
- Documentation of standard preparations
- Quality Control limits and Control charts

8.1.2.5. Certain projects may require an internal audit to ensure laboratory conformance to site work plans, sampling and analysis plans, QAPPs, etc.

8.1.2.6. A representative number of data audits are completed annually. Findings from these data audits are handled in the same manner as those from other internal and external audits.

8.1.2.7. The laboratory, as part of their overall internal audit program, ensures that a review is conducted with respect to any evidence of inappropriate actions or vulnerabilities related to data integrity. Discovery and reporting of potential data integrity issues are handled in a confidential manner. All investigations that result in findings of inappropriate activity are fully documented, including the source of the problem, the samples and customers affected the impact on the data, the corrective actions taken by the laboratory, and which final reports had to be re-issued. Customers must be notified within 30 days after the data investigation is completed and the impact to final results is assessed.

8.1.3. Internal Audit Reports and Corrective Action Plans

8.1.3.1. A full description of the audit, including the identification of the operation audited, the date(s) on which the audit was conducted, the specific systems examined, and the observations noted are summarized in an internal audit report. Although other personnel may assist with the performance of the audit, the SQM/QM writes and issues the internal audit report identifying which audit observations are deficiencies that require corrective action.

8.1.3.2. When audit findings cast doubt on the effectiveness of the operations or on the correctness of validity of the laboratory's environmental test results, the laboratory will take timely corrective action and notify the customer in writing within three business days, if investigations show that the laboratory results may have been affected.

8.1.3.3. Once completed, the internal audit report is issued jointly to the SGM/GM/AGM/OM and the manager(s)/supervisor(s) of the audited operation at a minimum. The responsible manager(s)/supervisor(s) responds within 14 days with a proposed plan to correct all of the deficiencies cited in the audit report. The SQM/QM may grant additional time for responses to large or complex deficiencies (not to exceed 30 days). Each response must include timetables for completion of all proposed corrective actions.

8.1.3.4. The SQM/QM reviews the audit responses. If the response is accepted, the SQM/QM uses the action plan and timetable as a guideline for verifying completion of the corrective action(s). If the SQM/QM determines that the audit response does not adequately address the correction of cited deficiencies, the response will be returned for modification.

8.1.3.5. To complete the audit process, the SQM/QM performs a re-examination of the areas where deficiencies were found to verify that all proposed corrective actions have been implemented. An audit deficiency is considered closed once implementation of the necessary corrective action has been audited and verified. This is usually within 60-90 days after implementation. If corrective action cannot be verified, the associated deficiency remains open until that action is completed.

8.2. External Audits

8.2.1. PASI laboratories are audited regularly by regulatory agencies to maintain laboratory certifications and by customers to maintain appropriate specific protocols.

8.2.2. Audit teams external to the company review the laboratory to assess the effectiveness of systems and degree of technical expertise. The SQM/QM and other QA staff host the audit team and assist in facilitation of the audit process. Generally, the auditors will prepare a formalized audit report listing deficiencies observed and follow-up requirements for the laboratory. In some cases, items of concern are discussed during a debriefing convened at the end of the on-site review process.

8.2.3. The laboratory staff and supervisors develop corrective action plans to address any deficiencies with the guidance of the SQM/QM. The SGM/GM/AGM/OM provides the necessary resources for staff to develop and implement the corrective action plans. The SQM/QM collates this information and provides a written response to the audit team. The response contains the corrective action plan and expected completion dates for each element of the plan. The SQM/QM follows-up with the laboratory staff to ensure corrective actions are implemented and that the corrective action was effective.

8.3. Quarterly Quality Reports

8.3.1. The SQM/QM is responsible for preparing a quarterly report to management summarizing the effectiveness of the laboratory Quality Systems. This status report will include:

- Overview of quality activities for the quarter
- Certification status
- Proficiency Testing study results
- SOP revision activities
- Company-wide 3P Document implementation (internal program)
- External audit findings
- Internal audit (method/system) findings
- Manual integration audit findings (Mintminer)
- Raw Data and Final Report review findings
- MDL activities
- Corrective action activities
- Training activity status
- Other significant Quality System items

8.3.2. The Corporate Director of Quality utilizes the information from each laboratory to make decisions impacting the quality program compliance of the company as a whole. Each SGM/GM/AGM/OM utilizes the quarterly report information to make decisions impacting Quality Systems and operational systems at a local level.

8.3.3. Additional information can be found in SOP S-NY-Q-220-rev.02 **Review of Requests, tenders, and Contracts Review** or its equivalent revision or replacement.

8.4. Annual Managerial Review

8.4.1. A managerial review of Quality Systems is performed on an annual basis at a minimum. This allows for assessing program effectiveness and introducing changes and/or improvements.

8.4.2. The managerial review must include the following topics of discussion:

- Suitability of quality management policies and procedures
- Manager/Supervisor reports
- Internal audit results
- Corrective and preventative actions
- External assessment results
- Proficiency testing studies
- Sample capacity and scope of work changes
- Customer feedback, including complaints
- Recommendations for improvement,
- Other relevant factors, such as quality control activities, resources, and staffing.

8.4.3. This managerial review must be documented for future reference by the SQM/QM and copies of the report are distributed to laboratory staff. Results should feed into the laboratory planning system and should include goals, objectives, and action plans for the coming year. The laboratory shall ensure that any actions identified during the review are carried out within an appropriate and agreed upon timescale.

8.5. Customer Service Reviews

8.5.1. As part of the annual managerial review listed previously, the sales staff is responsible for reporting on customer feedback, including complaints. The acquisition of this information is completed by performing surveys.

8.5.2. The sales staff continually receives customer feedback, both positive and negative, and reports this feedback to the laboratory management in order for them to evaluate and improve their management system, testing activities and customer service.

8.5.3. In addition, the labs must be willing to cooperate with customers or their representatives to clarify customer requests and to monitor the laboratory's performance in relation to the work being performed for the customers. This cooperation may include providing the customer reasonable access to relevant areas of the lab for the witnessing of tests being performed; or the preparation of samples or data deliverables to be used for verification purposes.

8.5.4. Customer service is an important aspect to Pace's overall objective of providing a quality product. Good communication should be provided to the customer's throughout projects. The lab should inform the customer of any delay or major deviations in the performance of analytical tests.

9.0. CORRECTIVE ACTION

During the process of sample handling, preparation, and analysis, or during review of quality control records, or during reviews of non-technical portions of the lab, certain occurrences may warrant the necessity of corrective actions. These occurrences may take the form of analyst errors, deficiencies in quality control, method deviations, or other unusual circumstances. The Quality System of PASI provides systematic procedures for the documentation, monitoring, completion of corrective actions, and follow-up verification of the effectiveness of these corrective actions. This can be done using PASI's LabTrack system or other system that lists among at a minimum, the deficiency by issue number, the deficiency source, responsible party, root cause, resolution, due date, and date resolved.

9.1. Corrective Action Documentation

9.1.1. The following items are examples of sources of laboratory deviations or non-conformances that warrant some form of documented corrective action:

- Internal Laboratory Non-Conformance Trends
- PE/PT Sample Results
- Internal and External Audits
- Data or Records Review (including non-technical records)
- Client Complaints
- Client Inquiries
- Holding Time violations

9.1.2. Documentation of corrective actions may be in the form of a comment or footnote on the final report that explains the deficiency (e.g., matrix spike recoveries outside of acceptance criteria) or it may be a more formal documentation (either paper system or computerized spreadsheet). This depends on the extent of the deficiency, the impact on the data, and the method or customer requirements for documentation.

9.1.3. The person who discovers the deficiency or non-conformance initiates the corrective action documentation on the Non-Conformance Corrective/ Preventative Action report and/or LabTrack. The documentation must include the affected projects and sample numbers, the name of the applicable Project Manager, the customer name, and the sample matrix involved. The person initiating the corrective action documentation must also list the known causes of the deficiency or non-conformance as well as any corrective/preventative actions that they have taken. Preventive actions must be taken in order to prevent or minimize the occurrence of the situation.

9.1.4. In the event that the laboratory is unable to determine the cause, laboratory personnel and management staff will start a root cause analysis by going through an investigative process. During this process, the following general steps must be taken into account: defining the non-conformance, assigning responsibilities, determining if the condition is significant, and investigating the root cause of the nonconformance. General non-conformance investigative techniques follow the path of the sample through the process looking at each individual step in detail. The root cause must be documented within LabTrack or on the Corrective/Preventative Action Report.

9.1.5. After all the documentation is completed, the routing of the Corrective/Preventative Action Report and /or LabTrack will continue from the person initiating the corrective action, to their immediate supervisor or the applicable Project Manager and finally to the SQM/QM, if applicable, who may be responsible for final review and signoff of corrective/preventative actions.

9.1.6. In the event that analytical testing or results do not conform to documented laboratory policies or procedures, customer requirements, or standard specifications, the laboratory shall investigate the significance of the non-conformance and document appropriate corrective actions. The proper level of laboratory management will review any departure from these requirements for technical suitability. These departures are permitted only with the approval of the SGM/GM/AGM/OM or the SQM/QM. Where necessary, Project Management will notify the customer of the situation and will advise of any ramifications to data quality (with the possibility of work being recalled).

9.2. Corrective Action Completion

9.2.1. Internal Laboratory Non-Conformance Trends

9.2.1.1. There are several types of non-conformance trends that may occur in the laboratory that would require the initiation of a corrective action report. Laboratories may choose to initiate a corrective action for all instances of one or more of these categories if they so choose, however the intent is that each of these would be handled according to its severity; one time instances could be handled with a footnote or qualifier whereas a systemic problem with any of these categories may require an official corrective action process. These categories, as defined in the Corrective Action SOP are as follows:

- Login error
- Preparation Error
- Contamination
- Calibration Failure
- Internal Standard Failure
- LCS Failure
- Laboratory accident
- Spike Failure
- Instrument Failure
- Final Reporting error

9.2.2. PE/PT Sample Results

9.2.2.1. Any PT result assessed as “not acceptable” requires an investigation and applicable corrective actions. The operational staff is made aware of the PT failures and they are responsible for reviewing the applicable raw data and calibrations and list possible causes for error. The SQM/QM reviews their findings and initiates another external PT sample or an internal PT sample to try and correct the previous failure. Replacement PT results must be monitored by the SQM/QM and reported to the applicable regulatory authorities.

9.2.3. Internal and External Audits

9.2.3.1. The SQM/QM is responsible for documenting all audit findings and their corrective actions. This documentation must include the initial finding, the persons responsible for the corrective action, the due date for responding to the auditing body, the root cause of the finding, and the corrective actions needed for resolution. The SQM/QM is also responsible for providing any back-up documentation used to demonstrate that a corrective action has been completed.

9.2.4. Data Review

9.2.4.1. In the course of performing primary and secondary review of data or in the case of raw data reviews (e.g., by the SQM/QM), errors may be found which require corrective actions. Any finding that affects the quality of the data requires some form of corrective action, which may include revising and re-issuing of final reports.

9.2.5. **Client Complaints**

9.2.5.1. Project Managers are responsible for issuing corrective action forms, when warranted, for customer complaints. As with other corrective actions, the possible causes of the problem are listed and the form is passed to the appropriate analyst or supervisor for investigation. After potential corrective actions have been determined, the Project Manager reviews the corrective action form to ensure all customer needs or concerns are being adequately addressed.

9.2.6. **Client Inquiries**

9.2.6.1. When an error on the customer report is discovered, the Project Manager is responsible for initiating a formal corrective action form that describes the failure (e.g., incorrect analysis reported, reporting units are incorrect, or reporting limits do not meet objectives). The Project Manager is also responsible for revising the final report if necessary and submitting it to the customer.

9.2.7. **Holding Time Violations**

9.2.7.1. In the event that a holding time has been missed, the analyst or supervisor must complete a formal corrective action form. The Project Manager and the SQM/QM must be made aware of all holding time violations.

9.2.7.2. The Project Manager must contact the customer in order that appropriate decisions are made regarding the hold time excursion and the ultimate resolution is then documented and included in the customer project file. The SQM/QM includes a list of all missed holding times in their Quarterly Report to the corporate quality office.

9.3. Preventive Action Documentation

9.3.1. Pace laboratories can take advantage of several available information sources in order to identify needed improvements in all of their systems including technical, managerial, and quality. These sources may include:

- Management Continuous Improvement Plan (CIP) metrics which are used by all production departments within Pace. When groups compare performance across the company, ways to improve systems may be discovered. These improvements can be made within a department or laboratory-wide.
- Annual managerial reviews- part of this TNI-required and NVLAP-required review is to look at all processes and procedures used by the laboratory over the past year and to determine ways to improve these processes in the future.
- Quality systems reviews- any frequent checks of quality systems (monthly logbook reviews, etc.) can uncover issues that can be corrected or adjusted before they become a larger issue.

9.3.2. When improvement opportunities are identified or if preventive action is required, the laboratory can develop, implement, and monitor preventive action plans.

10.0. GLOSSARY

The source of some of the definitions is indicated previous to the actual definition (e.g., TNI, DoD)

3P Program	The Pace Analytical continuous improvement program that focuses on Process, Productivity, and Performance. Best Practices are identified that can be used by all PASI labs.
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.
Accrediting Authority	DoD- The Territorial, State or Federal agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation.
Accrediting (or Accreditation) Body	DoD- Authoritative body that performs accreditation.
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.
Aliquot	DoD- A discrete, measured, representative portion of a sample taken for analysis.
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.
Analyte	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 which are analyzed together.
Analytical Uncertainty	TNI- A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis.
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).
Atomic Absorption Spectrometer	Instrument used to measure concentration in metals samples.
Atomization	DoD- 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. 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.
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 - 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.
Blind Sample	DoD- 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.
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	DoD- 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	DoD- 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)	DoD- 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: % Completeness = (Valid Data Points/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.
Conformance	DoD- 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	DoD- 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 that is required during the course of analysis 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 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.
Continuous Emission Monitor (CEM)	A flue gas analyzer designed for fixed use in checking for environmental pollutants.
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.
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.
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.
Data Audit	DoD- A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality (i.e. that they meet specified acceptance criteria).
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 quality, concentration and level of uncertainty. The levels of quality and uncertainty of the analytical data are consistent with the requirements for the decision to be made. Suitable for final decision-making.
Demonstration of Capability	TNI- A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision.
Detection Limit (DL)	DoD- The smallest analyte concentration that can be demonstrated to be different than zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate is 1%.
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) to convert the sample to a more easily measured form.
Document Control	DoD- 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.
Dry Weight	The weight after drying in an oven at a specified temperature.
Duplicate (also known as Replicate or Laboratory Duplicate)	DoD- 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	DoD- A solvent used to carry the components of a mixture through a stationary phase.
Elute	DoD- To extract, specifically, to remove (absorbed material) from an absorbent by means of a solvent.
Elution	DoD- 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	DoD- The process of measuring or collecting environmental data.

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.
Facility	A distinct location within the company that has unique certifications, personnel and waste disposal identifications.
False Negative	DoD- An analyte incorrectly reported as absent from the sample, resulting in potential risks from their presence.
False Positive	DoD- An item incorrectly identified as present in the sample, resulting in a high reporting value for the analyte of concern.
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 space 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.
Field of Accreditation	TNI- Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.
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.
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 time elapsed from the time of sampling to the time of extraction or analysis, or from extraction to analysis, as appropriate.
Homogeneity	The degree to which a property or substance is uniformly distributed throughout a sample.
Homolog	DoD- 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.
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-AES 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.
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- A standard obtained or prepared from a source independent of the source of the standards for the initial calibration. Its concentration should be at or near the middle of the calibration range. It is done after the initial calibration.
Inspection	DoD- An activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic.
Instrument Blank	DoD- 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	DoD- 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	DoD- Results from the various chemical processes that occur during atomization and later the absorption characteristics of the analyte.
Internal Standards	TNI - 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.
Intermediate Standard Solution	Reference solutions prepared by dilution of the stock solutions with an appropriate solvent.
International System of Units (SI)	DoD- 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	DoD- 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 (C6H14) could be n-hexane, 2-methylpentane, 3-methylpentane, 2,3-dimethylbutane, 2,2-dimethylbutane.
Laboratory	DoD- A body that calibrates and/or tests.
Laboratory Control Sample (LCS)	TNI - (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes 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	DoD- Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently.

Laboratory Information Management System (LIMS)	A computer system that is used to maintain all sample information from sample receipt, through preparation and analysis and including sample report generation.
LabTrack	Database used by Pace Analytical to store and track corrective actions and other laboratory issues.
Learning Management System (LMS)	A training database used by Pace Analytical to train their employees. This system is a self-paced system which is capable of tracking all employee training requirements and documentation.
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 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.
Limit(s) of Detection (LOD)	TNI- A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility. DoD- The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate is 1%.
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 lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.
Laboratory Information Management System (LIMS)	A computer system that is used to maintain all sample information from sample receipt, through preparation and analysis and including sample report generation.
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.
Lot	A quantity of bulk material of similar composition processed or manufactured at the same time.
Management	DoD- Those individuals directly responsible and accountable for planning, implementing, and assessing work.
Management System	DoD- System to establish policy and objectives and to achieve those objectives.
Manager (however named)	DoD- 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 System	TNI - A test method, as implemented at a particular laboratory, and which includes the equipment used to perform the test and the operator(s).
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.
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)	DoD- 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	DoD- 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.
MintMiner	Program used by Pace Analytical to review 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 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	DoD- 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	DoD- 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.
Performance Audit	DoD- The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.
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.
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	DoD- 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- Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis.
Procedure	TNI- A specified way to carry out an activity or process. Procedures can be documented or not.
Proficiency Testing	TNI - A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.
Proficiency Testing 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 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.

Protocol	TNI - A detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) that must be strictly followed.
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. DoD- An integrated system of activities involving planning, quality control, quality assessment, reporting, and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.
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)	DoD- 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.
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 - 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 - These matrix definitions are to be used for purposes of batch and quality control requirements: • **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 salt water 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 in a calibration curve between the LOQ and the highest successively analyzed initial calibration standard. The quantitation range lies within the calibration range.
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)	DoD- 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.
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 Standard	TNI- Standard used for the calibration of working measurement standards in a given organization or at a given location. DoD- A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived.
Reference Toxicant	DoD- The toxicant used in performing toxicity tests to indicate the sensitivity of a test organism and to demonstrate the laboratory's ability to perform the test correctly and obtain consistent results.
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 client-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 (or otherwise named)	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	DoD- Denotes a mandatory specification; often designated by the term "shall".
Retention Time	DoD- The time between sample injection and the appearance of a solute peak at the detector.
Sample	DoD- 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 Pace Analytical 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.

Selective 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.
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	DoD- 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.
Should	DoD- Denotes a guideline or recommendation whenever noncompliance with the specification is permissible.
Signal-to-Noise Ratio	DoD- The signal carries information about the analyte, while noise is made up of extraneous information that is unwanted because it degrades the accuracy and precision of an analysis and also places a lower limit on the amount of analyte that can be detected. In most measurements, the average strength of the noise is constant and independent of the magnitude of the signal. Thus, the effect of noise on the relative error of a measurement becomes greater and greater as the quantity being measured (producing the signal) decreases in magnitude.
Spike	DoD- 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)	DoD- 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	DoD- 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)	DoD- 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.
Supervisor	DoD- The individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses.
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.
Systems Audit	An on-site inspection or assessment of a laboratory's quality system.
Target Analytes	DoD- Analytes specifically named by a client (also called project-specific analytes).
Technical Director	DoD- 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	DoD- 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- An adoption of a scientific technique for performing a specific measurement as documented in a laboratory SOP or as published by a recognized authority.
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.
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. DoD- The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons.
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	DoD- 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 Measurement	The parameter associated with the result of a measurement that characterized the dispersion of the values that could be reasonably attributed to the measurand (i.e. the concentration of an analyte).
Validation	DoD- The confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.
Verification	TNI - Confirmation by examination and objective evidence that specified requirements have been met. Note: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment. The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.
Whole Effluent Toxicity (WET)	The aggregate toxic effect to aquatic organisms from all pollutants contained in a facility's wastewater (effluent).
Work Cell	DoD- A well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented.

11.0. REFERENCES

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12.0. REVISIONS

The PASI Corporate Quality Office files both a paper copy and electronic version of a Microsoft Word document with tracked changes detailing all revisions made to the previous version of the Quality Assurance Manual. This document is available upon request. All revisions are summarized in the table below.

Document Number	Reason for Change	Date
Quality Assurance Manual 15.0	General: reformatted and renumbered several sections. General: corrected names/numbers of corporate SOP references. General: changed General Manager to SGM/GM/AGM where applicable to account for changes in management structure in each lab. General: changed Quality Manager to SQM/QM where applicable to account for changes in management structure in each lab. Section 1.3.3: removed specific industry standards. Section 1.5.4: added section with current anonymous hotline number. Sections 1.7.3, 1.7.4, 1.7.5, 1.7.6, and 1.7.8: reworded to match changes in management structure. Section 1.8.4: added new job description for Senior Quality Manager. Section 1.8.5 (first bullet point): added language from DoD QSM gray box 4, added connection to the Director of Quality, and added new language regarding the QM reporting structure. Section 1.8.5: added new second bullet point from DoD QSM. Section 1.8.5 (third bullet point): added responsibility to do quarterly reports. Section 1.8.5 (twelfth bullet point): added language from DoD QSM. Section 1.8.6: added Quality Analyst job description. Section 1.10.3: added the current anonymous hotline number. Section 1.12.2: changed Sample Custodian to red text in case locally that is not the person responsible. Section 2.6.5: changed region codes to division codes and added division codes for Pompano Beach and Dallas and added in MT and VA, MN to code 10. Removed code 38 for PGH radiochem (all now under code 30). Section 3.4.2: added sentence about Drinking Water DOCs. Section 4.2.4: added specific TNI language for every target component to be spiked in LCS over a 2-year period (V1M4 1.7.3.2.3.b). Section 4.3.4: added specific TNI language for every target component to be spiked in the MS/MSD over a 2-year period (V1M4 1.7.3.3.1.c). Section 4.9.9: added DoD definition for LOD. Section 4.10.3: added caveat from TNI standard regarding LOQ verification (V1M4 1.5.2.2.e). Section 4.13.2: added new section to clarify when the rounding step occurs. Section 4.13.4: clarified the significant figure rules depending on the LIMS used. Section 4.14: added section on retention time windows. Section 5.1.3: added requirement from DoD QSM. Section 5.1.7.4: reworded for clarity. Section 6.2.6.1.4: reworded to match language in SW-846. Sections 6.2.6.2, 6.2.6.3 and 6.2.7.1: added language which prohibits rounding to pass calibration acceptance criteria. Section 6.2.6.4.1: added red section with language from 2010 DoD QSM (gray box 37). Section 6.3.3.1: changed weight calibration frequency to 5 years to match Support Equipment SOT. Section 6.4.7: removed language about instrument maintenance for clarity. Section 7.1.5: additional requirement for MA Sections 7.1.2 and 7.2.2: added language regarding documentation of primary analyst and data reviewer.	06Feb2012

Document Number	Reason for Change	Date
	Section 7.2.7: additional requirement for MA. Section 7.3.2.25: removed section. Section 7.3.3: additional requirement for MA. Section 7.3.7: Added AGM and SQM. Section 7.5.4: additional requirement for MA. Section 8.1.2.3: added clarifying language. Section 8.1.2.6: reworded for clarity. Section 8.5.3: added language from 2009 TNI standard (V1M2 4.7/ISO 4.7.1 note 1). Section 8.5.4: added new section with language from 2009 TNI standard (V1M2/ISO 4.7.1 note 2). Sections 9.1.5 and 9.1.6: reworded for clarity. Section 10: General- added indication of source of definitions within the chart (e.g., TNI, DoD, etc.) and added a sentence to that effect prior to the definition table. Section 10: Added clarification to the definition of 'batch' (TNI and DoD references) and corrected a couple of word deviations from previous version of QAM. Also added the 'batch' definition from the state of SC in red text based on their specific requirements. Section 10: **revised** definitions for accreditation, assessment, calibration curve, calibration standard, certified reference material, data reduction, finding, holding time (including caveat for prep start time), LCS, LOD, method, preservation, PT sample, protocol, quality system, raw data, reference material- per 2009 TNI standards (V1M2 section 3.1). Section 10: **added** definitions for measurement system, mobile laboratory, procedure, PT program, and technology- per 2009 TNI standards (V1M2 section 3.1). Section 10: **added** definitions for assessment, calibration curve, calibration standard, certified reference material, data reduction, demonstration of capability, finding, laboratory, matrix spike, preservation, PT sample, quality control, quality control sample, raw data, reference material, selectivity, SOP, and work cell- per 2010 DoD QSM 4.2 (Appendix B). Attachment VIII: completely revised the method/bottle/preservation table. Section 10: **added** definitions for facility, initial calibration blank, analysis sequence, serial dilution, post-digestion spike, and instrument detection limits- peer review of document. Section 11.20: Added TNI standard reference.	

ATTACHMENT I- 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 $\overline{CF}$ or $\overline{RF}$ of the ICAL Standards)
Measured Value = Amount measured (can also be the CF or RF of the CCV)

PERCENT DRIFT

$$\%Drift = \frac{CalculatedConcentration - TheoreticalConcentration}{TheoreticalConcentrtion} * 100$$

RELATIVE PERCENT DIFFERENCE (RPD)

$$RPD = \frac{|(R1 - R2)|}{(R1 + R2)/2} * 100$$

where:
R1 = Result Sample 1
R2 = Result Sample 2

CORRELATION COEFFICIENT (R)

$$CorrCoeff = \frac{\sum_{i=1}^{N} W_i * (X_i - \overline{X}) * (Y_i - \overline{Y})}{\sqrt{\left(\sum_{i=1}^{N} W_i * (X_i - \overline{X})^2\right) * \left(\sum_{i=1}^{N} W_i * (Y_i - \overline{Y})^2\right)}}$$

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

ATTACHMENT I- QUALITY CONTROL CALCULATIONS (CONTINUED)

STANDARD DEVIATION (S)

$$S = \sqrt{\sum_{i=1}^{n} \frac{(X_i - \overline{X})^2}{(n-1)}}$$

where:
n = number of data points
X_i = individual data point
X = average of all data points

AVERAGE (X)

$$\overline{X} = \frac{\sum_{n=1}^{i} X_i}{n}$$

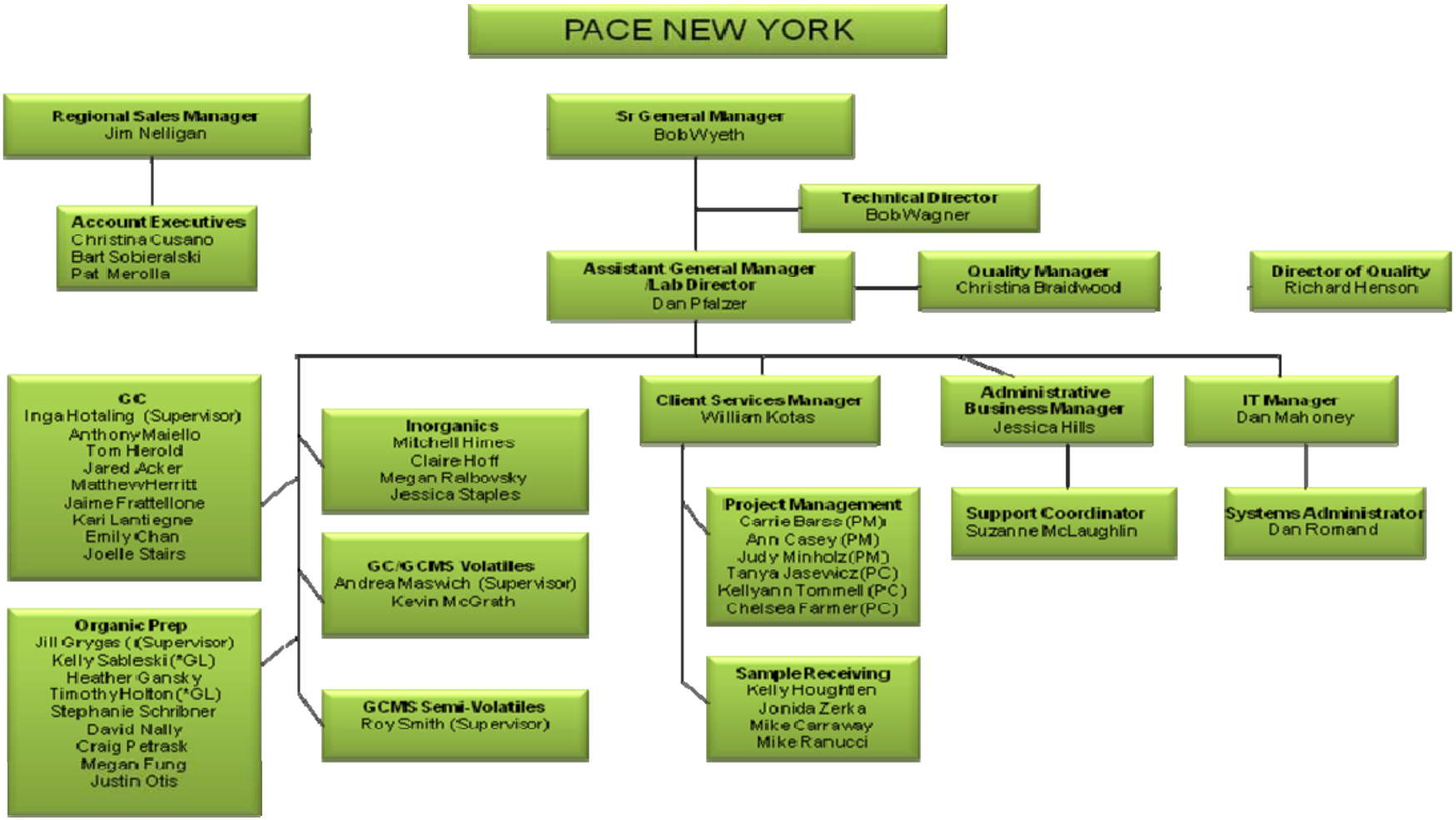
where:
n = number of data points
X_i = individual data point

RELATIVE STANDARD DEVIATION (RSD)

$$RSD = \frac{S}{\overline{X}} * 100$$

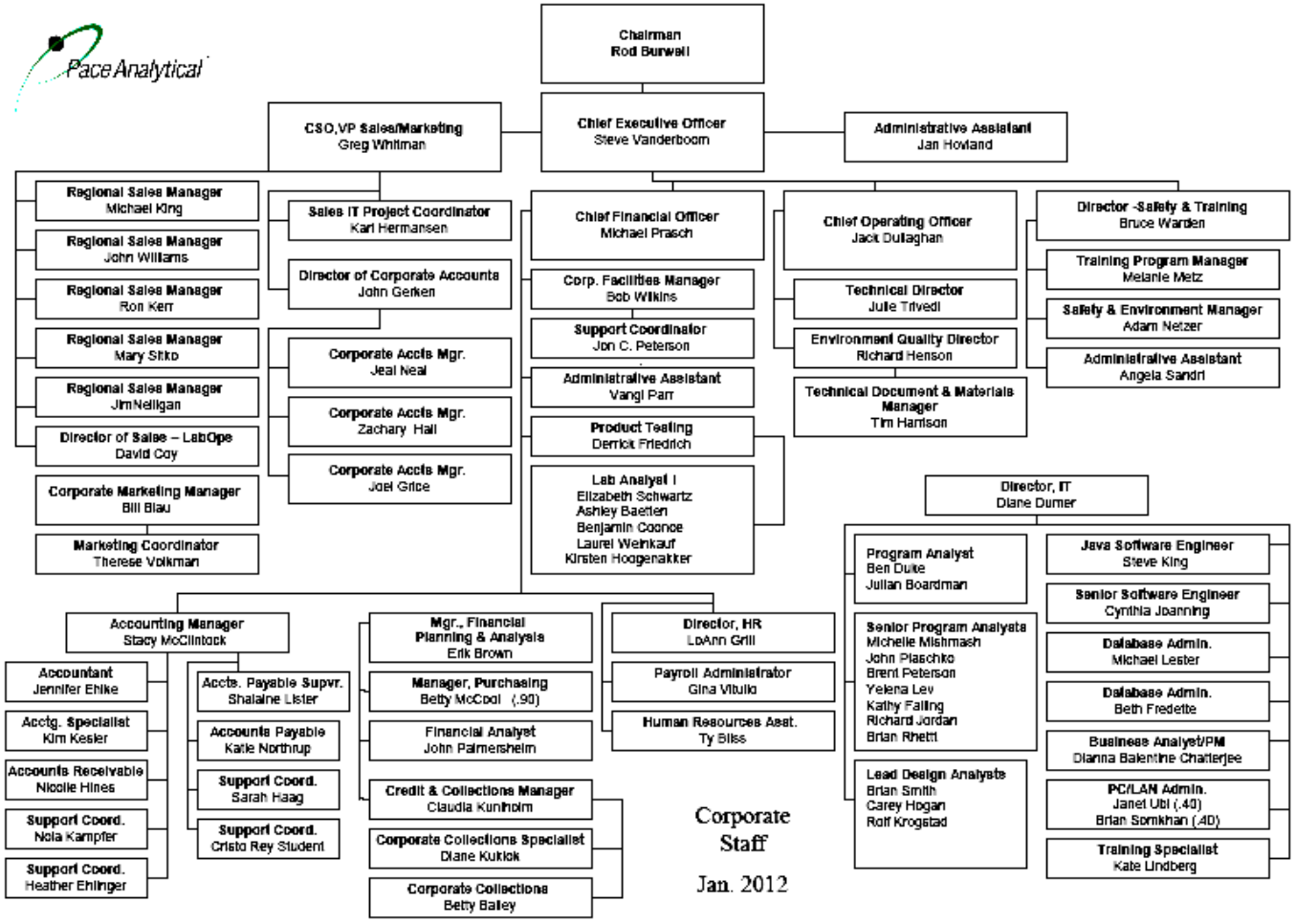
where:
S = Standard Deviation of the data points
X = average of all data points

ATTACHMENT IIA- LABORATORY ORGANIZATIONAL CHART



*Group Leader

ATTACHMENT IIB- CORPORATE ORGANIZATIONAL CHART



ATTACHMENT III- EQUIPMENT LIST

Tracking ID	Quantity	Description	Manufacturer	Model #	Serial #	PACE ID#	Location	Purchased	Status
1	1	Autosampler	Agilent	7683	US12511941	GC15	Organics Lab	2000	In Service
2	1	Gas Chromatograph	Agilent	6890N	US00041669	GC15	Organics Lab	2000	In Service
3	1	Autosampler	Agilent	7683	US10140095	GC16	Organics Lab	2000	In Service
4	1	Gas Chromatograph	Agilent	6890N	US13912900	GC16	Organics Lab	2000	In Service
5	1	Autosampler	Agilent	7683	US10143037	GC17	Organics Lab	2000	In Service
6	1	Gas Chromatograph	Agilent	6890	US11111033	GC17	Organics Lab	2000	In Service
7	1	Autosampler	CTC Analytics	LEAP	161109	GC21	Organics Lab	2006	In Service
8	1	Gas Chromatograph	Varian	3800	11273	GC21	Organics Lab	2004	In Service
9	1	Autosampler	CTC Analytics	LEAP	161134	GC18	Organics Lab	2006	In Service
10	1	Gas Chromatograph	Varian	3800	08816	GC18	Organics Lab	2001	In Service
11	1	Autosampler	Varian	8400	01365	GC19	Organics Lab	NA	In Service
12	1	Gas Chromatograph	Varian	3800	08818	GC19	Organics Lab	2001	In Service
13	1	Autosampler	CTC Analytics	HTS Pal	111148	GC20	Organics Lab	2007	In Service
14	1	Gas Chromatograph	Varian	3800	08817	GC20	Organics Lab	2001	In Service
15	1	Autosampler	Varian	CP-8400	01051	GC10	Organics Lab	NA	In Service

16	1	Gas Chromatograph	Varian	3800	04007	GC10	Organics Lab	1998	In Service
17	1	Autosampler	Varian	8100	02223	GC05	Organics Lab	1987	In Service
18	1	Gas Chromatograph	Varian	3400	09761	GC05	Organics Lab	1987	In Service
19	1	Autosampler	Varian	8100	01229	GC07	Organics Lab	1988	In Service
20	1	Gas Chromatograph	Varian	3400	09338	GC07	Organics Lab	1988	In Service
21	1	Autosampler	Varian	8400	02480	GC11	Organics Lab	NA	In Service
22	1	Gas Chromatograph	Varian	3800	04006	GC11	Organics Lab	1998	In Service
23	1	Autosampler	Varian	8200	8094	GC22	Organics Lab	NA	In Service
24	1	Gas Chromatograph	Varian	3400	17038	GC22	Organics Lab	1989	In Service
25	1	Fast GC System	Gerstel	MACH	1012	NA	Organics Lab	2006	In Service
26	1	Leak Detector	Gow-Mac	21250	C470808	NA	Organics Lab	2006	In Service
27	1	Autosampler	Varian	CP-8400	2569	GCMS03	Organics Lab	1999	In Service
28	1	Gas Chromatograph	Varian	3800	4638	GCMS03	Organics Lab	1999	In Service
29	1	Mass Spectrometer	Varian	Saturn 2000	4107	GCMS03	Organics Lab	1999	In Service
30	1	Autosampler	Varian	CP-8400	1346	GCMS04	Organics Lab	2003	In Service
31	1	Gas Chromatograph	Varian	3800	1497	GCMS04	Organics Lab	2003	In Service
32	1	Mass Spectrometer	Varian	Saturn 2200	5093	GCMS04	Organics Lab	2003	In Service

33	1	GPC	J2 Scientific	Accuprep GPC	03J-1092-3.1	NA	Organics Lab	2004	In Service
34	1	Refrigerator/Freezer	Hotpoint	CTF21CRP	LV651419	R14	Organics Lab	NA	In Service
35	1	Refrigerator/Freezer	Hotpoint	CTX18LYYBRWH	GM756364	R6	Organics Lab	NA	In Service
36	1	Gas Chromatograph	Varian	3800	11563	GCMS07	Organics Lab	NA	In Service
37	1	Mass Spectrometer	Varian	Saturn 2000	04943	GCMS07	Organics Lab	NA	In Service
38	1	Autosampler	Varian	CP-8400	00679	GCMS07	Organics Lab	NA	In Service
39	1	3 Bay Refrigerator	Continental	3R	14639459	R21	Organics Lab	2006	In Service
40	1	Vacuum Pump	Gast	DOA-P704-AA	NA	NA	Organics Lab	Sep-06	In Service
41	1	Autosampler	Varian	Archon	MS0902W027	GCMS08	VOC Lab	2009	In Service
42	1	Purge & Trap	OI Analytical	4660	D534466734P	GCMS08	VOC Lab	2009	In Service
43	1	Graphite Furnace Atomic Absorption	Varian	SpectrAA-240Z	EL04083663	NA	Metals	2004	In Service
44	1	CV Mercury Analyzer	Leeman	HydraAA	62528	NA	Metals	2001	In Service
45	1	Ph/ISE Meter	Orion	720A	3378	NA	Metals	NA	In Service
46	1	Heating Block	Environmental Express	NA	2484CEL1334	NA	Metals	2004	In Service
47	1	Analytical Balance	Mettler	AG204	1113380606	Scale 1	Metals	NA	In Service
48	1	Recirculating Chiller	Neslab	CFT-33	90NML47610-12	NA	Metals	NA	In Service
49	1	Centrifuge	IEC	HNS-II	235515712	NA	Metals	NA	In Service

50	1	Muffle Furnace	NA	NA	NA	NA	Metals	NA	In Service
51	1	Convection Oven	VWR	1370FM	08062705	NA	Metals	NA	In Service
52	1	Turbidimeter	VWR	TUB800	1355	NA	Metals	NA	In Service
53	1	Digital Pipette	Rainin	EDP	A16271	NA	Metals	NA	In Service
54	1	Digital Pipette	Rainin	EDP	A16433	NA	Metals	NA	In Service
55	1	ICP-AES	Thermo	iCAP6500 Duo	20104903	NA	Metals	2011	In Service
56	1	Recirculating Chiller	Thermo/Neslab	ThermoFlex900	111007080	NA	Metals	2011	In Service
57	1	Autosampler	ESI	SC-4 DX FAST	X4DX-HS-TSP-16-101108	NA	Metals	2011	In Service
58	1	Digital Pipette	Eppendorf	Xplorer 15-300µl	117304A	NA	Metals	2011	In Service
59	1	Extractor	Dionex	ASE 200	3040696	ASE4	Main Lab	1997	In Service
60	1	Extractor	Dionex	ASE 200	98030553	ASE2	Main Lab	1997	In Service
61	1	Extractor	Dionex	ASE 200	97020728	ASE1	Main Lab	1998	In Service
62	1	Extractor	Dionex	ASE 200	96090222	ASE3	Main Lab	1998	In Service
63	20	Extractor	Corning	Onestep	NA	NA	Main Lab	NA	In Service
64	1	Concentrator	Zymark	Turbovap	TV0433N12507	NA	Main Lab	NA	In Service
65	1	Concentrator	Zymark	Turbovap	TV0431N12480	NA	Main Lab	NA	In Service
66	1	Concentrator	Zymark	Turbovap	TV0525N12366	NA	Water Lab	NA	In Service

67	1	Concentrator	Zymark	TurbovapLV	TV427N12411	NA	Water Lab	NA	In Service
68	1	Concentrator	Organomation	N-EVAP	50385	NA	Water Lab	2010	In Service
69	1	Concentrator	Calipur	TurbovapLV	TV0919N15245	NA	Water Lab	2009	In Service
70	1	Concentrator	Calipur	Turbovap	TV0525N12366	NA	Water Lab	NA	In Service
71	1	Solid Phase Extractor	Horizon	SPE-DEX 4790	03-0439	R8	Water Lab	2001	In Service
72	1	Solid Phase Extractor	Horizon	SPE-DEX 4790	03-0440	R7	Water Lab	2001	In Service
73	1	Solid Phase Extractor	Horizon	SPE-DEX 4790	03-0442	R6	Water Lab	2001	In Service
74	1	Solid Phase Extractor	Horizon	SPE-DEX 4790	03-0441	R5	Water Lab	2001	In Service
75	1	Solid Phase Extractor	Horizon	SPE-DEX 4790	03-0427	R4	Water Lab	2001	In Service
76	1	Solid Phase Extractor	Horizon	SPE-DEX 4790	03-0428	R3	Water Lab	2001	In Service
77	1	Solid Phase Extractor	Horizon	SPE-DEX 4790	03-0429	R2	Water Lab	2001	In Service
78	1	Solid Phase Extractor	Horizon	SPE-DEX 4790	09-1192	L1	Water Lab	2009	In Service
79	1	Solid Phase Extractor	Horizon	SPE-DEX 4790	09-1197	L2	Water Lab	2009	In Service
80	1	Solid Phase Extractor	Horizon	SPE-DEX 4790	09-1198	L3	Water Lab	2009	In Service
81	1	Solid Phase Extractor	Horizon	SPE-DEX 4790	09-1191	L4	Water Lab	2009	In Service
82	1	Solid Phase Extractor	Horizon	SPE-DEX 4790	09-1194	L5	Water Lab	2009	In Service
83	1	Solid Phase Extractor	Horizon	SPE-DEX 4790	09-1196	L6	Water Lab	2009	In Service

84	1	Solid Phase Extractor	Horizon	SPE-DEX 4790	09-1195	L7	Water Lab	2009	In Service
85	1	Solid Phase Extractor	Horizon	SPE-DEX 4790	09-1193	L8	Water Lab	2009	In Service
86	1	Controller	Horizon	Envision Platform	1066	NA	Water Lab	2001	In Service
87	1	Controller	Horizon	Envision Platform	1067	NA	Water Lab	2009	In Service
88	1	Solid Phase Extractor	Horizon	SPE-DEX 4790	01-0203	R1	Water Lab	2006	In Service
89	1	Muffle Furnace	Thermolyne	30400	718950469774	NA	Water Lab	NA	In Service
90	1	Oven	Fisher Scientific	200	887	NA	Water Lab	NA	In Service
91	1	Oven	VWR	1370FD	0300891	NA	Water Lab	NA	In Service
92	1	Dishwasher	Meile	G7783	00/74311470	NA	Water Lab	NA	In Service
93	1	Refrigerator/Freezer	GE	TBF15DNF	TN632400	R16	Water Lab	NA	In Service
94	1	Wrist Shaker	Burrell	BB	NA	NA	Water Lab	NA	In Service
95	1	Centrifuge	IEC	HN-S	3472947	NA	Water Lab	2011	In Service
96	1	Syringe Pump	Hamilton	Microlab 500	MD90EB1510	NA	Water Lab	NA	In Service
97	2	Vacuum Pump	Gast	DAA-V186-EB	NA	NA	Water Lab	NA	In Service
98	1	Controller	Horizon	SPC-100	98-190	NA	Water Lab	2001	In Service
99	1	Refrigerator/Freezer	GE	TBF21DPB	LP507941	R7	VOC Lab	NA	In Service
100	1	Freezer	Kenmore	106-7391540	E93921072	F12	Sample Storage	NA	In Service

101	1	Refrigerator	GE	NA	NA	R9	VOC Lab	NA	In Service
102	1	Freezer	Admiral	SKF163A	DA4452560	F11	VOC Lab	NA	In Service
103	1	Analytical Balance	Mettler	AG204	1120363108	Scale 2	Waste Room	NA	In Service
104	1	Refrigerator/Freezer	GE	TBX145PGRAD	RF792992	NA	Lunch Room	NA	In Service
105	1	Refrigerator/Freezer	Hotpoint	CTXY14CMELAD	2D772635	NA	Lunch Room	NA	In Service
106	1	7.5 Ton HVAC with economizer package	Carrier	48TJE008	0999G30104	NA	Roof	NA	In Service
107	1	Make Up Air Unit, 10000CFM	Reznor	PCB100	53186	NA	Roof	NA	In Service
108	1	Condenser Unit	Carrier	38AH024-134	299F91520	NA	Roof	NA	In Service
109	1	7.5 Ton HVAC with economizer package	Carrier	48TJE008	0999G30103	NA	Roof	NA	In Service
110	1	5 Ton HVAC Unit with economizer package	Carrier	48TJE006	0999G21090	NA	Roof	NA	In Service
111	1	4 Ton HVAC Unit	Carrier	48TJE005	0999G20747	NA	Roof	NA	In Service
112	1	Hot Water Heater	John Wood	FG1E5050T4NOW	0414109659	NA	Utility Room	NA	In Service
113	1	Recirculating Chiller	VWR	1173MD	108600146	NA	Main Lab	NA	In Service
114	1	Recirculating Chiller	Thermo	Merlin M-33	104008031	NA	Main Lab	NA	In Service
115	1	Recirculating Chiller	Thermo	Merlin M-33	103345042	NA	Main Lab	NA	In Service
116	1	Recirculating Chiller	Thermo	Merlin M-33	104110091	NA	Main Lab	NA	In Service
117	1	Recirculating Heated Water Bath	KS Lauda	K20	802010	NA	Main Lab	NA	In Service

118	1	Recirculating Chiller	Neslab	CFT-33	810727-1	NA	Main Lab	NA	In Service
119	1	Recirculating Heated Water Bath	VWR Scientific	11302	414481	NA	Main Lab	NA	In Service
120	1	Analytical Balance	Mettler	PL303	1203170362	NA	Fish Room	NA	In Service
121	1	Grinder	Hobart	M-22	AK00133	NA	Fish Room	NA	In Service
122	1	Tissue Grinder	Retch	GM200	92304015	NA	Fish Room	NA	In Service
123	1	Tissue Grinder	Retch	GM200	92304017	NA	Fish Room	NA	In Service
124	1	Wrist Shaker	Burrell	75	NA	NA	Main Lab	NA	In Service
125	1	Wrist Shaker	Burrell	75	NA	NA	Main Lab	NA	In Service
126	1	Rack Shaker	Burrell	75	NA	NA	Main Lab	NA	In Service
127	1	Tumbler, 6 position	NA	NA	NA	NA	Main Lab	NA	In Service
128	1	Exhaust Fan, Main	Hartzell Fan	06124 BCM3	11104A1A	NA	Roof	NA	In Service
129	1	Exhaust Fan, Metals	Twin City Fan	182C12, TFE3W	99-14172-1-1	NA	Roof	NA	In Service
130	1	Exhaust Fan, Water Lab	Penn Ventilator	24-B	NA	NA	Roof	NA	In Service
131	1	Exhaust Fan, Waste Room	Carnes	VUBK12LA1NA20???	581284.007	NA	Roof	NA	In Service
132	1	Concentrator	Zymark	ZW640-3	04364	NA	Main Lab	NA	In Service
133	1	Concentrator	Zymark	ZW640-3	04641	NA	Main Lab	NA	In Service
134	1	Tissuemiser	IKA Works	T25BS1	03.009612	NA	Main Lab	NA	In Service

135	1	Mantle Controller, 3 position	GlassCol	104A4612	411560	NA	Main Lab	NA	In Service
136	1	Mantle Controller, 3 position	GlassCol	104A4612	411561	NA	Main Lab	NA	In Service
137	1	Mantle Controller, 3 position	GlassCol	104A4612	411559	NA	Main Lab	NA	In Service
138	1	Mantle Controller, 3 position	GlassCol	104A4612	411558	NA	Main Lab	NA	In Service
139	1	Mantle Controller, 3 position	GlassCol	104A4612	414200	NA	Main Lab	NA	In Service
140	1	Mantle Controller, 3 position	GlassCol	104A4612	414201	NA	Main Lab	NA	In Service
141	1	Mantle Controller, 3 position	GlassCol	104A4612	414198	NA	Main Lab	NA	In Service
142	1	Mantle Controller, 3 position	GlassCol	104A4612	414199	NA	Main Lab	NA	In Service
143	1	6 Place Mantle	GlassCol	100DRX30412	411662	NA	Main Lab	NA	In Service
144	1	6 Place Mantle	GlassCol	100DRX30412	411663	NA	Main Lab	NA	In Service
145	1	6 Place Mantle	GlassCol	100DRX30412	413525	NA	Main Lab	NA	In Service
146	1	6 Place Mantle	GlassCol	100DRX30412	413526	NA	Main Lab	NA	In Service
147	1	Refrigerator 3 Bay	TRUE Manufacturing	TS-72	1-3742814	R20	Sample Storage	NA	In Service
148	1	Refrigerator 3 Bay	TRUE Manufacturing	TS-72	1-374284	R19	Sample Storage	NA	In Service
149	1	Fish Scaler	Bear Paw Tackle	NA	47K32399R	NA	Fish Room	NA	In Service
150	1	Analytical Balance	Mettler	PE-16	121565-002	NA	Fish Room	NA	In Service
151	1	Pure Water System	Modulab	NA	NA	NA	RO Water Room	NA	In Service

152	1	RO Water System	US Filter	ROSLW1001	9108-582	NA	RO Water Room	NA	In Service
153	1	Flashpoint Tester	Precision	74537	10AX-10	NA	Main Lab	NA	In Service
154	1	Mantle Control, 2 unit	Barnstead	NA	10767242	NA	Main Lab	NA	In Service
155	1	Mantle Control, 2 unit	Barnstead	NA	10757982	NA	Main Lab	2006	In Service
156	1	Mantle Control	Glas-Col	PL3122	306312	NA	Main Lab	NA	In Service
157	1	Mantle Control	Glas-Col	PL3122	306295	NA	Main Lab	NA	In Service
158	1	Mantle Control	Glas-Col	PL3122	327117	NA	Main Lab	NA	In Service
159	1	Mantle Control	Glas-Col	PL3122	326824	NA	Main Lab	NA	In Service
160	1	Mantle Control	Glas-Col	PL3122	327108	NA	Main Lab	NA	In Service
161	1	Mantle Control	Glas-Col	PL3122	306307	NA	Main Lab	NA	In Service
162	1	Mantle Control	Glas-Col	PL3122	311007	NA	Main Lab	NA	In Service
163	1	Mantle Control	Glas-Col	PL3122	326809	NA	Main Lab	NA	In Service
164	1	Mantle Control	Glas-Col	PL3122	342829	NA	Main Lab	NA	In Service
165	1	IR Temperature Gun	Cole-Parmer	39650-02	2717990101-0034	NA	Login	NA	In Service
166	1	Pipet Holder	BioHT	Midiplus	YM31962	NA	Main Lab	NA	In Service
167	1	Pipet Holder	BioHT	Midiplus	YM60480	NA	Main Lab	NA	In Service
168	1	Pipet Holder	BioHT	Midiplus	YM21076	NA	Main Lab	NA	In Service

169	1	Pipette Holder	BioHT	Midiplus	YM60479	NA	Main Lab	NA	In Service
170	1	Pipette Holder	BioHT	Midiplus	YM60481	NA	Main Lab	NA	In Service
171	40	Heating Mantles	Various	Various	NA	NA	Main Lab	NA	In Service
172	60	250ml Round Bottom	Various	NA	NA	NA	Main Lab	NA	In Service
173	70	Soxhlet Extractors	Various	NA	NA	NA	Main Lab	NA	In Service
174	400	Volumetric Flasks	Various	NA	NA	NA	Main Lab	NA	In Service
175	75	Powder Columns	Various	NA	NA	NA	Main Lab	NA	In Service
176	14	Snyder Columns	Various	NA	NA	NA	Main Lab	NA	In Service
177	33	Beakers	Various	NA	NA	NA	Main Lab	NA	In Service
178	40	Separatory Funnels	Various	NA	NA	NA	Main Lab	NA	In Service
179	120	Turbo Tubes	Zymark	NA	NA	NA	Main Lab	NA	In Service
180	60	Allihn Condensors	Various	NA	NA	NA	Main Lab	NA	In Service
181	75	Graduated Cylinders	Various	NA	NA	NA	Main Lab	NA	In Service
182	6	2000ml Flasks	Various	NA	NA	NA	Main Lab	NA	In Service
183	3	Large Scale Extractors	Various	NA	NA	NA	Main Lab	NA	In Service
184	45	Gas Regulators	Various	NA	NA	NA	Various	NA	In Service
185		Gas Chromatograph	Varian	3900	803	GCMS08	VOC Lab	2009	In Service

186		Mass Spectrometer	Varian	Saturn 2000	8501	GCMS08	VOC Lab	2009	In Service
187	1	Refrigerator/Freezer	GE	TBF21DNB	DN577412	F15	Waste Room	NA	In Service
188	1	Autosampler	Varian	CP-8400	2569	GCMS03	SVOC Lab	1999	In Service
189	1	Gas Chromatograph	Varian	3800	4638	GCMS03	SVOC Lab	1999	In Service
190	1	Mass Spectrometer	Varian	Saturn 2000	4107	GCMS03	SVOC Lab	1999	In Service
191	1	Autosampler	Varian	CP-8400	2463	GCMS04	SVOC Lab	2003	In Service
192	1	Gas Chromatograph	Varian	3800	1497	GCMS04	SVOC Lab	2003	In Service
193	1	Mass Spectrometer	Varian	Saturn 2200	5093	GCMS04	SVOC Lab	2003	In Service
194	1	Gas Chromatograph	Varian	3800	11563	GCMS07	SVOC Lab	2004	In Service
195	1	Mass Spectrometer	Varian	Saturn 2000	04943	GCMS07	SVOC Lab	2004	In Service
196	1	Autosampler	Varian	CP-8400	01346	GCMS07	SVOC Lab	2004	In Service
197	2	Solid Sampler	Shimadzu	SSM-5000A	38835629	NA	Wet Lab	2006	In Service
198	2	Liquid Autosampler	Shimadzu	ASI-V	A52104200350	NA	Wet Lab	2006	In Service
199	1	TOC Analyzer	Shimadzu	TOCVCSH	A51104100008	NA	Wet Lab	2006	In Service
200	1	TOC Boat Sampler	Tekmar	183	US02210004	NA	Wet Lab	NA	In Service
201	1	TOC Analyzer	Tekmar	DC-190	99126008	NA	Wet Lab	NA	In Service
202	1	Fluorimeter	Turner Designs	NA	720000175	NA	Wet Lab	NA	In Service

203	1	Hydrocarbon Analyzer	Buck Scientific	404	420	NA	Wet Lab	NA	In Storage
204	1	Spectrophotometer, Vis	Bausch & Lomb	Spectronic-20	5767WB	NA	Wet Lab	NA	In Service
205	1	Heating Block	Lachat	Microdist	A2000-689	NA	Wet Lab	2007	In Service
206	1	Analytical Balance	Mettler	AG204	1113380606	NA	Metals	Metals	In Service
207	1	Tumbler TCLP, 8 position	NA	NA	NA	NA	Wet Lab	NA	In Service
208	1	Tumbler ZHE, 6 position	Associated Design and Manufacturing	NA	1458	NA	Wet Lab	NA	In Service
209	6	TCLP Filter Housing	NA	NA	NA	NA	Wet Lab	NA	In Service
210	1	Turbidimeter	VWR	TUB800	1355	NA	Wet Lab	NA	In Service
211	1	Autosampler	Varian	8100	02223	GC05	GC	1987	In Service
212	1	Gas Chromatograph	Varian	3400	09761	GC05	GC	1987	In Service
213	1	Autosampler	Varian	8100	01229	GC07	GC	1988	Not in Service
214	1	Gas Chromatograph	Varian	3400	09338	GC07	GC	1988	Not in Service
215	1	Autosampler	Varian	CP-8400	01051	GC10	GC	NA	Not in Service
216	1	Autosampler	CTC/LEAP	RePAL	PXY0040	GC10	GC	Refurb-2011	In Service
217	1	Gas Chromatograph	Varian	3800	04007	GC10	GC	1998	In Service
218	1	Autosampler	Varian	8400	02480	GC11	GC	NA	Not in Service
219	1	Autosampler	CTC/LEAP	RePAL	211249	GC11	GC	Refurb-2011	In Service

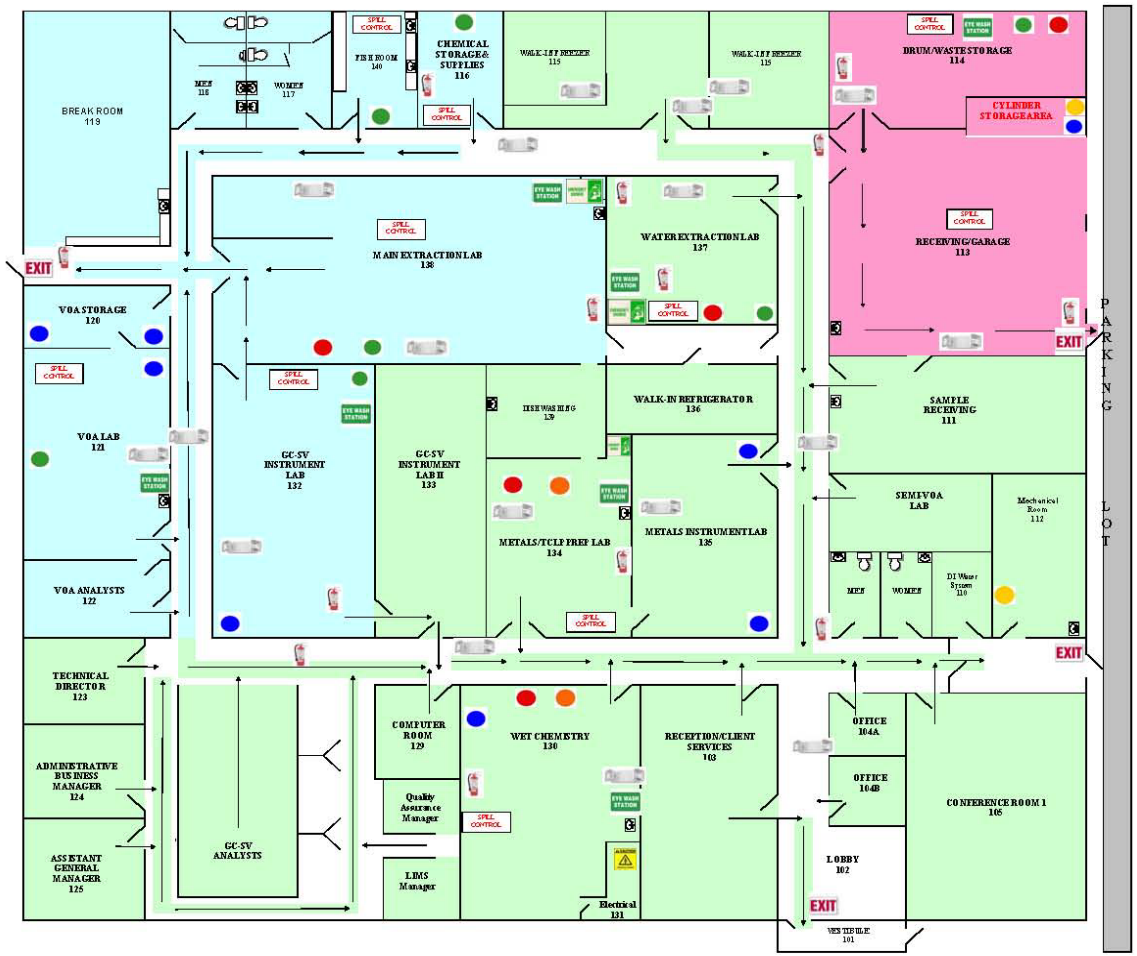
220	1	Gas Chromatograph	Varian	3800	04006	GC11	GC	1998	In Service
221	1	Autosampler Tray	Agilent	G2614A	US12511941	GC15	GC	2000	In Service
222	1	Gas Chromatograph	Agilent	6890N	US00041669	GC15	GC	2000	In Service
223	1	Injector	Agilent	7683	US12511941	GC15	GC	2000	In Service
224	1	Gas Chromatograph	Agilent	6890	US10140095	GC16	GC	2001	In Service
225	1	Autosampler Tray	Agilent	G2614A	US14213141	GC16	GC	2001	In Service
226	1	Injector	Agilent	7683	CN15223825	GC16	GC	2001	In Service
227	1	Gas Chromatograph	Agilent	6890	US10143037	GC17	GC	2001	In Service
228	1	Autosampler Tray	Agilent	G2614A	US14913704	GC17	GC	2001	In Service
229	1	Injector	Agilent	7683	CN14723375	GC17	GC	2001	In Service
230	1	Gas Chromatograph	Varian	CP-3800	8816	GC18	GC	2002	In Service
231	1	Autosampler	CTC/LEAP	GC PAL	161134	GC18	GC	2005	In Service
232	1	Gas Chromatograph	Varian	CP-3800	8818	GC19	GC	2002	In Service
233	1	Autosampler	CTC/LEAP	RePAL	210673	GC19	GC	2009	In Service
234	1	Gas Chromatograph	Varian	CP-3800	8817	GC20	GC	2008	In Service
235	1	Autosampler	CTC/LEAP	HTS PAL	111148	GC20	GC	2002	In Service
236	1	Gas Chromatograph	Varian	CP-3800	11273	GC21	GC	2004	In Service

237	1	Autosampler	CTC/LEAP	GC PAL	161109	GC21	GC	2005	In Service
238	1	Autosampler	Varian	8200	8094	GC22	GC	NA	In Service
239	1	Gas Chromatograph	Varian	3400 Star	17038	GC22	GC	2008	In Service
240	1	Autosampler	CTC/LEAP	RePAL	211142	GC23	GC	NA	In Service
241	1	Gas Chromatograph	Agilent	7890N	US10906059	GC24	GC	Mar-2009	In Service
242	1	Autosampler Tray	Agilent	G2614A	CN85252214	GC24	GC	Mar-2009	In Service
243	1	Injector	Agilent	7683B	CN85154864	GC24	GC	Mar-2009	In Service
244	1	Gas Chromatograph	Agilent	7890N	US10906049	GC25	GC	Mar-2009	In Service
245	1	Autosampler Tray	Agilent	G2614A	CN85252206	GC25	GC	Mar-2009	In Service
246	1	Injector	Agilent	7683B	CN85154856	GC25	GC	Mar-2009	In Service
247	1	Gas Chromatograph	Varian	450 GC	GC0902B010	GC26	GC	Mar-2009	In Service
248	1	Autosampler	CTC/LEAP	RePAL	210927	GC26	GC	2009	In Service
249	1	Gas Chromatograph	Varian	450 GC	GC0902B009	GC27	GC	Mar-2009	In Service
250	1	Autosampler	CTC/LEAP	RePAL	210366	GC27	GC	2009	In Service
251	1	Gas Chromatograph	Varian	450 GC	GC0902B039	GC28	GC	Mar-2009	In Service
252	1	Autosampler	CTC/LEAP	RePAL	210580	GC28	GC	2009	In Service
253	1	Gas Chromatograph	Bruker	450 GC	BR1103M028	GC29	GC	2011	In Service

254	1	Autosampler	CTC/LEAP	RePAL	110639	GC29	GC	2011	In Service
255	1	Gas Chromatograph	Agilent	7890A	CN1114025	GC30	GC	Mar-2011	In Service
256	1	Autosampler Tray	Agilent	G4514A	CN11080020	GC30	GC	Mar-2011	In Service
257	1	Injector	Agilent	G4513A	CN11120197	GC30	GC	Mar-2011	In Service

Pace Analytical Services, Inc.
2190 Technology Dr.
Schenectady, NY 12308

Fire Evacuation Route and Safety Equipment Map



2190 Technology Drive

Legend

Fire Extinguisher
Emergency Light
Eye Wash Station
Shower Station
Acids
Liquid Gases
Solvents
Bases
SINK

ATTACHMENT V- LABORATORY SOP LIST

DEPT.	TITLE	SOP ID	DOCUMENT CONTROL #
QA/QC	Determination & Verification of MDL/IDL/PQL	NE021_07	S-NY-Q-021-rev.07
INORG	Determination of pH	NE022_08	S-NY-I-022-rev.08
VOA	Analysis of Groundwater by EPA Method 503.1 by EPA 502.2 (Modified)	NE023_10	S-NY-O-023-rev.10
INORG	The Analysis of Mercury by Cold Vapor Atomic Absorption (CVAA)	NE025_09	S-NY-M-025-rev.09
SVOA	Analysis of BNA SVOAs by EPA Method 625	NE026_08	S-NY-O-026-rev.08
VOA	Analysis of Volatile Organics by EPA Method 624	NE030_08	S-NY-O-030-rev.08
ORG	Extraction of Herbicides by EPA 8151	NE037_10	S-NY-O-037-rev.10
SAFETY	Inspection and Cleaning of the Emergency Showers and Eyewashes	NE038_06	S-NY-S-038-rev.06
SVOA	Analysis of PCBs by GC/MS Method 680	NE040_05	S-NY-O-040-rev.05
DATA	Creating a Certificate of Analysis	NE043_04	S-NY-C-043-rev.04
LOGIN	Sub-contracting Sample Analysis	NE044_07	S-NY-C-044-rev.07
SVOA	Analysis of SVOCs by GC/MS EPA Method 8270C	NE045_08	S-NY-O-045-rev.08
LOGIN	Refrigerator and Freezer Temperature Monitoring	NE046_05	S-NY-C-046-rev.05
SAFETY	Classification and Disposal of Laboratory Waste	NE054_09	S-NY-W-054-rev.09
INORG	The Operation of Eppendorf and Ranin Pipettes	NE055_06	S-NY-I-055-rev.06
ORG	Cleaning Glassware with Muffle Oven	NE057_06	S-NY-O-057-rev.06
INORG	Operation of the Continental RO Modulab Laboratory Water System	NE059_03	S-NY-I-059-rev.03
LOGIN	Sample Container Preservation and Bottleware Storage	NE060_07	S-NY-C-060-rev.07
SAFETY	Power Failure	NE061_05	S-NY-S-061-rev.05
INORG	The Extraction Portion of the Toxicity Characteristic Leaching procedure (TCLP)	NE063_06	S-NY-I-063-rev.06
SAFETY	Safety Training	NE069_06	S-NY-S-069-rev.06
INORG	The Hot Block Digestion Procedure for GFAA & ICP	NE070_05	S-NY-M-070-rev.05
QA/QC	Calibration and Verification of Laboratory Balances, Laboratory Weights, and Maintenance	NE076_07	S-NY-Q-076-rev.07
INORG	Operation of Handheld Conductivity Meter	NE077_06	S-NY-I-077-rev.06

WATER	Extraction of SVOCs by Separatory Funnel EPA 3510C/625	NE079_10	S-NY-O-079-rev.10
VOA	Preparation & Analysis of Volatile Organics by GC/MS EPA Method 8260B	NE081_08	S-NY-O-081-rev.08
INORG	Determination of Trace Elements by GFAA	NE082_06	S-NY-M-082-rev.06
SAFETY	Monitoring of Fume Hoods	NE084_04	S-NY-S-084-rev.04
SAFETY	Spills in the Laboratory	NE085_04	S-NY-S-085-rev.04
SAFETY	Chemical Transportation	NE086_04	S-NY-S-086-rev.04
INORG	Determination of Filterable Residue (TDS) in Water	NE087_06	S-NY-I-087-rev.06
ORG	Extraction of PCB (Wipes) by Soxhlet Extraction EPA 3540C & Analysis by 8082	NE088_07	S-NY-O-088-rev.07
INORG	Percent Total Solids Determination (TS)	NE090_04	S-NY-I-090-rev.04
LOGIN	The Collection of Environmental Samples by Pace Analytical Services, Inc. Personnel	NE101_02	S-NY-C-101-rev.02
VOA	Analysis of Volatile Aromatics by GC EPA Method 602	NE102_09	S-NY-O-102-rev.09
VOA	Preparation & Analysis of EPA Method 8021/N.Y.S.- STARS	NE106_06	S-NY-O-106-rev.06
ORG	Extraction & Clean-up by Waste Dilution EPA 3580 for PCB 8082	NE111_08	S-NY-O-111-rev.08
WATER	Extraction for SVOCs by CLLE EPA 3520 and EPA 8270	NE114_09	S-NY-O-114-rev.09
INORG	Determination of Non-Filterable Residue (TSS)	NE117_06	S-NY-I-117-rev.06
WATER	Extraction of PCBs by CLLE 3520 and Analysis by EPA 8082 and EPA 680	NE118_09	S-NY-O-118-rev.09
ORG	Extraction & Clean-Up of PCBs by Ultrasonication by EPA 3550B	NE120_06	S-NY-O-120-rev.06
INORG	Determination of Metals & Trace Elements by ICP	NE122_07	S-NY-M-122-rev.07
INORG	Determination of Flashpoint Using Pensky Martens Closed Cup Tester	NE123_06	S-NY-I-123-rev.06
WATER	Preparation & Extraction by CLLE (CSPCB-Green Bay) EPA 3520C	NE124_08	S-NY-O-124-rev.08
INORG	Determination of Hexavalent Chromium	NE127_06	S-NY-I-127-rev.06
INORG	Determination of TOC/DTOC/POC in Water	NE128_08	S-NY-I-128-rev.08
INORG	Determination of AVS-SEM by EPA 821/12-91/100	NE129_05	S-NY-I-129-rev.05
INORG	Reactive Sulfide and Cyanide Determination	NE130_05	S-NY-I-130-rev.05
GC	Analysis of Pesticides by EPA Method 8081A	NE131_07	S-NY-O-131-rev.07
ORG	Preparation & Homogenization of Biota and Plant Matrices	NE132_07	S-NY-O-132-rev.07
GC	Analysis of PCBs by EPA Method 8082A Congener Spec. PCB (CQCS)	NE133_04	S-NY-O-133-rev.04

GC	Analysis of Herbicides by EPA Method 8151(Modified)	NE135_04	S-NY-O-135-rev.04
VOA	Analysis of Petroleum (Qualitative) in Water by NYS DOH 310-14	NE136_05	S-NY-O-136-rev.05
VOA	Preparation & Analysis of Diesel Range Organics by EPA 8015	NE137_06	S-NY-O-137-rev.06
GC	PCB Aroclor Gas Chromatography Screening Method	NE140_06	S-NY-O-140-rev.06
WATER	Extraction of PCBs by Separatory Funnel EPA 3510C for Analysis by EPA 508, 608, 8082	NE141_08	S-NY-O-141-rev.08
WATER	Extraction & Preparation by CLLE EPA 3520C for Analysis by 8082 CQCS	NE142_09	S-NY-O-142-rev.09
ORG	ASE Extraction for PCB by 8082 & 3545	NE143_06	S-NY-O-143-rev.09
ORG	ASE Extraction for Wipe PCB by 8082 & 3545	NE144_07	S-NY-O-144-rev.07
ORG	ASE Extraction for Pesticide by 8081 & 3545	NE145_08	S-NY-O-145-rev.08
ORG	ASE Extraction for Semivolatiles by EPA 8270 & 3545	NE146_07	S-NY-O-146-rev.07
ORG	ASE Extraction for DRO by EPA 3545	NE147_08	S-NY-O-147-rev.08
GC	Determination of PCBs using GC by Capillary Column EPA Method 8082	NE148_07	S-NY-O-148-rev.07
ORG	PUF Extraction for TO-4A 8082 Analysis	NE151_07	S-NY-O-151-rev.07
ORG	The Purification, Preparation, Handling, and Storage of PUF Air Cartridges	NE153_06	S-NY-O-153-rev.06
ORG	PET ID Extraction (Oil/Waste)	NE154_06	S-NY-O-154-rev.06
ORG	PET ID Extraction (H2O by Separatory Funnel)	NE155_07	S-NY-O-155-rev.07
ORG	PET ID Extraction (Soil)	NE156_07	S-NY-O-156-rev.07
WATER	Extraction & Concentration of Pesticides by CLLE by EPA 3520C & 8081	NE157_08	S-NY-O-157-rev.08
ORG	The Extraction of Fish and Biota Material	NE158_05_01	S-NY-O-158-rev.05
SAFETY	MSDS and COA Maintenance and Storage	NE163_05	S-NY-S-163-rev.05
VOA	Preparation & Analysis of GRO by GC-FID EPA Method 8015	NE164_06	S-NY-O-164-rev.06
VOA	Sampling & Analysis of Zero Headspace by EPA Method 5035	NE165_04	S-NY-O-165-rev.04
SAFETY	Pollution Prevention at Pace Analytical Services, Inc.	NE168_05	S-NY-S-168-rev.05
WATER	Extraction of DRO by CLLE EPA 3520C & 8015	NE171_05	S-NY-O-171-rev.05
WATER	Solvent Testing for Water Lab	NE172_05	S-NY-O-172-rev.05
WATER	Aqueous Filtration for PCB Analysis	NE173_05	S-NY-O-173-rev.05
INORG	Total Organic Carbon Lloyd Kahn/Triplicate Analysis Option	NE177_04	S-NY-I-177-rev.04
WATER	1-Liter Extraction of PCBs by SPE EPA 3535 for GEHR BMP	NE178_05	S-NY-O-178-rev.05

INORG	Determination of Percent Moisture	NE179_04	S-NY-O-179-rev.04
ORG	Extraction of HEM from Solids by EPA 9071	NE180_03	S-NY-I-180-rev.03
INORG	The Analysis of Percent Moisture, Ash, and Organic Matter	NE182_04	S-NY-I-182-rev.04
SAFETY	Emergency Evacuation Procedures	NE185_04_01	S-NY-S-185-rev.04
INORG	Determination of Bulk Density	NE188_04	S-NY-I-188-rev.04
SVOA	The Use of Thru Put Software for SVOCs by EPA 8270C & 625	NE189_03	S-NY-O-189-rev.03
INORG	Paint Filter Free Liquid Test	NE190_04	S-NY-I-190-rev.04
ORG	Extraction of Oil & Grease from Water by Separatory Funnel EPA1664	NE191_04	S-NY-O-191-rev.04
IT	Symantec Back-up Exec V.11 for Windows & Linux Software	NE193_03	S-NY-IT-193-rev.03
ORG	Extraction of High Level PCB by Separatory Funnel EPA 8082	NE194_04	S-NY-O-194-rev.04
IT	Empower V.2 for Data Archiving & Dearchiving	NE195_02	S-NY-IT-195-rev.02
DATA	Shipping and Receiving by Delivery Service	NE199_03	S-NY-C-199-rev.03
INORG	Preparation of Solid Samples by TOC	NE205_04	S-NY-I-205-rev.04
DATA	Data Packaging for PCBs by GC/MS EPA 680	NE206_05	S-NY-C-206-rev.05
GC	Analysis of Low Level Green Bay Congener Specific PCBs	NE207_04_01	S-NY-O-207-rev.04
WATER	Extraction of PCBs by Large Volume SPE EPA 3535 for GEHR BMP	NE208_05	S-NY-O-208-rev.05
VOA	Archon Autosampler Operation	NE217_05	S-NY-O-217-rev.05
WATER	Extraction of PCBs by Solid Phase Membrane Disk (SPE) EPA 3535	NE218_03	S-NY-O-218-rev.03
QA/QC	Data Control, Data Review, and Manual Integrations	NE219_04	S-NY-Q-219-rev.04
QA/QC	Review of Requests Tenders and Contracts Review	NE220_02	S-NY-Q-220-rev.02
QA/QC	Document Control for NELAC Compliance	NE221_03	S-NY-Q-221-rev.03
LOGIN	Sample Login Using LIMS	NE223_04	S-NY-C-223-rev.04
QA/QC	Laboratory Ethics	NE224_03	S-NY-Q-224-rev.03
INORG	Ignitability for Solids	NE225_03	S-NY-I-225-rev.03
SVOA	GPC Cleanup by EPA 3640A	NE226_03	S-NY-O-226-rev.03
LOGIN	Sample Receipt, Sample Storage, and Sample Security	NE227_06	S-NY-C-227-rev.06
INORG	Determination of Total Residue (TS) in Water	NE228_03_01	S-NY-I-228-rev.03
VOA	Preparation of Volatiles in Soil and Solid Waste by EPA 5030A	NE229_02	S-NY-O-229-rev.03

GC	Analysis of Polychlorinated Biphenyls (PCBs) by EPA Modified 508 Method	NE231_02	S-NY-O-231-rev.02
INORG	Determination of Chlorophyll A and Pheophytin A	NE232_03	S-NY-I-232-rev.02
WATER	Apparatus Set-up of Continuous Liquid Liquid Extraction (CLLE) for EPA 3520C	NE233_03	S-NY-O-233-rev.03
INORG	Preparation & Analysis of TOC Solid by Quadruplicate Lloyd Kahn Method	NE234_02	S-NY-I-234-rev.02
ORG	Determination of Biomass	NE236_04	S-NY-O-236-rev.04
SVOA	Analysis of Low Level SVOCs (PAH) by GC/MS EPA Method 8270-SIM	NE238_05	S-NY-O-238-rev.05
ORG	PUF Extraction for TO-10A (Soxhlet) by EPA 8082/680 Analysis	NE241_03	S-NY-O-241-rev.03
INORG	Determination of TVS & VSS	NE242_04	S-NY-I-242-rev.04
DATA	Controlled Destruction of Paper Copy Documents.	NE247_02	S-NY-C-247-rev.02
INORG	Determination of Total Cyanide	NE249_04	S-NY-I-249-rev.04
ORG	Cleaning of Glassware at Pace Analytical, Inc.	NE256_02	S-NY-O-256-rev.02
SVOA	Extraction & Determination of PAHs by Ambient Air Using GC/MS Method TO-13A	NE257_01	S-NY-O-257-rev.01
IT	Computer-Resident Sample Data Control	NE259_02	S-NY-IT-259-rev.02
ORG	Preparation and Analysis of PCBs for Indoor Air Monitoring by NIOSH Method 5503	NE260_03	S-NY-O-260-rev.03
DATA	Organization and Assembly of Data Reports for Packaging	NE261_02	S-NY-C-261-rev.02
QA/QC	Confidentiality of Client Data	NE262_02	S-NY-Q-262-rev.02
QA/QC	Calibration Procedures, Standards, and Frequency	NE263_02	S-NY-Q-263-rev.02
QA/QC	Analytical Standard Identification, Traceability, and Storage Procedures	NE264_02	S-NY-Q-264-rev.02
IT	Data Processing Systems and Corrective Action Reporting Procedures	NE265_02	S-NY-IT-265-rev.02
QA/QC	Documentation Procedures, Data Review Process, and Inventory Procedures	NE266_02	S-NY-Q-266-rev.02
QA/QC	Data Validation and Self-Inspection Procedures	NE267_02	S-NY-Q-267-rev.02
QA/QC	Maintenance Activities for Pace Analytical Services, Inc.	NE268_02	S-NY-Q-268-rev.02
ORG	Extraction and Cleanup Procedures of Fish Oil for PCB Aroclor or PAH	NE269_02	S-NY-O-269-rev.02
INORG	Analysis of Water Samples for Turbidity	NE270_03	S-NY-I-270-rev.03
INORG	Determination of Settable Solids	NE271_03	S-NY-I-271-rev.03
ORG	Preparation and Extraction on Alumina Columns	NE272_02	S-NY-O-272-rev.02

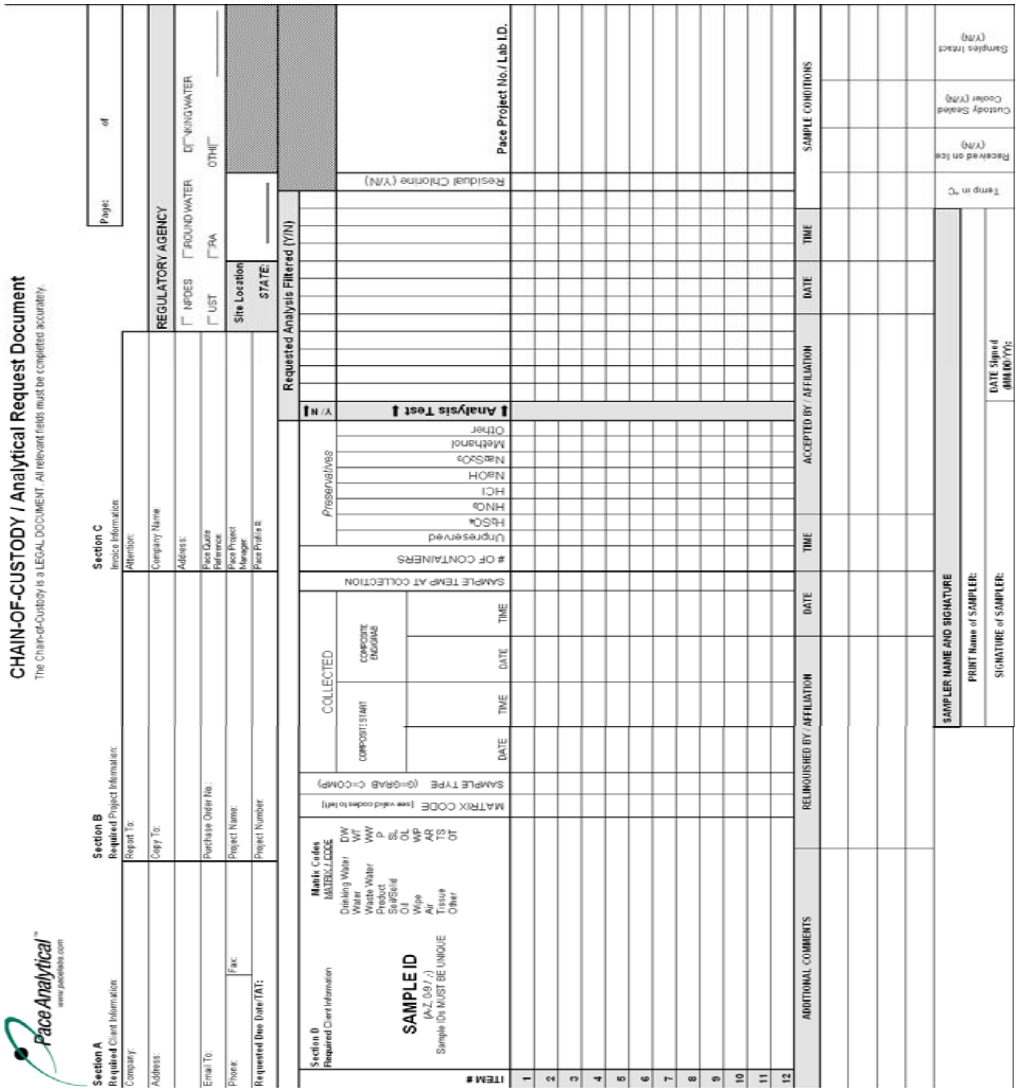
WATER	Solid Phase Extraction by EPA Method 508 Modified	NE273_02	S-NY-O-273-rev.02
QA/QC	Training at Northeast Analytical, Inc.	NE274_01	S-NY-Q-274-rev.01
WATER	Composition & Filtration	NE275_00	S-NY-O-275-rev.00
INORG	Mass of Solids for Sediment Samples	NE277_01_01	S-NY-I-277-rev.01
SVOA	Microwave Analysis of PAH extractions	NE278_00	S-NY-O-278-rev.00
SVOA	Microwave Analysis of SVOC extractions	NE279_00	S-NY-O-279-rev.00
ORG	Microwave Analysis of PCB extractions	NE280_00	S-NY-O-280-rev.00
ORG	Standard Operating Procedure for GEHR3545	GEHR3545	S-NY-O-GEHR-rev.05
GC	Standard Operating Procedure for GEHR8082	GEHR8082	S-NY-O-GEHR8082-rev.04
GC	Standard Operating Procedure for SSAP8082	SSAP8082	S-NY-O-SSAP8082-rev.03
INORG	Microwave Analysis of Inorganic Digestions by EPA Methods 3015 & 3051	NE281_02	S-NY-M-281-rev.02
ORG	Microscale Solvent Extraction (MSE)	NE282_00	S-NY-O-282-rev.00
ORG	Reagent Preparation for Organic Extraction, Testing, & Clean-up	NE283_00	S-NY-O-283-rev.00
ORG	Extraction & Cleanup of Petroleum Hydrocarbons (EPH) by EPA Method 3545 & 3520C	NE284_00	S-NY-O-284-rev.00
VOA	Analysis of Volatile Petroleum Hydrocarbons (VPH) by EPA Method 8260B	NE285_00	S-NY-O-285-rev.00
SVOA	Analysis of Extractable Petroleum Hydrocarbons (EPH) & PAH by EPA Method 8270C	NE286_01	S-NY-O-286-rev.01
LOGIN	Carboy Processing	NE287_00	S-NY-W-287-rev.00
INORG	Black Carbon Processing and Analysis by a Modified USEPA Lloyd Kahn Method	NE288_00	S-NY-I-288-rev.00
IT	Creating and Account for New Employee	NE289_00	S-NY-IT-289-rev.00
IT	Remotely Connecting to the Network	NE290_00	S-NY-IT-290-rev.00
IT	Installing Cisco VPN Client	NE291_00	S-NY-IT-291-rev.00
IT	Set-Up for Windows Wireless Network	NE292_00	S-NY-IT-292-rev.00
GC	Analysis of BZ4 and BZ10 by Modified SW-846 Method 8082 with CQCS Analysis	NE293_00	S-NY-O-293-rev.00
GC	Low Level Congener-Specific PCB Quantification by GC/ECD	NE294_00	S-NY-O-294-rev.00
INORG	Inductively Coupled Plasma (ICP) Thermo Analysis Using SW-846 6010B, 200.7, and 200.2	NE295_00	S-NY-I-295-rev.00
SAFETY	Rescue Alert Lanyard System	NE296_00	S-NY-S-296-rev.00

INORG	Synthetic Precipitation Leaching Procedure	NE297_00	S-NY-I-297-rev.00
INORG	Hexavalent Chromium by 7196A	NE298_00	S-NY-I-298-rev.00
GC	Extractable Total petroleum Hydrocarbons (ETPH)	NE299_00	S-NY-O-299-rev.00

ATTACHMENT VI- LABORATORY CERTIFICATION LIST

Program Category	Accrediting Agency	Certification #	Expiration Date
Drinking Water	Department of Health- Environmental Laboratory Accreditation Program	11078	4/1/2011
Non-Potable Water	Department of Health- Environmental Laboratory Accreditation Program	11078	4/1/2011
Solid and Hazardous Waste	Department of Health- Environmental Laboratory Accreditation Program	11078	4/1/2011
Air Emissions	Department of Health- Environmental Laboratory Accreditation Program	11078	4/1/2011
Non-Potable Water	Department of Public Health Environmental Health section	PH-0337	12/31/2012
Wastewater	Department of Public Health Environmental Health section	PH-0337	12/31/2012
Solid Waste/ Soil	Department of Public Health Environmental Health section	PH-0337	12/31/2012
Non-Potable Water	The Commonwealth of Massachusetts Department of Environmental Protection	M-NY906	6/30/2011
Solid and Hazardous Waste	State of New Jersey Department of Environmental Protection	NY026	6/30/2011
Wastewater/ Groundwater	State of North Carolina Department of the Environment and Natural Resources	668	12/31/2011
Permit to Move Live Plant Pests, Noxious Weeds, am Soil	United States Department of Agriculture Animal and Plant Health Inspection Service	P526P-09-02260	7/15/2012

ATTACHMENT VII- PACE CHAIN-OF-CUSTODY



ATTACHMENT VIII- METHOD HOLD TIME, CONTAINER AND PRESERVATION GUIDE

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Acidity	SM2310B	Water	Plastic/Glass	$\leq 6^oC$	14 Days
Actinides	HASL-300	Water		pH<2 HNO_3	180 Days
Actinides	HASL-300	Solid		None	180 Days
Alkalinity	SM2320B/310.2	Water	Plastic/Glass	$\leq 6^oC$	14 Days
Alkylated PAHs		Water		$\leq 6^oC$; pH<2 1:1 HCl (optional)	14/40 Days preserved; 7/40 Days unpreserved
Alkylated PAHs		Solid		$\leq 10^oC$	1 Year/40 Days
Total Alpha Radium (see note 3)	9315/903.0	Water	Plastic/Glass	pH<2 HNO_3	180 days
Total Alpha Radium (see note 3)	9315	Solid		None	180 days
Anions (Br, Cl, F, NO_2, NO_3, o-Phos, SO_4 , bromate, chlorite, chlorate)	300.0/300.1/SM4110B	Water	Plastic/Glass	$\leq 6^oC$; EDA if bromate or chlorite run	All analytes 28 days except: NO_2, NO_3, o-Phos (48 Hours); chlorite (immediately for 300.0; 14 days for 300.1). NO_2/NO_3 combo 28 days.
Anions (Br, Cl, F, NO_2, NO_3, o-Phos, SO_4 , bromate, chlorite, chlorate)	300.0	Solid	Plastic/Glass	$\leq 6^oC$	All analytes 28 days except: NO_2, NO_3, o-Phos (48 hours); chlorite (immediately). NO_2/NO_3 combo 28 days.
Anions (Br, Cl, F, NO_2, NO_3, o-Phos, SO_4	9056	Water/ Solid	Plastic/Glass	$\leq 6^oC$	28 days
Aromatic and Halogenated	8021	Solid	5035 vial kit	See note 1	14 days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Volatiles (see note 1)					
Aromatic and Halogenated Volatiles	602/8021	Water	40mL vials	pH<2 HCl; ≤ 6°C; $Na_2S_2O_3$ if Cl present	14 Days (7 Days for aromatics if unpreserved)
Acid Volatile Sulfide	Draft EPA 1629	Solid	8oz Glass	≤ 6°C	14 Days
Bacteria, Total Plate Count	SM9221D	Water	Plastic/WK	≤ 6°C; $Na_2S_2O_3$	24 Hours
Base/Neutrals and Acids	8270	Solid	8oz Glass	≤ 6°C	14/40 Days
Base/Neutrals and Acids	625/8270	Water	1L Amber Glass	≤ 6°C; $Na_2S_2O_3$ if Cl present	7/40 Days
Base/Neutrals, Acids & Pesticides	525.2	Water	1L Amber Glass	pH<2 HCl; ≤ 6°C; Na sulfite if Cl present	14/30 Days
Biomarkers		Water	≤ 6°C; pH<2 1:1 HCl (optional)	14/40 Days preserved; 7/40 Days unpreserved	≤ 6°C; pH<2 1:1 HCl (optional)
Biomarkers		Solid	≤ 10°C	1 Year/40 Days	≤ 10°C
BOD/cBOD	SM5210B	Water	Plastic/Glass	≤ 6°C	48 hours
BTEX/Total Hydrocarbons	TO-3	Air	Summa Canister	None	14 Days
BTEX/Total Hydrocarbons	TO-3	Air	Tedlar Bag or equivalent	None	48 Hours
Cation/Anion Balance	SM1030E	Water	Plastic/Glass	None	None
Cation Exchange	9081	Solid	8oz Glass	None	Unknown
Chloride	SM4500Cl-C,E	Water	Plastic/Glass	None	28 Days
Chlorine, Residual	SM4500Cl-D,E,G/330.5/Hach 8167	Water	Plastic/Glass	None	15 Minutes

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Chlorophyll	SM10200H	Water	Opaque bottle or aluminum foil		
COD	SM5220C, D/410.4/Hach 8000	Water	Plastic/Glass	pH<2 H_2SO_4; ≤ 6°C	28 Days
Coliform, Fecal	SM9222D	Water	100mL Plastic	≤ 6°C	6 Hours
Coliform, Fecal	SM9222D	Solid	100mL Plastic	≤ 6°C	6 Hours
Coliform, Total and Escherichia (E. coli)	SM9223B	Water	100mL Plastic	≤ 10°C	48 Hours after collection; results from samples analyzed 30-48 hours after collection must be qualified as analyzed >30 hours
Color	SM2120B,E	Water	Covered Plastic/Acid Washed Amber Glass	≤ 6°C	24 Hours
Condensable Particulate Emissions	EPA 202	Air	Solutions	None	6 Months
Cyanide, Reactive	SW846 chap.7	Water	Plastic/Glass	None	28 Days
Cyanide, Reactive	SW846 chap.7	Solid	Plastic/Glass	None	28 Days
Cyanide, Total and Amenable	SM4500CN-A,B,C,D,E,G,I,N/9010/9012/335.4	Water	Plastic/Glass	pH≥12 NaOH; ≤ 6°C; ascorbic acid if Cl present	14 Days (24 Hours if sulfide present-applies to SM4500CN only)
Diesel Range Organics- Alaska DRO	AK102	Solid	8oz Glass	≤ 6°C	14/40 Days
Diesel Range Organics- Alaska DRO	AK102	Water	1L Glass	pH<2 HCl; ≤ 6°C	14/40 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Diesel Range Organics- TPH DRO	8015	Solid	8oz Glass Jar	≤ 6°C	14/40 Days
Diesel Range Organics- TPH DRO	8015	Water	1L Amber Glass	≤ 6°C; $Na_2S_2O_3$ if Cl present	7/40 Days
Diesel Range Organics- TPH DRO	8015	Tissue	1L Amber Glass	≤ - 10°C	1 Year if frozen/40 Days
Diesel Range Organics- NwTPH-Dx	Nw-TPH-Dx	Solid	8oz Glass Jar	≤ 6°C	14/40 Days
Diesel Range Organics- NwTPH-Dx	Nw-TPH-Dx	Water	1L Amber Glass	pH <2 HCl; ≤ 6°C	14/40 Days; 7 Days from collection to extraction if unpreserved
Diesel Range Organics- Wisconsin DRO	WI MOD DRO	Solid	Tared 4oz Glass Jar	≤ 6°C	10/47 Days
Diesel Range Organics- Wisconsin DRO	WI MOD DRO	Water	1L Amber Glass	≤ 6°C	14/40 Days
Dioxins and Furans	1613B	Solid	8oz Glass	≤ -10°C	1 year
Dioxins and Furans	1613B	Water	1L Amber Glass	≤ 6°C; $Na_2S_2O_3$ if Cl present	1 year
Dioxins and Furans	1613B	Fish/ Tissue	Aluminum foil	< -10°C	1 year
Dioxins and Furans	8290	Water	1L Amber Glass	≤ 6°C; $Na_2S_2O_3$ if Cl present	30/45 Days
Dioxins and Furans	8290	Solid	8oz Glass	≤ 6°C	30/45 Days
Dioxins and Furans	8290	Fish/ Tissue	Not specified	< -10°C	30/45 Days
Dioxins and Furans	TO-9	Air	PUF	None	30/45 Days
EDB/DBCP (8011) EDB/DBCP/1,2,3-TCP (504.1)	504.1/8011	Water	40mL vials	≤ 6°C; $Na_2S_2O_3$ if Cl	14 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
				present	
Explosives	8330/8332	Water	1L Amber Glass	≤ 6°C	7/40 Days
Explosives	8330/8332	Solid	8oz Glass Jar	≤ 6°C	14/40 Days
Extractable Petroleum Hydrocarbons (aliphatic and aromatic)	MA-EPH	Water	1L Amber Glass	pH<2 HCl; ≤ 6°C	14/40 Days
Extractable Petroleum Hydrocarbons (aliphatic and aromatic)	MA-EPH	Solid	4oz Glass Jar	≤ 6°C	7/40 Days
Ferrous Iron	SN3500Fe-D	Water	Glass	None	Immediate
Flashpoint/Ignitability	1010	Liquid	Plastic/Glass	None	28 Days
Fluoride	SM4500Fl-C,D	Water	Plastic	None	28 Days
Gamma Emitting Radionuclides	901.1	Water	Plastic/Glass	pH<2 HNO_3	180 days
Gasoline Range Organics	8015	Water	40mL vials	pH<2 HCl	14 Days
Gasoline Range Organics	8015	Solid	5035 vial kit	See note 1	14 days
Gasoline Range Organics-Alaska GRO	AK101	Solid	5035 vial kit	See 5035 note*	28 Days if GRO only (14 Days with BTEX)
Gasoline Range Organics-Alaska GRO	AK101	Water	40mL vials	pH<2 HCl; ≤ 6°C	14 Days
Gasoline Range Organics-NwTPH-Gx	Nw-TPH-Gx	Water	40mL vials	pH<2 HCl; ≤ 6°C	7 Days unpreserved; 14 Days preserved
Gasoline Range Organics-NwTPH-Gx	Nw-TPH-Gx	Solid	40mL vials	≤ 6°C; packed jars with no headspace	14 Days
Gasoline Range Organics-Wisconsin GRO	WI MOD GRO	Water	40mL vials	pH<2 HCl; ≤ 6°C	14 Days
Gasoline Range Organics-Wisconsin GRO	WI MOD GRO	Solid	40mL MeOH vials	≤ 6°C in MeOH	21 Days
Gross Alpha (NJ 48Hr Method)	NJAC 7:18-6	Water	Plastic/Glass	pH<2 HNO_3	48 Hrs

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Gross Alpha and Gross Beta	9310/900.0	Water	Plastic/Glass	pH<2 HNO_3	180 Days
Gross Alpha and Gross Beta	9310	Solid	Glass	None	180 Days
Haloacetic Acids	552.1/552.2	Water	40mL Amber vials	NH_4Cl; ≤ 6°C	14/7 Days if extracts stored ≤ 6°C or 14/14 Days if extracts stored at ≤ -10°C
Hardness, Total ($CaCO_3$)	SM2340B,C/130.1	Water	Plastic/Glass	pH<2 HNO_3	6 Months
Heterotrophic Plate Count (MPC)	SM9215B	Water	100mL Plastic	≤ 6°C	24 Hours
Herbicides, Chlorinated	8151	Solid	8oz Glass Jar	≤ 6°C	14/40 Days
Herbicides, Chlorinated	8151	Water	1L Amber Glass	≤ 6°C; $Na_2S_2O_3$ if Cl present	7/40 Days
Herbicides, Chlorinated	515.1/515.3	Water	1L Amber Glass	≤ 6°C; $Na_2S_2O_3$ if Cl present	14/28 Days
Hexavalent Chromium	7196/218.6/SM3500Cr-C,D	Water	Plastic/Glass	≤ 6°C	24 Hours
Hexavalent Chromium	7196 (with 3060A)	Solid		≤ 6°C	24 Hours after extraction
Hydrogen Halide and Halogen Emissions	EPA 26	Air	Solutions	None	6 Months
Ignitability of Solids	1030	Non-liquid Waste	Plastic/Glass	None	28 Days
Lead Emissions	EPA 12	Air	Filter/Solutions	None	6 Months
Lipids	Pace Lipids	Tissue	Plastic/Glass	≤ -10°C	1 Year if frozen
Mercury, Low-Level	1631E	Solid			
Mercury, Low-Level	1631E	Water	Fluoropolymer bottles (Glass if Hg is only analyte being	12N HCl or BrCl	48 Hours for preservation or analysis; 28 Days to preservation if

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
			tested)		sample oxidized in bottle; 90 Days for analysis if preserved
Mercury, Low-Level	1631E	Tissue	Plastic/Glass	≤ - 10°C	28 Days if frozen
Mercury	7471	Solid	8oz Glass Jar	≤ 6°C	28 days
Mercury	7470/245.1/245.2	Water	Plastic/Glass	pH<2 HNO_3	28 Days
Mercury	7471/245.6	Tissue	Plastic/Glass	≤ - 10°C	28 Days if frozen
Metals (GFAA)	7000/200.9	Water	Plastic/Glass	pH<2 HNO_3	6 Months
Metals (ICP)	NIOSH 7300A/7303	Air	Filters	None	6 Months
Metals (ICP/ICPMS)	6010/6020	Solid	8oz Glass Jar	None	6 months
Metals (ICP/ICPMS)	6010/6020/200.7/200.8	Water	Plastic/Glass	pH<2 HNO_3	6 Months
Metals (ICP/ICPMS)	6020	Tissue	Plastic/Glass	≤ -10°C	6 Months if frozen
Methane, Ethane, Ethene	8015 modified	Water	40mL vials	HCl	14 Days
Methane, Ethane, Ethene	RSK-175	Water	40mL vials	HCl	14 Days
Methane, Ethane, Ethene	EPA 3C	Air	Summa Canister	None	14 Days
Methane, Ethane, Ethene	EPA 3C	Air	Tedlar Bag or equivalent	None	48 Hours
Methanol, Ethanol	8015 modified	Water	40mL vials	≤ 6°C	14 Days
Methanol, Ethanol	8015 modified	Solid	2oz Glass	≤ 6°C	14 Days
Nitrogen, Ammonia	SM4500NH3/350.1	Water	Plastic/Glass	pH<2 H_2SO_4; ≤ 6°C	28 Days
Nitrogen, Kjeldahl (TKN)	351.2	Solid	Plastic/Glass	≤ 6°C	28 Days
Nitrogen, Kjeldahl (TKN)	SM4500-Norg/351.2	Water	Plastic/Glass	pH<2 H_2SO_4; ≤ 6°C	28 Days
Nitrogen, Nitrate	SM4500-NO3/352.1	Water	Plastic/Glass	≤ 6°C	24 Hours preferred
Nitrogen, Nitrate & Nitrite combination	353.2	Solid	Plastic/Glass	≤ 6°C	28 Days
Nitrogen, Nitrate & Nitrite combination	SM4500-NO3/353.2	Water	Plastic/Glass	pH<2 H_2SO_4; ≤ 6°C	28 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Nitrogen, Nitrite or Nitrate separately	SM4500-NO2/353.2	Water	Plastic/Glass	$\leq 6^oC$	48 Hours
Nitrogen, Organic	SM4500-Norg/351.2	Water	Plastic/Glass	pH<2 H_2SO_4; $\leq 6^oC$	28 Days
Non-Methane Organics	EPA 25C	Air	Summa Canister	None	14 Days
Non-Methane Organics	EPA 25C	Air	Tedlar Bag or equivalent	None	48 Hours
Odor	SM2150B	Water	Glass	$\leq 6^oC$	24 Hours
Oil and Grease/HEM	1664A/SM5520B/9070	Water	Glass	pH<2 H_2SO_4 or HCl; $\leq 6^oC$	28 Days
Oil and Grease/HEM	9071	Solid	Glass	$\leq 6^oC$	28 Days
PBDEs	1614	Water	1L Amber Glass	$\leq 6^oC$	1 Year/1 Year
PBDEs	1614	Solid	Wide Mouth Jar	$\leq 6^oC$	1 Year/1 Year
PBDEs	1614	Tissue	Aluminum Foil	$\leq -10^oC$	1 Year/1 Year
PCBs and Pesticides, Organochlorine (OC)	TO-4/TO-10	Air	PUF	None	7/40 Days
PCBs and Pesticides, Organochlorine (OC)	608	Water	1L Amber Glass		Pest: 7/40 Days; PCB: 1 Year/1 Year
Pesticides, Organochlorine (OC)	8081	Water	1L Amber Glass	$\leq 6^oC$; $Na_2S_2O_3$ if Cl present	7/40 Days
Pesticides, Organochlorine (OC)	8081	Solid	8oz Glass Jar	$\leq 6^oC$	14/40 Days
Pesticides, Organochlorine (OC)	8081	Tissue	8oz Glass Jar	$\leq -10^oC$	1 Year if frozen/40 Days
Pesticides, Organophosphorus (OP)	8141	Solid	8oz Glass Jar	$\leq 6^oC$	14/40 Days
Pesticides, Organophosphorus (OP)	8141	Water	1L Amber Glass	pH 5-8 with NaOH or	7/40 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
				H_2SO_4; ≤ 6°C; $Na_2S_2O_3$ if Cl present	
PCBs (Aroclors)	8082	Water	1L Amber Glass	≤ 6°C; $Na_2S_2O_3$ if Cl present	1 Year/1 Year
PCBs (Aroclors)	8082	Solid	8oz Glass Jar	≤ 6°C	1 Year/1 Year
PCBs (Aroclors)	8082	Tissue	Plastic/Glass	≤ -10°C	1 Year if frozen/1 Year
PCB Congeners	1668A	Water	1L Amber Glass	≤ 6°C but above freezing	1 Year/1 Year
PCB Congeners	1668A	Solid	4-8oz Glass Jar	≤ 6°C but above freezing	1 Year/1 Year
PCB Congeners	1668A	Tissue	4-8oz Glass Jar	≤ -10°C	1 Year/1 Year
Oil Range Organics- ORO					
Oxygen, Dissolved (Probe)	SM4500-O	Water	Glass	None	15 minutes
Paint Filter Liquid Test	9095	Water	Plastic/Glass	None	N/A
Particulates	PM-10	Air	Filters	None	6 Months
Permanent Gases	EPA 3C	Air	Summa Canister	None	14 Days
Permanent Gases	EPA 3C	Air	Tedlar Bag or equivalent	None	48 Hours
pH	SM4500H+B/9040	Water	Plastic/Glass	None	15 minutes
pH	9045	Solid	Plastic/Glass	None	
Phenol, Total	420.1/420.4/9065/9066	Water	Glass	pH<2 H_2SO_4; ≤ 6°C	28 Days
Phosphorus, Orthophosphate	SM4500P/365.1/365.3	Water	Plastic	Filter; ≤ 6°C	Filter within 15 minutes, Analyze within 48 Hours
Phosphorus, Total	SM4500P/	Water	Plastic/Glass	pH<2 H_2SO_4;	28 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
	365.1/365.3/365.4			≤ 6°C	
Phosphorus, Total	365.4	Solid	Plastic/Glass	≤ 6°C	28 Days
Polynuclear Aromatic Hydrocarbons (PAH)	TO-13	Air	PUF	None	7/40 Days
Polynuclear Aromatic Hydrocarbons (PAH)	8270 SIM	Solid	8oz Glass Jar	≤ 6°C	14/40 Days
Polynuclear Aromatic Hydrocarbons (PAH)	8270 SIM	Water	1L Amber Glass	≤ 6°C; $Na_2S_2O_3$ if Cl present	7/40 Days
Polynuclear Aromatic Hydrocarbons (PAH)	8270 SIM	Tissue	Plastic/Glass	≤ -10°C	1 Year if frozen/40 Days
Radioactive Strontium	905.0	Water	Plastic/Glass	pH<2 HNO_3	180 days
Radium-226	903.0/903.1	Water	Plastic/Glass	pH<2 HNO_3	180 days
Radium-228 (see note 3)	9320/904.0	Water	Plastic/Glass	pH<2 HNO_3	180 days
Radium-228 (see note 3)	9320	Solid			
Residual Range Organics-Alaska RRO	AK103	Solid	8oz Glass	≤ 6°C	14/40 Days
Saturated Hydrocarbons		Water	≤ 6°C; pH<2 1:1 HCl (optional)	14/40 Days preserved; 7/40 Days unpreserved	≤ 6°C; pH<2 1:1 HCl (optional)
Saturated Hydrocarbons		Solid	≤ 10°C	1 Year/40 Days	≤ 10°C
Silica, Dissolved	SM4500Si-D	Water	Plastic	≤ 6°C	28 Days
Solids, Settleable	SM2540F	Water	Glass	≤ 6°C	48 Hours
Solids, Total	SM2540B	Water	Plastic/Glass	≤ 6°C	7 Days
Solids, Total	SM2540G	Solid	Plastic/Glass	≤ 6°C	7 Days
Solids, Total (FOC, OM, Ash)	ASTM D2974	Solid	Plastic/Glass	≤ 6°C	7 Days
Solids, Total Dissolved	SM2540C	Water	Plastic/Glass	≤ 6°C	7 Days
Solids, Total Suspended	SM2540D/USGS I-3765-85	Water	Plastic/Glass	≤ 6°C	7 Days
Solids, Total Volatile	160.4/SM2540E	Water	Plastic/Glass	≤ 6°C	7 Days
Solids, Total Volatile	160.4	Solid	Plastic/Glass	≤ 6°C	7 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Specific Conductance	SM2510B/9050/120.1	Water	Plastic/Glass	≤ 6°C	28 Days
Stationary Source Dioxins and Furans	EPA 23	Air	XAD Trap	None	30/45 Days
Stationary Source Mercury	EPA 101	Air	Filters	None	6 Months, 28 Days for Hg
Stationary Source Metals	EPA 29	Air	Filters	None	6 Months, 28 Days for Hg
Stationary Source PM10	EPA 201A	Air	Filters	None	6 Months
Stationary Source Particulates	EPA 5	Air	Filter/Solutions	None	6 Months
Sulfate	SM4500SO4/9036/ 9038/375.2/ASTM D516	Water	Plastic/Glass	≤ 6°C	28 Days
Sulfide, Reactive	SW-846 Chap.7	Water	Plastic/Glass	None	28 Days
Sulfide, Reactive	SW-846 Chap.7	Solid	Plastic/Glass	None	28 Days
Sulfide, Total	SM4500S/9030	Water	Plastic/Glass	pH>9 NaOH; ZnOAc; ≤ 6°C	7 Days
Sulfite	SM4500SO3	Water	Plastic/Glass	None	15 minutes
Surfactants (MBAS)	SM5540C	Water	Plastic/Glass	≤ 6°C	48 Hours
Total Organic Carbon (TOC)	SM5310B,C,D/9060	Water	Glass	pH<2 H_2SO_4 or HCl; ≤ 6°C	28 Days
Total Organic Carbon (TOC)	9060/Walkley Black	Solid	Glass	≤ 6°C	14 Days
Total Organic Halogen (TOX)	SM5320/9020/9021	Water	Glass; no headspace	≤ 6°C	14 Days
Tritium	906.0	Water	Glass	None	180 days
Turbidity	SM2130B/180.1	Water	Plastic/Glass	≤ 6°C	48 Hours
Total Uranium	908.0/ASTM D5174-97	Water	Plastic/Glass	pH<2 HCl	180 days
Volatile Petroleum Hydrocarbons (aliphatic and aromatic)	MA-VPH	Water	40mL vials	pH<2 HCl; ≤ 6°C	14 Days preserved
Volatile Petroleum	MA-VPH	Solid	4-8oz Glass Jar	≤ 6°C;	7/28 Days

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Hydrocarbons (aliphatic and aromatic)				packed jars with no headspace	
Volatiles	TO-14	Air	Summa Canister	None	30 Days
Volatiles	TO-14	Air	Tedlar Bag or equivalent	None	48 Hours
Volatiles	TO-15	Air	Summa Canister	None	30 Days
Volatiles	8260	Solid	5035 vial kit	See note 1	14 days
Volatiles	8260	Water	40mL vials	pH<2 HCl; ≤ 6°C; $Na_2S_2O_3$ if Cl present	14 Days
Volatiles	8260	Conc. Waste	5035 vial kit or 40mL vials	≤ 6°C	14 Days
Volatiles	624	Water	40mL vials	pH<2 HCl; ≤ 6°C; $Na_2S_2O_3$ if Cl present	14 Days (7 Days for aromatics if unpreserved)
Volatiles (see note 2)	524.2	Water	40mL vials (in duplicate)	pH<2 HCl; ≤ 6°C; Ascorbic acid or $Na_2S_2O_3$ if Cl present[2]	14 Days

[1] **5035/5035A Note**: 5035 vial kit typically contains 2 vials water, preserved by freezing **or**, 2 vials aqueous sodium bisulfate preserved at 4°C, **and** one vial methanol preserved at ≤6°C **and** one container of unpreserved sample stored at ≤6°C.

[2] Method 524.2 lists ascorbic acid as the preservative when residual chlorine is suspected, unless gases or Table 7 compounds are NOT compounds of interest and then sodium thiosulfate is the preservative recommended.

[3] Methods 9315 and 9320 both state that if samples are unpreserved, the samples should be brought to the lab within 5 days of collection, preserved in the lab, and then allowed to sit for a minimum of 16 hours before sample preparation/analysis.

Cover Page:

Quality Assurance Manual

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Quality Assurance Manual
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Technical Supervisor - **(Wet Chemistry)** – Mike Wesoloski	12/08/11 Date
Director of Project Management – David Miller	12/07/11 Date
General Manager – Albert F. Vicinie	12/16/11 Date

SECTION 2

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REFERENCED CORPORATE SOPs AND POLICIES

SOP / Policy Reference	Title
CA-Q-S-001	Solvent and Acid Lot Testing and Approval
CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-004	Method Compliance & Data Authenticity Audits
CA-Q-S-006	Detection Limits
CA-Q-S-008	Management Systems Review
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)
CW-L-S-002	Internal Investigation of Potential Data Discrepancies and Determination for Data Recall
CA-L-S-002	Subcontracting Procedures
CW-L-P-004	Ethics Policy
CA-L-P-002	Contract Compliance Policy
CW-F-P-002	Authorization Matrix
CW-F-P-004	Procurement and Contracts Policy

SOP / Policy Reference	Title
CA-C-S-001	Work Sharing Process
CA-T-P-001	Qualified Products List
CW-F-S-007	Controlled Purchases Policy
CW-F-S-018	Vendor Selection
CA-Q-M-002	Corporate Quality Management Plan
CW-E-M-001	Corporate Environmental Health & Safety Manual

REFERENCED LABORATORY SOPs

SOP Reference	Title
PT-QA-001	Employee Orientation and Training (DOCs) (Sec. 17.3) & (Sec. 19.4.2)
PT-QA-002	Internal Auditing
PT-QA-003	Glassware Clean-up for Organic/Inorganic Procedures
PT-QA-005	Uncertainty Measurement
PT-QA-006	Procurement of Standards and Materials; Labeling and Traceability
PT-QA-007	Detection Limits (Sec. 19.7)
PT-QA-008	Thermometer Calibration and Temperature Monitoring
PT-QA-010	Preparation and Management of Standard Operating Procedures (SOPs) and Other Controlled Documents (Sec. 3.4.1) & (Sec. 19.2)
PT-QA-011	Data Recording Requirements
PT-QA-012	Selection and Calibration of Balances and Weights
PT-QA-013	Independent QA Data Review
PT-QA-016	Nonconformance and Corrective Action System (Sec .10.1)
PT-QA-017	Aqueous Pipette / Dispenser Calibration – Gravimetric Method
PT-QA-018	Technical Data Review Requirements
PT-QA-019	Records Information Management
PT-QA-020	Report Production (Sec. 14.1.4)
PT-QA-021	Quality Control Requirements
PT-QA-022	Equipment Maintenance
PT-QA-024	Subsampling (22.5)
PT-QA-025	DoD QSM Version 3 Requirements
PT-QA-026	Container Accuracy Verification – Gravimetric
PT-QA-027	Sample Receiving and Chain of Custody (Sec. 23.2.1.3)
PT-QA-028	Bottle and Cooler Preparation

SOP Reference	Title
PT-QA-029	DoD QSM Version 4.2 Requirements
PT-IT-W-001	Servers Data Back-up and Computer Systems Security (Sec. 19.14.1)
PT-QA-W-002	SOP List

SECTION 3. INTRODUCTION , *SCOPE AND APPLICABILITY*

3.1 INTRODUCTION AND COMPLIANCE REFERENCES

TestAmerica Pittsburgh's Quality Assurance Manual (QAM) is a document prepared to define the overall policies, organization objectives and functional responsibilities for achieving TestAmerica's data quality goals. The laboratory maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.

The QAM has been prepared to assure compliance with The NELAC Institute (TNI) Standard, dated 2009, Volume 1 Modules 2 and 4, and ISO/IEC Guide 17025:2005(E) **or DoD ELAP.**(TNI). In addition, the policies and procedures outlined in this manual are compliant with TestAmerica's Corporate Quality Management Plan (CQMP) and the various accreditation and certification programs listed in Appendix 3. The CQMP provides a summary of TestAmerica's quality and data integrity system. It contains requirements and general guidelines under which all TestAmerica facilities shall conduct their operations.

The QAM has been prepared to be consistent with the requirements of the following documents:

- EPA 600/4-88/039, *Methods for the Determination of Organic Compounds in Drinking Water,* EPA, Revised July 1991.
- EPA 600/R-95/131, *Methods for the Determination of Organic Compounds in Drinking Water,* Supplement III, EPA, August 1995.
- EPA 600/4-79-019, *Handbook for Analytical Quality Control in Water and Wastewater Laboratories,* EPA, March 1979.
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008.*
- *U.S. Department of Defense, Quality Systems Manual for Environmental Laboratories, Version 4.2, October 2010.*
- *Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261.*
- *Statement of Work for Inorganics & Organics Analysis, SOM and ISM, current versions, USEPA Contract Laboratory Program Multi-media, Multi-concentration.*

- APHA, *Standard Methods for the Examination of Water and Wastewater,* 18th Edition, 19th, 20th, 21st and on-line Editions.
- *U.S. Department of Energy* Order 414.1C, *Quality Assurance*, June 17, 2005.
- *U.S. Department of Energy*, *Quality Systems for Analytical Services*, Revision 3.6, November 2010.
-
- U.S. Department of Defense, *Air Force Center for Environmental Excellence Quality Assurance Project Plan (QAPP),* Version 4.0.02, May 2006.
- Nuclear Regulatory Commission (NRC) quality assurance requirements.
- Marine Protection, Research, and Sanctuaries Act (MPRSA).
- Toxic Substances Control Act (TSCA).

3.2 TERMS AND DEFINITIONS

A Quality Assurance Program is a company-wide system designed to ensure that data produced by the laboratory conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. The TestAmerica program is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

Refer to Appendix 2 for the Glossary/Acronyms.

3.3 SCOPE / FIELDS OF TESTING

The laboratory analyzes a broad range of environmental and industrial samples every month. Sample matrices vary among, effluent water, groundwater, hazardous waste, sludge, soils and tissue. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical, physical and biological parameters. The Program also contains guidelines on maintaining documentation of analytical processes, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all analytical requests are thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found in Tables 3-1-3-6. The current list of accredited methods is maintained with the scope of accreditation which is maintained in the QA files in N:\QA\01_Facility_QA_Documents\04_Certifications.The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet these requirements. All methods performed by the laboratory shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual. In these cases, the laboratory will abide by the requested criteria following review and

acceptance of the requirements by the Laboratory Director and the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director and the QA Manager must determine if it is in the lab's best interest to follow the less stringent requirements.

3.3.1 Specialty Analyses

3.3.1.1 Dredged Material Evaluations

TestAmerica Pittsburgh offers trace level testing of waters (site-waters and elutriates), sediments, and tissues in support of Dredged Material Evaluations for in-water (ocean and inland waters) and upland (Confined Disposal Facilities (CDFs), beneficial use, etc.) disposal options. In-house capabilities for commonly requested sediment program parameters include:

- Organochlorine Pesticides
- Organophosphorus Pesticides
- PCBs (as Aroclors)
- Volatile Organics
- Semivolatile Organics
- Polynuclear Aromatic Hydrocarbons (PAHs)
- Metals
- Cyanide
- Total Sulfides
- Acid Volatile Sulfide (AVS) and Simultaneously Extracted Metals (SEM)
- Nitrogen, Ammonia
- Nitrogen, Nitrate + Nitrite
- Biochemical Oxygen Demand (BOD)
- Chemical Oxygen Demand (COD)
- Total Organic Carbon (combustion procedure for sediments)
- Total Solids/Moisture Content
- Total Volatile Solids
- Lipids
- With teaming arrangements with other TestAmerica facilities, additional sediment program capabilities include:

- Polychlorinated Dibenzo-Dioxins and Furans (PCDDs/PCDFs)
- Butyl Tins (mono – tetra)
- Total Kjeldahl Nitrogen
- Total Phosphorus
- Grain Size
- Specific Gravity
- Atterberg Limits
- PCBs (as Congeners)

TestAmerica Pittsburgh also generates elutriate samples following appropriate U.S. Army Corps of Engineers procedures. These include:

- Standard Elutriate Test (SET) for in-water disposal evaluations, and
- Modified Elutriate Test (MET) or Effluent Elutriate Test (EET) for CDF disposal evaluations.
- Illinois Resuspension Tests (Supernatant and Elutriate Tests).
- Dredge Elutriate Test (DRET)

TestAmerica Pittsburgh currently supports dredge material evaluation projects following several state specific programs, as well as, under the following guidance documents:

- Ocean Testing Manual or OTM (USACE, 1991).
- New Jersey's Tidal Waters Technical Manual (NJDEP, 1997).
- Inland Testing Manual or ITM (USACE, 1998).
- Upland Testing Manual or UTM (USACE, 2003).

3.3.1.2 Tissue Analyses

TestAmerica Pittsburgh has extensive experience in supporting projects requiring tissue analyses. These include analyses of laboratory cultured reference species from bioaccumulation tests associated with dredged material evaluations to a variety of field collected species (aquatic and terrestrial). TestAmerica Pittsburgh has developed modifications to the standard solid methodologies (where possible) to allow for the use of smaller sample weights and achieve lower quantitation limits. In-house capabilities for commonly requested tissue parameters include:

- Organochlorine Pesticides
- PCBs (as Aroclors)
- Semivolatile Organics
- Polynuclear Aromatic Hydrocarbons (PAHs)
- Metals
- Lipids
- Moisture Content

With teaming arrangements with other TestAmerica facilities, additional tissue capabilities include:

- Polychlorinated Dibenzo-Dioxins and Furans (PCDDs/PCDFs)
- Butyl Tins (mono – tetra)
- PCBs (as Congeners)

3.4 MANAGEMENT OF THE MANUAL

3.4.1 Review Process

The template on which this manual is based is reviewed annually by Corporate Quality Management Personnel to assure that it remains in compliance with Section 3.1. This manual itself is reviewed annually by senior laboratory management to assure that it reflects current practices and meets the requirements of the laboratory's clients and regulators as well as the CQMP. Occasionally, the manual may need changes in order to meet new or changing regulations and operations. The QA Manager will review the changes in the normal course of business and incorporate changes into revised sections of the document. All updates will be reviewed by the senior laboratory management staff. The laboratory updates and approves such changes according to our Document Control & Updating procedures (refer to SOP No. PT-QA-010).

Laboratory-specific QAM changes are approved and documented through the periodic and annual reviews as per SOP No. PT-QA-010, Preparation and Management of Standard Operating Procedures (SOPs) and Other Controlled Documents.

Table 3-1

Wet Chemistry Methods

Analytical Parameters	Matrix	Fields of Testing		
		CWA/NPDES	RCRA (SW846)	Other
Acidity	Water	SM 2310B (4a)	---	---
	Waste	---	---	---
Alkalinity	Water	2320B	---	---
	Waste	---	---	---
Biochemical Oxygen Demand (plus CBOD)	Water	5210B	---	---
Bromide	Water	EPA 300.0	SW 9056A	---
	Waste	---	SW 9056A	---
	Solid	---	SW 9056A	---
Chemical Oxygen Demand	Water	EPA 410.4	---	---
	Solid	EPA 410.4 (M)	---	---
Chloride	Water	EPA 300.0 SM 4500 CL E	SW 9056A	---
	Waste	---	SW 9056A	---
	Solid	---	SW 9056A	---
Chromium, Hexavalent	Water	SM 3500-Cr-B (SM 20)	SW 7196A/ 6800	---
	Waste	---	SW 3060A/7196A/6800	---
	Solid	---	SW 3060A/7196A	---
Color	Water	SM 2120B	---	---
	Waste	---	---	---
	Solid	---	---	---
Specific Conductance	Water	EPA 120.1	SW 9050A	---
	Waste	EPA 120.1	SW 9050A	---
Cyanide (Total)	Water	EPA 335.4	SW 9012A/B	
	Waste	EPA 335.4	SW 9012A/B	
	Solid	---	SW 9012A/B	
Cyanide (Available)	Water	EPA 1677	---	---

Table 3-1

Wet Chemistry Methods

Analytical Parameters	Matrix	Fields of Testing		
		CWA/NPDES	**RCRA (SW846)**	**Other**
	Waste	EPA 1677	9013 Extraction	---
	Solid	EPA 1677	9013 Extraction	---
Fluoride	Water	EPA 300.0	SW 9056A	---
	Waste	EPA 300.0 (M)	SW 9056A	---
	Solid	--	SW 9056A	---
Ignitability (Flashpoint)	Water	---	SW 1010A/ 1020B	---
	Waste	---	SW 7.1.2 SW 1010A/ 1020B	---
Hardness	Water	SM2340 B & C	---	---
Moisture	Solid	---	) SM 2540 G	
Nitrogen, Ammonia	Water	EPA 350.1	---	---
	Waste	EPA 350.1 (M)	---	---
	Solid	EPA 350.1 (M)	---	---
Nitrite (NO_2)	Water	EPA 300.0 EPA 353.2	SW 9056A	---
	Waste	---	SW 9056A	---
	Solid	EPA 300.0 (M) EPA 353.2 (M)	SW 9056A	---
Nitrate (NO_3)	Water	EPA 300.0	SW 9056A	---
	Waste	---	SW 9056A	---
	Solid	EPA 300.0 (M)	SW 9056A	---
Nitrate plus Nitrite	Water	EPA 353.2	SW 9056A	---
	Waste	---	SW 9056A	
	Solid	EPA 353.2 (M)	SW 9056A	---

Table 3-1

Wet Chemistry Methods

Analytical Parameters	Matrix	Fields of Testing		
		CWA/NPDES	RCRA (SW846)	Other
Methylene Blue Active Substances (MBAS)	Water	SM 5540C	---	---
Oil and Grease & NPM	Water	EPA 1664A	SW 9070A	---
HEM / HEM-SGT	Waste	EPA 1664A	SW 9070A	---
	Solid	---	SW 9071B	---
Ortho-phosphate O-PO_4	Water	EPA 300.0	SW 9056A	---
	Waste	EPA 300.0 (M)	SW 9056A	---
	Solid	--	SW 9056A	---
Paint Filter Liquids Test	Water	---	---	---
	Waste	---	SW 9095B	---
	Solid	---	---	---
pH	Water	SM 4500-H^+B	SW 9040B./C	---
	Waste	---	SW 9045C/D	---
	Solid	---	SW 9045C/D	---
Phenolics	Water	EPA 420.1 EPA 420.4	SW 9065 SW 9066	---
	Waste	---	SW 9065 SW 9066	---
	Solid	---	SW 9065 SW 9066	---
Sulfate (SO_4)	Water	EPA 300.0	SW 9056A	---
	Waste	EPA 300.0 (M)	SW 9056A	---
	Solid	--	SW 9056A	---
Sulfide	Water	SM 4500 S^{-2} F	SW 9034	---
	Solid	---	SW 9030B/9034	---

Table 3-1

Wet Chemistry Methods

Analytical Parameters	Matrix	Fields of Testing		
		CWA/NPDES	RCRA (SW846)	Other
Total Organic and Inorganic Carbon (TOC & TIC)	Water	SM 5310 C	SW 9060A	---
	Waste	---	---	---
	Solid	---	Walkley-Black	Lloyd Khan
Total Petroleum Hydro-carbons	Water	EPA 1664 (SGT-HEM)	9070A	---
	Waste	EPA 1664 (SGT-HEM)	9071B	---
	Solid	EPA 1664 (SGT-HEM)	9071B	---
Total Solids	Water	SM 2540 B	---	---
	Waste	SM 2540 B	---	---
	Solid	---	---	SM 2540 G (%)
Total Dissolved Solids (Residue, Filterable)	Water	SM 2540 C	---	---
Total Suspended Solids (Non-filterable)	Water	SM 2540 D	---	---
Total Volatile Solids	Solid	EPA 160.4	---	SM 2540 G (%)
Volatile Suspended Solids	Water	EPA 160.4	---	SM 2540 E
Settleable Solids	Water	SM 2540 F	---	---

Key to Table
M Indicates a DI leach procedure is performed prior to analysis.

Table 3-2

Methods for Mercury by Cold Vapor Atomic Absorption

Analytical Parameters	Matrix	Fields of Testing		
		CWA/NPDES	RCRA (SW846)	Other
Mercury	Water	EPA 245.1	EPA 7470A	---
	TCLP Leachate	---	EPA 7470A	---
	Waste	---	EPA 7471A/B	---
	Solid	---	EPA 7471A/B	---

Table 3-3

Methods for Metals by ICP & ICPMS

Analytical Parameters	Matrix	Fields of Testing		
		CWA/NPDES	RCRA (SW846)	Other
Aluminum	Water	EPA 200.7/200.8	EPA 6010B/C, 6020/ 6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Antimony	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Arsenic	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	----
	Solid	---	6010B/C, 6020/6020A	---
Barium	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---

Table 3-3

Methods for Metals by ICP & ICPMS

Analytical Parameters	Matrix	Fields of Testing		
		CWA/NPDES	RCRA (SW846)	Other
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Beryllium	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Boron	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Calcium	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Cadmium	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Cobalt	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Chromium	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---

Table 3-3

Methods for Metals by ICP & ICPMS

Analytical Parameters	Matrix	Fields of Testing		
		CWA/NPDES	RCRA (SW846)	Other
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Hexavalent Chromium	Water	---	EPA 6800	---
	Waste	---	---	---
	Solid	---	EPA 6800	---
Copper	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Cobalt	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Iron	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Lead	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Lithium	Water	EPA 200.7	EPA 6010B/C	---
	Waste	---	EPA 6010B/C	---
	Solid	---	EPA 6010B/C	---
Magnesium	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---

Table 3-3

Methods for Metals by ICP & ICPMS

Analytical Parameters	Matrix	Fields of Testing		
		CWA/NPDES	RCRA (SW846)	Other
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Manganese	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Molybdenum	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Nickel	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Potassium	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Selenium	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Silicon	Water	EPA 200.7	EPA 6010B/C	---
	Waste	---	EPA 6010B/C	---
	Solid	---	EPA 6010B/C	---

Table 3-3

Methods for Metals by ICP & ICPMS

Analytical Parameters	Matrix	Fields of Testing		
		CWA/NPDES	RCRA (SW846)	Other
Silver	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Sodium	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Strontium	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Tin	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Thallium	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Titanium	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---

Table 3-3

Methods for Metals by ICP & ICPMS

Analytical Parameters	Matrix	Fields of Testing		
		CWA/NPDES	RCRA (SW846)	Other
Vanadium	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---
Zinc	Water	EPA 200.7/200.8	6010B/C, 6020/6020A	---
	Waste	---	6010B/C, 6020/6020A	---
	Solid	---	6010B/C, 6020/6020A	---

Table 3-4

Metals Sample Preparation Methods

Analytical Parameters	Matrix	Fields of Testing		
		CWA/NPDES	RCRA (SW846)	Other
Toxicity Characteristic Leaching Procedure (TCLP)	Water	---	EPA 1311	---
	Waste	---	EPA 1311	---
	Solid	---	EPA 1311	---
ICP Metals	Water	EPA 200.7	EPA 3005A EPA 3010A	---
	TCLP Leachate	---	EPA 3010A	---
	Waste	---	EPA 3050B	---
	Solid	EPA 200.7	EPA 3050B	---

Table 3-4

Metals Sample Preparation Methods

Analytical Parameters	Matrix	Fields of Testing		
		CWA/NPDES	**RCRA (SW846)**	**Other**
CVAA	Water	EPA 245.1	EPA 7470A	---
	TCLP Leachate	---	EPA 7470A	---
	Waste	---	EPA 7471A/B	---
	Solid	---	EPA 7471A/B	
ICPMS	Water	200.8	EPA 3005A EPA 3010A	---
	TCLP Leachate	---	EPA 3010A	---
	Waste	---	EPA 3050B	---
	Solid	---	EPA 3050B/3060A (Cr VI – EPA 6800)	---

Table 3-5

Organic Sample Preparation Methods

Analytical Parameters	Matrix	Fields of Testing		
		CWA/NPDES	**RCRA (SW846)**	**Other**
Volatiles by GC/MS	Water	EPA 624	EPA 5030B	---
	TCLP Leachate	---	EPA 5030B	---
	Waste	---	EPA 5030B EPA 5035	---
	Solid	---	EPA 5035	---
Semivolatiles by GC/MS	Water	EPA 625	EPA 3510C EPA 3520C	---
	TCLP Leachate	---	EPA 3510C EPA 3520C	---
	Waste	---	EPA 3550B/3550C EPA 3580A	---

Table 3-5

Organic Sample Preparation Methods

Analytical Parameters	Matrix	Fields of Testing		
		CWA/NPDES	RCRA (SW846)	Other
	Solid	---	EPA 3580A EPA 3541	---
PAHs by GC/MS/SIM (other analytes are available)	Water	---	EPA 3510C EPA 3520C	---
	Waste	---	EPA 3550B/3550C EPA 3580A	---
	Solid	---	EPA 3580A EPA 3541	---
Pesticides/ PCBs by GC	Water	EPA 608	EPA 3510C EPA 3520C	---
	TCLP Leachate	---	EPA 3510C EPA 3520C	---
	Waste	---	EPA 3580A	---
	Solid	---	EPA 3550B/3550C EPA 3541	
Pesticides (Organophos-phorus) by GC	Water	---	EPA 3510C EPA 3520C	---
	Waste	---	EPA 3550B/3550C EPA 3580A	---
	Solid	---	EPA 3541	---
PAHs by HPLC	Water	EPA 610	EPA 3510C EPA 3520C	---
	Waste	---	EPA 3550B/3550C EPA 3580A	---
	Solid	---	EPA 3541	---
Herbicides by GC	Water	---	EPA 8151A	---
	TCLP Leachate	---	EPA 8151A	---
	Waste	---	EPA 8151A	---
	Solid	---	EPA 8151A	---

Table 3-6

Organic Analysis Methods

Analytical Parameters		Fields of Testing		
	Matrix	**CWA/NPDES**	**RCRA (SW846)**	**Other**
Volatiles By GC/MS	Water	EPA 624	EPA 8260B	---
	TCLP Leachate	---	EPA 8260B	---
	Waste	---	EPA 8260B	---
	Solid	---	EPA 8260B	---
Dissolved Gases (GC)	Water	---	---	RSK-175
Semivolatiles By GC/MS	Water	EPA 625	EPA 8270C/8270D	
	TCLP Leachate	---	EPA 8270C/8270D	---
	Waste	---	EPA 8270C/8270D	---
	Solid	---	EPA 8270C/8270D	---
PAHs by GC/MS/SIM (other analytes are available)	Water	---	EPA 8270C/8270D SIM	---
	Waste	---	EPA 8270C/8270D SIM	---
	Solid	---	EPA 8270C/8270D SIM	---
Pesticides/ PCBs by GC	Water	EPA 608	Pesticides EPA 8081A/8081B PCBs EPA 8082/8082A	---
	TCLP Leachate	---	Pesticides EPA 8081A/8081B PCBs EPA 8082/8082A	---
	Waste	---	Pesticides EPA 8081A/8081B EPA PCBs 8082/8082A	---

Table 3-6

Organic Analysis Methods

Analytical Parameters	Matrix	Fields of Testing		
		CWA/NPDES	RCRA (SW846)	Other
	Solid	---	Pesticides EPA 8081A/8081B PCBs EPA 8082/8082A	
Pesticides (Organophos-phorus) by GC	Water	---	EPA 8141A/8141B	---
	Waste	---	EPA 8141A/8141B	---
	Solid	---	EPA 8141A/8141B	---
PAHs by HPLC	Water	EPA 610	EPA 8310	---
	Waste	---	EPA 8310	---
	Solid	---	EPA 8310	---
Phenoxyacid Herbicides by GC	Water	---	EPA 8151A	---
	TCLP Leachate	---	EPA 8151A	---
	Waste	---	EPA 8151A	---
	Solid	---	EPA 8151A	---
Nonhalogenated Organic using GC/FID (Direct Aqueous Injection) - Ethylene Glycol	Water	---	EPA 8015B/C	---
	Solid	---	EPA 8015B/C	---
EDB and DBCP	Water	---	EPA 8011	---
	TCLP Leachate	---	---	---
	Waste	---	---	---
	Solid	---	---	---

SECTION 4.

MANAGEMENT *REQUIREMENTS*

4.1 Overview

TestAmerica Pittsburgh is a local operating unit of TestAmerica Laboratories, Inc.. The organizational structure, responsibilities and authorities of the corporate staff of TestAmerica Laboratories, Inc. are presented in the CQMP. The laboratory has day-to-day independent operational authority overseen by corporate officers (e.g., President, Chief Operating Officer, Corporate Quality, etc.). The laboratory operational and support staff work under the direction of the Laboratory Director. The organizational structure for both Corporate & TestAmerica Pittsburgh is presented in Figure 4-1.

4.2 Roles And Responsibilities

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The following descriptions briefly define each role in its relationship to the Quality Assurance Program.

4.2.1 Additional Requirements for Laboratories

The responsibility for quality resides with every employee of the laboratory. All employees have access to the QAM, are trained to this manual, and are responsible for upholding the standards therein. Each person carries out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs. Role descriptions for Corporate personnel are defined in the CQMP. This manual is specific to the operations of TestAmerica's Pittsburgh laboratory.

4.2.2 General Manager (GM)

Each GM reports directly to a COO. Each GM has full responsibility for the overall administrative and operational management of their respective laboratories. The GM's responsibilities include allocation of personnel and resources, long-term planning, setting goals, and achieving the financial, business, and quality objectives of TestAmerica. The GM ensures timely compliance with corporate management directives, policies, and management systems reviews. The GM is also responsible for restricting any laboratory from performing analyses that cannot be consistently and successfully performed to meet the standards set forth in this manual.

4.2.3 Laboratory Director /Technical Manager

Pittsburgh's Laboratory Director is responsible for the overall quality, safety, financial, technical, human resource and service performance of the whole laboratory and reports to their respective GM. The Laboratory Director provides the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program. The Laboratory Director can also serve as the Technical Manager.

Specific responsibilities include, but are not limited to:

- Provides one or more technical directors for the appropriate fields of testing. If the Technical Manager is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director must designate another full time staff member meeting the qualifications of the Technical Manager to temporarily perform this function. If the absence exceeds 65 consecutive calendar days, the primary accrediting authority must be notified in writing.
- Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented.
- Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work.
- Ensures TestAmerica's human resource policies are adhered to and maintained.
- Ensures that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director.
- Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.
- Pursues and maintains appropriate laboratory certification and contract approvals. Supports ISO 17025 requirements.
- Ensures client specific reporting and quality control requirements are met.
- Captains the management team, consisting of the QA Manager, the Technical Mangers(s) and Director or Project Management as direct reports.
- Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and providing technical and troubleshooting expertise on routine and unusual or complex problems. Interfaces with management on solving day-to-day technical issues.
- Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis. Training includes instruction on calculations, instrumentation management to include troubleshooting and preventive maintenance.
- The Technical Manager meets the requirements specified in the Section 5.2.6.1 of the TNI standards.

4.2.4 Quality Assurance (QA) Manager or Designee

The QA Manager has responsibility and authority to ensure the continuous implementation of the quality system based on TNI Standard and DoD QSM. The QA Manager reports directly to the Laboratory Director and has access to Corporate QA for advice and resources. This position is able to evaluate data objectively and perform assessments without outside (e.g., managerial) influence. Corporate QA may be used as a resource in dealing with regulatory requirements, certifications and other quality assurance related items. The QA Manager directs the activities of the QA officers to accomplish specific responsibilities, which include, but are not limited to:

- Serves as the focal point for QA/QC in the laboratory.
- Ensuring Communication & monitoring standards of performance to ensure that systems are in place to produce the level of quality as defined in this document.
- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs are temporarily suspended following the procedures outlined in Section 12.
- Evaluation of the thoroughness and effectiveness of training.
- QA Manager has the authority and responsibility for ensuring that all personnel understand their contributions to the quality system; evaluates the effectiveness of training; or uses available tools, such as audit and surveillance results, control charts, proficiency testing results, data analysis, corrective and preventive actions, customer feedback, and management reviews in efforts to monitor trends and continually improve the quality system.
- Maintains, approves, and updates the QAM.
- Has joint signature authority, with the Laboratory Director and Technical Managers for approval of quality documents.
- Directs controlled distribution laboratory quality documents.
- Provides Quality System training to all new personnel.
- Reviews and approves documentation of analyst training records.
- Serves as a focal point for QA and QC issues, reviews corrective actions and recommends resolution for recurring nonconformances within the laboratory.
- Monitoring and communicating regulatory changes that may affect the laboratory to management.
- Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples. Maintaining certifications.
- Monitors data quality measures via statistical methods to verify that the laboratory routinely meets stated quality goals.
- Hosts external audits conducted by outside agencies.
- Responsible for approving quality control reference data changes in the LIMS.
- Oversees the selection, review, and approval of analytical subcontractors.
- Prepares monthly QA Reports to management describing significant quality events to Laboratory Director and/or Corporate QA.
- Has the final authority to accept or reject data and to stop work in progress in the event that procedures or practices compromise the validity and integrity of analytical data.
- Coordinating, writing, and reviewing preparation of all test methods SOPs, with regard to quality, integrity, regulatory He/she insures that the SOPs are properly managed and adhered to at the bench.

- Have documented training and/or experience in QA/QC procedures and the laboratory's Quality System.
- Having a general knowledge of the analytical test methods for which data audit/review is performed (and/or having the means of getting this information when needed).
- Arranging for or conducting internal audits on quality systems and the technical operation.
- The laboratory QA Manager will maintain records of all ethics-related training, including the type and proof of attendance.
- Maintain, improve, and evaluate the corrective action database and the corrective and preventive action systems.
- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs shall be investigated following procedures outlined in Section 12 and if deemed necessary may be temporarily suspended during the investigation.
- Objectively monitor standards of performance in quality control and quality assurance without outside (e.g., managerial) influence.
- Coordinating of document control of SOPs, MDLs and control limits.
- Follow-up with audits to ensure client QAPP requirements are met.
- Development of suggestions and recommendations to improve quality systems.
- Research of current state and federal requirements and guidelines.
- Compliance with ISO 17025.

4.2.5 Quality Assurance Specialist

The QA Scientist is responsible for QA documentation and involvement in the following activities:

- Assist the QA Manager in performing the annual internal laboratory audits, compiling the evaluation, and coordinating the development of an action plan to address any deficiency identified.
- Facilitate external audits, coordinating with the QA Manager and Laboratory Staff to address any deficiencies noted at the time of the audit and subsequently presented in the final audit report.
- Assist the QA Manager in the preparation of new SOP's and in the maintenance of existing SOPs, coordinating annual reviews and updates.
- Manages the performance testing (PT) studies, coordinates follow up studies for failed analytes and works with QA Manager and Laboratory Staff to complete needed corrective action reports.
- Personnel training records review and maintenance.

- Document control maintenance.
- Assists the Quality Manager and Project Management Group in the review of program plans for consistency with organizational and contractual requirements. Summarize and convey to appropriate personnel anomalies or inconsistencies observed in the review process.
- Manages certifications and accreditations.
- Monitors for compliance the following QA Metrics: Temperature Monitoring of refrigeration units and incubators; thermometer calibrations; balance calibrations; eppendorf/pipette calibrations; and proper standard/reagent storage.
- Periodic checks on the proper use and review of instrument logs.
- Initiate Analyst/Data audits and the Mint-miner data file review process for organic instrumentation. Maintain tracking of reviews.
- Assist in the technical review of data packages which require QA review.

4.2.6 Technical Manager or Designee

The Technical Manager(s) report(s) directly to the Laboratory Director. The scope of responsibility ranges from the new-hire training and existing technology through the ongoing training and development programs for existing analysts and new instrumentation and for compliance with the ISO 17025 Standard. Specific responsibilities include, but are not limited to:

- Reviewing and approving, with input from the QA Manager, proposals from marketing, in accordance with an established procedure for the review of requests and contracts. This procedure addresses the adequate definition of methods to be used for analysis and any limitations, the laboratory's capability and resources, the client's expectations. Differences are resolved before the contract is signed and work begins. A system documenting any significant changes is maintained, as well as pertinent discussions with the client regarding their requirements or the results of the analyses during the performance of the contract. All work subcontracted by the laboratory must be approved by the client. Any deviations from the contract must be disclosed to the client. Once the work has begun, any amendments to the contract must be discussed with the client and so documented.
- Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and providing technical and troubleshooting expertise on routine and unusual or complex problems.
- Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis. Training includes instruction on calculations, instrumentation management to include troubleshooting and preventive maintenance.
- Enhancing efficiency and improving quality through technical advances and improved LIMS utilization. Capital forecasting and instrument life cycle planning for second generation methods and instruments as well as asset inventory management.

4.2.7 Director of Project Management

The Director of Project Management reports to the Laboratory Director and serves as the interface between the laboratory's technical departments and the laboratory's clients. The staff consists of the Project Management team. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Technical training and growth of the Project Management team.
- Technical liaison for the Project Management team.
- Human resource management of the Project Management team.
- Responsible to ensure that clients receive the proper sampling supplies.
- Accountable for response to client inquiries concerning sample status.
- Responsible for assistance to clients regarding the resolution of problems concerning COC.
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory.
- Notifying the supervisors of incoming projects and sample delivery schedules.
- Accountable to clients for communicating sample progress in daily status meeting with agreed-upon due dates.
- Responsible for discussing with client any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff.
- Responsible for staff familiarization with specific quotes, sample log-in review, and final report completeness.
- Monitor the status of all data package projects in-house to ensure timely and accurate delivery of reports.
- Inform clients of data package-related problems and resolve service issues.
- Coordinate requests for sample containers and other services (data packages).

4.2.8 Project Manager

- Reports directly to the Director of Project Management or designee.
- Monitors analytical and QA project requirements for a specified project.
- Acts as a liaison between the client and the laboratory staff.
- Prepares Quality Assurance Summary (QAS) or equivalent summary form and communicates project-specific requirements to all parties involved.
- Assists the laboratory staff with interpretation of work plans, contracts, and QAPP requirements.

- Reviews project data packages for completeness and compliance to client needs.
- Has signature authority for final reports.
- Keeps the laboratory and client informed of project status.
- Together with the QA Manager, approves customer requested variances to methods and to standard laboratory protocols.
- Monitors, reviews, and evaluates the progress and performance of projects.
- Reports client inquiries involving data quality issues or data acceptability to the facility QA Manager and to the operations staff.
- Prepares reissue requests for project data.
- Responsible for meeting quality requirements.

4.2.9 Report Production Manager

Reports directly to the Laboratory Director or designee.

- Supervises daily activities of the Report Production Groups.
- Works with the Technical Managers and/or Group/Team Leaders to ensure that projects are reported in a timely manner.

4.2.10 Report Production Staff

- Reports directly to the Report Production Manager or designee.
- Accurately generates and compiles analytical reports and associated deliverables for delivery to the client.
- Responsible for meeting quality requirements.
- Produce as needed reports that meet the NELAC requirements.

4.2.11 Customer Service Manager (CSM)

- Reports directly to the Laboratory Director or designee
- Has signature authority for contracts for laboratory services, as detailed in TestAmerica policy, and for laboratory reports.
- Defines customer requirements through project definition.
- Assesses and assures customer satisfaction.
- Provides feedback to management on changing customer needs.
- Brings together resources necessary to ensure customer satisfaction.

4.2.12 Organics Department Technical Manager

Manages the GC and GCMS groups. Reports directly to the Laboratory Director or designee.

- Ensure that analysts in their department adhere to applicable SOPs and the QA Manual. He/she performs frequent SOP and QA Manual review to determine if analysts are in compliance and if new, modified, and optimized measures are feasible and should be added to these documents. Responsible for review and approval of SOPs for their section.
- With regard to analysts, participates in the selection, training, development of performance objectives and standards of performance, appraisal (measurement of objectives), scheduling, counseling, discipline, and motivation of analysts and documents these activities in accordance with systems developed by the QA and Personnel Departments. They evaluate staffing sufficiency and overtime needs. Training consists of familiarization with SOP, QC, Safety, and computer systems.
- Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and documentation, self-supervise, and function as a department team.
- Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Managers and/or QA Manager. Each is responsible ensuring 100% implementation of the data review and documentation, non-conformance and corrective action issues, the timely and accurate completion of performance evaluation samples and MDLs, for his/her department.
- Ensure all logbooks are maintained, current, and properly labeled or archived.
- Report all non-conformance conditions to the QA Manager, Technical Managers and/or Laboratory Director.
- Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He/she is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments.
- Maintain adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Achieve optimum turnaround time on analyses and compliance with holding times.
- Conduct efficiency and cost control evaluations on an ongoing basis to determine optimization of labor, supplies, overtime, first-run yield, capacity (designed vs. demonstrated), second- and third-generation production techniques/instruments, and long-term needs for budgetary planning.
- Develop, implement, and enhance calibration programs.
- Provide written responses to external and internal audit issues.

4.2.13 Team Leader/Supervisor or Technical Manager

Reports directly to the Organics Manager and/or Laboratory Director or designee.

- Ensure that analysts in their department adhere to applicable SOPs and the QA Manual. He/she performs frequent SOP and QA Manual review to determine if analysts are in compliance and if new, modified, and optimized measures are feasible and should be added to these documents. Responsible for review and approval of SOPs for their section.
- With regard to analysts, participates in the selection, training, development of performance objectives and standards of performance, appraisal (measurement of objectives), scheduling, counseling, discipline, and motivation of analysts and documents these activities in accordance with systems developed by the QA and Personnel Departments. They evaluate staffing sufficiency and overtime needs. Training consists of familiarization with SOP, QC, Safety, and computer systems.
- Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and documentation, self-supervise, and function as a department team.
- Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Manager(s) and/or QA Manager. Each is responsible ensuring 100% implementation of the data review and documentation, non-conformance and corrective action issues, the timely and accurate completion of performance evaluation samples and MDLs, for his/her department.
- Ensure all logbooks are maintained, current, and properly labeled or archived.
- Report all non-conformance conditions to the QA Manager, Technical Manager (s) and/or Laboratory Director.
- Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He/she is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments.
- Maintain adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
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- Conduct efficiency and cost control evaluations on an ongoing basis to determine optimization of labor, supplies, overtime, first-run yield, capacity (designed vs. demonstrated), second- and third-generation production techniques/instruments, and long-term needs for budgetary planning.
- Develop, implement, and enhance calibration programs.
- Provide written responses to external and internal audit issues.

4.2.14 Laboratory Analyst

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the team leader or supervisor. The responsibilities of the analysts are listed below:

- Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- Ensures sample and data integrity by adhering to internal chain-of-custody procedures.
- Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on bench sheets, lab notebooks, run logs, and/or the Non-Conformance Database.
- Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor or Technical Manager (s), and/or the QA Manager or member of QA staff.
- Perform 100% review of the data generated prior to entering and submitting for secondary level review. Performs data processing using available tools/software.
- Suggest method improvements to their supervisor, the Technical Manager (s), and the QA Manager. These improvements, if approved, will be incorporated. Ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, are encouraged.
- Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

4.2.15 Sample Custodian/Sample Receiving Team Leader

- Ensures implementation of proper sample receipt procedures, including maintenance of chain-of-custody.
- Reports nonconformances associated with condition-upon-receipt of samples.
- Logs samples into the LIMS.
- Ensures that all samples are stored in the proper environment.
- Assists Environmental Health and Safety staff with sample disposal.
- Responsible for meeting quality requirements.

4.2.16 Field Service Technician

The Field Service Technicians report to the Field Services Project Manager. The responsibilities of the Field Service Technicians are outlined below:

- Perform sample collection and sample pick-up

- Ensures sample containers are prepared for sampling
- Performs field tests and measurements and operates and maintains equipment used for those purposes.

4.2.17 Health and Safety Coordinator

The Health and Safety Coordinator reports to the Laboratory Director and ensures that systems are maintained for the safe operation of the laboratory. The Safety Officer is responsible to:

- Conduct ongoing, necessary safety training and conduct new employee safety orientation.
- Assist in developing and maintaining the Chemical Hygiene/Safety Manual.
- Administer dispersal of all Material Safety Data Sheet (MSDS) information.
- Perform regular chemical hygiene and housekeeping instruction.
- Give instruction on proper labeling and practice.
- Serve as chairman of the laboratory safety committee.
- Provide and train personnel on protective equipment.
- Oversee the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed.
- Supervise and schedule fire drills and emergency evacuation drills.
- Determine what initial and subsequent exposure monitoring, if necessary to determine potential employee exposure to chemicals used in the laboratory.
- When determined necessary, conduct exposure monitoring assessments.
- Determine when a complaint of possible over-exposure is “reasonable” and should be referred for medical consultation.
- Assist in the internal and external coordination of the medical consultation/monitoring program conducted by TestAmerica’s medical consultants.

4.3 DEPUTIES

The following table defines who assumes the responsibilities of key personnel in their absence:

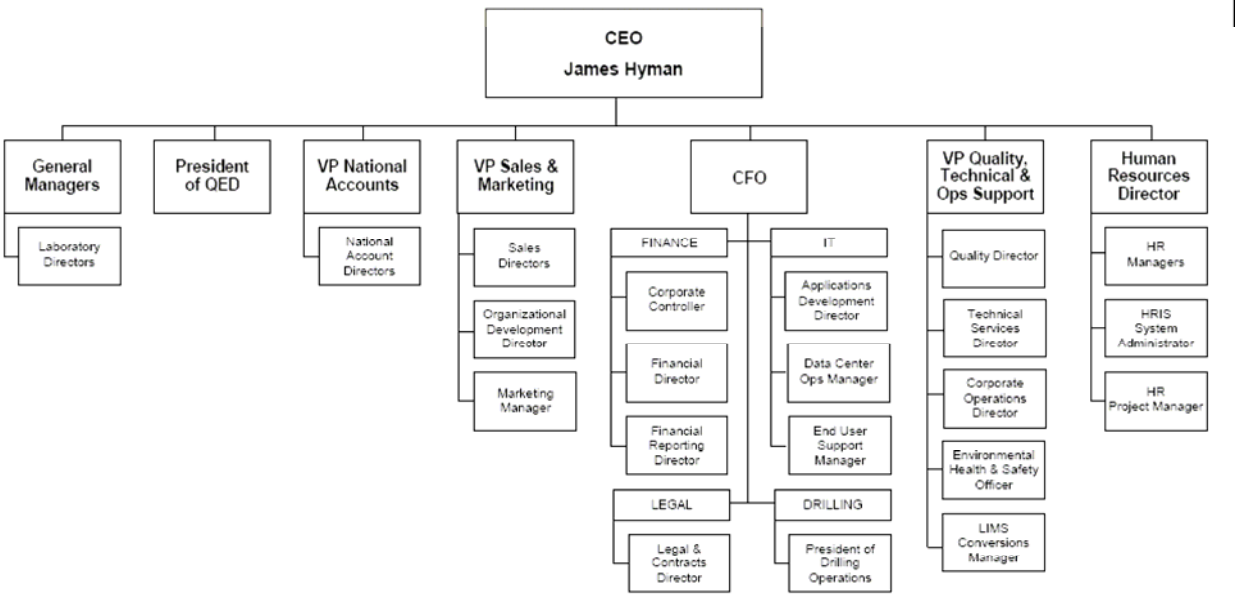
Key Personnel	Deputy	Comment
Laboratory Director: Deborah Lowe	Director of Project Management: Dave Miller	
Quality Assurance Manager: Nasreen DeRubeis	Quality Assurance Specialist: Pam Dudeck	
Director of Project Management: Dave Miller	Designated Project Manager	

Key Personnel	Deputy	Comment
Technical Manager: Larry Matko	Laboratory Director: Deborah Lowe	
Organics Manager: Sharon Bacha	Designated GC and GCMS Analyst	A designated senior Analyst in GC and GCMS groups
Metals Supervisor: Bill Reinheimer	Designated Senior Metals Analyst	
Wet Chemistry Supervisor: Mike Wesoloski	Designated Senior Wet Chemistry Analyst	
Organic Prep Team Leader: Brian Pino	Designated Senior Organic Prep Analyst	
Report Production Supervisor: Roseann Ruyechan	Designated person in the group or Lab Director	
Sample Receiving Manager: Christine Kovitch	Lab Director or Designated person in the group	

Figure 4-1.

Corporate and Laboratory Organization Charts

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING



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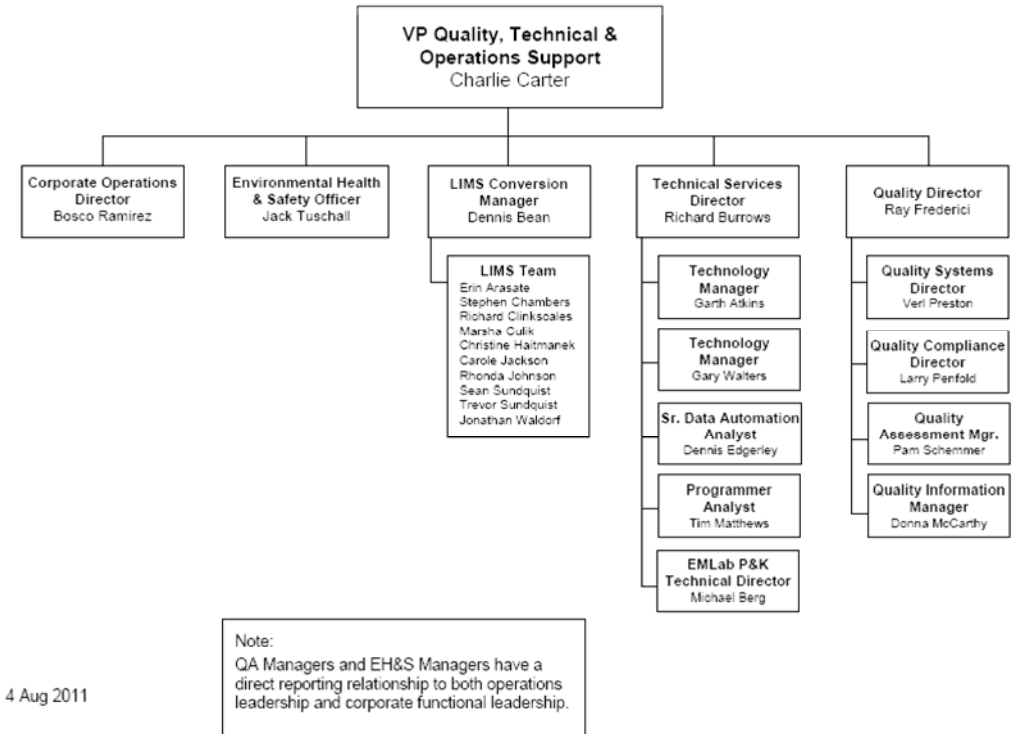
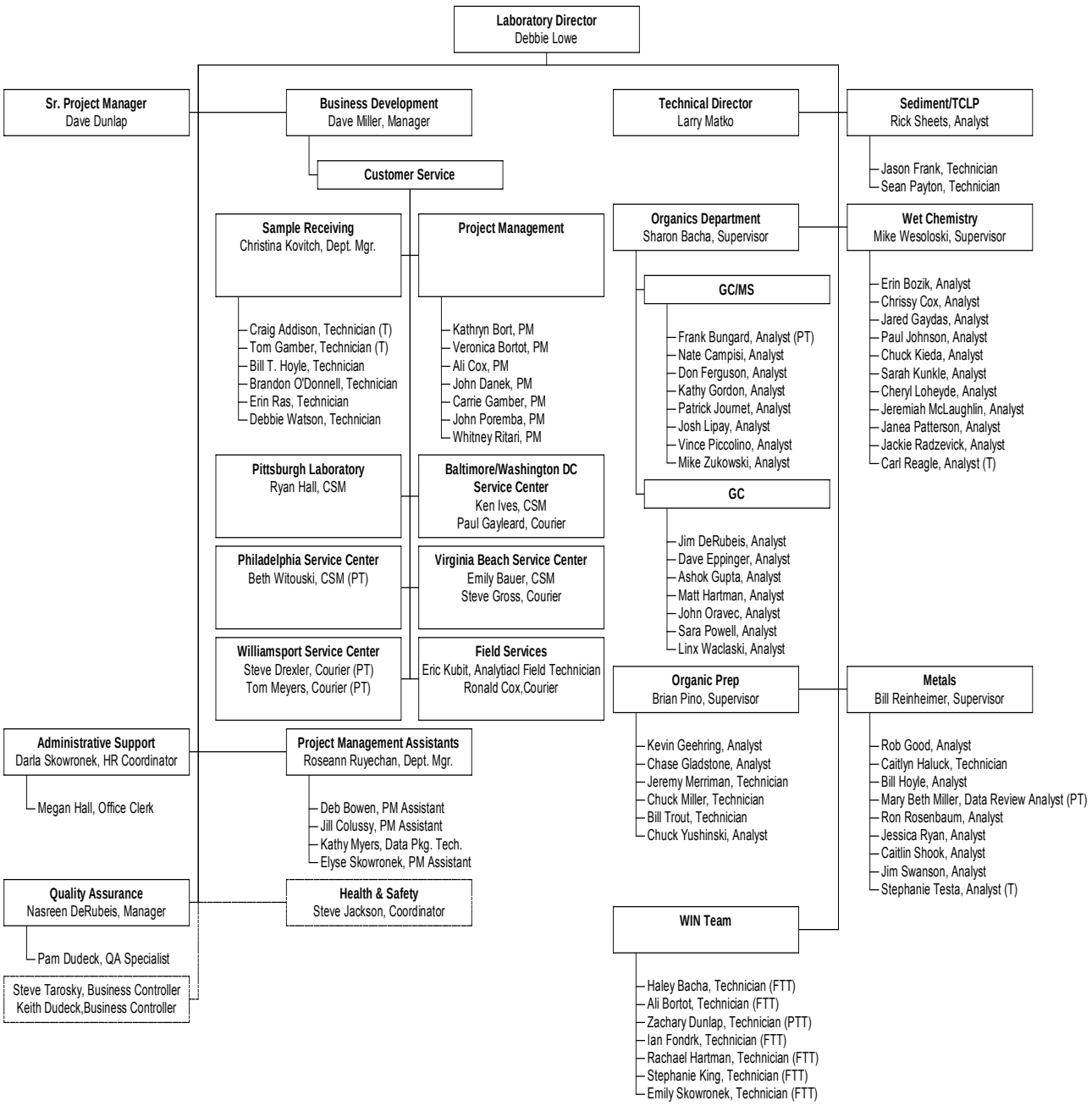
Quality, Technical & Operations Support



Pittsburgh Laboratory Organizational Chart



SECTION 5

QUALITY SYSTEM

5.1 Quality Policy Statement

It is TestAmerica's Policy to:

- Provide data of known quality to its clients by adhering to approved methodologies, regulatory requirements and the QA/QC protocols.
- Effectively manage all aspects of the laboratory and business operations by the highest ethical standards.
- Continually improve systems and provide support to quality improvement efforts in laboratory, administrative and managerial activities. TestAmerica recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff.
- Provide clients with the highest level of professionalism and the best service practices in the industry.
- To comply with the ISO/IEC 17025:2005(E) International Standard, the 2009 TNI Standard and to continually improve the effectiveness of the management system.

Every staff member at the laboratory plays an integral part in quality assurance and is held responsible and accountable for the quality of their work. It is, therefore, required that all laboratory personnel are trained and agree to comply with applicable procedures and requirements established by this document.

5.2 Ethics And Data Integrity

TestAmerica is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The elements of TestAmerica's Ethics and Data Integrity Program include:

- Ethics Policy (Corporate Policy No. CW-L-P-004) and Employee Ethics Statements.
- Ethics and Compliance Officers (ECOs).
- A Training Program.
- Self-governance through disciplinary action for violations.
- A Confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct. (Corporate SOP No. CW-L-S-002.)
- Procedures and guidance for recalling data if necessary (Corporate SOP No. CW-L-S-002).
- Effective external and internal monitoring system that includes procedures for internal audits (Section 15).

- Produce results, which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).
- Present services in a confidential, honest and forthright manner.
- Provide employees with guidelines and an understanding of the Ethical and Quality Standards of our Industry.
- Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.
- Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.
- Educate clients as to the extent and kinds of services available.
- Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
- Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

5.3 Quality System Documentation

The laboratory's Quality System is communicated through a variety of documents.

- Quality Assurance Manual – Each laboratory has a lab specific quality assurance manual.
- Corporate SOPs and Policies - Corporate SOPs and Policies are developed for use by all relevant laboratories. They are incorporated into the laboratory's normal SOP distribution, training and tracking system. Corporate SOPs may be general or technical.
- Work Instructions - A subset of procedural steps, tasks or forms associated with an operation of a management system (e.g., checklists, preformatted bench sheets, forms).
- Laboratory SOPs – General and Technical
- Laboratory QA/QC Policy Memorandums

5.3.1 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows:

- Corporate Quality Management Plan (CQMP)
- Corporate SOPs and Policies
- Laboratory QA/QC Policy Memorandum
- Laboratory Quality Assurance Manual (QAM)
- Laboratory SOPs and Policies
- Other (Work Instructions (WI), memos, flow charts, etc.)

Note: The laboratory has the responsibility and authority to operate in compliance with regulatory requirements of the jurisdiction in which the work is performed. Where the CQMP

conflicts with those regulatory requirements, the regulatory requirements of the jurisdiction shall hold primacy. The laboratory's QAM shall take precedence over the CQMP in those cases.

5.4 QA/QC Objectives For The Measurement Of Data

Quality Assurance (QA) and Quality Control (QC) are activities undertaken to achieve the goal of producing data that accurately characterize the sites or materials that have been sampled. Quality Assurance is generally understood to be more comprehensive than Quality Control. Quality Assurance can be defined as the integrated system of activities that ensures that a product or service meets defined standards.

Quality Control is generally understood to be limited to the analyses of samples and to be synonymous with the term *"analytical quality control"*. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives in order to ensure that analytical services closely correspond to client needs. The client is responsible for developing the QAPP. In order to ensure the ability of the laboratory to meet the Data Quality Objectives (DQOs) specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. Additionally, the laboratory will provide support to the client for developing the sections of the QAPP that concern laboratory activities.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity and sensitivity (PARCCSS).

5.4.1 Precision

The laboratory objective for precision is to meet the performance for precision demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike (MS) duplicate samples.

5.4.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Accuracy is defined as the degree of bias in a measurement system. Accuracy may be documented through the use of laboratory control samples (LCS) and/or MS. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery.

5.4.3 Representativeness

The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is a measurement of both analytical and field sampling precision. The representativeness of the analytical data is a function of the procedures used in procuring and processing the samples. The representativeness can be documented by the relative percent difference between separately procured, but otherwise identical samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory may provide guidance to the client regarding proper sampling and handling methods in order to assure the integrity of the samples.

5.4.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness and reporting limit statistics are similar to these quality indicators generated by other laboratories for similar samples, and data generated by the laboratory over time.

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision and reporting limits with those of other laboratories.

5.4.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project), expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability will be defined in a QAPP, project scope or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

5.4.6 Selectivity

Selectivity is defined as: The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: extractions (separation), digestions (separation), interelement corrections (separation), use of matrix modifiers (separation), specific retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), specific electrodes (separation and identification), etc..

5.4.7 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (Method Detection Limit) or quantified (Reporting Limit).

5.5 Criteria For Quality Indicators

The laboratory maintains a Quality Control Limit Summary (from LIMS) that contains tables that summarizes the precision and accuracy acceptability limits for analyses performed at TestAmerica Pittsburgh. This summary includes an activation date, is updated each time new limits are generated and is located in the LIMS. Current limits are controlled through the LIMS. The limits in effect for a given date are archived in the LIMS with the associated sample data. Unless otherwise noted, limits within these tables are laboratory generated. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, the laboratory has developed limits from evaluation of data from similar matrices. Criteria for development of control limits is contained in Section 24.

5.6 Statistical Quality Control

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846) and programs [such as the Ohio Voluntary Action Plan (VAP)]. The laboratory routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The analysts are instructed to use the current limits in the laboratory (dated and approved by the area Technical Manager/supervisor and QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory. These limits are maintained in the LIMS as part of the analytical historical record. If a method defines the QC limits, the method limits are used. For further details refer to SOP No. PT-QA-021.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of the LIMS following the guidelines described in Section 24. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The analyst then evaluates if the sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

5.6.1 QC Charts

The generation and use of QC Charts (Control Charts) are described in the laboratory SOP PT-QA-021.

5.7 Quality System Metrics

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 16). These metrics are used to drive continuous improvement in the laboratory's Quality System.

SECTION 6

DOCUMENT CONTROL

6.1 Overview

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are archived or destroyed. The following documents, at a minimum, must be controlled:

- Laboratory Quality Assurance Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions and Forms
- Corporate Policies and Procedures distributed outside the intranet

Corporate Quality posts Corporate Manuals, SOPs, Policies, Work Instructions, White Papers and Training Materials on the company intranet site. These Corporate documents are only considered controlled when they are read on the intranet site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. A detailed description of the procedure for issuing, authorizing, controlling, distributing, and archiving Corporate documents is found in Corporate SOP No. CW-Q-S-001, Corporate Document Control and Archiving. The laboratory's internal document control procedure is defined in SOP No. PT-QA-010.

The laboratory QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. Instrument manuals (hard or electronic copies) are also maintained by the laboratory.

The laboratory maintains control of records for raw analytical data and supporting records such as audit reports and responses, logbooks, standard logs, training files, MDL studies, Proficiency Testing (PT) studies, certifications and related correspondence, and corrective action reports and Nonconformance Memos (NCMs). Raw analytical data consists of bound logbooks, instrument printouts, any other notes, magnetic media, electronic data and final reports.

6.2 Document Approval And Issue

The pertinent elements of a document control system for each document include a unique document title and number, pagination, the total number of pages of the item or and 'end of document' page, the effective date, revision number and the laboratory's name. The QA personnel are responsible for the maintenance of this system.

Controlled documents are authorized by the QA Department. In order to develop a new document, a technical manager/supervisor submits an electronic or paper draft to the QA Department for suggestions and approval before use. Upon approval, QA personnel add the identifying version information to the document and retains that document as the official

document on file. That document is then provided to all applicable operational units (may include electronic access). Controlled documents are identified as such and records of their distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution.

The QA Department maintains a list of the official versions of controlled documents.

Quality System Policies and Procedures will be reviewed at a minimum of every two years and revised as appropriate. Changes to documents occur when a procedural change warrants. For DoD program, the related documents are reviewed every year and revised as appropriate.

6.3 Procedures For Document Control Policy

For changes to the QA Manual, refer to SOP No. PT-QA-010. Uncontrolled copies must not be used within the laboratory. Previous revisions and back-up data are stored by the QA department. Electronic copies are stored on the Public server in sops on 'pitsvr01' (X:) by lab area.

For changes to SOPs and QA manual, refer to SOP No. CW-Q-S-002, Writing a Standard Operating Procedure SOP and laboratory SOP PT-QA-010. The SOP identified above also defines the process of changes to SOPs.

Controlled documents are marked as such, and posted to the intranet (QA Web page) by the QA department. Controlled distribution is achieved electronically. Details of the numbering system, required format, and controlled distribution of documents are described in SOP No. PT-QA-010, "Preparation and Management of Standard Operating Procedures (SOPs) .

Forms, worksheets, work instructions and information are organized by department by the QA office. Electronic versions are kept on a hard drive in the QA department; hard copies can be printed out as needed. Most forms used in the laboratory are tracked by a database which can be accessed by the QA department and the IT group. The procedure for the care of these documents is in SOP No. PT-QA-010, "Preparation and Management of Standard Operating Procedures (SOPs) and Other Controlled Documents".

6.4 Obsolete Documents

All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are marked obsolete on the cover or destroyed. At least one copy of the obsolete document is archived according to SOP No. PT-QA-019.

SECTION 7

SERVICE TO THE CLIENT

7.1 Overview

The laboratory has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory's capability and resources to meet the contract's requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is the laboratory's intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab's capability to perform them must be established. Projects, proposals and contracts are reviewed for adequately defined requirements and the laboratory's capability to meet those requirements. Alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab. A review of the lab's capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity (detection and reporting levels), accuracy, and precision requirements (% Recovery and RPD). The reviewer ensures that the laboratory's test methods are suitable to achieve these requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

The laboratory must determine if it has the necessary physical, personnel and information resources to meet the contract, and if the personnel have the expertise needed to perform the testing requested. Each proposal is checked for its impact on the capacity of the laboratory's equipment and personnel. As part of the review, the proposed turnaround time will be checked for feasibility.

Electronic or hard copy deliverable requirements are evaluated against the laboratory's capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another TestAmerica facility or to an outside firm, this will be documented and discussed with the client prior to contract approval. (Refer to Section 8 for Subcontracting Procedures.)

The laboratory informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and the laboratory's capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that the contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or TestAmerica, are documented in writing.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

The same contract review process used for the initial review is repeated when there are amendments to the original contract by the client, and the participating personnel are informed of the changes.

7.2 Review Sequence And Key Personnel

Appropriate personnel will review the work request at each stage of evaluation.

For routine projects and other simple tasks, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has any required certifications, that it can meet the clients' data quality and reporting requirements and that the lab has the capacity to meet the clients turn around needs. It is recommended that, where there is a sales person assigned to the account, an attempt should be made to contact that sales person to inform them of the incoming samples.

For new, complex or large projects, the proposed contract is given to the National Account Director, who will decide which lab will receive the work based on the scope of work and other requirements, including certification, testing methodology, and available capacity to perform the work. The contract review process is outlined in TestAmerica's Corporate SOP No. CA-L-P-002**,** Contract Compliance Policy.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on scope of contract, to evaluate all of the requirements shown above (not necessarily in the order below):

- Legal & Contracts Director if applicable
- Customer Service Manager
- The Laboratory Project Management
- The Laboratory Director Technical Manager
- Laboratory Quality Assurance Manager if applicable
- PM or CSM reviews the formal laboratory quote. The Laboratory Director makes final acceptance for their facility.

The Sales Director, Legal Contracts Director, Account Executive or local account representative then submits the final proposal to the client.

In the event that one of the above personnel is not available to review the contract, his or her back-up will fulfill the review requirements.

The Legal & Contracts Director maintains copies of all signed contracts**.** In Pittsburgh laboratory copies of contracts are maintained in the laboratory network public drive (N:\Weekly\Quotes_Scanned) by the sales/marketing personnel.

7.3 Documentation

Appropriate records are maintained for every contract or work request. All stages of the contract review process are documented and include records of any significant changes. Contracts review documentation is forwarded to the Human Resources Coordinator and is maintained in the network public drive.

The contract will be distributed to and maintained by the appropriate sales/marketing personnel and the Account Manager. A copy of the contract and formal quote will be filed with the laboratory PM and the Lab Director.

Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. The PM keeps a phone log or electronic mail of conversations with the client.

7.3.1 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, the laboratory assigns a PM to each client. It is the PM's responsibility to ensure that project-specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA department involvement may be needed to assist in the evaluation of custom QC requirements.

PM's are the primary client contact and they ensure resources are available to meet project requirements. Although PM's do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new projects to the laboratory staff through project kick-off meetings or to the supervisory staff during production meetings. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, project notes may be associated with each sample batch as a reminder upon sample receipt and analytical processing.

During the project, any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes (e.g., use of a non-standard method or modification of a method) and approvals must be documented prior to implementation. Documentation pertains to any document, e.g., letter, e-mail, variance, contract addendum, which has been signed by both parties.

Such changes are also communicated to the laboratory during operations meetings. Such changes are updated to the project notes and are introduced to the managers at these meetings. The laboratory staff is then introduced to the modified requirements via the PM or the individual laboratory Technical Manager. After the modification is implemented into the laboratory process, documentation of the modification is made in the case narrative of the data report(s).

The laboratory strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

7.4 Special Services

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. It is the laboratory's goal to meet all client requirements in addition to statutory and regulatory requirements. The laboratory has procedures to ensure confidentiality to clients (Section 25).

Note: ISO/IEC 17025 states that a laboratory "shall afford clients or their representatives cooperation to clarify the client's request". This topic is discussed in Section 7.

The laboratory's standard procedures for reporting data are described in Section 25. Special services are also available and provided upon request. These services include:

- Reasonable access for our clients or their representatives to the relevant areas of the laboratory for the witnessing of tests performed for the client.
- Assist client-specified third party data validators as specified in the client's contract.
- Supplemental information pertaining to the analysis of their samples. Note: An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

7.5 Client Communication

Project managers are the primary communication link to the clients. They shall inform their clients of any delays in project completion as well as any non-conformances in either sample receipt or sample analysis. Project management will maintain ongoing client communication throughout the entire client project.

Laboratory Director, Technical Manager or designee are available to discuss any technical questions or concerns that the client may have.

7.6 Reporting

The laboratory works with our clients to produce any special communication reports required by the contract.

7.7 Client Surveys

The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality , client service and testing activities.

TestAmerica's Sales and Marketing teams periodically develops lab and client specific surveys to assess client satisfaction.

SECTION 8

SUBCONTRACTING OF TESTS

8.1 Overview

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the TestAmerica laboratories. The phrase "work sharing" refers to internal transfers of samples between the TestAmerica laboratories. The term outsourcing refers to the act of subcontracting tests.

When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When the need arises to outsource testing for our clients because project scope, changes in laboratory capabilities, capacity or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and will meet the same commitments we have made to the client. Refer to TestAmerica's Corporate SOP's on Subcontracting Procedures (CA-L-S-002) and the Work Sharing Process (CA-C-S-001).

When outsourcing analytical services, the laboratory will assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document, the requirements specified in TNI/ISO 17025 and/or the client's Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation will be placed with an appropriately accredited laboratory. The laboratory performing the subcontracted work will be identified in the final report, as will non-TNI accredited work where required.

Project Managers (PMs), Customer Service Managers (CSM), Account Executives (AE) or designee for the Export Lab are responsible for obtaining client approval prior to outsourcing any samples. The laboratory will advise the client of a subcontract or work sharing arrangement in writing and when possible approval from the client shall be retained in the project folder.

Note: In addition to the client, some regulating agencies, (e.g, USDA) or contracts (e.g, certain USACE projects) may require notification prior to placing such work**.**

For DOD projects the subcontractor laboratories used must have an established and documented laboratory quality system that complies with DoD QSM requirements. The subcontractor laboratories are evaluated following the procedures outlined below and as seen in Figure 8-1. The subcontractor laboratory must receive project-specific approval from the DoD client before any samples are analyzed.

The QSM has 5 specific requirements for subcontracting:

1. Subcontractor laboratories must have an established laboratory quality system that complies with the QSM.

2. Subcontractor laboratories must be approved by the specific DoD Component laboratory approval process.
3. Subcontractor laboratories must demonstrate the ability to generate acceptable results from the analysis of PT samples, subject to availability, using each applicable method, in the specified matrix, and provide appropriate documentation to the DoD client.
4. Subcontractor laboratories must receive project-specific approval from the DoD client before any samples are analyzed.
5. Subcontractor laboratories are subject to project-specific, on-site assessments by the DoD client or their designated representatives

8.2 Qualifying And Monitoring Subcontractors

Whenever a PM or Account Executive (AE) or Customer Service Manager (CSM becomes aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) shall be selected based on the following:

- The first priority is to attempt to place the work in a qualified TestAmerica laboratory;
- Firms specified by the client for the task (Documentation that a subcontractor was designated by the client must be maintained with the project file. This documentation can be as simple as placing a copy of an e-mail from the client in the project folder);
- Firms listed as pre-qualified and currently under a subcontract with TestAmerica: A listing of all approved subcontracting laboratories is available on the TestAmerica intranet site. Supporting documentation is maintained by corporate offices and by the TestAmerica laboratory originally requesting approval of the subcontract lab. Verify necessary accreditation, where applicable, (e.g., on the subcontractors TNI, A2LA accreditation or State Certification).
- Firms identified in accordance with the company's Small Business Subcontracting program as small, women-owned, veteran-owned and/or minority-owned businesses;
- TNI or A2LA accredited laboratories.
- In addition, the firm must hold the appropriate certification to perform the work required.

All TestAmerica laboratories are pre-qualified for work sharing provided they hold the appropriate accreditations, can adhere to the project/program requirements, and the client approved sending samples to that laboratory. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs. (Corporate SOP No. CA-C-S-001, Work Sharing Process).

When the potential sub-contract laboratory has not been previously approved, Account Executives, CSMs or PMs may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Laboratory Director. The Laboratory Director requests that the QA Manager begin the process of approving the subcontract laboratory as outlined in Corporate SOP No. CA-L-S-002, Subcontracting Procedures. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is

sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented).

8.2.1 Once the appropriate accreditation and legal information is received by the laboratory, it is evaluated for acceptability (where applicable) and forwarded to Corporate Contracts for formal contracting with the laboratory. They will add the lab to the approved list on the intranet site and notify the finance group for JD Edwards.

8.2.2 The client will assume responsibility for the quality of the data generated from the use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are known to meet minimal standards. TestAmerica does not certify laboratories. The subcontractor is on our approved list and can only be recommended to the extent that we would use them.

8.2.3 The status and performance of qualified subcontractors will be monitored periodically by the Corporate Contracts and/or Quality Departments. Any problems identified will be brought to the attention of TestAmerica's Corporate Finance or Corporate Quality personnel.

- Complaints shall be investigated. Documentation of the complaint, investigation and corrective action will be maintained in the subcontractor's file on the intranet site. Complaints are posted using the Vendor Performance Report.
- Information shall be updated on the intranet when new information is received from the subcontracted laboratories.
- Subcontractors in good standing will be retained on the intranet listing. The QA Manager will notify all TestAmerica laboratories, Corporate Quality and Corporate Contracts if any laboratory requires removal from the intranet site. This notification will be posted on the intranet site and e-mailed to all Laboratory Directors/Managers, QA Managers and Sales Personnel.

8.3 Oversight And Reporting

The PM or CSM must request that the selected subcontractor be presented with a subcontract, if one is not already executed between the laboratory and the subcontractor. The subcontract must include terms which flow down the requirements of our clients, either in the subcontract itself or through the mechanism of work orders relating to individual projects. A standard subcontract and the Lab Subcontractor Vendor Package (posted on the intranet) can be used to accomplish this, and the Legal & Contracts Director can tailor the document or assist with negotiations, if needed. The PM (or AE or CSM) responsible for the project must advise and obtain client consent to the subcontract as appropriate, and provide the scope of work to ensure that the proper requirements are made a part of the subcontract and are made known to the subcontractor.

Prior to sending samples to the subcontracted laboratory, the PM confirms their certification status to determine if it's current and scope-inclusive. The information is documented on the project folder or scanned into LIMS. For TestAmerica laboratories, certifications can be viewed on the company's TotalAccess Database.

The Sample Control department is responsible for ensuring compliance with QA requirements and applicable shipping regulations when shipping samples to a subcontracted laboratory.

All subcontracted samples must be accompanied by a TestAmerica Chain of Custody (COC). A copy of the original COC sent by the client must also be included with all samples workshared within TestAmerica. Client CoCs are only forwarded to external subcontractors when samples are shipped directly from the project site to the subcontractor lab. Under routine circumstances, client CoCs are not provided to external subcontractors.

Through communication with the subcontracted laboratory, the PM monitors the status of the subcontracted analyses, facilitates successful execution of the work, and ensures the timeliness and completeness of the analytical report.

Non-TNI accredited work must be identified in the subcontractor's report as appropriate. If TNI accreditation is not required, the report does not need to include this information.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data is incorporated into the laboratories EDD (i.e., imported), the report must explicitly indicate which lab produced the data for which methods and samples.

Note: The results submitted by a TestAmerica work sharing laboratory may be transferred electronically and the results reported by the TestAmerica work sharing lab are identified on the final report. The report must explicitly indicate which lab produced the data for which methods and samples. The final report must include a copy of the completed COC for all work sharing reports.

8.4 Contingency Planning

The Laboratory Director may waive the full qualification of a subcontractor process temporarily to meet emergency needs; however, this decision & justification must be documented in the project files, and the 'Purchase Order Terms And Conditions For Subcontracted Laboratory Services' must be sent with the samples and Chain-of-Custody. In the event this provision is utilized, the laboratory (e.g., PM) will be required to verify and document the applicable accreditations of the subcontractor. All other quality and accreditation requirements will still be applicable, but the subcontractor need not have signed a subcontract with TestAmerica at this time. The comprehensive approval process must then be initiated within 30 calendar days of subcontracting.

SECTION 9

PURCHASING SERVICES AND SUPPLIES

9.1 Overview

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, which may affect quality, all purchases from specific vendors are approved by a member of the supervisory or management staff. Capital expenditures are made in accordance with TestAmerica's Corporate Controlled Purchases Procedure, SOP No. CW-F-S-007.

Contracts will be signed in accordance with TestAmerica's Corporate Authorization Matrix Policy, Policy No. CW-F-P-002. Request for Proposals (RFP's) will be issued where more information is required from the potential vendors than just price. Process details are available in TestAmerica's Corporate Procurement and Contracts Policy (Policy No. CW-F-P-004). RFP's allow TestAmerica to determine if a vendor is capable of meeting requirements such as supplying all of the TestAmerica facilities, meeting required quality standards and adhering to necessary ethical and environmental standards. The RFP process also allows potential vendors to outline any additional capabilities they may offer.

9.2 Glassware

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

9.3 Reagents, Standards & Supplies

Purchasing guidelines for equipment and reagents must meet the requirements of the specific method and testing procedures for which they are being purchased. Solvents and acids are pre-tested in accordance with TestAmerica's Corporate SOP on Solvent & Acid Lot Testing & Approval, SOP No. CA-Q-S-001.

9.3.1 Purchasing

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Materials used in the analytical process must be of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP. The analyst completes the Purchase Requisition Form (Figure 9-1) when requesting reagents, standards, or supplies*:* The

analyst may check the item out of the on-site consignment system that contains items approved for laboratory use. If an item is not in the consignment system, the analyst must obtain approval from the area team leader/supervisor and Laboratory Director prior to placing the order. All the orders are submitted to the Laboratory Receptionist or Team Leaders/designated laboratory area personnel by completing the Purchase Requisition Form (Figure 9-1). The Receptionist or Team Leaders/designated laboratory area personnel will enter the orders into the JD Edwards system (JDE). The Receptionist also places the orders for rush items, office supplies and obtains purchase orders for instrument/equipment repairs and maintenance. The laboratory Director will approve or deny the order in the JDE. Every order is given a purchase order number in the JDE. The actual order to the vendor is placed through the purchasing department in the TestAmerica North Canton Laboratory.

9.3.2 Receiving

It is the responsibility of the Sample Receiving department to receive the shipment. It is the responsibility of the analyst who ordered the materials to document the date the materials were received. Once the ordered reagents or materials are received, the analyst compares the information on the label or packaging to the original order to ensure that the purchase meets the quality level specified. The analyst dates and initials the packing slip and forwards it to the Receptionist for filing. Material Safety Data Sheets (MSDSs) are available online through the Company's intranet website. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

9.3.3 Specifications

Methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, analytical reagent grade will be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.

Chemicals must not be used past the manufacturer's expiration date and must not be used past the expiration time noted in a method SOP. If expiration dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals and solvents unless noted otherwise by the manufacturer or by the reference source method. Chemicals/solvents should not be used past the manufacturer's or SOPs expiration date unless 'verified' (refer to item 3 listed below).

- An expiration date cannot be extended if the dry chemical/solvent is discolored or appears otherwise physically degraded, the dry chemical/solvent must be discarded.

- Expiration dates can be extended if the dry chemical/solvent is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), Blanks, Laboratory Control Sample (LCS), etc.).

- If the dry chemical/solvent is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical/solvent is compared to an unexpired independent

source in performing the method and the performance of the dry chemical/solvent is found to be satisfactory. The comparison must show that the dry chemical/solvent meets CCV limits. The comparison studies are maintained with each lab department and copy forwarded to QA office.

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user.

Compressed gases in use are checked for pressure and secure positioning daily. The minimum total pressure must be 500 psig or the tank must be replaced. To prevent a tank from going to dryness, close observation of the tank gauge must take place as pressure decreases towards 500psig, or the tank must be replaced. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

Water used in the preparation of standards or reagents must have a specific conductivity of less than 1- µmho /cm (or specific resistivity of greater than 1.0 megohm-cm) at 25^{o}C. The specific conductivity is checked and recorded daily. If the water's specific conductivity is greater than the specified limit, the Facility Manager and appropriate Technical Managers/Supervisors must be notified immediately in order to notify all departments, decide on cessation (based on intended use) of activities, and make arrangements for correction.

The laboratory may purchase reagent grade (or other similar quality) water for use in the laboratory. This water must be certified "clean" by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard.

Purchased bottleware used for sampling must be certified clean and the certificates must be maintained. If uncertified sampling bottleware is purchased, all lots must be verified clean prior to use. This verification must be maintained.

Records of manufacturer's certification and traceability statements are maintained in files or binders in each laboratory section. These records include date of receipt, lot number (when applicable), and expiration date (when applicable). Incorporation of the item into the record indicates that the analyst has compared the new certificate with the previous one for the same purpose and that no difference is noted, unless approved and so documented by the Technical Manager (s) or QA Manager.

9.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Storage conditions are per the Corporate Environmental Health & Safety Manual (Corp. Doc. No. CW-E-M-001) and method SOPs or manufacturer instructions.

9.4 Purchase Of Equipment/Instruments/Software

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or supervisor makes a supply request to the Technical Manager (s) and/or the Laboratory Director. If they agree with the request, the procedures outlined in TestAmerica's Corporate Policy No. CA-T-P-001, Qualified Products List, are followed. A decision is made as to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed and purchasing places the order.

Upon receipt of a new or used piece of equipment, an identification name is assigned and added to the equipment list. IT must also be notified so that they can synchronize the instrument for back-ups. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated, followed by MDLs, Demonstration of Capabilities (DOCs), and other relevant criteria (refer to Section 19). For software, its operation must be deemed reliable and evidence of instrument verification must be retained by the IT Department or QA Department. Software certificates supplied by the vendors are filed with the LIMS Administrator. The manufacturer's operation manual is retained at the be

9.5 Services

Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 20. The need for service is determined by analysts and/or Technical Managers. The service providers that perform the services are approved by the Laboratory Technical Manager / Director.

9.6 Suppliers

TestAmerica selects vendors through a competitive proposal / bid process, strategic business alliances or negotiated vendor partnerships (contracts). This process is defined in the Corporate Finance documents on Vendor Selection (SOP No. CW-F-S-018) and Procurement & Contracts Policy (Policy No. CW-F-P-004). The level of control used in the selection process is dependent on the anticipated spending amount and the potential impact on TestAmerica business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items of defined quality that meet the end use requirements. The JD Edwards purchasing system includes all suppliers/vendors that have been approved for use.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality. This is documented by signing off on packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Corporate Purchasing Group by completing a Vendor Performance Report.

The Corporate Purchasing Group will work through the appropriate channels to gather the information required to clearly identify the problem and will contact the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc.

As deemed appropriate, the Vendor Performance Reports will be summarized and reviewed to determine corrective action necessary, or service improvements required by vendors

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the JD Edwards purchasing system.

9.6.1 New Vendor Procedure

TestAmerica employees who wish to request the addition of a new vendor must complete a J.D. Edwards Vendor Add Request Form.

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are also evaluated to determine if there are ethical reasons or potential conflicts of interest with TestAmerica employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department and/or the Technology Director are consulted with vendor and product selection that have an impact on quality.

Figure 9-1.

Example - Purchase Requisition Form

Date:	**For Purchasing Use Only**
Vendor Name:	**Order Date:**
Exact Date Needed:	**Account Number:**
Requested By:	**Order Number:**
Department Name/Number:	**P.O. Number:**

Item	Quantity	Unit of Measure	Catalog No.	Description	Unit Cost	Total Cost
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						

Authorized Signature Date

SECTION 10

COMPLAINTS

10.1 Overview

The laboratory considers an effective client complaint handling processes to be of significant business and strategic value. Listening to and documenting client concerns captures 'client knowledge' that enables our operations to continually improve processes and client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services (e.g., communications, responsiveness, data, reports, invoicing and other functions) expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for addressing both external and internal complaints with the goal of providing satisfactory resolution to complaints in a timely and professional manner.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 12 (Corrective Actions) and is documented following the Customer Complaint System, SOP No. PT-QA-016. This is a database created to track, followup and close out customer complaints and corrective actions. It is the laboratory's goal to provide a satisfactory resolution to complaints in a timely and professional manner.

10.2 External Complaints

An employee that receives a complaint initiates the complaint resolution process by first documenting the complaint in the database, according to (SOP No. PT-QA-016).

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data was repeatedly late. Non-correctable complaints should be reviewed for preventive action measures to reduce the likelihood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving and Documenting Complaints
- Complaint Investigation and Service Recovery

- Process Improvement

The laboratory shall inform the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

10.3 Internal Complaints

Internal complaints include, but are not limited to: errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and shall follow the procedures outlined in Section 12. In addition, Corporate Management, Sales and Marketing and IT may initiate a complaint by contacting the laboratory or through the corrective action system described in Section 12.

10.4 Management Review

The number and nature of client complaints is reported by the QA Manager to the laboratory and QA Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Annual Management Review (Section 16).

SECTION 11

CONTROL OF NON-CONFORMING WORK

11.1 Overview

When data discrepancies are discovered or deviations and departures from laboratory SOPs, policies and/or client requests have occurred, corrective action is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then, a corrective action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's corrective action system (refer to Section 12).

Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed. When an analyst encounters such a situation, the problem is presented to the supervisor for advice. The supervisor may elect to discuss it with the Laboratory Director or QA Manager or have a PM contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst documents it using the laboratories corrective action system described in Section 12. This information can then be supplied to the client in the form of a case narrative with the report.

Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or opt to reject the request based on technical or ethical merit.

An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in Section 19. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Laboratory Director and QA Manager, documented and included in the project folder. Deviations **must** also be noted on the final report with a statement that the compound is not reported in compliance with TNI (or the analytical method) requirements and the reason. Data being reported to a non-TNI state would need to note the change made to how the method is normally run.

11.2 Responsibilities And Authorities

TestAmerica's Corporate SOP entitled *Internal Investigation of Potential Data Discrepancies and Determination for Data Recall* (SOP No. CW-L-S-002), outlines the general procedures for the reporting and investigation of data discrepancies and alleged incidents of misconduct or violations of TestAmerica's data integrity policies as well as the policies and procedures related to the determination of the potential need to recall data.

Under certain circumstances, the Laboratory Director, a Technical Manager, or a member of the QA team may authorize departures from documented procedures or policies. The departures may be a result of procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient sample to reanalyze, etc.. In most cases, the client will be informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory's corrective action procedures. This information is documented on a Nonconformance Memo (NCM) and may also be documented in logbooks and/or data review checklists as appropriate. Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any misrepresentation or possible misrepresentation of analytical data discovered by any laboratory staff member must be reported to facility Senior Management within 24-hours. The Senior Management staff is comprised of the Laboratory Director, the QA Manager, and the Technical Managers. The reporting of issues involving alleged violations of the company's Data Integrity or Manual Integration procedures must be conveyed to an Ethics and Compliance Officer (ECO), Director of Quality & Client Advocacy and the laboratory's Quality Director within 24 hours of discovery.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect.

The Laboratory Director, QA Manager, ECOs, Corporate Quality, the COO, General Managers and the Quality Directors have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work.

11.3 Evaluation Of Significance And Actions Taken

For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data,

whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.

TestAmerica's Corporate Data Investigation & Recall Procedure (SOP No. CW-L-S-002) distinguishes between situations when it would be appropriate for laboratory management to make the decision on the need for client notification (written or verbal) and data recall (report revision) and when the decision must be made with the assistance of the ECO's and Corporate Management. Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/corrective action reporting in lieu of the data recall determination form contained in TestAmerica's Corporate SOP No. CW-L-S-002.

11.4 Prevention Of Nonconforming Work

If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory's corrective action system. Periodically as defined by the laboratory's preventive action schedule, or on a monthly basis, the QA Department evaluates non-conformances to determine if any nonconforming work has been repeated multiple times. If so, the laboratory's corrective action process may be followed.

11.5 Method Suspension/Restriction (Stop Work Procedures

In some cases, it may be necessary to suspend/restrict the use of a method or target compound which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any of the persons noted in Section 11.2, Paragraph 5.

Prior to suspension/restriction, confidentiality will be respected, and the problem with the required corrective and preventive action will be stated in writing and presented to the Laboratory Director.

The Laboratory Director shall arrange for the appropriate personnel to meet with the QA Manager as needed. This meeting shall be held to confirm that there is a problem, that suspension/restriction of the method is required and will be concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases, that may not be necessary if all appropriate personnel have already agreed there is a problem and there is agreement on the steps needed to bring the method, target or test fully back on line.

The QA Manager will also initiate a corrective action report as described in Section 12 if one has not already been started. A copy of any meeting notes and agreed upon steps should be faxed or e-mailed by the laboratory to the appropriate General Manager and member of Corporate QA. This fax/e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for viewing on the internet. It is the responsibility of the Laboratory Director to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction (e.g., Project Management, Log-in, etc.). Clients will NOT generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

Within 72 hours, the QA Manager will determine if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (Laboratory Director, Technical Manager/Director, QA Manager) can devise a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management, and the Directors of Client Services and Sales and Marketing must be notified if clients must be notified or if the suspension/restriction affects the laboratory's ability to accept work. The QA Manager must approve start-up or elimination of any restrictions after all corrective action is complete. This approval is given by final signature on the completed corrective action report.

SECTION 12

CORRECTIVE ACTION

12.1 Overview

A major component of TestAmerica's Quality Assurance (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence. Corrective actions are documented using Non-Conformance Memos (NCM) in LIMS (Figure 12-1) or the Corrective Action Reports (CAR) using the corrective action database (Figures 12-2 and 12-3).

12.2 General

Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, proficiency testing (PT) performance, client complaints, staff observation, etc..

The purpose of a corrective action system is to:

- Identify non-conformance events and assign responsibility(s) for investigating.
- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify systematic problems before they become serious.
- Identify and track client complaints and provide resolution.

12.2.1 Non-Conformance Memo (NCM) - is used to document the following types of corrective actions (Figures 12-1):

- Deviations from an established procedure or SOP
- QC outside of limits (non-matrix related)
- Isolated reporting / calculation errors
- Client Complaints

- Discrepancies in materials / goods received vs. manufacturer packing slips.

12.2.2 Corrective Action Database (Figures 12-2 - 12-3) - is used to document the following types of corrective actions:

- Questionable trends that are found in the review of NCMs.
- Issues found while reviewing NCMs that warrant further investigation.
- Failed or unacceptable PT results.
- Corrective actions that cross multiple departments in the laboratory.
- Systematic reporting / calculation errors.
- Complaints received from clients are documented in the corrective action database.
- Data recall investigations
- Identified poor process or method performance trends
- Excessive revised reports

This will provide background documentation to enable root cause analysis and preventive action.

12.3 Closed Loop Corrective Action Process

Any employee in the company can initiate a corrective action. There are four main components to a closed-loop corrective action process once an issue has been identified: Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up.

12.3.1 Cause Analysis

- Upon discovery of a non-conformance event, the event must be defined and documented. An NCM, CAR or the documentation in the complaint database must be initiated. Someone is assigned to investigate the issue and the event is investigated for root cause. Table 12-1 provides some general guidelines on determining responsibility for assessment.
- The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.
- If the root cause is not readily obvious, the Supervisor, Laboratory Technical Manager, Laboratory Director, or QA Manager (or QA designee) is consulted.

12.3.2 Selection and Implementation of Corrective Actions

- Where corrective action is needed, the laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.
- Corrective actions shall be to a degree appropriate to the magnitude of the problem identified through the cause analysis.
- Whatever corrective action is determined to be appropriate, the laboratory shall document and implement the changes. The NCM or CAR is used for this documentation.

12.3.3 Root Cause Analysis

Root Cause Analysis is a class of problem solving (investigative) methods aimed at identifying the basic or causal factor(s) that underlie variation in performance or the occurrence of a significant failure. The root cause may be buried under seemingly innocuous events, many steps preceding the perceived failure. At first glance, the immediate response is typically directed at a symptom and not the cause. Typically, root cause analysis would be best with three or more incidents to triangulate a weakness.

Systematically analyze and document the Root Causes of the more significant problems that are reported. Identify, track, and implement the corrective actions required to reduce the likelihood of recurrence of significant incidents. Trend the Root Cause data from these incidents to identify Root Causes that, when corrected, can lead to dramatic improvements in performance by eliminating entire classes of problems.

Identify the one event associated with problem and ask why this event occurred. Brainstorm the root causes of failures; for example, by asking why events occurred or conditions existed; and then why the cause occurred 5 consecutive times until you get to the root cause. For each of these sub events or causes, ask why it occurred. Repeat the process for the other events associated with the incident.

Root cause analysis does not mean the investigation is over. Look at technique, or other systems outside the normal indicators. Often creative thinking will find root causes that ordinarily would be missed, and continue to plague the laboratory or operation.

12.3.4 Monitoring of the Corrective Actions

- The Technical Manager and QA Manager are responsible to ensure that the corrective action taken was effective.
- Ineffective actions are documented and re-evaluated until acceptable resolution is achieved. Technical Managers are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.
- Each NCM is entered into a database for tracking purposes and a monthly summary of all NCMs is reviewed to aid in ensuring that the appropriate corrective actions have taken effect. CARs are also compiled and reviewed monthly. Corrective actions or complaints that result in corrective action are also reviewed monthly.
- The QA Manager reviews NCMs and CARs monthly for trends. Highlights are included in the QA monthly report (refer to Section 16). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.
- Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.

12.3.5 Follow-up Audits

- Follow-up audits may be initiated by the QA Manager and shall be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or federal requirements.
- These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered.

(Also refer to Section 15.1.4, Special Audits.)

12.4 Technical Corrective Actions

In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs, the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 11). The documentation of these procedures is through the use of an NCM or CAR.

Table 12-1 includes examples of general technical corrective actions. For specific criteria and corrective actions, refer to the analytical methods or specific method SOPs. The laboratory may also maintain Work Instructions on these items that are available upon request.

Table 12-1 provides some general guidelines for identifying the individual(s) responsible for assessing each QC type and initiating corrective action. The table also provides general guidance on how a data set should be treated if associated QC measurements are unacceptable. Specific procedures are included in Method SOPs, Work Instructions, QAM Sections 19 and 20. All corrective actions are reviewed monthly, at a minimum, by the QA Manager and highlights are included in the QA monthly report.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If the deficiency does not impair the usability of the results, data will be reported with an appropriate data qualifier and/or the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by an NCM and appropriate corrective action (e.g., reanalysis) is taken and documented.

12.5 Basic Corrections

When mistakes occur in records, each mistake shall be crossed-out, [not obliterated (e.g. no white-out)], and the correct value entered alongside. All such corrections shall be initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original "uncorrected" file must be maintained intact and a second "corrected" file is created.

This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated.

When corrections are due to reasons other than obvious transcription errors, the reason for the corrections (or additions) shall also be documented.

Figure 12-1.
Example - Nonconformance Memo Screen - LIMS

Nonconformance Memo – LIMS

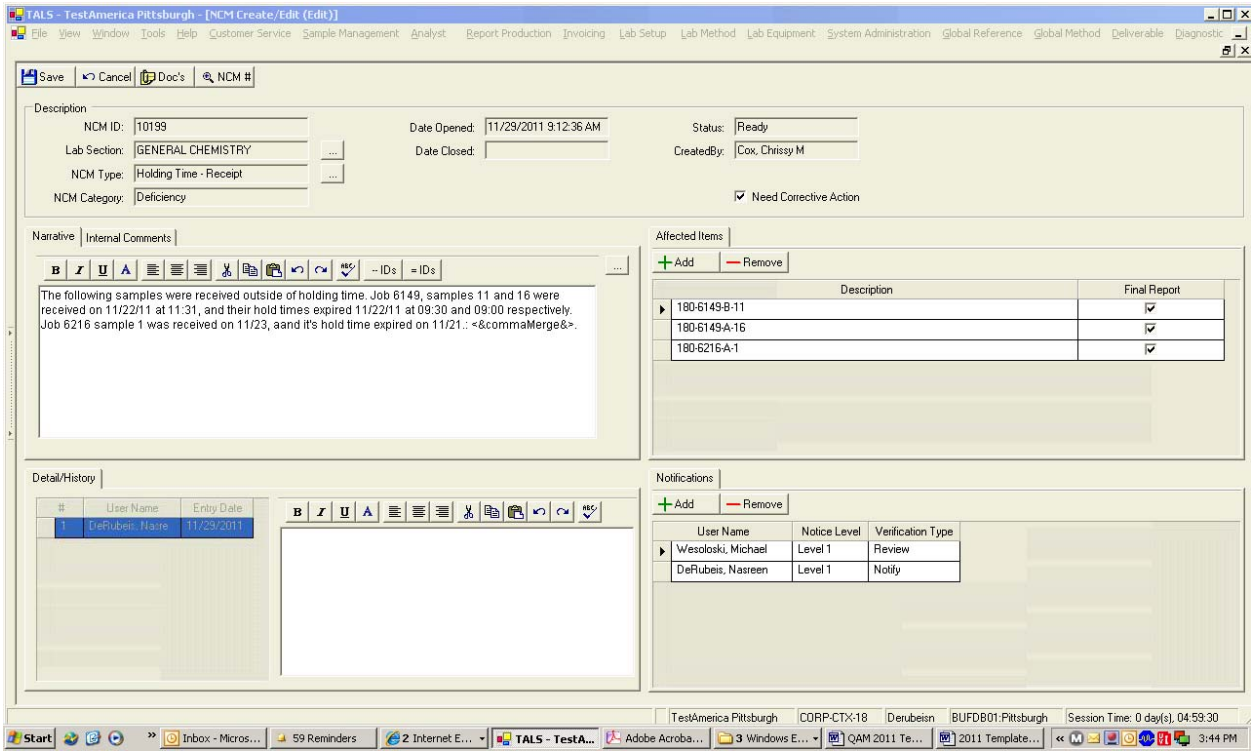


Figure 12-2.

Example – Corrective Action Database

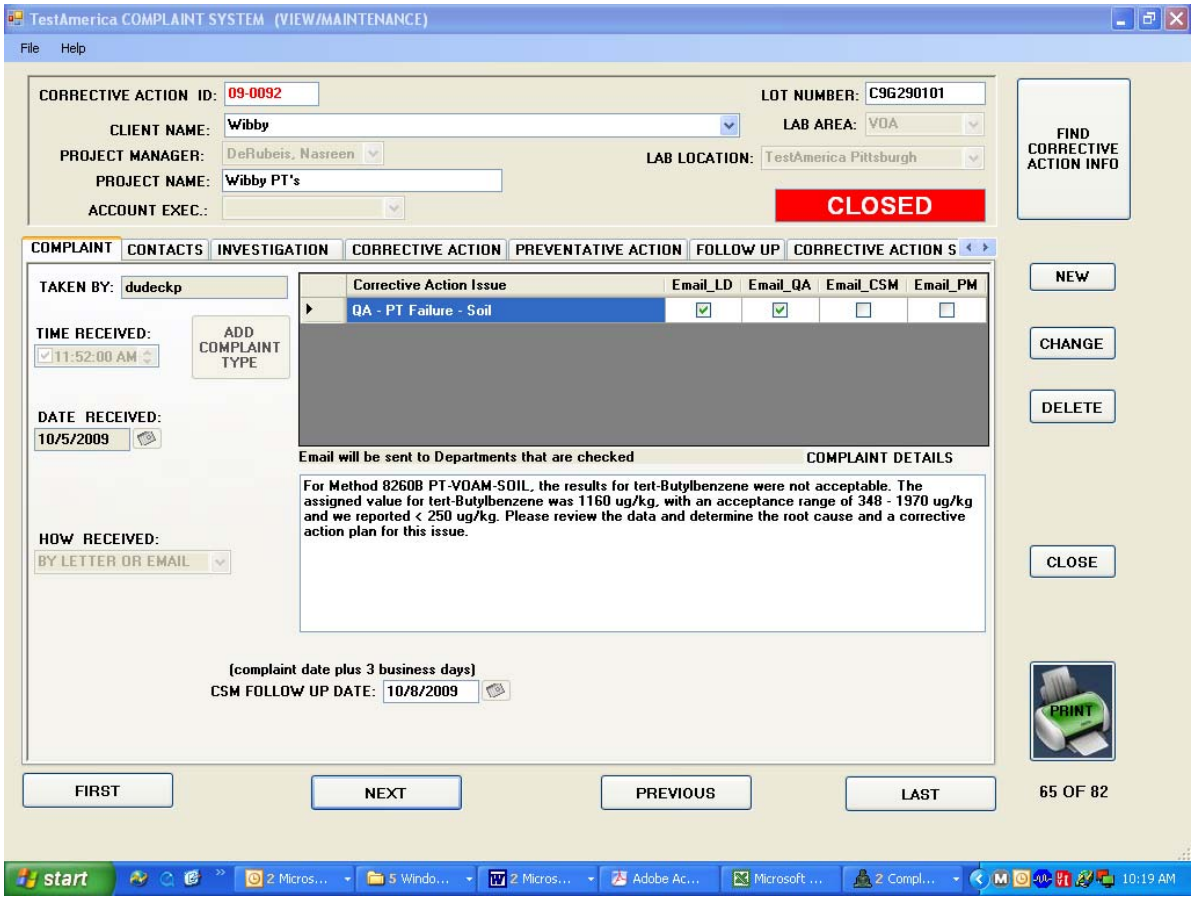


Figure 12-3.

Example – Corrective Action Database Report

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Nonconformance and Corrective Action

CLIENT NAME:
PROJECT MANAGER:
PROJECT NAME:
ACCOUNT EXEC:
STATUS:
LOT NUMBER:
LAB AREA:
CORRECTIVE ACTION ID:
LAB LOCATION: TestAmerica Pittsburgh

ENTERED BY:
DATE RECEIVED:
TIME RECEIVED:
PROBLEM DESCRIPTION:
RESOLUTION DUE BY:

INVESTIGATED BY:
DATE COMPLETED:
INVESTIGATION / ROOT CAUSE:

RESPONSIBLE PARTY:
DATE COMPLETED:
DUE:
CORRECTIVE ACTION:

PREVENTATIVE ACTION DATE:

PREVENTATIVE ACTION:

Table 12-1.

Example – General Corrective Action Procedures

QC Activity *(Individual Responsible for Initiation/Assessment)*	Acceptance Criteria	Recommended Corrective Action
Initial Instrument Blank *(Analyst)*	- Instrument response < MDL.	- Prepare another blank. - If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc..
Initial Calibration Standards *(Analyst, Technical Manager(s))*	- Correlation coefficient > 0.99 or standard concentration value. - % Recovery within acceptance range. - See details in Method SOP.	- Reanalyze standards. - If still unacceptable, remake standards and recalibrate instrument.
Independent Calibration Verification (Second Source) *(Analyst, Technical Manager(s))*	- % Recovery within control limits.	- Remake and reanalyze standard. - If still unacceptable, then remake calibration standards or use new primary standards and recalibrate instrument.
Continuing Calibration Standards *(Analyst, Data Reviewer)*	% Recovery within control limits.	- Reanalyze standard. - If still unacceptable, then recalibrate and rerun affected samples.
Matrix Spike / Matrix Spike Duplicate (MS/MSD) *(Analyst, Data Reviewer)*	- % Recovery within limits documented in LIMS.	- If the acceptance criteria for duplicates or matrix spikes are not met because of matrix interferences, the acceptance of the analytical batch is determined by the validity of the LCS. - If the LCS is within acceptable limits the batch is acceptable. - The results of the duplicates, matrix spikes and the LCS are reported with the data set. - For matrix spike or duplicate results outside criteria the data for that sample shall be reported with qualifiers.

QC Activity *(Individual Responsible for Initiation/Assessment)*	Acceptance Criteria	Recommended Corrective Action
Laboratory Control Sample (LCS) *(Analyst, Data Reviewer)*	- % Recovery within limits specified in LIMS,	- Batch must be re-prepared and re-analyzed. **Note:** If there is insufficient sample or the holding time cannot be met, contact client and report with flags. This includes any allowable marginal exceedance. When not using marginal exceedances, the following exceptions apply: 1) when the acceptance criteria for the positive control are exceeded high (i.e., high bias) and there are associated samples that are non-detects, then those non-detects may be reported with data qualifying codes; 2) when the acceptance criteria for the positive control are exceeded low (i.e., low bias), generally with low bias samples are reprepared and reanalzyed.
Surrogates *(Analyst, Data Reviewer)*	- % Recovery within limits of method or within three standard deviations of the historical mean.	- Individual sample must be repeated. Place comment in LIMS. - Surrogate results outside criteria shall be reported with qualifiers.
Method Blank (MB) *(Analyst, Data Reviewer)*	< Reporting Limit [1] For DoD requirements no analytes detected at greater than and equal to ½ RL. For common lab contaminants, no analytes detected at greater than and equal to RL (refer to SOP PT-QA-025 & SOP PT-QA-029).	- Reanalyze blank. - If still positive, determine source of contamination. If necessary, reprocess (i.e. digest or extract) entire sample batch. Report blank results. - Qualify the result(s) if the concentration of a targeted analyte in the MB is at or above the reporting limit and is > 1/10 of the amount measured in the sample.
Proficiency Testing (PT) Samples *(QA Manager, Technical Manager(s))*	- Criteria supplied by PT Supplier.	- Any failures or warnings must be investigated for cause. Failures may result in the need to repeat a PT sample to show the problem is corrected.
Internal / External Audits *(QA Manager, Technical Manager(s), Laboratory Director)*	- Defined in Quality System documentation such as SOPs, QAM, etc..	- Non-conformances must be investigated through CAR system and necessary corrections must be made.

QC Activity *(Individual Responsible for Initiation/Assessment)*	Acceptance Criteria	Recommended Corrective Action
Reporting / Calculation Errors (Depends on issue – possible individuals include: Analysts, Data Reviewers, Project Managers, *Technical Manager(s)*, QA Manager, Corporate QA, Corporate Management)	- SOP CW-L-S-002, Internal Investigation of Potential Data Discrepancies and Determination for Data Recall.	- Corrective action is determined by type of error. Follow the procedures in SOP CW-L-S-002 .
Client Complaints *(Project Managers, Lab Director, Sales and Marketing)*	-	- Corrective action is determined by the type of complaint. For example, a complaint regarding an incorrect address on a report will result in the report being corrected and then follow-up must be performed on the reasons the address was incorrect (e.g., database needs to be updated).
QA Monthly Report (Refer to Section 16 for an example) (QA Manager, Lab Director, *Technical Manager(s)*)	- QAM, SOPs.	- Corrective action is determined by the type of issue. For example, CARs for the month are reviewed and possible trends are investigated.
Health and Safety Violation (Safety Officer, Lab Director, *Technical Manager(s)*)	- Environmental Health and Safety (EHS) Manual.	- Non-conformance is investigated and corrected through CAR system.

Note:

1. Except as noted below for certain compounds, the method blank should be below the reporting limit unless there is a client specific requirement. Concentrations up to five times the reporting limit will be allowed for the ubiquitous laboratory and reagent contaminants: methylene chloride, toluene, acetone, 2-butanone and phthalates **provided** they appear in similar levels in the reagent blank and samples. This allowance presumes that the detection limit is significantly below any regulatory limit to which the data are to be compared and that blank subtraction will not occur. For benzene and ethylene dibromide (EDB) and other analytes for which regulatory limits are extremely close to the detection limit, the method blank must be below the method detection limit.

SECTION 13

PREVENTIVE ACTION / IMPROVEMENT

13.1 Overview

The laboratory's preventive action programs improve or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive and continuous process if improvement activities that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA Department has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes the laboratory's commitment to its Quality Program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, customer service and client satisfaction can be improved through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered during management reviews, the monthly QA Metrics Report, evaluation of internal or external audits, results and evaluation of proficiency testing (PT) performance, data analysis & review processing operations, client complaints, staff observation, etc..

The monthly Management Systems Metrics Report shows performance indicators in all areas of the laboratory and quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, ethics training, etc. These metrics are used in evaluating the management and quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

The laboratory's corrective action process is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further occurrence of a non-compliance event. Historical review of corrective action provides a valuable mechanism for identifying preventive action opportunities.

13.1.1 The following elements are part of a preventive action system:

- Identification of an opportunity for preventive action.
- Process for the preventive action.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action.
- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action.
- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action. Documentation of Preventive Action is incorporated into the monthly QA reports, corrective action process and management review.

13.1.2 Any Preventive Actions undertaken or attempted shall be taken into account during the Annual Management Systems Review (Section 16). A highly detailed report is not required; however a summary of success and failure within the preventive action program is sufficient to provide management with a measurement for evaluation.

13.2 Management Of Change

The Management of Change process is designed to manage significant events and changes that occur within the laboratory. Through these various tracking indicators, the potential risks inherent with a new event or change are identified and evaluated. The risks are minimized or eliminated through pre-planning and the development of preventive measures. The types of indicators monitored under this collective system include:

- SOP Tracking
  - Current Revisions w/ Effective Dates
  - Required Annual/Biennial Revisions w/ Due Date
- Proficiency Testing (PT) Sample Tracking
  - Pass / Fail – most current 2 out of 3 studies.
- Instrument / Equipment List
  - Current / Location
- Accreditations
  - New / Expiring
- Method Capabilities
  - Current Listing by program (e.g., Potable Water, Soils, etc.)
- Key Personnel
  - Technical Managers, Department Supervisors, etc..

These items are maintained on TestAmerica's Intranet (Proposal Library) or on our internal database (TotalAccess) which uploads to our company internet site.

SECTION 14

CONTROL OF RECORDS

The laboratory maintains a records management system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued.

14.1 Overview

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. A record index is listed in Table 14-1. Quality records are maintained by the Quality Assurance (QA) department electronically in laboratory's designated network drive which is backed up as part of the regular network backup. Records are of two types; either electronic or hard copy paper formats

depending on whether the record is computer or hand generated (some records may be in both formats). Technical records are maintained by report production group and HR Coordinator as outlined in SOP No. PT-QA-019.

Table 14-1. Record Index[1]

	Record Types [1]:	Retention Time:
Technical Records	- Raw Data - Logbooks[2] - Standards - Certificates - Analytical Records - MDLs/IDLs/DOCs - Lab Reports	5 Years from analytical report issue*
Official Documents	- Quality Assurance Manual (QAM) - Work Instructions - Policies - SOPs - Policy Memorandums - Manuals	5 Years from document retirement date*
QA Records	- Internal & External Audits/Responses - Certifications - Corrective/Preventive Actions - Management Reviews - Method & Software Validation / Verification Data - Data Investigation	5 Years from archival* **Data Investigation:** 5 years or the life of the affected raw data storage whichever is greater (beyond 5 years if ongoing project or pending investigation)
Project Records	- Sample Receipt & COC Documentation - Contracts and Amendments - Correspondence - QAPP -SAP - Telephone Logbooks - Lab Reports	5 Years from analytical report issue*
Administrative Records	Finance and Accounting	10 years
	EH&S Manual, Permits	7 years
	Disposal Records	Indefinitely
	Employee Handbook	Indefinitely
	Personnel files, Employee Signature & Initials, Administrative Training Records (e.g., Ethics)	7 Years (HR Personnel Files must be maintained indefinitely)
	Administrative Policies Technical Training Records	7 years

[1] Record Types encompass hardcopy and electronic records.

[2] Examples of Logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature (hardcopy or electronic records).
* Exceptions listed in Table 14-2.

14.1.1 All records are stored and retained in such a way that they are secure and readily retrievable at the laboratory facility or an offsite location that provides a suitable environment to prevent damage or deterioration and to prevent loss at the laboratory or the Business Records Management Facility. Depending on the type of report requested, the onsite retention of laboratory data records varies. For projects with LIMS report (R02), the raw data generated by the laboratory is maintained on-site for three months. After this period the laboratory data is destroyed because all this data is maintained electronically and can be reproduced. The chain of custodies, level I, II, and III reviews, mercury data, Sample Receipt Checklist, client summary of analysis, invoices, any correspondences if available in the project file are maintained and archived for a minimum of 5 and maximum of 7 years. For full data packages, all the laboratory data is scanned as reported and stored electronically on CDs, which are maintained in the laboratory reporting area file cabinet. Also backup CD archive is made and stored in a fireproof safe. The data package hard copy is stored on-site for a minimum of three months**.** All records shall be protected against fire, theft, loss, environmental deterioration, and vermin. In the case of electronic records, electronic or magnetic sources, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration.

Access to the data is limited to laboratory and company employees**.** Records archived off-site are stored in a secure location where a record is maintained of any entry into the storage facility. Whether off-site storage is used, logs are maintained to note removal and return of records. All data records are uploaded into LIMS and maintained in LIMS. Records are maintained for a minimum of five years unless otherwise specified by a client or regulatory requirement.

For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as Controlled Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 14-2 have lengthier retention requirements and are subject to the requirements in Section 14.1.3.

14.1.2 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in Table 14-2 with their retention requirements. In these cases, the longer retention requirement is enacted. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Table 14-2. Special Record Retention Requirements

Program	[1]Retention Requirement
Drinking Water – All States	5 years (project records) 10 years Radiochemistry (project records)
Drinking Water Lead and Copper Rule	12 years (project records)
Commonwealth of MA – All environmental data 310 CMR 42.14	10 years
FIFRA – 40 CFR Part 160	Retain for life of research or marketing permit for pesticides regulated by EPA
Housing and Urban Development (HUD) Environmental Lead Testing	10 years
Alaska	10 years
Louisiana – All	10 years
Michigan Department of Environmental Quality – all environmental data	10 years
Navy Facilities Engineering Service Center (NFESC)	10 years
NY Potable Water NYCRR Part 55-2	10 years
Ohio VAP	10 years and State contacted prior to disposal
TSCA - 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement

[1]Note: Extended retention requirements must be noted with the archive documents or addressed in facility-specific records retention procedures.

14.1.3 The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format. For analytical reports that are maintained as copies in PDF format, refer to SOP No. PT-QA-019, Records Information Management and SOP No. PT-QA-020, Report Production.

14.1.4 The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data (Records stored off site should be accessible within 2 days of a request for such records). The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This shall include inter-laboratory transfers of samples and/or extracts.

- The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved. All analytical work contains the initials (at least) of the personnel involved. The laboratory's copy of the chain of custody is stored with the invoice in LIMS. Details of this procedure is described in SOP No. PT-QA-019. The chain of custody would indicate the

name of the sampler. If any sampling notes are provided with the chain of custody, they are kept with main folder or scanned into LIMS.

- All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.

- The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes (e.g., set format for naming electronic files, set format for what is included with a given analytical data set are described in SOP No. PT-QA-019. Instrument data is stored sequentially by instrument. Run logs are maintained for each instrument; a copy of each day's run long or instrument sequence is stored with the data to aid in re-constructing an analytical sequence. Where an analysis is performed without an instrument, bound logbooks or bench sheets are used to record and file data or the data is entered in LIMS. Standard and reagent information is recorded in electronic standard log in LIMS.

- Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

- The reason for a signature or initials on a document is clearly indicated in the records such as "sampled by," "prepared by," "reviewed by", or "analyzed by".

- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink.

- Hard copy data may be scanned into PDF format for record storage as long as the scanning process can be verified in order to ensure that no data is lost and the data files and storage media must be tested to verify the laboratory's ability to retrieve the information prior to the destruction of the hard copy that was scanned. The procedure for this verification can be found in SOP No. PT-QA-019.

- Also refer to Section 19.14.1 'Computer and Electronic Data Related Requirements'**.**

14.2 Technical And Analytical Records

14.2.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of five years unless otherwise specified by a client or regulatory requirement. The records for each analysis shall contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records shall include the identity of laboratory personnel responsible for the sampling, performance of each analysis and reviewing results.

14.2.2 Observations, data and calculations are recorded real-time and are identifiable to the specific task.

14.2.3 Changes to hardcopy records shall follow the procedures outlined in Section 12 and

19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:

- Laboratory sample ID code**;**
- Date of analysis; Time of Analysis is also required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. Where a time critical step exists in an analysis, location for such a time is included as part of the documentation in a specific logbook, on a benchsheet or in LIMS.
- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically recorded in instrument maintenance logs where available.
- analysis type**;**
- all manual calculations and manual integrations**;**
- analyst's or operator's initials/signature**;**
- sample preparation including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents**;**
- test results**;**
- standard and reagent origin, receipt, preparation, and use**;**
- calibration criteria, frequency and acceptance criteria**;**
- data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions**;**
- quality control protocols and assessment**;**
- electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and
- Method performance criteria including expected quality control requirements. These are indicated both in the LIMS and on specific analytical report formats**.**

14.3 Laboratory Support Activities

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records)**;**

- a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value**;**
- copies of final reports**;**
- archived SOPs**;**
- correspondence relating to laboratory activities for a specific project**;**
- all corrective action reports, audits and audit responses**;**
- proficiency test results and raw data; and
- results of data review, verification, and crosschecking procedures

14.3.1 Sample Handling Records

Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

- sample preservation including appropriateness of sample container and compliance with holding time requirement;
- sample identification, receipt, acceptance or rejection and login;
- sample storage and tracking including shipping receipts, sample transmittal / COC forms; and
- procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

14.4 Administrative Records

The laboratory also maintains the administrative records in either electronic or hard copy form. Refer to Table 14-1.

14.5 Records Management, Storage And Disposal

14.5.1 All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. Certification related records are available upon request.

14.5.2 All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

14.5.3 Records that are stored or generated by computers or personal computers have hard copy, write-protected backup copies, or an electronic audit trail controlling access**.**

14.5.4 The laboratory has a record management system (a.k.a., document control) for

control of laboratory instrument/run logbooks, standard logbooks, balance logs, maintenance logs, bench sheets where applicable and records for data reduction, validation and reporting. Laboratory notebooks are issued on a per analysis basis, and are numbered sequentially. All sample data are recorded in LIMS. Bench sheets are filed sequentially. Standards are maintained in the electronic standards in LIMS. Records are considered archived when noted as such in the records management system (a.k.a., document control).

14.5.5 Transfer of Ownership

In the event that the laboratory transfers ownership or goes out of business, the laboratory shall ensure that the records are maintained or transferred according to client's instructions. Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of the corporate headquarters. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

14.5.6 Records Disposal

14.5.6.1 Records are removed from the archive and destroyed after 5 years unless otherwise specified by a client or regulatory requirement. On a project specific or program basis, clients may need to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration. (Refer to Tables 14-1 and 14-2 and SOP No. PT-QA-019).

14.5.6.2 Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

14.5.6.3 If a third party records management company is hired to dispose of records, a "Certificate of Destruction" is required.

SECTION 15

AUDITS

15.1 Internal Audits

Internal audits are performed to verify that laboratory operations comply with the requirements of the lab's quality system and with the external quality programs under which the laboratory operates. Audits are planned and organized by the QA staff. Personnel conducting the audits should be independent of the area being evaluated. Auditors will have sufficient authority, access to work areas, and organizational freedom necessary to observe all activities affecting quality and to report the assessments to laboratory management and when requested to corporate management.

Audits are conducted and documented as described in the TestAmerica Corporate SOP on performing Internal Auditing, SOP No. CA-Q-S-004. More detail on the specific elements for internal audits and data audit is described in Pittsburgh Laboratory's SOP No. PT-QA-002, and SOP No. PT-QA-013. Technical data review requirement are described in Section 19.14.4 and SOP No. PT-QA-018. The types and frequency of routine internal audits are shown in Table 15-1. Special or ad hoc assessments may be conducted as needed under the direction of the QA staff.

Table 15-1. Types of Internal Audits and Frequency

Description	Performed by	Frequency
Quality Systems Audits	QA Department, QA approved designee, or Corporate QA	All areas of the laboratory annually
Method Audits	Joint responsibility: a) QA Manager or designee b) Technical Manager or Designee (Refer to CA-Q-S-004)	Methods Audits Frequency: 50% of methods annually **100% of methods annually (DoD)**
Special	QA Department or Designee	Surveillance or spot checks performed as needed, e.g., to confirm corrective actions from other audits.
Performance Testing	Analysts with QA oversight	Two successful per year for each TNI field of testing or as dictated by regulatory requirements

15.1.1 Annual Quality Systems Audit

An annual quality systems audit is required to ensure compliance to analytical methods and SOPs, TestAmerica's Data Integrity and Ethics Policies, TNI quality systems, client, state requirements, and DoD QSM and the effectiveness of the internal controls of the analytical process, including but not limited to data review, quality controls, preventive action and corrective action. The completeness of earlier corrective actions is assessed for effectiveness & sustainability. The audit is divided into sections for each operating or support area of the lab, and each section is comprehensive for a given area. The area audits may be performed on a rotating schedule throughout the year to ensure adequate coverage of all areas. This schedule may change as situations in the laboratory warrant.

Effectiveness of training will be determined during our annual QA systems evaluation. Evidence of successful training includes:

- Audit and surveillance results, control charts, proficiency testing results, data analysis, corrective and preventive actions, customer feedback, and management reviews in efforts to monitor trends and continually improve the quality system:

- Adequate documentation of training within operational areas, including one-on-one technical training for individual technologies, and particularly for people cross-trained.

- Analysts knowledge of QA Manual and SOPs. Analysts following SOPs, i.e., practice matches SOPs.
- Analysts regularly communicate to supervisors and QA if SOPs need revision.

15.1.2 QA Technical Audits

QA technical audits are based on client projects, associated sample delivery groups, and the methods performed. Reported results are compared to raw data to verify the authenticity of results. The validity of calibrations and QC results are compared to data qualifiers, footnotes, and case narratives. Documentation is assessed by examining run logs and records of manual integrations. Manual calculations are checked. Where possible, electronic audit miner programs (e.g., MintMiner and Chrom AuditMiner) are used to identify unusual manipulations of the data deserving closer scrutiny. QA technical audits will include all methods within a two-year period.

15.1.3 SOP Method Compliance

Compliance of all SOPs with the source methods and compliance of the operational groups with the SOPs will be assessed by the Technical Manager or qualified designee at least every two years. It is also recommended that the work of each newly hired analyst is assessed within 3 months of working independently, (e.g., completion of method IDOC). In addition, as analysts add methods to their capabilities, (new IDOC) reviews of the analyst work products will be performed within 3 months of completing the documented training.

15.1.4 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

15.1.5 Performance Testing

The laboratory participates semi-annually in performance audits conducted through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies: Water Pollution Program, Water Supply Program, Hazardous Waste Program, client supplied PTs and Lab internal PTs.

It is TestAmerica's policy that PT samples be treated as typical samples in the production process. Furthermore, where PT samples present special or unique problems, in the regular production process they may need to be treated differently, as would any special or unique request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

Written responses to unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

15.2 EXTERNAL AUDITS

External audits are performed when certifying agencies or clients conduct on-site inspections or submit performance testing samples for analysis. It is TestAmerica's policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. Laboratory supervisors are responsible for providing corrective actions to the QA Manager who coordinates the response for any deficiencies discovered during an external audit. Audit responses are due in the time allotted by the client or agency performing the audit. When requested, a copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

15.2.1 Confidential Business Information (CBI) Considerations

During on-site audits, auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found in within the 2009 TNI standards.

15.3 Audit Findings

Audit findings are documented using the corrective action process database or spreadsheet. The laboratory's corrective action responses for both types of audits may include action plans that could not be completed within a predefined timeframe. In these instances, a completion date must be set and agreed to by operations management and the QA Manager.

Developing and implementing corrective actions to findings is the responsibility of the Technical Manager where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the QA monthly report. When requested a copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory shall take timely corrective action, and

shall notify clients in writing if the investigations show that the laboratory results have been affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

Clients must be notified promptly in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or amendment to a test report. The investigation must begin within 24-hours of discovery of the problem and all efforts are made to notify the client within two weeks after the completion of the investigation.

SECTION 16

MANAGEMENT REVIEWS

16.1 Quality Assurance Report

A comprehensive QA Report shall be prepared each month by the laboratory's QA Department and forwarded to the Laboratory Director, Technical Manager(s), their Quality Director as well as the General Manager. All aspects of the QA system are reviewed to evaluate the suitability of policies and procedures. During the course of the year, the Laboratory Director, General Manager or Corporate QA may request that additional information be added to the report.

On a monthly basis, Corporate QA compiles information from all the monthly laboratory reports. The Corporate Quality Directors prepare a report that includes a compilation of all metrics and notable information and concerns regarding the QA programs within the laboratories. The report also includes a listing of new regulations that may potentially impact the laboratories. This report is presented to the Senior Management Team and General Managers.

16.2 Annual Management Review

The senior lab management team (Laboratory Director, QA Manager, General Manager, Senior Project Manager, and Director of Project Management) conducts a review annually of its quality systems and LIMS to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. It will also provide a platform for defining goals & objectives and action items that feed into the laboratory planning system. Corporate Operations and Corporate QA personnel is to be included in this meeting at the discretion of the Laboratory Director. The LIMS review consists of examining any audits, complaints or concerns that have been raised through the year that are related to the LIMS. The laboratory will summarize any critical findings that cannot be solved by the lab and report them to Corporate IT.

This management system review (Corporate SOP No. CA-Q-S-008 & Work Instruction No. CA-Q-WI-020) uses information generated during the preceding year to assess the "big picture" by ensuring that routine actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review should keep the quality systems current and effective, therefore, the annual review is a formal senior management process to review specific

existing documentation. Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review.
- Prior Monthly QA Reports issues.
- Laboratory QA Metrics.
- Review of report reissue requests.
- Review of client feedback and complaints.
- Issues arising from any prior management or staff meetings.
- Minutes from prior senior lab management meetings. Issues that may be raised from these meetings include:
  - Adequacy of staff, equipment and facility resources.
  - Adequacy of policies and procedures.
  - Future plans for resources and testing capability and capacity.
- The annual internal double blind PT program sample performance (if performed),
- Compliance to the Ethics Policy and Data Integrity Plan. Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.

A report is generated by the QA Manager and management. The report is distributed to the appropriate General Manager and the Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants.
- A reference to the existing data quality related documents and topics that were reviewed.
- Quality system or operational changes or improvements that will be made as a result of the review [e.g., an implementation schedule including assigned responsibilities for the changes (Action Table)].

Changes to the quality systems requiring update to the laboratory QA Manual shall be included in the next revision of the QA Manual.

16.3 Potential Integrity Related Managerial Reviews

Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. TestAmerica's Corporate Data Investigation/Recall SOP shall be followed (SOP No. CW-L-S-002). All investigations that result in finding of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

TestAmerica's COO, VP of Client & Technical Services, General Managers and Quality Directors receive a monthly report from the Director of Quality & Client Advocacy summarizing any current data integrity or data recall investigations. The General Manager's are also made aware of progress on these issues for their specific labs.

SECTION 17

PERSONNEL

17.1 Overview

The laboratory's management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel as outlined in the organization chart in Figure 4-1.

All personnel must demonstrate competence in the areas where they have responsibility. Any staff that is undergoing training shall have appropriate supervision until they have demonstrated their ability to perform their job function on their own. Staff shall be qualified for their tasks based on appropriate education, training, experience and/or demonstrated skills as required.

The laboratory employs sufficient personnel with the necessary education, training, technical knowledge and experience for their assigned responsibilities.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for lab staff with respect to education, training and skills and ensuring that the laboratory has a policy and procedures for identifying training needs and providing training of personnel. The training shall be relevant to the present and anticipated responsibilities of the lab staff.

The laboratory only uses personnel that are employed by or under contract to, the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance to the laboratory's quality system.

17.2 Education And Experience Requirements For Technical Personnel

The laboratory makes every effort to hire analytical staffs that possess a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions can be made based upon the individual's experience and ability to learn. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for TestAmerica employees are outlined in job descriptions and are generally summarized for analytical staff in the table below.

The laboratory maintains job descriptions for all personnel who manage, perform or verify work affecting the quality of the environmental testing the laboratory performs. Job Descriptions are

located on the TestAmerica intranet site's Human Resources web-page (Also see Section 4 for position descriptions/responsibilities).

Experience and specialized training are occasionally accepted in lieu of a college degree (basic lab skills such as using a balance, pipette or quantitation techniques, etc., are also considered).

As a general rule for analytical staff:

Specialty	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), or Titrimetric and Gravimetric Analyses	H.S. Diploma	On the job training (OJT)
GFAA, CVAA, FLAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC	A college degree in an applied science or 2 years of college and at least 1 year of college chemistry	Or 2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pesticides, PCB, Herbicides, HPLC, etc.), GCMS	A college degree in an applied science or 2 years of college chemistry	or 5 years of prior analytical experience
Spectra Interpretation	A college degree in an applied science or 2 years of college chemistry	And 2 years relevant experience Or 5 years of prior analytical experience
Technical Manager (s) – **General**	Bachelors Degree in an applied science or engineering with 24 semester hours in chemistry An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years experience in environmental analysis of representative analytes for which they will oversee
Technical Manager (s) – **Wet Chem** only (no advanced instrumentation)	Associates degree in an applied science or engineering or 2 years of college with 16 semester hours in chemistry	And 2 years relevant experience

When an analyst does not meet these requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Technical Manager, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

17.3 Training

The laboratory is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. Below are examples of various areas of required employee training:

Required Training	Time Frame	Employee Type
Environmental Health & Safety	Prior to lab work	All
Ethics – New Hires	1 week of hire	All
Ethics – Comprehensive	90 days of hire	All
Data Integrity	30 days of hire	Technical and PMs
Quality Assurance	90 days of hire	All
Ethics – Comprehensive Refresher	Annually	All
Initial Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also refer to "Demonstration of Capability" in Section 19.

The training of technical staff is kept up to date by:

- Each employee must have documentation in their training file that they have read, understood and agreed to follow the most recent version of the laboratory QA Manual and SOPs in their area of responsibility. This documentation is updated as SOPs are updated.
- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics are maintained in their training file.
- Documentation of proficiency (refer to Section 19).
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training.
- A Confidentiality Agreement signed by each staff member signed at the time of employment.
- Human Resources maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics). This information is maintained in the employee's secured personnel file.

Evidence of successful training could include such items as:

- Adequate documentation of training within operational areas, including one-on-one technical training for individual technologies, and particularly for people cross-trained.
- Analysts knowledge to refer to QA Manual for quality issues.

- Analysts following SOPs, i.e., practice matches SOPs.
- Analysts regularly communicate to supervisors and QA if SOPs need revision, rather than waiting for auditors to find problems.

Further details of the laboratory's training program are described in the Laboratory Training SOP No. PT-QA-001.

17.4 Data Integrity And Ethics Training Program

Establishing and maintaining a high ethical standard is an important element of a Quality System. Ethics and data integrity training is integral to the success of TestAmerica and is provided for each employee at TestAmerica. It is a formal part of the initial employee orientation within 1 week of hire followed by technical data integrity training within 30 days, comprehensive training within 90 days, and an annual refresher for all employees. Senior management at each facility performs the ethics training for their staff.

In order to ensure that all personnel understand the importance TestAmerica places on maintaining high ethical standards at all times; TestAmerica has established a Corporate Ethics Policy (Policy No. CW-L-P-004) and an Ethics Statement. All initial and annual training is documented by signature on the signed Ethics Statement demonstrating that the employee has participated in the training and understands their obligations related to ethical behavior and data integrity.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize TestAmerica's ability to do work on Government contracts, and for that reason, TestAmerica has a Zero Tolerance approach to such violations.

Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. Key topics covered in the presentation include:

- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.
- Ethics Policy
- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping.
- Discussion regarding data integrity procedures.
- Specific examples of breaches of ethical behavior (e.g. peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion)
- Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.

- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient.

Additionally, a data integrity hotline (1-800-736-9407) is maintained by TestAmerica and administered by the Corporate Quality Department.

SECTION 18

ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS

18.1 Overview

The laboratory is a 33,000 ft^2 secure laboratory facility with controlled access and designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

The laboratory is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc., OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The laboratory is separated into specific areas for sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis, and administrative functions.

18.2 Environment

Laboratory accommodation, test areas, energy sources, lighting are adequate to facilitate proper performance of tests. The facility is equipped with heating, ventilation, and air conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control and recording of environmental conditions that may affect the results of environmental tests as required by the relevant specifications, methods, and procedures. Such environmental conditions include humidity, voltage, temperature, and vibration levels in the laboratory.

When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing will be discontinued until the environmental conditions are returned to the required levels.

Environmental conditions of the facility housing the computer network and LIMS are regulated to protect against raw data loss.

18.3 Work Areas

There is effective separation between neighboring areas when the activities therein are incompatible with each other. Examples include:

- Volatile organic chemical analysis areas, including sample preparation.

Access to and use of all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory.

Work areas are available to ensure an unencumbered work area. Work areas include:

- Access and entryways to the laboratory.
- Sample receipt areas.
- Sample storage areas.
- Chemical and waste storage areas.
- Data handling and storage areas.
- Sample processing areas.
- Sample analysis areas.

18.4 Floor Plan

A floor plan can be found in Appendix 1.

18.5 Building Security

Building keys and alarm codes are distributed to employees as necessary.

Visitors to the laboratory sign in and out in a visitor's logbook. A visitor is defined as any person who visits the laboratory who is not an employee of the laboratory. In addition to signing into the laboratory, the Environmental, Health and Safety Manual contains requirements for visitors and vendors. There are specific safety forms that must be reviewed and signed.

Visitors (with the exception of company employees) are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor's logbook.

SECTION 19

TEST METHODS AND METHOD VALIDATION

19.1 Overview

The laboratory uses methods that are appropriate to meet our clients' requirements and that are within the scope of the laboratory's capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement of uncertainty as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory's approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

19.2 Standard Operating Procedures (SOPs)

The laboratory maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory. A SOP list is included in Appendix 4. The most current list of SOPs is maintained in the QA SOP directory in PT-QA-W-002.

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.
- Procedures for writing an SOP are incorporated by reference to TestAmerica's Corporate SOP entitled 'Writing a Standard Operating Procedure', No. CW-Q-S-002 or the laboratory's SOP No. PT-QA-010, Preparation and Management of Standard Operating Procedures (SOPs) and Other Controlled Documents .

- SOPs are reviewed at a minimum of every 2 years (annually for Drinking Water and DoD SOPs), and where necessary, revised to ensure continuing suitability and compliance with applicable requirements.

19.3 Laboratory Methods Manual

For each test method, the laboratory shall have available the published referenced method as well as the laboratory developed SOP.

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory shall demonstrate that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.

The laboratory maintains an SOP Index for both technical and non-technical SOPs. Technical SOPs are maintained to describe a specific test method. Non-technical SOPs are maintained to describe functions and processes not related to a specific test method.

19.4 Selection Of Methods

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists), the method of choice is selected based on client needs and available technology. The methods selected should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

19.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods shall be used.

When clients do not specify the method to be used or methods are not required, the methods used will be clearly validated and documented in an SOP and available to clients and/or the end user of the data.

The analytical methods used by the laboratory are those currently accepted and approved by the U. S. EPA and the state or territory from which the samples were collected. Reference methods include:

- *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and Appendix A-C; 40 CFR Part 136, USEPA Office of Water. Revised as of July 1, 1995, Appendix A to Part 136 - Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (EPA 600 Series)*
- *Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.*
- *Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.*
- *Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.*
- *Statement of Work for Organics Analysis, OLM04.2, USEPA Contract Laboratory Program, Multi-media, Multi-concentration.*
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- *Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th /on-line edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.*
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008.*
- *Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.*
- *Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261*
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008.*

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.

Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory shall inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory's recommendation, it will be documented.

19.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory shall confirm that it can properly operate the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix sample. If the method is for the testing of analytes that are not conducive to spiking, demonstration of capability may be performed on quality control samples.

19.4.2.1 A demonstration of capability (DOC, Lab SOP # PT-QA-001) is performed whenever there is a change in instrument type (e.g., new instrumentation), method or personnel (e.g., analyst hasn't performed the test within the last 12 months).

19.4.2.2 The initial demonstration of capability must be thoroughly documented and approved by the Technical Director or Lab Director and QA Manager prior to independently analyzing client samples. All associated documentation must be retained in accordance with the laboratories archiving procedures.

19.4.2.3 The laboratory must have an approved SOP, demonstrate satisfactory performance, and conduct an MDL study (when applicable). There may be other requirements as stated within the published method or regulations (i.e., retention time window study).

Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QA Manual (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for regulatory purposes, the result may be reported as long as the following criteria are met:

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method or criteria are per project DQOs).
- The laboratory's nominal or default reporting limit (RL) is equal to the quantitation limit (QL), must be at or above the lowest non-zero standard in the calibration curve and must be reliably determined. Project RLs are client specified reporting levels which may be higher than the QL. Results reported below the QL must be qualified as estimated values. Also see Section 19.6.1.3, Relationship of Limit of Detection (LOD) to Quantitation Limit (QL).
- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted: *Reporting Limit based on the low standard of the calibration curve.*

19.4.3 Initial Demonstration of Capability (IDOC) Procedures

Initial Demonstration and Capability (IDOC) procedure is described in Pittsburgh SOP No. PT-QA-010.

19.4.3.1 The spiking standard used must be prepared independently from those used in instrument calibration. The LCS is used to document IDOCs for all applicable methods.

19.4.3.2 The analyte(s) shall be diluted in a volume of clean matrix sufficient to prepare four aliquots (4 LCS) at the concentration specified by a method or the laboratory SOP.

19.4.3.3 At least four laboratory control samples from different batches shall be prepared (including any applicable clean-up procedures) and analyzed according to the test method (either concurrently or over a period of days).

19.4.3.4 Using all of the results, calculate the mean recovery in the appropriate reporting units and the standard deviations for each parameter of interest.

19.4.3.5 When it is not possible to determine the mean and standard deviations, such as for presence, absence and logarithmic values, the laboratory will assess performance against criteria described in the Method SOP.

19.4.3.6 Compare the information obtained above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory generated acceptance criteria (LCS or interim criteria) if there is no mandatory criteria established. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

19.4.3.7 When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to either option listed below:

- Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with 19.4.3.3 above.
- Beginning with 19.4.3.3 above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with 19.4.3.1 above.

Note: Results of successive LCS analyses can be used to fulfill the DOC requirement.

A certification statement (refer to Figure 19-1 as an example shall be used to document the completion of each initial demonstration of capability. A copy of the certification is archived in the analyst's training folder.

19.5 Laboratory Developed Methods And Non-Standard Methods

Any new method developed by the laboratory must be fully defined in an SOP and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must also be in agreement to the use of the non-standard method.

19.6 Validation Of Methods

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

19.6.1 Method Validation and Verification Activities for All New Methods

While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

19.6.1.1 Determination of Method Selectivity

Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices from other analytes or interference. In some cases to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

19.6.1.2 Determination of Method Sensitivity

Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed.

19.6.1.3 Relationship of Limit of Detection (LOD) to the Quantitation Limit (QL)

An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum concentration of analyte that can be quantitatively determined with acceptable precision and bias. For most instrumental measurement systems, there is a region

where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

19.6.1.4 Determination of Interferences

A determination that the method is free from interferences in a blank matrix is performed.

19.6.1.5 Determination of Range

Where appropriate to the method, the quantitation range is determined by comparison of the response of an analyte in a curve to established or targeted criteria. Generally the upper quantitation limit is defined by highest acceptable calibration concentration. The lower quantitation limit or QL cannot be lower than the lowest non-zero calibration level, and can be constrained by required levels of bias and precision.

19.6.1.6 Determination of Accuracy and Precision

Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

19.6.1.7 Documentation of Method

The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Attachment describing the specific differences in the new method is acceptable in place of a separate SOP.

19.6.1.8 Continued Demonstration of Method Performance

Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS, method blanks or PT samples.

19.7 Method Detection Limits (MDL)/ Limits Of Detection (LOD)

Method detection limits (MDL) are initially determined in accordance with 40 CFR Part 136, Appendix B or alternatively by other technically acceptable practices that have been accepted by regulators. MDL is also sometimes referred to as Limit of Detection (LOD). The MDL theoretically represents the concentration level for each analyte within a method at which the

Analyst is 99% confident that the true value is not zero. The MDL is determined for each analyte initially during the method validation process and updated as required in the analytical methods, whenever there is a significant change in the procedure or equipment, or based on project specific requirements. Generally, the analyst prepares at least seven replicates of solution spiked at one to five times the estimated method detection limit (most often at the lowest standard in the calibration curve) into the applicable matrix with all the analytes of interest. Each of these aliquots is extracted (including any applicable clean-up procedures) and analyzed in the same manner as the samples. Where possible, the seven replicates should be analyzed over 2-4 days to provide a more realistic MDL. [To allow for some flexibility, this low level standard may be analyzed every batch or every week or some other frequency rather than doing the study all at once. In addition, a larger number of data points may be used if the appropriate t-value multiplier is used]

Refer to the Corporate SOP No. CA-Q-S-006 or the laboratory's SOP No. PT-QA-007 for details on the laboratory's MDL process and DoD requirements.

19.8 Instrument Detection Limits (IDL)

19.8.1 The IDL is sometimes used to assess the reasonableness of the MDLs or in some cases required by the analytical method or program requirements. IDLs are most used in metals analyses but may be useful in demonstration of instrument performance in other areas.

19.8.2 IDLs are calculated to determine an instrument's sensitivity independent of any preparation method. IDLs are calculated either using 7 replicate spike analyses, like MDL but without sample preparation, or by the analysis of 10 instrument blanks and calculating 3 x the absolute value of the standard deviation.

19.8.3 If IDL is > than the MDL, it may be used as the reported MDL. For ICP IDLs determined shall be less than or equal to the MDL as per DoD QSM, Version 3, Appendix DoD-B, Table B-6. DoD QSM 4.2 requirements are detailed in SOP No. PT-QA-025 and SOP PT-QA-029.

19.9 Verification Of Detection And Reporting Limits

19.9.1 Once the MDL is determined, it must be verified on each instrument used for the given method. TestAmerica defines the DoD QSM Detection Limit (DL) as being equal to the MDL. TestAmerica also defines the DoD QSM Limit of Detection (LOD) as being equal to the lowest concentration standard that successfully verifies the MDL, also referred to as the MDLV standard. MDL and MDLV standards are extracted/digested and analyzed through the entire analytical process. The MDL and MDLV determinations do not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDLV standard is not successful, then the laboratory will redevelop their MDL or perform and pass two consecutive MDLVs at a higher concentration and set the LOD at the higher concentration. Initial and quarterly verification is required for all methods listed in the laboratory's DoD ELAP Scope of Accreditation. Refer to the laboratory SOP PT-QA-007 Detection Limits (MDLs/DLs) for further details.

19.9.2 When the laboratory establishes a quantitation limit, it must be initially verified by the analysis of a low level standard or QC sample at 1-2 times the reporting limit and annually thereafter. The annual requirement is waved for methods that have an annually verified MDL. The laboratory will comply with any regulatory requirements.

19.9.3 The laboratory quantitation limit is equivalent to the DoD Limit of Quantitation (LOQ), which is at a concentration equal to or greater than the lowest non-zero calibration standard. The DoD QSM requires the laboratory to perform an initial characterization of the bias and precision at the LOQ and quarterly LOQ verifications thereafter. If the quarterly verification results are not consistent with three-standard deviation confidence limits established initially, then the bias and precision will be reevaluated and clients contacted for any on-going projects. For DoD projects, TestAmerica makes a distinction between the Reporting Limit (RL) and the LOQ. The RL is a level at or above the LOQ that is used for specific project reporting purposes, as agreed to between the laboratory and the client. The RL cannot be lower than the LOQ concentration, but may be higher.

19.10 Retention Time Windows

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis or as specific in the reference method, each analyte will have a specific time of elution from the column to the detector. This is known as the analyte's retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte used for that method. These records are kept with the files associated with an instrument for later quantitation of the analytes. Complete details are available in the laboratory SOPs.

19.11 Evaluation Of Selectivity

The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, second column confirmation, ICP interelement interference checks, chromatography retention time windows, sample blanks, spectrochemical, atomic absorption or fluorescence profiles, co-precipitation evaluations and specific electrode response factors.

19.12 Estimation Of Uncertainty Of Measurement

19.12.1 Uncertainty is "a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand" (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result's validity. Its value accounts for all the factors which could possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical

procedure, and random variation. Some national accreditation organizations require the use of an "expanded uncertainty": the range within which the value of the measurand is believed to lie within at least a 95% confidence level with the coverage factor k=2.

19.12.2 Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

19.12.3 The minimum uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling and the variability due to matrix effects). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

19.12.4 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the lower end of the uncertainty range, and multiply the result by the decimal of the upper end of the LCS range percent value for the upper end of the uncertainty range. These calculated values represent a 99%-certain range for the reported result. As an example, suppose that the result reported is 1.0 mg/l, and the LCS percent recovery range is 50 to 150%. The uncertainty range would be 0.5 to 1.5 mg/l, which could also be written as 1.0 +/- 0.5 mg/l. Uncertainty determination is further described in SOP No. PT-QA-005.

19.12.5 In the case where a well recognized test method specifies limits to the values of major sources of uncertainty of measurement (e.g., 524.2, 525, etc.) and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

19.13 Sample Reanalysis Guidelines

Because there is a certain level of uncertainty with any analytical measurement, a sample re-preparation (where appropriate) and subsequent analysis (hereafter referred to as 'reanalysis') may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g., sample homogeneity, analyte precipitation over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will reanalyze samples at a client's request with the following caveats. **Client specific Contractual Terms & Conditions for reanalysis protocols may supercede the following items.**

- Homogenous samples: If a reanalysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within $\pm$ 1 reporting limit for samples $\leq$ 5x the

reporting limit, the original analysis will be reported. At the client's request, both results may be reported.

- If the reanalysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy and reanalyze the sample a third time for confirmation if sufficient sample is available.

- Any potential charges related to reanalysis are discussed in the contract terms and conditions or discussed at the time of the request. The client will typically be charged for reanalysis unless it is determined that the lab was in error.

- Due to the potential for increased variability, reanalysis may not be applicable to Non-homogenous, Encore, and Sodium Bisulfate preserved samples. See the Area Technical Manager/Supervisor or Laboratory Director if unsure.

19.14 Control Of Data

The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

19.14.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below. The laboratory is currently running the TALs LIMS which is a custom in-house developed LIMS system that has been highly customized to meet the needs of the laboratory. It is referred to as LIMS for the remainder of this section. The LIMS utilizes Microsoft SQL Server e which is an industry standard relational database platform. It is referred to as Database for the remainder of this section.

19.14.1.1 Maintain the Database Integrity: Assurance that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protection, data change requirements, as well as an internal LIMS permissions procedure.

- LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.
- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use. Cells containing calculations must be lock-protected and controlled.
- Instrument hardware and software adjustments are safeguarded through maintenance logs, audit trails and controlled access.

19.14.1.2 Ensure Information Availability: Protection against loss of information or service is ensured through scheduled back-ups, stable file server network architecture, secure

storage of media, line filter, Uninterruptible Power Supply (UPS), and maintaining older versions of software as revisions are implemented.

19.14.1.3 **Maintain Confidentiality:** Ensure data confidentiality through physical access controls such as password protection or website access approval, when electronically transmitting data.

19.14.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., Wet Chemistry, the data is reduced by the analyst and then verified by the Department Manager or alternate analyst prior to updating the data in LIMS. The spreadsheets, or any other type of applicable documents, are signed by both the analyst and alternate reviewer to confirm the accuracy of the manual entry(s). The applicable data/spreadsheet is scanned in LIMS with the batch.

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the TestAmerica Corporate SOP No. CA-Q-S-002, Acceptable Manual Integration Practices.

Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer's indication; otherwise, it should not be performed. Calculations are independently verified by appropriate laboratory staff. Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

19.14.2.1 All raw data must be retained, including computer file (if appropriate), and/or run log. All criteria pertinent to the method must be recorded. The documentation is recorded at the time observations or calculations are made and must be signed or initialed/dated (month/day/year). It must be easily identifiable who performed which tasks if multiple people were involved.

19.14.2.2 In general, concentration results are reported in milligrams per liter (mg/l) or micrograms per liter (µg/l) for liquids and milligrams per kilogram (mg/kg) or micrograms per kilogram (µg/kg) for solids. For values greater than 10,000 mg/l, results can be reported in percent, i.e., 10,000 mg/l = 1**%.** Units are defined in each lab SOP.

19.14.2.3 In reporting, the analyst or the instrument output records the raw data result using values of known certainty plus one uncertain digit. If final calculations are performed

external to LIMS, the results should be entered in LIMS with at least three significant figures. In general, results are reported to 2 significant figures on the final report.

19.14.2.4 For those methods that do not have an instrument printout or an instrumental output compatible with the LIMS System, the raw results and dilution factors are entered directly into LIMS by the analyst, and the software calculates the final result for the analytical report. LIMS has a defined significant figure criterion for each analyte.

19.14.2.5 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS electronically after reviewing the quantitation report, and removing unrequested or poor spectrally-matched compounds. The analyst prints a copy of what has been entered to check for errors. This printout and the instrument's printout of calibrations, concentrations, retention times, chromatograms, and mass spectra, if applicable, are retained with the data file. The data file is stored on the server and every night backed up to a tape file.

19.14.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out 'real time' and have enough information on them to trace the events of the applicable analysis/task. (e.g. calibrations, standards, analyst, sample ID, date, time on short holding time tests, temperatures when applicable, calculations are traceable, etc.)

- Corrections are made following the procedures outlined in Section 12.
- Logbooks are controlled by the QA department. A record is maintained of all logbooks in the lab.
- Unused portions of pages must be "Z"'d out, signed and dated.
- Worksheets are created with the approval of the Lab area supervisor/Technical Manager and QA Manager at the facility. The QA Manager controls all worksheets following the procedures in Section 6.

19.14.4 Review / Verification Procedures

Data review procedures comprise a set of computerized and manual checks applied at appropriate levels of the measurement process. Technical data review procedures are out lined in Pittsburgh SOP No. PT-QA-018 to ensure that reported data are free from calculation and transcription errors, that QC parameters have been reviewed and evaluated before data is reported. The laboratory uses the Corporate SOP No. CA-Q-S-002, Acceptable Manual Integration Practices, discussing Manual Integrations to ensure the authenticity of the data. The

general review concepts are discussed below, more specific information can be found in the SOPs.

19.14.4.1 The data review process at the laboratory starts at the Sample Receiving level. Sample Receiving personnel review chain-of-custody forms and input the sample information and required analyses into a computer LIMS. The Sample Receiving personnel review the transaction of the chain-of-custody forms and the inputted information. The Project Managers perform final review of the chain-of-custody forms and inputted information.

19.14.4.2 The next level of data review occurs with the Analysts. As results are generated, analysts review their work to ensure that the results generated meet QC requirements and relevant EPA methodologies. The Analysts transfer the data into the LIMS and add data qualifiers if applicable. To ensure data compliance, a different analyst performs a second level of review. Second level review is accomplished by checking reported results against raw data and evaluating the results for accuracy. During the second level review, blank runs, QA/QC check results, initial and continuing calibration results, laboratory control samples, sample data, qualifiers and spike information are evaluated. Where calibration is not required on a daily basis, secondary review of the initial calibration results may be conducted at the time of calibration. Approximately 15% of all sample data from manual methods and from automated methods, all GC/MS spectra and all manual integrations are reviewed. Manual integrations are also electronically reviewed utilizing auditing software to help ensure compliance to ethics and manual integration policies. Issues that deem further review include the following:

- QC data are outside the specified control limits for accuracy and precision
- Reviewed sample data does not match with reported results
- Unusual detection limit changes are observed
- Samples having unusually high results
- Samples exceeding a known regulatory limit
- Raw data indicating some type of contamination or poor technique
- Inconsistent peak integration
- Transcription errors
- Results outside of calibration range

19.14.4.3 Unacceptable analytical results may require reanalysis of the samples. Any problems are brought to the attention of the Laboratory Director, Project Manager, Quality Assurance Manager, Technical Manager/area Supervisor for further investigation. Corrective action is initiated whenever necessary.

19.14.4.4 The results are then entered or directly transferred into the computer database and a hard copy (or .pdf) is printed for the client.

19.14.4.5 As a final review prior to the release of the report, the Project Manager reviews the results for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The process includes, but is not limited to, verifying that chemical relationships are evaluated, COC is followed, cover letters/ narratives are present, flags are appropriate, and project specific requirements are met.

19.14.4.6 Any project that requires a data package is subject to a tertiary data review for transcription errors and acceptable quality control requirements. The Project Manager then signs the final report. The Project Managers also check the report for any clerical or invoicing errors. When complete, the report is sent out to the client.

19.14.4.7 A visual summary of the flow of samples and information through the laboratory, as well as data review and validation, is presented in Figure 19-2.

19.14.5 Manual Integrations

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using TestAmerica's Corporate SOP (CA-Q-S-002) as the guideline.

19.14.5.1 The analyst must adjust baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved or when a peak shoulder needs to be separated from the peak of interest. The analyst must use professional judgment and common sense to determine when manual integrating is required. Analysts are encouraged to ask for assistance from a senior analyst or manager when in doubt.

19.14.5.2 Analysts shall not increase or decrease peak areas for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principals and policy and is grounds for immediate termination.

19.14.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.

19.14.5.4 All manual integrations receive a second level review. Manual integrations must be indicated on an expanded scale "after" chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale "before" chromatograms are also required for all manual integrations on QC parameters (calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented corporate approved procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices.

Figure 19-1.
Example - Demonstration of Capability Documentation

DEMONSTRATION OF CAPABILITIY (DOC)

Laboratory Name:_____
Laboratory Address:_____
Method:_____ Matrix:_____
Date:_____ Analyst(s):_____
Source of Analyte(s):_____

Analytical Results

Analyst	Conc. (Units)	Rep 1	Rep 2	Rep 3	Rep 4	Avg. % Recovery	% RSD

% RSD = Percent relative standard deviation = standard deviation divided by average % Recovery

Raw data reference: _____

Certification Statement:

We, the undersigned, certify that:
1. The cited test method has met Demonstration of Capability requirements.
2. The test method was performed by the analyst(s) identified on this certification.
3. A copy of the test method and the laboratory-specific SOPs are available for all personnel on site.
4. The data associated with the method demonstration of capability are true, accurate, complete, and self-explanatory.
5. All raw data necessary to reconstruct and validate these analyses have been retained at the facility, and the associated information is well organized and available for review.
6.

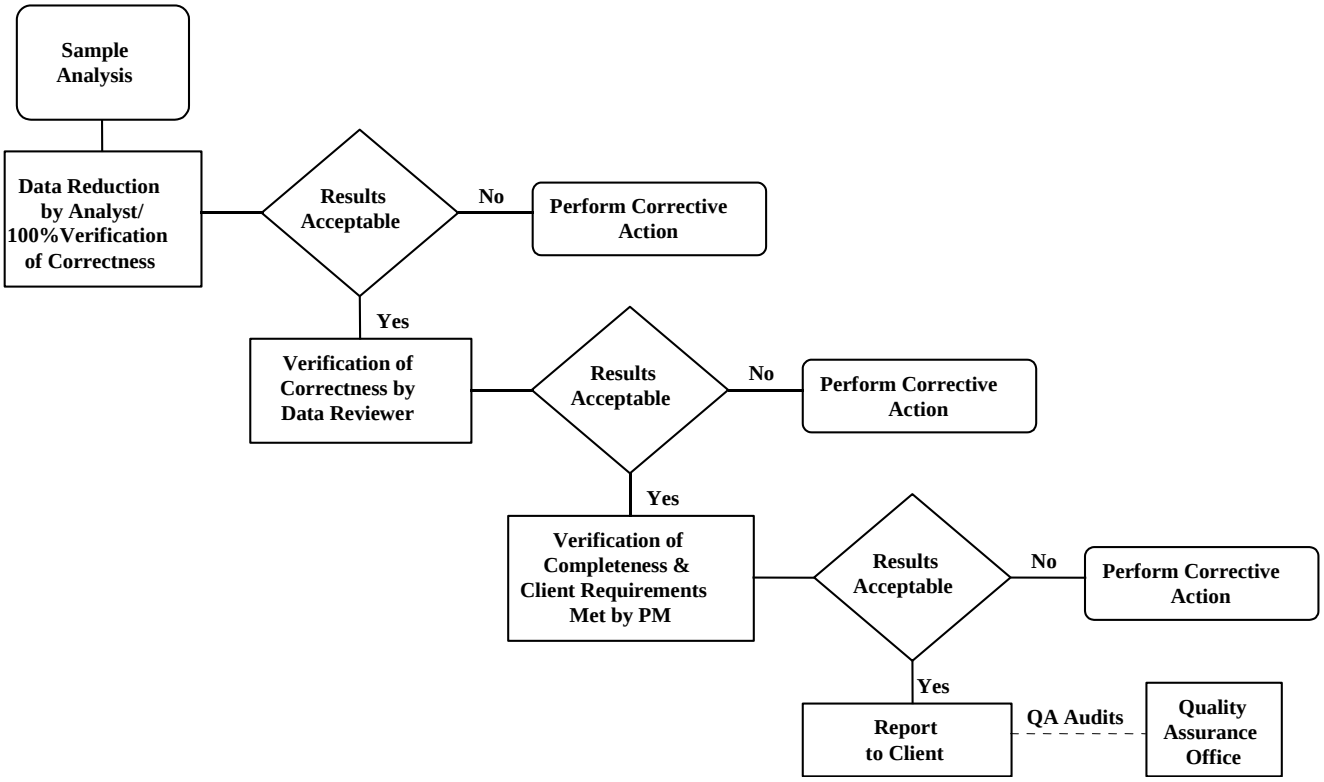
_____ _____
Analyst Signature Date

_____ _____
Technical Director Signature Date

_____ _____
Quality Assurance Coordinator Signature Date

Figure 19-2

Work Flow



SECTION 20

EQUIPMENT AND CALIBRATIONS

20.1 Overview

The laboratory purchases the most technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory SOPs. A list of laboratory instrumentation is presented in Table 20-1.

Equipment is only operated by authorized and trained personnel. Manufacturers instructions for equipment use are readily accessible to all appropriate laboratory personnel.

20.2 Preventive Maintenance

20.2.1 The laboratory follows a well-defined maintenance program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

20.2.2 Routine preventive maintenance procedures and frequency, such as cleaning and replacements, should be performed according to the procedures outlined in the manufacturer's manual. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

20.2.3 Table 20-2 through 20-14 lists examples of scheduled routine maintenance. It is the responsibility of each Technical Manager to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures may be / are also outlined in analytical SOPs or instrument manuals. Further detail for equipment maintenance is included in SOP No. PT-QA-022. (Note: for some equipment, the log used to monitor performance is also the maintenance log. Multiple pieces of equipment may share the same log as long as it is clear as to which instrument is associated with an entry.)

20.2.4 Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs shall be kept for all major pieces of equipment. Instrument maintenance logs may also be used to specify instrument parameters.

20.2.4.1 Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments.

20.2.4.2 Each entry in the instrument log includes the Analyst's initials, the date, a detailed description of the problem (or maintenance needed/scheduled), a detailed explanation of the solution or maintenance performed, and a verification that the equipment is functioning properly (state what was used to determine a return to control. e.g. CCV run on *'date'* was acceptable, or instrument recalibrated on 'date' with acceptable verification, etc.) must also be documented in the instrument records.

20.2.4.3 When maintenance or repair is performed by an outside agency, service receipts detailing the service performed can be affixed into the logbooks adjacent to pages describing the maintenance performed. This stapled in page must be signed across the page entered and the logbook so that it is clear that a page is missing if only half a signature is found in the logbook.

20.2.5 If an instrument requires repair (subjected to overloading or mishandling, gives suspect results, or otherwise has shown to be defective or outside of specified limits) it shall be taken out of operation and tagged as out-of-service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory shall examine the effect of this defect on previous analyses.

20.2.6 In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted.

20.2.7 If an instrument is sent out for service or transferred to another facility, it must be recalibrated and verified (including new initial MDL study) prior to return to lab operations.

20.3 Support Equipment

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, field sampling devices, temperature measuring devices, thermal/pressure sample preparation devices and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document instrument performance.

20.3.1 Weights and Balances

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

Each balance is checked prior to initial serviceable use with at least two certified ASTM type 1 weights spanning its range of use (weights that have been calibrated to ASTM type 1 weights may also be used for daily verification). ASTM type 1 weights used only for calibration of other weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually and if no damage is observed, they are calibrated at least every 5 years by an outside calibration laboratory. Any weights (including ASTM Type 1) used for daily balance checks or other purposes are recalibrated/recertified annually to NIST standards (this may be done internally if laboratory maintains "calibration only" ASTM type 1 weights).

All balances are serviced annually by a qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

All of this information is recorded in logs, and the recalibration/recertification certificates are kept on file. Refer to SOP No. PT-QA-012 for balance and weight calibration.

20.3.2 pH, Conductivity, and Turbidity Meters

The pH meters used in the laboratory are accurate to ± 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters are also calibrated before each use with a known standard to demonstrate the meters do not exceed an error of 1% or one umhos/cm.

Turbidity meters are also calibrated before each use. All of this information is documented in logs.

Consult pH and Conductivity, and Turbidity SOPs for further information.

20.3.3 Thermometers

All thermometers are calibrated on an annual basis with a NIST-traceable thermometer. IR thermometers, digital probes and thermocouples are calibrated quarterly.

The NIST thermometer is recalibrated every five years (unless thermometer has been exposed to temperature extremes or apparent separation of internal liquid) by an approved outside service and the provided certificate of traceability is kept on file. The NIST thermometer(s) have increments of 1 degree (0.5 degree or less increments are required for drinking water microbiological laboratories), and have ranges applicable to method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

All of this information is documented in logbooks. Monitoring method-specific temperatures, including incubators, heating blocks, water baths, and ovens, is documented in method-specific

logbooks. More information on this subject can be found in the thermometer calibration SOP No. PT-QA-008.

20.3.4 Refrigerators/Freezer Units, Waterbaths, Ovens and Incubators

The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day. (Sample storage is monitored 7 days a week for DoD requirement).

Ovens, waterbaths and incubators are monitored on days of use.

All of this equipment has a unique identification number, and is assigned a unique thermometer for monitoring.

Sample storage refrigerator temperatures are kept between > 0ºC and ≤ 6 ºC.

Specific temperature settings/ranges for other refrigerators, ovens waterbaths, and incubators can be found in method specific SOPs.

All of this information is documented in Daily Temperature Logbooks or electronically. Refer to SOP No. PT-QA-008 for temperature monitoring.

20.3.5 Autopipettors, Dilutors, and Syringes

Mechanical volumetric dispensing devices (except Class A Glassware) are given unique identification numbers and the delivery volumes are verified gravimetrically, at a minimum, on a quarterly basis. Glass micro-syringes are considered the same as Class A glassware.

For those dispensers that are not used for analytical measurements, a label is / can be applied to the device stating that it is not calibrated. Any device not regularly verified can not be used for any quantitative measurements. Pipette calibration is described in Pittsburgh SOP No. PT-QA-017.

Micro-syringes are purchased from Hamilton Company. Each syringe is traceable to NIST. The laboratory keeps on file an “Accuracy and Precision Statement of Conformance” from Hamilton attesting established accuracy.

20.3.6 Field Sampling Devices (Isco Auto Samplers)

Each Auto Sampler (ISCO) is assigned a unique identification number in order to keep track of the calibration. This number is also recorded on the sampling documentation.

The Auto Sampler is calibrated semiannually by setting the sample volume to 100ml and recording the volume received. The results are filed in a logbook/binder. The Auto Sampler is programmed to run three (3) cycles and each of the three cycles is measured into a graduated cylinder to verify 100ml are received.

If the RSD (Relative Standard Deviation) between the 3 cycles is greater than 10%, the procedure is repeated and if the result is still greater than 10%, then the Auto Sampler is taken out of service until it is repaired and calibration verification criteria can be met. The results of this check are kept in a logbook/binder.

20.4 Instrument Calibrations

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method, instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response, type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.

If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration will be reported with appropriate data qualifiers (refer to Section 12).

Note: Instruments are calibrated initially and as needed after that and at least annually (the annual requirement does not apply to Isotope dilution).

20.4.1 Calibration Standards

Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP. If a reference method does not specify the number of calibration standards, a minimum of 3 calibration points (exception being ICP and ICP/MS methods) will be used.

Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to national or international standards of measurement, or to national or international standard reference materials.

The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument

calibration standards (within calibration range to at least the same number of significant figures used to report the data) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). The exception to these rules is ICP methods or other methods where the referenced method does not specify two or more standards.

All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst would be considered a second source. This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

20.4.1.1 Calibration Verification

The calibration relationship established during the initial calibration must be verified at least daily as specified in the laboratory method SOPs in accordance with the referenced analytical methods and in the 2009 TNI standard. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models. Initial calibration verification is with a standard source secondary (second source standard) to the calibration standards, but continuing calibration verifications may use the same source standards as the calibration curve.

Note: The process of calibration verification referred to is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration.

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met, i. e., RPD, per 2009 TNI Std. EL-V1M4 Sec. 1.7.2.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative methods or SOPs.

Generally, the initial calibrations must be verified at the beginning of each 12-hour analytical shift during which samples are analyzed. (Some methods may specify more or less frequent verifications). The 12-hour analytical shift begins with the injection of the calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the analysis of the last sample, QC, or standard that can be injected within 12 hours of the beginning of the shift.

A continuing instrument calibration verification (CCV) must be repeated at the beginning and, for methods that have quantitation by external calibration models, at the end of each analytical batch. Some methods have more frequent CCV requirements see specific SOPs. Most

Inorganic methods require the CCV to be analyzed after every 10 samples or injections, including matrix or batch QC samples.

Note: If an internal standard calibration is being used (basically GCMS) then bracketing standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

If the results of a CCV are outside the established acceptance criteria and analysis of a second consecutive (and immediate) CCV fails to produce results within acceptance criteria, corrective action shall be performed. Once corrective actions have been completed & documented, the laboratory shall demonstrate acceptable instrument / method performance by analyzing two consecutive CCVs, or a new initial instrument calibration shall be performed.

Sample analyses and reporting of data may not occur or continue until the analytical system is calibrated or calibration verified. However, data associated with an unacceptable calibration verification may be fully useable under the following special conditions: **and reported based upon discussion and approval of the client:**

a). when the acceptance criteria for the CCV are exceeded high (i.e., high bias) and the associated samples within the batch are non-detects, then those non-detects may be reported with a footnote or case narrative explaining the high bias. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted; or

b). when the acceptance criteria for the CCV are exceeded low (i.e., low bias), samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted.

20.4.1.2 Verification of Linear and Non-Linear Calibrations

Calibration verification for calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. (These calculations are available in the laboratory method SOPs.) Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

Regardless of whether a linear or non-linear calibration model is used, if initial verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

- When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

- When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted. Alternatively, a reporting limit standard may be analyzed to demonstrate that the laboratory can still support non-detects at their reporting limit.

20.5 Tentatively Identified Compounds (Tics) – GC/MS Analysis

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

Note: If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is both qualitatively and/or quantitatively identifiable, it should not be reported as a TIC. If the compound is reported on the same form as true TICs, it should be qualified and/or narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable).

For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification.

20.6 GC/MS TUNING

Prior to any GCMS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.

Prior to tuning/auto-tuning the mass spec, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally don't need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log.

Table 20-1

Instrumentation/Equipment List

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC1		6890	US00024872	--	
GC w/ Dual ECD with EPC	Hewlett-Packard Lab ID: GC2	Real-Time Plot Version 4.1 ZF12	5890A	3235A48356	1991	
GC w/ Dual FID	Hewlett-Packard Lab ID: GC3		5890 Series II	2921A23920	--	Used
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC4	Real-Time Plot Version 4.1 ZF12	5890E	3118A35332	1989	
GC w/ Dual NPD	Hewlett-Packard Lab ID: GC5	Chem Station Rev. A 09.03 [1417]	6890A	US00025516	1998	
GC w/ Dual FPD	Hewlett-Packard Lab ID: GC6	Chem Station Rev. A 09.03 [1417]	6890N	US10145113	2001	
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC8	Chem Station Rev. A 06.03 [509]	6890	US00023401	1998	
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC10	Chem Station Rev. A 09.01 [1206]	6890N	US10145114	2001	
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC12	Chem Station Rev. A 09.01 [1206]	6890N	US10237038	2002	
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC14	Chem Station Rev. A 07.01 [682]	6890	US00026141	2005	Used
HPLC (UV and Fluorescence)	Hewlett-Packard Lab ID: GC7	ThermoQuest Thru-Put Rev. 4.14Build 10 09/16/2003	1100	US53600346	1998	
Balance	Mettler Lab ID: 119696		AE200	119696		
Hydrogen Generator	Parker Balston				2005	
Hydrogen Generator	Parker Balston		H2-800	H2800104C	2006	
Nitrogen Generator	Parker Balston				2005	
GC/MS	Hewlett-Packard Lab ID: HP3	Enviroquant Chem Station G1701BA Version B.01.001	6890 (GC) 5973 (MSD)	US00009844 (GC) US72020964 (MSD)	1997	New
Concentrator	OI Analytical		Eclipse	D617466100P	2006	New
GC/MS	Hewlett-Packard Lab ID: HP4	Enviroquant Chem Station G1701BA Version B.01.001	6890 (GC) 5973 (MSD)	US00010799 (GC) US72821085 (MSD)	1998	New
Concentrator	OI Analytical		Eclipse	D616466032P	2006	New
GC/MS	Hewlett-Packard Lab ID: HP5	Enviroquant Chem Station G1701BA Version B.01.001	6890 (GC) 5973 (MSD)	US00023292 (GC) US82322212 (MSD)	1998	New
Concentrator	OI Analytical		Eclipse	D616466026P	2006	New
GC/MS	Hewlett-Packard Lab ID: HP6	Enviroquant Chem Station G1701BA Version B.01.001	6890 (GC) 5973 (MSD)	US00030465 (GC) US92522786 (MSD)	1999	New
Concentrator	OI Analytical		Eclipse	B414466952P	2006	New

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
GC/MS	Hewlett-Packard Lab ID: HP7	Enviroquant Chem Station G1701BA Version B.01.001	6890 (GC) 5973 (MSD)	US00028345 (GC) US91411730 (MSD)	2005	Used
Concentrator	OI Analytical		Eclipse	D617466098P	2006	New
Autosampler	EST Analytical		Centurion: CENT WS	CENTS136020110	2010	New
GC/MS	Hewlett-Packard Lab ID: HP8		6890 FID	US00001295 (GC) 3526I01420 (Headspace)	2001	New
Oven	Fisher Scientific Lab ID: VOA Glassware Oven		625G	503N0042	2005	New
Balance	Sartorius Lab ID: 40019078		B120S	40019078		
GC/MS	Hewlett-Packard Lab ID: 71	EnviroQuant Chem Station G1701BA Version B.01.00	6890 (GC) 5973 (MSD)	US00029391 (GC) US91422511 (MSD)	1999	New
GC/MS	Hewlett-Packard Lab ID: 722	EnviroQuant Chem Station G1701BA Version B.01.00	6890 (GC) 5973 (MSD)	US00029396 (GC) US91922512 (MSD)	1999	New
GC/MS	Hewlett-Packard Lab ID: 731	EnviroQuant Chem Station G1701BA Version B.01.00	6890 (GC) 5973 (MSD)	US00031329 (GC) US93112052 (MSD)	2000	New
GC/MS	Hewlett-Packard Lab ID: 732	MSD Chem Station D.01.02.16 06/15/2004	6890N (GC) 5973 (MSD)	CN10426047 (GC) US41746674 (MSD)	2004	New
GC/MS	Hewlett-Packard Lab ID: 733	EnviroQuant Chem Station G1701BA Version B.01.001	6890 (GC) 5972 (MSD)	US91411735 (MSD) US00028233 (GC)	2005	Used
GC/MS	Hewlett-Packard Lab ID: APEX	EnviroQuant Chem Station G1701BA Version B.01.001	6890 (GC) 5973 (MSD)	US 71410457 (MSD) US00007984 (GC)	2002	Used
GC/MS	Hewlett-Packard Lab ID: MSD7	EnviroQuant Chem Station G1701BA Version B.01.001	6890 (GC) 5972 (MSD)	US80210935 (MSD) DE00020249 (GC)	2002	Used
ICP	Thermo Fisher Lab ID: TRACEICP	Thermo-Spec	61E Trace	209390	1993	New
ICP	Thermo Fisher Lab ID: 6500	ITEVA	6500	ICP-20074812	2008	New
ICP/MS	Thermo Electron Lab ID: ICPMS	Plasma Lab	X-Series ICPMS	X0225	2003	New
ICP/MS	Thermo Electron Lab ID: ICPMS2	Plasma Lab	X Series ICPMS	X0344	2006	Used
Mercury Analyzer	Leeman Labs Lab ID: HGHYDRA	WIN HG	Hydra	3009	2003	New
Mercury Analyzer	Leeman Labs	ENVOY	Hydra II	0024	2010	New
Waterbath	Fisher Scientific Lab ID: Hg Waterbath		Isotemp 228	011N0286	2004	New
Metals Digestion Block	Environmental Express		Hot Block		2003	New

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
	Lab ID: H_2O #1					
Metals Digestion Block	Environmental Express Lab ID: H_2O #2		Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: H_2O #3		Hot Block		2000	New
Metals Digestion Block	Environmental Express Lab ID: H_2O #4		Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: H_2O #5		Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: H_2O #6		Hot Block		2000	New
Metals Digestion Block	Environmental Express Lab ID: Soil #1		Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: Soil #2		Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: Soil #3		Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: Soil #4		Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: Soil #5		Hot Block		2003	New
Metals Digestion Block	Environmental Express Lab ID: Soil #6		Hot Block		2003	New
Balance	AND Lab ID: P1856709		EK-610I	P1856709	2008	New
Balance	AND Lab ID: P1856710		EK-610I	P1856710	2008	New
Ion Chromatograph (IC2100A)	Dionex	Chromeleon Client 6.80 SP4 Build 2361 (130805) 58031	ICS 2100	11050879	2011	New
Ion Chromatograph (IC25)	Dionex	Chromeleon Client 6.80 SP4 Build 2361 (130805) 58031	IC 25	00040396	2000	New
Ion Chromatograph (IC3)	Dionex	Chromeleon Client 6.80 SP4 Build 2361 (130805) 58031	ICS 5000	11020753	2011	New

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
Ion Chromatograph (IC2000)	Dionex	Chromeleon Client 6.80 SP4 Build 2361 (130805) 58031	ICS 2000	08050561	2008	New
Ion Chromatograph (ICS2100B)	Dionex	Chromeleon Client 6.80 SP4 Build 2361 (130805) 58031	ICS 2100	11050258	2011	New
Astoria 2 Analyzer system	Astoria Pacific International	FASPAC II Flow Analyzer Software Version 2.1.2	200-A100-03	200231	5/21/2010	New
Astoria 2 Analyzer Sampler 311, XYZ, Diluter			311-A100-03	4940A14695	5/21/2010	New
Astoria 2 Analyzer 322 Two Channel Auxiliary Pump			322-A100-00	322199	5/21/2010	New
Astoria Analyzer Diluter Module 312-M2, 5 ml Syringe			312-A200-5ML	4803A12911	5/21/2010	New
Diluter Module: Valve Module, 312 Diluter			312-B002-00	300971	5/21/2010	New
Autoanalyzer (ALPKEM1)	OI Analytical (Test: 350.1)	WINFLOW 4.03	Alpkem Flow Solution IV	928893438	1998	New
UV/VIS	Milton Roy	Spectronic	Genesys5	3V08239002	2003	Used
UV/VIS	Thermo Electron Corp. (Test: 3060A/7196A)		GENESYS 10 335900-000	2D5K278001	2007	New
Midi Distillation Blocks	Westco Scientific		Easy Dist		2000	New
Midi Distillation Blocks	Westco Scientific		Easy Dist		2000	New
Midi Distillation Blocks	Westco Scientific		Easy Dist		2001	New
Midi Distillation Blocks	Westco Scientific		Easy Dist		2005	New
pH meter	Fisher Scientific		AR25	AR93315378	2004	New
pH meter	Fisher Scientific		AR25	AR93312320	1990	New
pH meter	Fisher Scientific		AR25	AR 81202030	2003	New
pH meter	Fisher Scientific		XL25	94003394	2007	New
Autotitrator	Man-Tech Associates (Test: pH, Specific Conductance, Alkalinity, Hardness, Fluoride, and Acidity		PC-Titration Plus	MS0A3-329	2003	New
MultiMeter	Myron L Co.		Ultrameter 6P	616555		New
Oven	Thermolyne		6000			New

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
Oven	Blue M Electric Co. Lab ID: Oven #2		OV-18A	OV1-15300		New
Oven	Fisher Scientific Lab ID: OV02		Isotemp 630G	001O0035		New
Oven	Precision Scientific Lab ID: OV08		18EG	10AV-9		New
Oven	Fisher Lab ID: ZHE Oven		Isotemp Oven Model 301			
COD Reactor	HACH		DRB200	1131194	2005	New
COD Reactor	HACH		45600	020300022933	2002	New
TOC Analyzer	OI Analytical Lab ID: 1010		1010	5108710555	2001	New
TOC Analyzer	OI Analytical Lab ID: 1030		Aurora 1030	E717730273	2007	New
TOC (Lloyd Khan Method) Analyzer	Thermo Electron Corp.	Eager 300 Version 2.2 9/2004	Flash EA 112 MAS 200R NC Soil Analyzer	20057159-20057135	2006	New
Autoanalyzer	Thermo Clinical Labsystems Lab ID: KONELAB-1 (Tests:9012/420.2/420.4/9066/SM 4500 CL E/410.4)	KoneLab Workstation Software	Aqua 200	A0619933	2005	New
Method 1677 Autoanalyzer (ALPKEM2)	OI Analytical FS3000	WINFLOW v 4.03	A0001604	135804017	2001	New
Method 1677 Autoanalyzer (ALPKEM3)	OI Analytical FS3000	WINFLOW v 4.03	A0001604	120804293	2007	Used
BOD Meter - Automated	YSI	BOD Assay PLUS V. 3.0	52	03L0794	2004	New
BOD Meter - Manual	YSI		50B	91K033593	2003	New
Flashpoint Tester	Rapid Tester Lab ID: SETA-1		RT-00001	024149	2002	New
Flashpoint Tester	Petrotest Pensky Martin		PMA-4	0741043006	2004	New
Flashpoint Tester	Fisher Scientific		K-16200	2501		
Turbidimeter	HF Scientific Inc.		Micro 100	105034		
Speed Vap II	Horizon		Speed Vap # 9000	01-0333	2001	New
Speed Vap II	Horizon		Speed Vap # 9000	01-0332	2001	New
Hotplate	Thermolyne Lab ID: #2		Cimarec 3	611941237080		Used

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
Hotplate	Thermolyne Lab ID: #3		Cimarec 3	1073390872643		Used
Hotplate	Thermolyne Lab ID: #1		Cimarec 3	1073010868586	2005	New
Waterbath	Thermo Electron Corp.		Precision 2872	202471	2007	New
Centrifuge	Damon/IEC Division Lab ID: CENT-3		CU-5000	33473227		
Balance	Mettler Lab ID: 1126472457		PB602	1126472457	2005	New
Balance	Sartorius Lab ID: 37110039		A210P	37110039	2003	New
Balance	Mettler Lab ID: G76383		AE240	G76383		
Balance	Fisher Lab ID: 25606		S-400	25606		
Balance	Mettler Lab ID: AB204S		AB204S	1126020829	2005	New
Balance	A & D Lab ID: GR-200		GR-200	14224939	2007	New
Sonicator	Fisher Scientific		550 Sonic Dismembrator	F2099	1985	
Concentrator	Meyer		N-Evap 112	5376		
Concentrator	Meyer		N-Evap 115	9217		
Concentrator	Horizon Lab ID: 1		Dry Vap	227253	2006	New
Concentrator	Horizon Lab ID: 2		Dry Vap	227254	2006	New
Concentrator	Horizon Lab ID: 3		Dry Vap	227255	2006	New
Concentrator	Horizon Lab ID: 4		Dry Vap	227256	2006	New
Soxtherm Extractor	Gerhardt Lab ID: 1		SE-3A/S306A	4012404	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 7		SE-3A/S306A	4012399	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 6		SE-3A/S306A	4012398	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 5		SE-3A/S306A	4012403	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 4		SE-3A/S306A	4012402	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 2		SE-3A/S306A	4012401	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 3		SE-3A/S306A	4012400	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 8		SE-3A/S306A	4002039	2002	New
Soxtherm Extractor	Gerhardt Lab ID: 9		SE-3A/S306A	4020237	2007	Used

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
Electric Kiln	Cress		FTX-27P	46053	1992	
Electric Oven	Wilt Industries		A85		1999	
TCLP Tumbler	Associated Design & Manufacturing Co. Lab ID: T-8		6004-0590	1788		
ZHE Rotator	Associated Design & Manufacturing Co. Lab ID: Z1		3740-8-BRE	1223		
ZHE Rotator	Bodine (Associated Design) Lab ID: Z2		362RA9018			
ZHE Rotator	Bodine Electric Co. Lab ID: Z3/Z5		42R5BFC1-E3			
ZHE Rotator	Bodine (Associated Design) Lab ID: Z4		34R4BFC1-5R			
TCLP Tumbler	Environmental Express Lab ID: T6			3209-12-466		
TCLP Tumbler	Environmental Express Lab ID: T7			3209-12-467		
TCLP Tumbler	Environmental Express Lab ID: T9			3209-12-463		
TCLP Tumbler	Dayton (motor) Lab ID: T1		2Z794D			
TCLP Tumbler	Dayton (motor) Lab ID: T2		5K939E			
TCLP Tumbler	Dayton (motor) Lab ID: T3		5K939B			
TCLP Tumbler	Dayton (motor) Lab ID: T5		5K939B			
pH Meter	Accumet		AR25			
Balance	A & D Lab ID: 14628771		GF6000	14628771		
Balance	A & D Lab ID: 11684		GX4000	14536813		
Balance	Mettler Lab ID: 1120122641		PB8001S	1120122641		
Hot Plate	Thermodyne Lab ID: TCLP Hot Plate		2200			
Centrifuge	Beckman		J6-M	8749	2007	New
Centrifuge	Beckman		J6-M	8551	2007	New
Centrifuge	Thermo Electron Corp. Lab ID: Cent-1		K	71654833		
Centrifuge	Thermo Electron Corp Lab ID: Cent-2		K	71654125		

Instrument Type	Manufacturer	Instrument Software	Model Number	Serial Number	Year Put into Service	Condition When Received
Method 1664A UCT Cartridge	Enviro-Clean		ENUCNIOG XF	UCT #1	2009	New
Oil-Less Vacuum Pump for UCT Cartridge System	Rocker (110V, 60 Hz)		400	TGTJ094	2009	New
SPE-DEX Extractor System	Horizon Technology		4790	#1 - 09-1208 #2 - 09-1210 #3 - 09-1209 #4 - 09-1207	2009	New
GPC – AccuPrep (GPC2)	J2 Scientific		MPS	GPC-1022-1.0-DI	2009	New
GPC - AccuVap Concentrator System	J2 Scientific		FLX	AVM-251-2.5-F	2009	New
GPC – Autosampler Module	J2 Scientific	J2 Software	PrepLinc AS4	ASA-1045-1.3	2009	New
Freezer	Kenmore by Sears		253.280528 03	WB91633867	2009	New
Digital Barometer	Fisher Scientific		02-401	91116011	2009	New
Digital Burette	Brand		4761161 TM (catalogue #)	11G38510	2010	New
IR Thermometer	EXTECH Instruments		42511	SR IR#1	2010	New
IR Thermometer	EXTECH Instruments		42511	SR IR#2	2010	New
IR Thermometer	EXTECH Instruments		42511	WC IR#1	2010	New
IR Thermometer	EXTECH Instruments		42511	OP IR#1	2010	New
Gel Permeation Chromatograph – GPC1	J2 Scientific	J2 Software	Prep Linc GPC	GPC-1089-1.0 4340A1855 PLH-1126-1.1	2010	New
GC w/ Dual ECD	Hewlett-Packard Lab ID: GC15	Chem Station Rev. B 04.03(16)	7890A	10441121	2010	New
Autosampler	Hewlett-Packard GC15		7693	10390085	2010	New
Freezer	Kenmore Lab ID: WC Freezer #2		253.280528 06	WB02643189	2010	New
Freezer	Frigidaire Lab ID: Tissue Freezer #3		FKFH21F7 WB	WB02442941	2010	New
Freezer	Frigidaire Lab ID: Tissue Freezer #4		FKCH17F7WC	WB02851917	2010	New
Freezer	Frigidaire Lab ID: Tissue Freezer #5		253.280928 01	WB92436406	2010	New
UV/VIS	Thermo Fisher Scientific		GENESYS 10S Vis Spectrophot ometer	2D9P070001	2011	New
Muffle Furnace	Thermo Fisher		F6010	015297880111062 1	6/21/201 1	New

Tables 20-2 - 20-14. Schedule of Routine Maintenance

Table 20-2

Inductively Coupled Argon Plasma/Mass Spectrometry (ICP/MS) Instrument Maintenance Schedule

Daily	Weekly	Monthly	Quarterly	Annually	As Needed
Check sample waste container level.	Check peristaltic pump: proper roller pressure, sample introduction tubing, correct pump rotation, and condition of drain tubing.	Clean all filters and fans.	Replace oil in roughing pumps.	Replace oil in turbo-molecular pump.	Check electronic settings for optimum sensitivity: resolution, mass calibration, ion optics, CEM, deflector voltage.
Check quartz torch condition.	Check condition of sampler and skimmer cones.	Check recirculator water level.			
Measure quartz torch for proper alignment.	Check and drain oil mist eliminator on roughing pumps.				
Clean spray chamber and nebulizer.					
Check oil level of roughing pumps.					

Table 20-3

ICP Instrument Maintenance Schedule

Daily	Monthly or As Needed	Semi-annually	Annually
Check gases Check that argon tank pressure is 50-60 psi and that a spare tank is available. Check aspiration tubing	Clean plasma torch assembly to remove accumulated deposits.	Change vacuum pump oil.	Notify manufacturer service engineer for scheduled preventive maintenance service.
Check vacuum pump gage. (<10 millitorr)	Clean nebulizer and drain chamber; keep free flowing to maintain optimum performance.	Replace coolant water filter. (may require more or less frequently depending on the quality of water)	
Check that cooling water supply system is full and drain bottle is not full. Also that drain tubing is clear, tight fitting and has few bends.	Clean filters on back of power unit to remove dust.		
Check that nebulizer is not clogged.	Replace when needed: peristaltic pump tubing sample capillary tubing autosampler sipper probe		
Check that capillary tubing is clean and in good condition.	Check yttrium position.		

Table 20-3

ICP Instrument Maintenance Schedule

Daily	Monthly or As Needed	Semi-annually	Annually
	Check O-rings Clean/lubricate pump rollers.		
Check that peristaltic pump windings are secure.			
Check that high voltage switch is on.			
Check that exhaust screens are clean.			
Check that torch, glassware, aerosol injector tube, bonnet are clean.			

Table 20-4

Cold Vapor Atomic Absorption (Leeman PS 200) Instrument Maintenance Schedule

Daily	As Needed	Annually
Change drying tube	Change pump tubing	Change Hg lamp.
Check pump tubing/drain tubing	Check/change Hg lamp	
Check gas pressure	Clean optical cell	
Check aperture reading Check tubing	Lubricate pump	

Table 20-5

Gas Chromatograph Instrument Maintenance Schedule

Daily	As Needed	Quarterly/Semi-annually/Annually
Check for sufficient supply of carrier and detector gases. Check for correct column flow and/or inlet pressures.	Replace front portion of column packing or break off front portion of capillary columns. Replace column if this fails to restore column performance or when column performance (e.g. peak tailing, poor resolution, high backgrounds, etc.) indicates it is required.	Quarterly ELCD: change-roughing resin, clean cell assembly. Quarterly FID: clean detector
Check temperatures of injectors and detectors. Verify temperature programs.	Change glass wool plug in injection port and/or replace injection port liner when front portion of column packing is changed or front portion of capillary column is removed.	Semi-annually ECD: perform wipe test.
Check inlets, septa. Replace septum Clean injector port		Annually ELCD: change finishing resin, clean solvent filter. Annually FID: Replace flame tip ECD: detector cleaning and re-foiling, every five years or whenever loss of sensitivity, or erratic response or failing resolution is observed.
Check baseline level.	Perform gas purity check (if high baseline indicates that impure carrier gas may be in use).	
Check reactor temperature of electrolytic conductivity detector.	Replace or repair flow controller if constant gas flow cannot be maintained.	
	Replace fuse.	
Inspect chromatogram to verify symmetrical peak shape and adequate resolution between closely eluting peaks.	Reactivate external carrier gas dryers.	
	Detectors: clean when baseline indicates	

Table 20-5

Gas Chromatograph Instrument Maintenance Schedule

Daily	As Needed	Quarterly/Semi-annually/Annually
Clip column leader	contamination or when response is low. FID: clean/replace jet, replace igniter. NPD: clean/replace collector assembly. PID: clean lamp window monthly or replace as needed, replace seals. ELCD: check solvent flow weekly, change reaction tube, replace solvent, change reaction gas, clean/replace Teflon transfer line. ECD: follow manufacturers suggested maintenance schedule	
	Reactivate flow controller filter dryers when presence of moisture is suspected.	
	HP 7673 Autosampler: replace syringe, fill wash bottle, dispose of waste bottle contents.	
	Purge & trap devices: periodic leak checks quarterly, replace/condition traps (when poor response or disappearance of reactive or poorly trapped compounds), clean sample lines, valves (if they become contaminated), clean glassware. Clean sparger weekly. Check purge flow monthly. Bake trap as needed to correct for high background. Change trap annually, or as needed whenever loss of sensitivity, or erratic response or failing resolution is observed.	
	Purge & trap autosamplers: leak check system, clean sample lines, valves. PTA-30 autosampler also requires cleaning the syringes, frits, valves, and probe needles, adjustment of micro switches, replacement of Teflon valve, and lubrication of components.	

Table 20-6

Mass Spectrometer Instrument Maintenance Schedule

Daily	Weekly	As Needed	Quarterly	Semi-Annually	Annually
Check for sufficient gas supply. Check for correct column flow and/or inlet pressure.	Check mass calibration (PFTBA or FC-43)	Check level of oil in mechanical pumps and diffusion pump if vacuum is insufficient. Add oil if needed between service contract maintenance.	Check ion source and analyzer (clean, replace parts as needed)		Replace the exhaust filters on the mechanical rough pump every 1-2 years.
Check temperatures of injector, detector. Verify temperature programs.		Replace electron multiplier when the tuning voltage approaches the maximum and/or when sensitivity falls below required levels.	Check vacuum, relays, gas pressures and flows	Clean rods	
Check inlets, septa.		Clean Source, including all ceramics and lenses - the source cleaning is indicated by a variety of symptoms including inability of the analyst to tune the instrument to specifications, poor response,	Change oil in the mechanical rough pump. Relubricate the turbomolecular pump-bearing wick.		

Table 20-6

Mass Spectrometer Instrument Maintenance Schedule

Daily	Weekly	As Needed	Quarterly	Semi-Annually	Annually
		and high background contamination.			
Check baseline level.		Repair/replace jet separator.			
Check values of lens voltages, electron multiplier, and relative abundance and mass assignments of the calibration compounds.		Replace filaments when both filaments burn out or performance indicates need for replacement.			

Table 20-7

High Pressure Liquid Chromatograph Instrument Maintenance Schedule

Daily	As Needed
Check level of solution in reservoirs. If adding, verify that solvent is from the same source. If changing, rinse gas and delivery lines to prevent contamination of the new solvent.	Replace columns when peak shape and resolution indicate that chromatographic performance of column is below method requirements.
Check gas supply.	Oil autosampler slides when sample does not advance.
Flush with an appropriate solvent to remove all bubbles.	Rinse flow cell with 1N nitric acid if sensitivity low.
Pre-filter all samples.	Change pump seals when flow becomes inconsistent.
	Repack front end of column Backflush column.

Table 20-8

Wet Chemistry and Support Equipment Maintenance Schedule

Equipment	Daily	Monthly	Annually	As Needed
Sonicator	Daily when used: Inspect probe tips for inconsistencies (etching/pitting).		Tune sonicator assembly	Disassemble and clean sonicator probe tips. Replace probe tip.
Analytical/Top Loading Balance	Check using Class S or Class 1 verified weights once daily or before use Clean pan and weighing compartment		Manufacture r cleaning and calibration.	
Refrigerators/Walk-In Coolers	Temperatures checked and documented.			Refrigerant system and electronics serviced.
Ovens	Temperatures checked and documented.			Electronics serviced.
pH Meter	Inspect electrode. Verify electrodes are properly connected and filled. Inspect electrode proper levels of filling solutions. Make sure electrode is stored in buffer (pH 4.0).			Clean electrode. Refill reference electrode
Specific Digital Ion Analyzer	Daily when used: Calibrate with check standards. Inspect electrode daily, clean as needed. Inspect electrode proper levels of filling solutions daily, fill as needed. Clean probe, each use.			Electronics serviced.
Dissolved Oxygen	Daily when used:			Electronics

Table 20-8

Wet Chemistry and Support Equipment Maintenance Schedule

Equipment	Daily	Monthly	Annually	As Needed
Meter	Calibrate with check standards. Check probe membrane for deterioration. Clean and replace membrane with electrode solution.			serviced.
Conductance Meter	Daily when used: Check probe and cables. Standardize with KCl. Inspect conductivity cell			Electronics serviced.
Chemical Oxygen Demand (COD) Reactor	Daily when used: Calibrate with check standards.			Electronics serviced.
Spectrophotometer	Check the zero %A adjustment. Clean sample compartment. Clean cuvettes.	Clean windows	Check instrument manual. Perform wavelength calibration. Replace lamp annually or when erratic response is observed. Clean and align optics.	Dust the lamp and front of the front lens
Digestion Block			Check temperature	

Table 20-8

Wet Chemistry and Support Equipment Maintenance Schedule

Equipment	Daily	Monthly	Annually	As Needed
			with NIST thermometer	
Flash Point Tester	Check tubing. Clean sample cup each use. Check gas. Clean flash assembly. Check stirrer		Check thermometer against NIST thermometer, when used.	
Zero Headspace Extractors	Verify rotation speed and record. Check for leakage			Vendor repair
TCLP Extractors	Verify rotation speed and record.			

Table 20-9

AlpChem Auto Analyzer Instrument Maintenance Schedule

As Needed	Daily	Monthly	Bi-monthly	Annually
Prepare fresh reagents.	Check detector and make sure there are no trapped bubbles in detector cell.	Replace tubing.	Lubricate pump roller.	Clean pump rollers with steel wool and lubricate.
	Check Valves			
	Check Reference source			
Replace pump tubing	Check peristaltic tubing and	Clean pump, diluter, and XYZ		

Table 20-9

AlpChem Auto Analyzer Instrument Maintenance Schedule

As Needed	Daily	Monthly	Bi-monthly	Annually
	rollers. Check sampler	Sampler.		
	Clean sample probe shaft.			

Table 20-10

Alpkem FS3000 (1677 Available Cyanide) Instrument Maintenance Schedule

As Needed	Daily	Monthly	Bi-monthly
Prepare fresh reagents.	Clean detector cell and make sure there are no trapped bubbles in lines.	Replace tubing.	Lubricate pump roller Replace Diffusion Membrane
Replace pump tubing	Check peristaltic tubing and rollers.		Clean Reference Electrode
			Replace Reference solution

Table 20-11

Konelab Instrument Maintenance Schedule

Daily	Weekly	Monthly
Run “Start Up”	Empty liquid waste	Restore adjustments from disk
Review water check	Clean wash wells and tubing to waste	Save database to CD
Empty waste bin	Check for chemical residue	Print – then delete messages
Fill diluent with fresh DI water	Clean off any chemical residue	Print – Water Check
Check waste container	Check syringe plunger Teflon tip	Run Dichromate test at 480nm

Table 20-11

Konelab Instrument Maintenance Schedule

Daily	Weekly	Monthly
Run "Stand By"	Run Dichromate test at 480 nm	Clean and Lube incubator rod
Print or save results to file	Reboot computer	Clean and Lube fetcher rod
Clear daily files		
Clean incubator		

Table 20-12
Ion Chromatograph Instrument Maintenance Schedule

As Needed	Daily	Weekly	Monthly	Semi-annually
Clean micromembrane suppressor when decreases in sensitivity are observed.	Check plumbing/leaks.	Check pump heads for leaks.	Check all air and liquid lines for discoloration and crimping, if indicated.	Lubricate left hand piston.
Check fuses when power problems occur.		Check filter (inlet)	Check/change bed supports guard and analytical columns, if indicated.	Clean conductivity cell.
Reactivate or change column when peak shape and resolution deteriorate or when retention time shortening indicates that exchange sites have become deactivated.	Check pump pressure.			Check conductivity cell for calibration.
De-gas pump head when flow is erratic.	Check conductivity meter.			

Table 20-13

Total Organic Carbon Analyzer Instrument Maintenance Schedule

Daily	As Needed	Weekly	Monthly	Semi-Annually
Check: Oxygen supply Persulfate supply Acid supply Carrier gas flow rate (~ 150 cc/min) IR millivolts for stability (after 30 min. warm-up) Reagent reservoirs	Check injection port septum after 50-200 runs. Tube end-fitting connections after 100 hours or use. Indicating drying tube. NDIR zero, after 100 hours of use. Sample pump, after 2000 hours for use. Digestion vessel/condensation chamber, after 2000 hours of use. Permeation tube, after 2000 hours of use. NDIR cell, after 2000 hours of use.	Check liquid-flow-rate-pump-tubing conditions on autosampler Check injection port septum	Clean digestion vessel Clean condenser column Do the leak test	Change pump tubing

Note: Refer to manufacturer's instructions for each equipment to identify and perform maintenance operations.

Table 20-14.

Periodic Calibration

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Analytical Balance	Accuracy determined using NIST traceable weights. Minimum of 2 standards bracketing the weight of interest. Inspected and calibrated by an approved vendor annually.	Daily	± 0.1% or ± 0.5mg, whichever is larger unless method specific guidance exists.	Clean, check level, insure lack of drafts, and that unit is warmed up, recheck. If fails, call service.
Top Loading Balance	Accuracy determined using-NIST traceable weights. Minimum of 2 standards bracketing the weight of interest. Inspected and calibrated by an approved vendor annually.	Daily	± 0.5%	Clean. Replace.
Weights (NIST Traceable – non Class 1)	Accuracy determined against NIST Traceable Class 1 weights.	1 year	As per certificate.	Replace.
Weights (NIST Traceable – Class 1)	Accuracy determined by an approved vendor.	3 Years	As per certificate.	Replace.
NIST-Traceable Thermometer	Accuracy determined by an approved weights and measurement laboratory.	5 years	As per certificate.	Replace.
Thermometer	Against NIST-traceable thermometer	Yearly at appropriate temperature range for intended use	± 1.2°C	Replace
Minimum-Maximum Thermometers	Against NIST-traceable thermometer	Yearly	± 1.5°C	Replace

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
InfraRed Temperature Guns	Against NIST-traceable thermometer	Quarterly at appropriate temperature range for intended use.	± 1.5°C	Repair/replace
Digital Thermometer	Against NIST-traceable thermometer - at two temperatures that bracket target temperature(s); if only a single temperature is used, at the temperature of use	TNI Annually - DoD requires Quarterly at appropriate temperature range for intended use.	± 1.5°C	Repair/replace
Dial-type Thermometers	Against NIST-traceable thermometer	Quarterly at appropriate temperature range for intended use.	± 1.5°C	Replace
Refrigerator	Temperature checked using NIST-traceable thermometer. Thermometer must be immersed in a liquid such as mineral oil or glycol.	Daily. If out of range, check again in two hours.	4.0 ± 2°C	Adjust. Repair. While waiting for repair, seal door, attach "Out of Service" sign, move items to functional unit. Notify Team Leader.
Freezer	Temperature checked using NIST-traceable thermometer	Daily. If out of range, check again in two hours.	(-10) to (-20)°C	Adjust. Repair. While waiting for repair, seal door, attach "Out of Service" sign, move items to functional unit. Notify Team Leader.
Oven	Temperature checked using NIST-traceable thermometer.	When in use.	Compliance with method specific requirements or within ± 5% of set temperature 104 ± 1°C (drying) 180 ± 2°C (TDS)	Adjust. Replace.

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Incubator	Temperature checked using NIST-traceable thermometer.	When in use.	BOD: 20 ± 1.0°C	Adjust. Replace.
Water Bath	Temperature checked using NIST-traceable thermometer.	When in use.	± 2°C	Adjust. Replace.
Volumetric Dispensing Devices (Eppendorf ® pipette, automatic dilutor or dispensing devices)	One delivery by weight. Using DI water, dispense into tared vessel. Record weight with device ID number.	Quarterly	± 2% Calculate accuracy by dividing weight by stated volume times 100 for percent.	Adjust. Replace.
Glass Microliter Syringes	Accuracy verified every six months as per SOP.	Accuracy must be initially demonstrated if syringe was not received with a certificate attesting to established accuracy.	± 1%	Not applicable.
Conductivity Meter	Cell impedance calibrated with three KCl standards.	Each use.	$r \geq 0.99$	Recalibrate.
Deionized Water	Check in-line conductivity meter on system with conductivity meter in Wet Chem Department.	Daily	<10 µmhos/cm^2	Record on log. Report discrepancies to QA Manager.

SECTION 21

MEASUREMENT TRACEABILITY

21.1 Overview

Traceability of measurements shall be assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard shall be subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems,

automatic pipettes and other volumetric measuring devices. (Refer to Section 20.3). With the exception of Class A Glassware and Glass microliter syringes , quarterly accuracy checks are performed for all mechanical volumetric devices. Microsyringes can be verified at least semi-annually or disposed of after 6 months of use. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. Class A Glassware and Glass microliter syringes should be routinely inspected for chips, acid etching or deformity (e.g., bent needle). If the Class A glassware or syringe is suspect, the accuracy of the glassware will be assessed prior to use.

21.2 NIST-Traceable Weights And Thermometers

Reference standards of measurement shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For NIST-traceable weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program), APLAC (Asia-Pacific Laboratory Accreditation Cooperation), or EA (European Cooperation for Accreditation). A certificate and scope of accreditation is kept on file at the laboratory.

21.3 Reference Standards / Materials

Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared standard materials are purchased from vendors accredited by A2LA, NVLAP, ISO 9001:2000, ISO 17025 standard with an accompanying Certificate of Analysis that documents the standard purity. If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The receipt of all reference standards must be documented. Reference standards are labeled with a unique Standard Identification Number and expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the 'true' value does not exceed method requirements. The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor certified different lot is acceptable for use as a second source. For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst would be considered a second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS (where there is no sample preparation) is used as the second source confirmation. These checks are generally performed as an integral part of the analysis method (e.g. calibration checks, laboratory control samples).

All standards and materials must be stored and handled according to method or manufacturer's requirements in order to prevent contamination or deterioration. Refer to the Corporate

Environmental Health & Safety Manual or laboratory SOPs. For safety requirements, please refer to method SOPs and the laboratory Environmental Health and Safety Manual.

Standards and reference materials shall not be used after their expiration dates unless their reliability is verified by the laboratory and their use is approved by the Quality Assurance Manager. The laboratory must have documented contingency procedures for re-verifying expired standards.

21.4 Documentation And Labeling Of Standards, Reagents, And Reference Materials

Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the expiration date are documented. The lots for most of the common solvents and acids are tested for acceptability prior to company wide purchase. (Refer to TestAmerica's Corporate SOP (CA-Q-S-001), Solvent and Acid Lot Testing and Approval.)

All manufacturer or vendor supplied Certificate of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These records are maintained in the QA public drive N:\QA\Facility_QA_Documents\Certificate_of_Analysis. Standard certificates are maintained by each department and a copy should be scanned into LIMS Reagent log. Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection. For detailed information on documentation and labeling, please refer to method specific SOPs and SOP No. PT-QA-006, Procurement of Standard and Materials; Labeling and Traceability.

Commercial materials purchased for preparation of calibration solutions, spike solutions, etc., are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96% a correction will be made to concentrations applied to solutions prepared from the stock commercial material.

21.4.1 All standards, reagents, and reference materials that may affect quality must be labeled in an unambiguous manner. Standards are logged into the laboratory's LIMS system, and are assigned a unique identification number. The following information is typically recorded in the electronic database within the electronic database within LIMS.

- Standard ID
- Description of Standard
- Department
- Preparer's name
- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation Date
- Expiration Date

- Standard source type (stock or daughter)
- Standard type (spike, surrogate, other)
- Parent standard ID (if applicable)
- Parent Standard Analyte Concentration (if applicable)
- Parent Standard Amount used (if applicable)
- Component Analytes
- Final concentration of each analyte
- Comment box (text field)

Records are maintained electronically for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and preparer's name or initials. Preparation procedures are provided in the Method SOPs.

21.4.2 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date (include prep date for reagents)
- Standard ID (from electronic standard log in LIMS)
- Special Health/Safety warnings if applicable

Records must also be maintained of the date of receipt for commercially purchased items or date of preparation for laboratory prepared items. Special Health/Safety warnings must also be available to the analyst. This information is maintained in standard/reagent log. Health and safety warning are in the MSDS (Material Safety Data Sheets) which is accessed through company intranet site.

21.4.3 In addition, the following information may be helpful:

- Date of receipt for commercially purchased items or date of preparation for laboratory prepared items
- Date opened (for multi-use containers, if applicable)
- Description of standard (if different from manufacturer's label or if standard was prepared in the laboratory)
- Recommended Storage Conditions
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include, expiration date and an ID number to trace back to preparation.

Procedures for preparation of reagents can be found in the Method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets and raw data.

All reagents and standards must be stored in accordance to the following priority: 1) with the manufacturer's recommendations; 2) with requirements in the specific analytical methods as specified in the laboratory SOP.

SECTION 22

SAMPLING

22.1 Overview

The laboratory provides sampling services for the following matrices:

- Groundwater Sampling
- Wastewater Sampling
- Potable Sampling
- Waste Sampling
- Soil and Sediment Sampling
- Flow Monitoring
- Field Parameter Analysis
- Cleaning and Decontamination of Field Equipment

22.2 Sampling Containers

The laboratory offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required. Any certificates of cleanliness that are provided by the supplier are maintained at the laboratory. For detailed information regarding container/bottle order, refer to laboratory SOP PT-QA-028, Bottle and Cooler Preparation.

22.2.1 Preservatives

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – AR Select (ACS) or equivalent
- Methanol – Purge and Trap grade

- Nitric Acid – AR Select (ACS) or equivalent
- Sodium Hydroxide – AR Select (ACS) or equivalent
- Sulfuric Acid – AR Select (ACS) or equivalent
- Hexane – Ultra Resi – Analyzed or equivalent

22.3 Definition Of Holding Time

The date and time of sampling documented on the COC form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in "days" (e.g., 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in "hours" (e.g., 6 hours, 24 hours, etc.) are measured from date and time zero. The first day of holding time ends twenty-four hours after sampling. Holding times for analysis include any necessary reanalysis. However there are some programs that determine holding time compliance based on the date and specific time of analysis compared to the time of sampling regardless of how long the holding time is. DOD work requires that all holding times be measured to the exact time of sampling – not the day. For DOD requirements, refer to SOPs: PT-QA-025 for QSM 3.0 and PT-QA-029 for DoD QSM 4.2.

22.4 Sampling Containers, Preservation Requirements, Holding Times

The preservation and holding time criteria specified in the SOPs are derived from the source documents for the methods. If method required holding times as specified in the SOPs or preservation requirements are not met, the reports will be qualified using a flag, footnote or case narrative. As soon as possible or "ASAP" is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor the laboratory have a basis for a holding time.

22.5 Sample Aliquots / Subsampling

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation. It is the laboratory's responsibility to take a representative subsample or aliquot of the sample provided for analysis.

Analysts should handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

Guidelines for subsampling are located SOP # PT-QA-024.

SECTION 23

HANDLING OF SAMPLES

Sample management procedures at the laboratory ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

23.1 Chain Of Custody (COC)

The COC form is the written documented history of any sample and is initiated when bottles are sent to the field, or at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect. An example of a COC form may be found in Figure 23-1.

23.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label is:

- Sample identification
- Date and time
- Preservative

During the sampling process, the COC form is completed and must be legible (see Figure 23-1). This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification
- Date, time and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

When the sampling personnel deliver the samples directly to TestAmerica personnel, the samples are stored in a cooler with ice, as applicable, and remain solely in the possession of the client's field technician until the samples are delivered to the laboratory personnel. The sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample control personnel at the laboratory or to a TestAmerica courier. When sampling personnel deliver the samples through a

common carrier (Fed-Ex, UPS), the CoC relinquished date/time is completed by the field personnel and samples are released to the carrier. Samples are only considered to be received by lab when personnel at the fixed laboratory facility have physical contact with the samples.

Note: Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler. The receipt from the courier is stored in the project folder.

23.1.2 Legal / Evidentiary Chain-of-Custody

The laboratory may, upon special request, adhere to legal/evidentiary chain of custody requirements. If TestAmerica agrees to such procedures the samples are identified for legal/evidentiary purposes on the COC, login will complete the custody seal (Figure 23-4), retain the shipping record with the COC, and initiate an internal COC (Figure 23-5) for laboratory use by analysts and sample disposal record.

23.2 Sample Receipt

Samples are received at the laboratory by designated sample receiving personnel and a unique laboratory project identification number is assigned. Each sample container shall be assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking and storage procedures are summarized in the following sections.

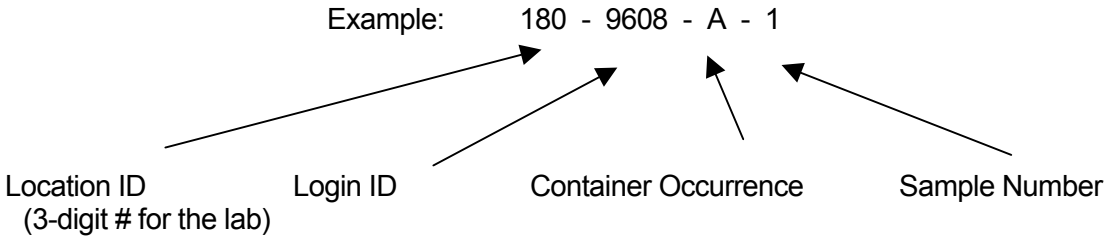
23.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented via the Sample Receipt application, Sample Receipt checklist (Figure 23-3). and brought to the immediate attention of the Project Manager who will, in turn, contact the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the project record. This procedure is further described in SOP No. PT-QA-027, Sample Receiving and Chain-of-Custody.

23.2.1.1 Unique Sample Identification

All samples that are processed through the laboratory receive a unique sample identification to ensure that there can be no confusion regarding the identity of such samples at anytime. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates.

The laboratory assigns a unique identification (e.g., Sample ID) code to each sample container received at the laboratory. This Primary ID is made up of the following information (consisting of 4 components):



The above example states that TestAmerica Pittsburgh Laboratory (Location 180). Login ID is 9608 (unique to a particular client/job occurrence). The container code indicates it is the first container ("A") of Sample #1.

If the primary container goes through a prep step that creates a "new" container, then the new container is considered secondary and gets another ID. An example of this being a client sample in a 1-Liter amber bottle is sent through a Liquid/Liquid Extraction and an extraction vial is created from this step. The vial would be a SECONDARY container. The secondary ID has 5 components.

Example: 180 - 9608 - A - 1 - **A** ← **Secondary Container Occurrence**

Example: 180-9608-A-1-A, would indicate the PRIMARY container listed above that went through a step that created the 1st occurrence of a Secondary container.

With this system, a client sample can literally be tracked throughout the laboratory in every step from receipt to disposal.

23.3 Sample Acceptance Policy

The laboratory has a written sample acceptance policy (Figure 23-2) that clearly outlines the circumstances under which samples shall be accepted or rejected. These include:

- a COC filled out completely;
- samples must be properly labeled;
- proper sample containers with adequate volume for the analysis and necessary QC;
- samples must be preserved according to the requirements of the requested analytical method ;
- sample holding times must be adhered to ;
- all samples submitted for water/solid Volatile Organic analyses must have a Trip Blank submitted at the same time;
- Efforts should be made to minimize any air bubbles in aqueous volatile samples. Air bubbles also the escape of volatile organics. This is especially important because air bubbles tend to form in iced samples. Volatile vials containing air bubbles larger than a pea will be treated as non-conformances;
- Samples that require chilling must be received at < 6 °C;
- If Matrix Spikes are required for the project, separate sample volumes must be available for the requested analyses;

- the project manager will be notified if any sample is received in damaged condition

Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined. A copy of the sample acceptance policy is provided to each client prior to shipment of samples.

23.3.1.1 After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.

23.3.1.2 Any deviations from these checks that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance policy criteria are not met, the laboratory shall either:

- Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or
- Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.
- If the conditions listed on the Acceptance Policy are not satisfactory and when lacking direction or agreement with the client, the sample will be rejected by the laboratory.

Note: North Carolina requires that they be notified when samples are processed that do not meet sample acceptance criteria.

Once sample acceptance is verified, the samples are logged into the LIMS according SOP No. PT-QA-027.

23.4 Sample Storage

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators suitable for the sample matrix. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples are never to be stored with reagents, standards or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed every two weeks.

Analysts and technicians retrieve the sample container allocated to their analysis from the designated cold room or refrigerator and place them on carts, analyze the sample, and return the remaining sample or empty container to the cold room or refrigerator from which it originally came. All unused portions of samples, including empty sample containers, are returned to the

secure sample control area. Raw samples requiring cold storage are kept in the cold room for approximately 30 days after reported. Volatile samples are stored in the VOA refrigerator. All sample extracts are kept in the refrigerators for approximately two to four weeks after analysis, which meets or exceeds most sample holding times. After this time the sample extracts are moved to cold room, where they are stored for an additional three to six months before they are disposed of. This holding period allows samples to be checked if a discrepancy or question arises. Special arrangements may be made to store samples for longer periods of time. This extended holding period allows additional metal analyses to be performed on the archived sample and assists clients in dealing with legal matters or regulatory issues.

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica.

23.5 Hazardous Samples And Foreign Soils

To minimize exposure to personnel and to avoid potential accidents, hazardous, for any sample that is known to be hazardous at the time of receipt a cautionary email communication should be sent to all applicable laboratory personnel by the project manger or designee. All hazardous samples are disposed of appropriately through a hazardous waste disposal process. Foreign soil samples are sent out for incineration by an USDA-approved waste disposal facility. Analysts will notify Sample Control of any sample determined to be hazardous after completion of analysis by sending an email. All hazardous samples are either returned to the client or disposed of appropriately through a hazardous waste disposal firm that lab-packs all hazardous samples and removes them from the laboratory. Foreign soil samples are sent out for incineration by a USDA-approved waste disposal facility.

23.6 Sample Shipping

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6.0°C during transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). A trip blank is enclosed for those samples requiring water/solid volatile organic analyses. The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a TestAmerica courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice. The Environmental, Health and Safety Manual contains additional shipping requirements.

Note: If a client does not request trip blank analysis on the COC or other paperwork, the laboratory will not analyze the trip blanks that were supplied. However, in the interest of good client service, the laboratory will advise the client at the time of sample receipt that it was noted that they did not request analysis of the trip blank; and that the laboratory is providing the notification to verify that they are not inadvertently omitting a key part of regulatory compliance testing.

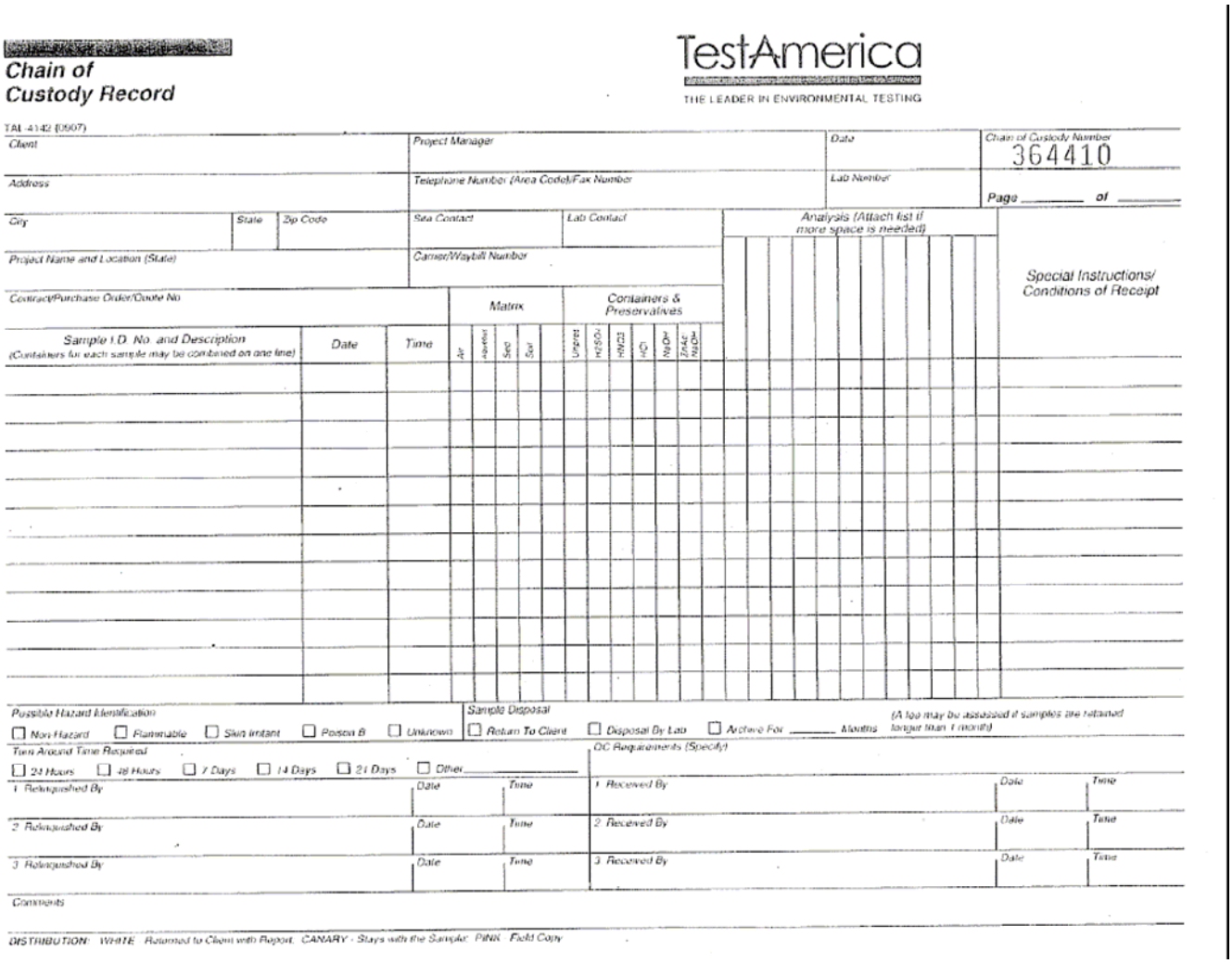
23.7 Sample Disposal

Samples should be retained for a minimum of 30 days after the project report is sent, however, provisions may be made for earlier disposal of samples once the holding time is exceeded. Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project report is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement. Several possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory's waste disposal procedures (SOP No. PT-HS-001 and Chemical Hygiene Plan). All procedures in the laboratory Environmental, Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than two months from receipt unless otherwise requested. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

If a sample is part of a known litigation, the affected legal authority, sample data user, and/or submitter of the sample must participate in the decision about the sample's disposal. All documentation and correspondence concerning the disposal decision process must be kept on file. Pertinent information includes the date of disposal, nature of disposal (such as sample depletion, hazardous waste facility disposal, return to client), names of individuals who conducted the arrangements and physically completed the task. The laboratory will remove or deface sample labels prior to disposal unless this is accomplished through the disposal method (e.g., samples are incinerated). A Waste Disposal Record should be completed.

Figure 23-1.

Example: Chain of Custody (COC)



Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TAL-4142 (0907)

Client | Project Manager | Date | Chain of Custody Number 364410

Address | Telephone Number (Area Code)/Fax Number | Lab Number | Page ____ of ____

City | State | Zip Code | Site Contact | Lab Contact | Analysis (Attach list if more space is needed)

Project Name and Location (State) | Carrier/Waybill Number | Special Instructions/ Conditions of Receipt

Contract/Purchase Order/Quote No.

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air, Aqueous, Sed., Soil	Containers & Preservatives: Unpres., H2SO4, HNO3, HCl, NaOH, ZnAc/NaOH

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other ____

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By			1. Received By		
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Figure 23-2

Example: Sample Acceptance Policy

All incoming work will be evaluated against the criteria listed below. Where applicable, data from any samples that do not meet the criteria listed below will be noted on the laboratory report defining the nature and substance of the variation. In addition the client will be notified either by telephone, fax or e-mail ASAP after the receipt of the samples.

1) Samples must arrive with labels intact with a Chain of Custody filled out completely. The following information must be recorded.
   - *Client name, address, phone number and fax number (if available)*
   - *Project name and/or number*
   - *Unique sample identification*
   - *Date, time and location of sampling*
   - *The collectors name*
   - *The matrix description*
   - *The container description*
   - *The total number of each type of container*
   - *Preservatives used*
   - *Analysis requested*
   - *Requested turnaround time (TAT)*
   - *Any special instructions*
   - *Purchase Order number or billing information (e.g. quote number) if available*
   - *The date and time that each person received or relinquished the sample(s), including their signed name.*
   - **Information must be legible**

2) Samples must be properly labeled.
   - Use durable labels (labels provided by TestAmerica are preferred)
   - Include a unique identification number
   - Include sampling date and time & sampler ID
   - Include preservative used.
   - Use indelible ink
   - **Information must be legible**

3) Proper sample containers with adequate volume for the analysis and necessary QC are required for each analysis requested.

4) Samples must be preserved according to the requirements of the requested analytical method. (See Sampling Guide)

5) Most analytical methods require chilling samples to 4° C (other than water samples for metals analysis). For these methods, the criteria are met if the samples are chilled to below 6° C and above freezing (0°C). For methods with other temperature criteria (e.g. some bacteriological methods require $\leq$ 10 °C), the samples must arrive within $\pm$ 2° C of the required temperature or within the method

specified range. **Note:** Samples that are hand delivered to the laboratory immediately after collection may not have had time to cool sufficiently. In this case the samples will be considered acceptable as long as there is evidence that the chilling process has begun (arrival on ice).

5i.) Samples that are delivered to the laboratory on the same day they are collected may not meet the requirements of Section 5. In these cases, the samples shall be considered acceptable if the samples were received on ice.

5ii.) If sample analysis is begun within fifteen (15) minutes of collection, thermal preservation is not required.

5iii.)Thermal preservation is not required in the field if the laboratory receives and refrigerates the sample within fifteen (15) minutes of collection.

- Chemical preservation (pH) will be verified prior to analysis and documented, either in sample control or at the analyst's level. The project manager will be notified immediately if there is a discrepancy. If analyses will still be performed, all affected results will be flagged to indicate improper preservation.

- **FOR WATER SAMPLES TESTED FOR CYANIDE (Method OIA-1677)**
  - In the Field: Samples are to be tested for Sulfide using lead acetate paper prior to the addition of Sodium Hydroxide (NaOH). If sulfide is present, the sample is treated in the field with lead carbonate or if the client requests the sample to be treated at the lab it will be filtered and treated at the lab with Cadmium Chloride.
    - If the sulfide test and treatment is not performed in the field, the lab will test the samples for sulfide using lead acetate paper at the time of receipt and if sulfide is present in the sample, the client will be notified and given the option of retaking the sample and treating in the field per the method requirements or the laboratory can analyze the samples as delivered and qualify the results in the final report.
  - It is the responsibility of the client to notify the laboratory if thiosulfate, sulfite, or thiocyanate are known or suspected to be present in the sample. This notification may be on the chain of custody. The samples may need to be subcontracted to a laboratory that performs a UV digestion. If the lab does not perform the UV digestion on samples that contain these compounds, the results must be qualified in the final report.
  - The laboratory must test the sample for oxidizing agents (e.g. Chlorine) prior to analysis and treat according to the methods prior to distillation. (ascorbic acid or sodium arsenite are the preferred choice).

6) *Matrix Spikes* are required for your project, separate sample volumes must be available for the requested analyses.

7) For Volatile Organic analyses: Efforts should be made to minimize any air bubbles in aqueous volatile samples. Air bubbles also the escape of volatile organics. This is especially important because air bubbles tend to form in iced samples. Volatile vials containing air bubbles larger than a pea will be treated as non-conformances.

8) All samples submitted for Volatile Organic analyses must have a Trip Blank submitted at the same time. TestAmerica will supply a blank with the bottle order.

9) Sample Holding Times

- TestAmerica will make every effort to analyze samples within the regulatory holding time. Samples must be received in the laboratory with enough time to perform the sample analysis. Except for short holding time samples (< 48hr HT) sample must be received with at least 48 hrs (working days) remaining on the holding time for us to ensure analysis.

- Analyses that are designated as "field" analyses (Odor, pH, Dissolved Oxygen, Disinfectant Residual; a.k.a. Residual Chlorine, and Redox Potential) should be analyzed ASAP by the field sampler prior to delivering to the lab (within 15 minutes). However, if the analyses are to be performed in the laboratory, TestAmerica will make every effort to analyze the samples within 24 hours from receipt of the samples in the testing laboratory. Samples for "field" analyses received after 4:00 pm on Friday or on the weekend will be analyzed no later than the next business day after receipt (Monday unless a holiday). Samples will remain refrigerated and sealed until the time of analysis. Samples analyzed in the laboratory will be qualified on the final report to indicate holding time exceedance.

10) The project manager will be notified if any sample is received in damaged condition. TestAmerica will request that a sample be resubmitted for analysis. The laboratory will notify the client upon sample receipt if the samples exhibit obvious signs of damage, contamination or inadequate preservation.

11) Recommendations for packing samples for shipment.

- Pack samples in Ice rather than "Blue" ice packs.

- Soil samples should be placed in plastic zip-lock bags. The containers often have dirt around the top and do not seal very well and are prone to intrusion from the water from melted ice.

- Water samples would be best if wrapped with bubble-wrap or paper (newspaper, or paper towels work) and then placed in plastic zip-lock bags.

- Fill extra cooler space with bubble wrap.

12) For DoD work, the Project Manager will notify the client that samples are received after hours they lab will not accept the samples until the following day.

If the conditions listed on the Acceptance Policy are not satisfactory and when lacking direction or agreement with the client, the sample will be rejected by the laboratory.

Figure 23-3.

Example: Sample Receipt Checklist

Login Sample Receipt Checklist

Client: Cardno ENTRIX — Job Number: 180-264-1

Login Number: 264
List Number: 1
Creator: Gamber, Tom
List Source: TestAmerica Pittsburgh

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	True	
The cooler's custody seal, if present, is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Figure 23-4.

Example: Custody Seal

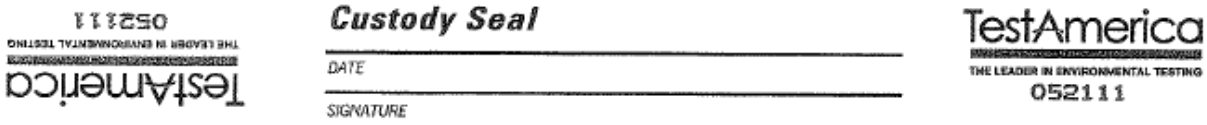
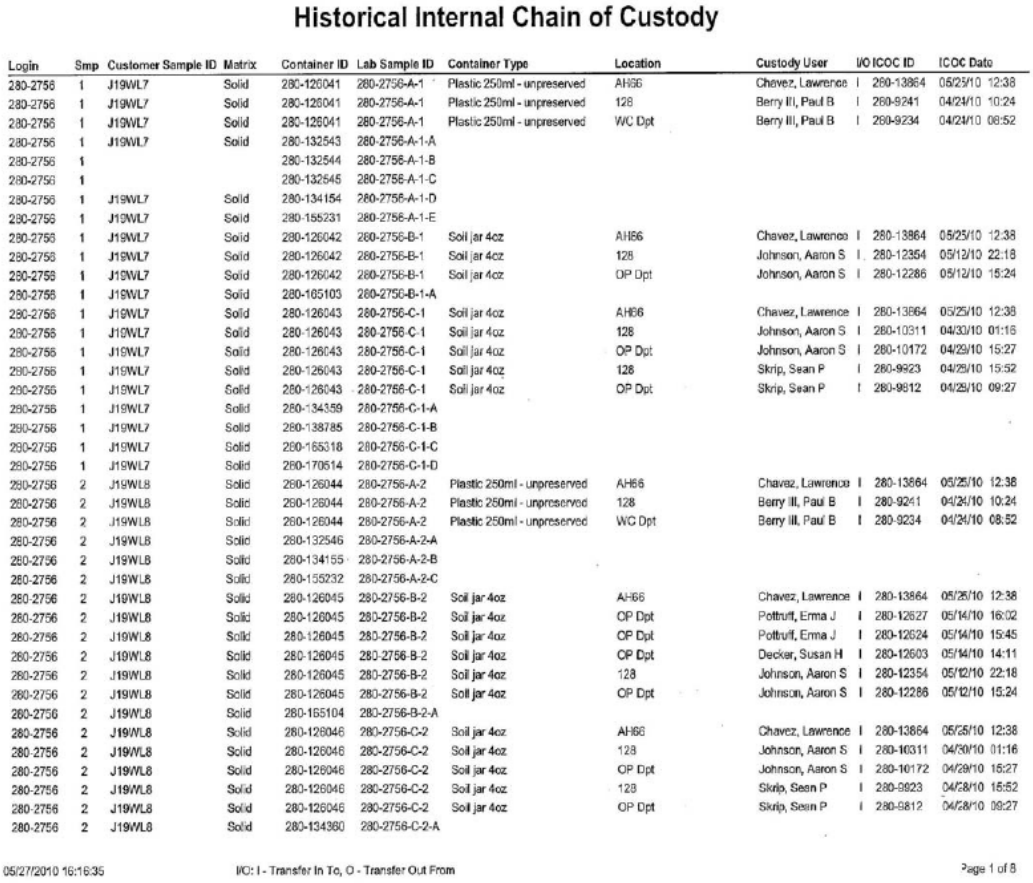


Figure 23-5.

Example: Internal Chain-of-Custody (COC) Form



Historical Internal Chain of Custody

Login	Smp	Customer Sample ID	Matrix	Container ID	Lab Sample ID	Container Type	Location	Custody User	I/O	COC ID	COC Date
280-2756	1	J19WL7	Solid	280-126041	280-2756-A-1	Plastic 250ml - unpreserved	AH66	Chavez, Lawrence	I	280-13864	05/25/10 12:38
280-2756	1	J19WL7	Solid	280-126041	280-2756-A-1	Plastic 250ml - unpreserved	128	Berry III, Paul B	I	280-9241	04/24/10 10:24
280-2756	1	J19WL7	Solid	280-126041	280-2756-A-1	Plastic 250ml - unpreserved	WC Dpt	Berry III, Paul B	I	280-9234	04/24/10 08:52
280-2756	1	J19WL7	Solid	280-132543	280-2756-A-1-A						
280-2756	1			280-132544	280-2756-A-1-B						
280-2756	1			280-132545	280-2756-A-1-C						
280-2756	1	J19WL7	Solid	280-134154	280-2756-A-1-D						
280-2756	1	J19WL7	Solid	280-155231	280-2756-A-1-E						
280-2756	1	J19WL7	Solid	280-126042	280-2756-B-1	Soil jar 4oz	AH66	Chavez, Lawrence	I	280-13864	05/25/10 12:38
280-2756	1	J19WL7	Solid	280-126042	280-2756-B-1	Soil jar 4oz	128	Johnson, Aaron S	I	280-12354	05/12/10 22:18
280-2756	1	J19WL7	Solid	280-126042	280-2756-B-1	Soil jar 4oz	OP Dpt	Johnson, Aaron S	I	280-12286	05/12/10 15:24
280-2756	1	J19WL7	Solid	280-165103	280-2756-B-1-A						
280-2756	1	J19WL7	Solid	280-126043	280-2756-C-1	Soil jar 4oz	AH66	Chavez, Lawrence	I	280-13864	05/25/10 12:38
280-2756	1	J19WL7	Solid	280-126043	280-2756-C-1	Soil jar 4oz	128	Johnson, Aaron S	I	280-10311	04/30/10 01:16
280-2756	1	J19WL7	Solid	280-126043	280-2756-C-1	Soil jar 4oz	OP Dpt	Johnson, Aaron S	I	280-10172	04/29/10 15:27
280-2756	1	J19WL7	Solid	280-126043	280-2756-C-1	Soil jar 4oz	128	Skrip, Sean P	I	280-9923	04/29/10 15:52
280-2756	1	J19WL7	Solid	280-126043	280-2756-C-1	Soil jar 4oz	OP Dpt	Skrip, Sean P	I	280-9812	04/29/10 09:27
280-2756	1	J19WL7	Solid	280-134359	280-2756-C-1-A						
280-2756	1	J19WL7	Solid	280-138785	280-2756-C-1-B						
280-2756	1	J19WL7	Solid	280-165318	280-2756-C-1-C						
280-2756	1	J19WL7	Solid	280-170514	280-2756-C-1-D						
280-2756	2	J19WL8	Solid	280-126044	280-2756-A-2	Plastic 250ml - unpreserved	AH66	Chavez, Lawrence	I	280-13864	05/25/10 12:38
280-2756	2	J19WL8	Solid	280-126044	280-2756-A-2	Plastic 250ml - unpreserved	128	Berry III, Paul B	I	280-9241	04/24/10 10:24
280-2756	2	J19WL8	Solid	280-126044	280-2756-A-2	Plastic 250ml - unpreserved	WC Dpt	Berry III, Paul B	I	280-9234	04/24/10 08:52
280-2756	2	J19WL8	Solid	280-132546	280-2756-A-2-A						
280-2756	2	J19WL8	Solid	280-134155	280-2756-A-2-B						
280-2756	2	J19WL8	Solid	280-155232	280-2756-A-2-C						
280-2756	2	J19WL8	Solid	280-126045	280-2756-B-2	Soil jar 4oz	AH66	Chavez, Lawrence	I	280-13864	05/25/10 12:38
280-2756	2	J19WL8	Solid	280-126045	280-2756-B-2	Soil jar 4oz	OP Dpt	Pottruff, Erma J	I	280-12627	05/14/10 16:02
280-2756	2	J19WL8	Solid	280-126045	280-2756-B-2	Soil jar 4oz	OP Dpt	Pottruff, Erma J	I	280-12624	05/14/10 15:45
280-2756	2	J19WL8	Solid	280-126045	280-2756-B-2	Soil jar 4oz	OP Dpt	Decker, Susan H	I	280-12603	05/14/10 14:11
280-2756	2	J19WL8	Solid	280-126045	280-2756-B-2	Soil jar 4oz	128	Johnson, Aaron S	I	280-12354	05/12/10 22:18
280-2756	2	J19WL8	Solid	280-126045	280-2756-B-2	Soil jar 4oz	OP Dpt	Johnson, Aaron S	I	280-12286	05/12/10 15:24
280-2756	2	J19WL8	Solid	280-165104	280-2756-B-2-A						
280-2756	2	J19WL8	Solid	280-126046	280-2756-C-2	Soil jar 4oz	AH66	Chavez, Lawrence	I	280-13864	05/25/10 12:38
280-2756	2	J19WL8	Solid	280-126046	280-2756-C-2	Soil jar 4oz	128	Johnson, Aaron S	I	280-10311	04/30/10 01:16
280-2756	2	J19WL8	Solid	280-126046	280-2756-C-2	Soil jar 4oz	OP Dpt	Johnson, Aaron S	I	280-10172	04/29/10 15:27
280-2756	2	J19WL8	Solid	280-126046	280-2756-C-2	Soil jar 4oz	128	Skrip, Sean P	I	280-9923	04/29/10 15:52
280-2756	2	J19WL8	Solid	280-126046	280-2756-C-2	Soil jar 4oz	OP Dpt	Skrip, Sean P	I	280-9812	04/29/10 09:27
280-2756	2	J19WL8	Solid	280-134360	280-2756-C-2-A						

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SECTION 24

ASSURING THE QUALITY OF TEST RESULTS

24.1 Overview

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 20, but also by routine process quality control measurements

(e.g. Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DUP), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

24.2 Controls

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, solvent extraction, sonication, acid digestion, filteration, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment. Control samples are added to each prep batch to monitor method performance and are processed through the entire analytical procedure with investigative/field samples.

24.3 Negative Controls

Table 24-1. Negative Controls

Control Type	Details
Method Blank (MB)	are used to assess preparation and analysis for possible contamination during the preparation and processing steps.
	The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.
	The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).
	Reanalyze or qualify associated sample results when the concentration of a targeted analyte in the blank is at or above the reporting limit as established by the method or by regulation, AND is greater than 1/10 of the amount measured in the sample.
Calibration Blanks	are prepared and analyzed along with calibration standards where applicable. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.
Instrument Blanks	are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.

Table 24-1. Negative Controls

Control Type	Details
Trip Blank [1]	are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses (or as specified in the client's project plan). Additionally, trip blanks may be prepared and analyzed for volatile analysis of air samples, when required by the client. A trip blank may be purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples.
Field Blanks [1]	are sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)
Equipment Blanks [1]	are also sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (TNI)
Holding Blanks	also referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory

[1] When known, these field QC samples should not be selected for matrix QC as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB."

Evaluation criteria and corrective action for these controls are defined in the specific standard operating procedure for each analysis. Also further detail is provided in SOP No. PT-QA-021.

24.4 Positive Controls

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon (1) Method Performance (Laboratory Control Sample (LCS) or Blank Spike (BS)), which entails both the preparation and measurement steps; and (2) Matrix Effects (Matrix Spike (MS) or Sample Duplicate (MD, DUP), which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch

Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method control samples are as listed in each analytical SOP.

24.4.1 Method Performance Control - Laboratory Control Sample (LCS)

24.4.1.1 The LCS measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects in a laboratory batch.

24.4.1.2 The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The LCS is spiked with verified known amounts of analytes or is made of a material containing known and verified amounts of analytes, taken through all preparation and analysis steps along with the field samples. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), a calibration verification standard is reported as the LCS. In some instances where there is no practical clean solid matrix available, aqueous LCS's may be processed for solid matrices; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the field samples.

24.4.1.3 Certified pre-made reference material purchased from a NIST/A2LA accredited vendor may also be used for the LCS when the material represents the sample matrix or the analyte is not easily spiked (e.g. solid matrix LCS for metals, TDS, etc.).

24.4.1.4 The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis. It is generally 1 for each batch of samples; not to exceed 20 environmental samples.

24.4.1.5 If the mandated or requested test method, or project requirements, do not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike) where applicable (e.g. no spike of pH). However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) shall be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period. For DoD requirements refer to SOPs PT-QA-025 and SOP PT-QA-029.

- For methods that have 1-10 target analytes, spike all components.
- For methods that include 11-20 target analytes, spike at least 10 or 80%, whichever is greater.
- For methods with more than 20 target analytes, spike at least 16 components.

- Exception: Due to analyte incompatibility in pesticides, Toxaphene and Chlordane are only spiked at client request based on specific project needs.

- Exception: Due to analyte incompatibility between the various PCB aroclors, aroclors 1016 and 1260 are used for spiking as they cover the range of all of the aroclors. Specific aroclors may be used by request on a project specific basis.

24.5 Sample Matrix Controls

Table 24-2. Sample Matrix Control

Control Type	Details	
Matrix Spikes (MS)	Use	used to assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used;
	Typical Frequency [1]	At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects. If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. Refer to the method SOP for complete details
	Description	essentially a sample fortified with a known amount of the test analyte(s).
Surrogate	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	Are added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the acceptance limits for the specific method. Poor surrogate recovery may indicate a problem with sample composition and shall be reported, with data qualifiers, to the client whose sample produced poor recovery.
	Description	Are similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.
Duplicates[2]	Use	For a measure of analytical precision, with each matrix-specific batch of samples processed, a matrix duplicate (MD or DUP) sample, matrix spike duplicate (MSD), or LCS duplicate (LCSD) is carried through the complete analytical procedure.
	Typical Frequency [1]	Duplicate samples are usually analyzed with methods that do not require matrix spike analysis.
	Description	Performed by analyzing two aliquots of the same field sample independently or an additional LCS.
Internal Standards	Use	Are spiked into all environmental and quality control samples (including the initial calibration standards) to monitor the qualitative aspect of organic and some inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

[1] See the specific analytical SOP for type and frequency of sample matrix control samples.

[2] LCSD's are normally not performed except when regulatory agencies or client specifications require them. The recoveries for the spiked duplicate samples must meet the same laboratory established recovery limits as the accuracy QC samples. If an LCSD is analyzed both the LCS and LCSD must meet the same recovery criteria and be included in the final report. The precision measurement is reported as "Relative Percent Difference" (RPD). Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling.

24.6 Acceptance Criteria (Control Limits)

24.6.1 As mandated by the test method and regulation, each individual analyte in the LCS, MS, or Surrogate Spike is evaluated against the control limits published in the test method. Where there are no established acceptance criteria, the laboratory calculates in-house control limits with the use of control charts or, in some cases, utilizes client project specific control limits. When this occurs, the regulatory or project limits will supersede the laboratory's in-house limits.

Note: For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

24.6.2 Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating. Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

24.6.3 Laboratory generated % Recovery acceptance (control) limits are generally established by taking $\pm$ 3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 20-30 data points (more points are preferred).

24.6.3.1 Regardless of the calculated limit, the limit should be no tighter than the Calibration Verification (ICV/CCV). (Unless the analytical method specifies a tighter limit).

24.6.3.2 In-house limits cannot be any wider than those mandated in a regulated analytical method. Client or contract required control limits are evaluated against the laboratory's statistically derived control limits to determine if the data quality objectives (DQOs) can be achieved. If laboratory control limits are not consistent with DQOs, then alternatives must be considered, such as method improvements or use of an alternate analytical method.

24.6.3.3 The lowest acceptable recovery limit will be 10% (the analyte must be detectable and identifiable). Exception: The lowest acceptable recovery limit for Benzidine will be 5% and the analyte must be detectable and identifiable.

24.6.3.4 The maximum acceptable recovery limit will be 150%.

24.6.3.5 The maximum acceptable RPD limit will be 35% for waters and 40% for soils. The minimum RPD limit is 10%.

24.6.3.6 If either the high or low end of the control limit changes by ≤ 5% from previous, the control chart is visually inspected and, using professional judgment, they may be left unchanged if there is no affect on laboratory ability to meet the existing limits.

24.6.4 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits. Refer to laboratory SOP No. PT-QA-021.

24.6.4.1 The Reference Data Summary generated from LIMS shows the precision and accuracy acceptability limits for analyses performed. This summary includes an effective date, is updated each time new limits are generated and is located in LIMS. Unless otherwise noted, limits are laboratory generated. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Team Leader/Area Supervisor and QA Manager) and entered into the Laboratory Information Management System (LIMS). Further details are described in Pittsburgh SOP No. PT-QA-021.

24.6.5 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for samples within the same batch must be qualified when reported. The internal corrective action process (see Section 12) is also initiated if an LCS exceeds the acceptance limits. Sample results may be qualified and reported without reanalysis if:

24.6.5.1 The analyte results are below the reporting limit and the LCS is above the upper control limit.

24.6.5.2 If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit. For further detail refer to SOP PT-QA-021 and method specific SOPs. For DoD requirements refer to SOPs PT-QA-25 and PT-QA-029.

24.6.6 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in the lab's method SOPs and in Section 12.

24.6.7 If a surrogate standard falls outside the acceptance limits, if there is not obvious chromatographic matrix interference, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets surrogate recovery criteria, the second run is reported (or both are reported if requested by the client). Under certain circumstances, where all of the samples are from the same location and share similar chromatography, the reanalysis may be performed on a single sample rather than all of the samples and if the surrogate meets the recovery criteria in the reanalysis, all of the affected samples would require reanalysis.

24.7 ADDITIONAL PROCEDURES TO ASSURE QUALITY CONTROL

24.7.1 The laboratory has written and approved method SOPs to assure the accuracy of the test method including calibration (see Section 20), use of certified reference materials (see Section 21) and use of PT samples (see Section 15).

24.7.2 A discussion regarding MDLs, Limit of Detection (LOD) and Limit of Quantitation (LOQ) can be found in Section 19.

24.7.3 Use of formulae to reduce data is discussed in the method SOPs and in Section 20.

24.7.4 Selection of appropriate reagents and standards is included in Section 9 and 21.

24.7.5 A discussion on selectivity of the test is included in Section 5.

24.7.6 Constant and consistent test conditions are discussed in Section 18.

24.7.7 The laboratories sample acceptance policy is included in Section 23.

SECTION 25

REPORTING RESULTS

25.1 Overview

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is conflict between client requests and laboratory ethics or regulatory requirements, the laboratory's ethical and legal requirements are paramount, and the laboratory will work with the client during project set up to develop an acceptable solution. Refer to Section 7.

A variety of report formats are available to meet specific needs.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client.

Review of reported data is included in Section 19.

25.2 Test Reports

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is printed on laboratory letterhead, reviewed, and signed by the appropriate project manager. At a minimum, the standard laboratory report shall contain the following information:

25.2.1 A report title (e.g. Analytical Report) on the cover page with a "Result" column header on the sample result page.

25.2.2 Each report cover page printed on company letterhead, which includes the laboratory name, address and telephone number.

25.2.3 A unique identification of the report (e.g. job Number) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

Note: Page numbers of report are represented as page # at the bottom of the page with page range # - ## on the right corner of the page. Where the first number is the page number and the second is the total number of pages.

25.2.4 A copy of the chain of custody (COC).

- Any COCs involved with Subcontracting are included.
- The applicable COC is paginated and it is an integral part of the report.
- Any additional addendum to the report must be treated in a similar fashion so it is a recognizable part of the report and cannot accidentally get separated from the report (eg. Sampling information)
- Any additional addenda to the report must be treated in a similar fashion so it is a recognizable part of the report and cannot accidentally get separated from the report (eg. Sampling information).

25.2.5 The name and address of client and a project name/number, if applicable.

25.2.6 Client project manager or other contact

25.2.7 Description and unambiguous identification of the tested sample(s) including the client identification code.

25.2.8 Date of receipt of sample, date and time of collection, and date(s) and time of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

25.2.9 Date reported or date of revision, if applicable.

25.2.10 Method of analysis including method code (EPA, Standard Methods, etc).

25.2.11 Reporting Limit.

25.2.12 Method detection limits (if requested)

25.2.13 Definition of Data qualifiers and reporting acronyms (e.g. ND).

25.2.14 Sample results.

25.2.15 QC data consisting of method blank, surrogate, LCS, and MS/MSD recoveries and control limits are included unless the client specifies they do not require reporting the QC.

25.2.16 Condition of samples at receipt including temperature. This may be accomplished in a narrative or by attaching sample login sheets (Refer to Sec. 25.2.4 – Item 3 regarding additional addenda). The temperature is documented on the sample receipt checklist and noted in the report case narrative.

25.2.17 A statement expressing the validity of the results, that the source methodology was followed and all results were reviewed for error.

25.2.18 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

25.2.19 A statement that the report shall not be reproduced except in full, without prior express written approval by the laboratory coordinator .

25.2.20 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Signatories are appointed by the Lab Director.

25.2.21 When TNI accreditation is required, the lab shall certify that the test results meet all requirements of TNI or provide reasons and/or justification if they do not.

25.2.22 If applicable, the laboratory includes a cover letter.

25.2.23 Where applicable, a narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

25.2.24 When soil samples are analyzed, a specific identification as to whether soils are reported on a “wet weight” or “dry weight” basis.

25.2.25 Appropriate laboratory certification number for the state of origin of the sample, if applicable.

25.2.26 If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report (e.g., preliminary report). A complete report must be sent once all of the work has been completed.

25.2.27 Any non-TestAmerica subcontracted analysis results are provided as a separate report on the official letterhead of the subcontractor. All TestAmerica subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

25.2.28 A clear statement notifying the client that non-accredited tests were performed and directing the client to the laboratory's accreditation certificates of approval shall be provided when non-accredited tests are included in the report.

Note: Refer to the Corporate SOP on Electronic Reporting and Signature Policy (No. CA-I-P-002) for details on internally applying electronic signatures of approval.

25.3 Reporting Level Or Report Type

The laboratory offers four levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

- Level I is a report with the features described in Section 25.2 above.
- Level II is a Level I report plus summary information, including results for the method blank reported to the laboratory MDL, percent recovery for laboratory control samples and matrix spike samples, and the RPD values for all MSD and sample duplicate analyses.
- Level III contains all the information supplied in Level II, but presented on the CLP-like summary forms, and relevant calibration information. A Level II report is not included, unless specifically requested. No raw data is provided.
- Level IV is the same as Level III with the addition of all raw supporting data.

In addition to the various levels of QC packaging, the laboratory also provides reports in diskette deliverable form. Initial reports may be provided to clients by facsimile. All faxed reports are followed by hardcopy. Procedures used to ensure client confidentiality are outlined in Section 25.6.

25.3.1 Electronic Data Deliverables (EDDs)

EDDs are routinely offered as part of TestAmerica's services. Pittsburgh offers a variety of EDD formats including Excel, CSV or as requested by the client.

EDD specifications are submitted to the IT department by the PM for review and undergo the contract review process. Once the facility has committed to providing data in a specific electronic format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained by the IT staff coding the EDD.

EDDs shall be subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD format must be reviewed until it is demonstrated that it can routinely be generated without

errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

25.4 Supplemental Information For Test

The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report.

25.4.1 Numeric results with values outside of the calibration range, either high or low are qualified as 'estimated'.

25.4.2 Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications is required, including identification of test results derived from any sample that did not meet TNI sample acceptance requirements such as improper container, holding time, or temperature.

25.4.3 Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

25.4.4 Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response will be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

Note: Review of data deliverable packages for submittal to regulatory authorities requires responses to non-conforming data concerning potential impact on data quality. This necessitates a limited scope of interpretation, and this work is performed by the Manager(s)/Team Leaders or as assigned by the lab Director. This is the only form of "interpretation" of data that is routinely performed by the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

25.5 Environmental Testing Obtained From Subcontractors

If the laboratory is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in the Corporate SOP on Subcontracting (SOP # CA-L-S-002).

Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client. Results from a subcontract laboratory

outside of TestAmerica are reported to the client on the subcontract laboratory's original report stationary and the report includes any accompanying documentation.

For DoD projects the subcontractor laboratories used must have an established and documented laboratory quality system that complies with DoD QSM requirements. The subcontractor laboratories will be evaluated according to SOP # CA-L-S-002, Subcontracting Procedures.,. The subcontractor laboratory must receive project-specific approval from the DoD client before any samples are analyzed as per DoD QSM, Version 3.0 & 4.2, Section 4.5.

25.6 Client Confidentiality

In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

TestAmerica will not intentionally divulge to any person (other than the Client or any other person designated by the Client in writing) any information regarding the services provided by TestAmerica or any information disclosed to TestAmerica by the Client. Furthermore, information known to be potentially endangering to national security or an entity's proprietary rights will not be released.

Note: This shall not apply to the extent that the information is required to be disclosed by TestAmerica under the compulsion of legal process. TestAmerica will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

25.6.1 Report deliverable formats are discussed with each new client. If a client requests that reports be faxed or e-mailed, the reports are faxed with a cover sheet or e-mailed with the following note that includes a confidentiality statement similar to the following:

This material is intended only for the use of the individual(s) or entity to whom it is addressed, and may contain information that is privileged and confidential. If you are not the intended recipient, or the employee or agent responsible for delivering this material to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify us immediately by telephone at the 1-800-765-0980 (or for e-mails: please notify us immediately by e-mail or by phone (1-800-765-0980) and delete this material from any computer.

25.7 Format Of Reports

The format of reports is designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

25.8 Amendments To Test Reports

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory's corrective action system (refer to Section 12).

The revised report is retained on the data server, as is the original report. The revised report is stored in the data server under the job number followed by "Rev (n)" where 'n' is the revision number. The revised report will have the words "Revision (n)" on the report cover page beneath the report date. Additionally, a section entitled "Revised Report" will appear on the Case Narrative page. A brief explanation of the reasons of the re-issue will be included in this section.

25.9 Policies On Client Requests For Amendments

25.9.1 Policy on Data Omissions or Reporting Limit Increases

Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

- Laboratory error.
- Sample identification is indeterminate (confusion between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists 8315 but client wanted 8310). A written request for the change is required.
- Incorrect limits reported based on regulatory requirements.
- The requested change has absolutely *no possible* impact on the interpretation of the analytical results and there is *no possibility* of the change being interpreted as misrepresentation by anyone inside or outside of our company.

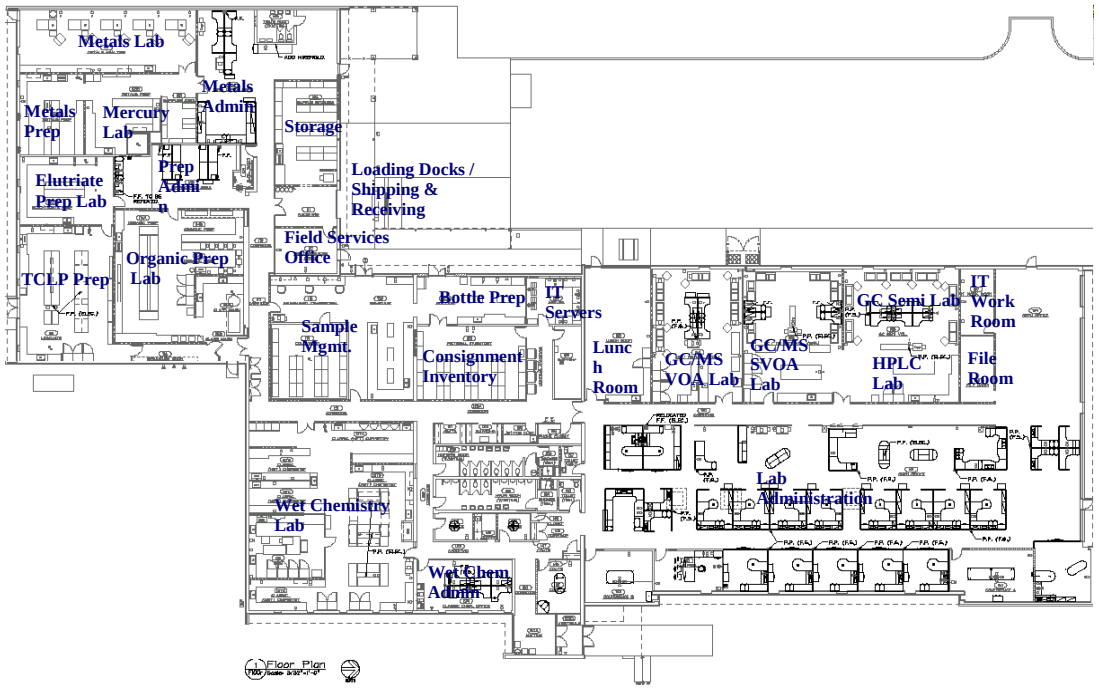
25.9.2 Multiple Reports

TestAmerica does not issue multiple reports for the same Lot number where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.

Appendix 1.

Laboratory Floor Plan

Pittsburgh Lab Floor Plan



Key Areas
- GC/MS VOA (Volatiles)
- GC/MS SVOA (Semivolatiles)
- GC Semi Lab
- HPLC Lab
- Organic Prep Lab
- Wet / General Chemistry
- Metals & Mercury Lab
- Elutriate Lab
- TCLP Prep
- Bottle Prep
- Sample Control/ Sample Receiving
- Field Services

301 Alpha Drive, Pittsburgh PA 15238

Appendix 2. Glossary/Acronyms

Glossary:

Acceptance Criteria:
Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation:
The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.

Accrediting Authority:
The Territorial, State, or Federal Agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation

Accuracy:
The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analyst:
The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (TNI)

Analytical Uncertainty: A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis. (TNI)

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation). (TNI)

Audit: 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. (TNI)

Batch:
Environmental samples which are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed twenty (20) samples. (TNI)

Bias: 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). (TNI)

Blank:
A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and

measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Calibration:
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. (TNI)

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 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:
The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (TNI)

Calibration Standard:
A substance or reference material used to calibrate an instrument (QAMS)

Certified Reference Material (CRM):
A reference material, accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute. (TNI)

Chain of Custody (COC) Form**:** Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; the collector; time of collection; preservation; and requested analyses. (TNI)

Compromised Samples:
Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified.

Confidential Business Information (CBI):
Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. TNI and its representatives agree to safeguarding identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation:
Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to Second Column Confirmation; Alternate wavelength; Derivatization; Mass spectral interpretation; Alternative detectors or Additional Cleanup procedures. (TNI)

Conformance:
An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Correction*:* Actions necessary to correct or repair analysis specific non-conformances. The acceptance criteria for method specific QC and protocols as well as the associated corrective actions. The analyst

will most frequently be the one to identify the need for this action as a result of calibration checks and QC sample analysis**.** No significant action is taken to change behavior, process or procedure.

Corrective Action:
The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit:
A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data re of acceptable quality (i.e., that they meet specified acceptance criteria). (TNI)

Data Reduction:
The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors, and collation into a more useable form. (TNI)

Deficiency:
An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC)

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. (TNI)

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 if performed. (ASQC)

Duplicate Analyses:
The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Equipment Blank:
Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures.

External Standard Calibration:
Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

Field Blank:
Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field of Accreditation:
Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.

Holding Times :
The maximum times that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Internal Standard:

A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (TNI)

Internal Standard Calibration:
Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

Instrument Blank:
A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Instrument Detection Limit (IDL): The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific instrument. The IDL is associated with the instrumental portion of a specific method only, and sample preparation steps are not considered in its derivation. The IDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is ± 100%. The IDL represents a range where qualitative detection occurs on a specific instrument. Quantitative results are not produced in this range.

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample):
A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, taken through all preparation and analysis 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 assess the performance of all or a portion of the measurement system.

An LCS shall be prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to determine batch acceptance.

Least Squares Regression (1st Order Curve):
The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for inorganics.

Limit of Detection (LOD):
[a.k.a., Method Detection Limit (MDL]: A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility. (TNI)

LOD Verification [a.k.a., MDL Verification]**:** A processed QC sample in the matrix of interest, spiked with the analyte at no more than 3X the LOD for single analyte tests and 4X the LOD for multiple analyte tests and processed through the entire analytical procedure.

Limit(s) of Quantitation (LOQ) [a.k.a., Reporting Limit]: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (TNI)

(QS) Matrix:

The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: Any aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking Water: any aqueous sample that has been designated as a potable or potential potable water source.

Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-aqueous Liquid: any organic liquid with <15% settleable solids.

Biological Tissue: any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Solids: includes soils, sediments, sludges, and other matrices with >15% settleable solids.

Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.

Air *& 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 sorbant tube, impinger solution, filter, or other device. (TNI)

Matrix Spike (spiked sample or fortified sample):

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 (spiked sample or fortified sample duplicate):
A replicate matrix spike prepared and analyzed to obtain a measure of the precision of the recovery for each analyte.

Method Blank:
A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

Method Detection Limit:
The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

Negative Control:
Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.

Non-conformance: An indication, judgment, or state of not having met the requirements of the relevant specifications, contract, or regulation.

Performance Audit:
The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

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.

Precision:
The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.

Preservation:
Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis. (TNI)

Proficiency Testing:
A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (TNI)

Proficiency Testing Program:
The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (TNI)

Proficiency Test Sample (PT):
A sample, the composition of which is unknown to the laboratory and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (TNIS)

Quality Assurance:
An integrated system of management activities involving planning, implementation, assessment,~~,~~ reporting and quality improvement to ensure that a process, item, ~~product~~ or service is of the type of quality needed and expected by the client. (TNI)

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. (EAP-QAD)

Quality Control:
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. (TNI)

Quality Control Sample:
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. (TNI)

Quality Manual:
A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (TNI)

Quality System:
A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC activities. (TNI)

Range:
The difference between the minimum and the maximum of a set of values.

Reference Material:
Material or substance one or more properties of which are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30-2.1)

Reference Standard:
Standard used for the calibration of working measurement standards in a given organization or a given location. (TNI)

Sampling: Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.

Second Order Polynomial Curve (Quadratic): The 2^{nd} order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2^{nd} order regression will generate a coefficient of determination (COD or r^2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r^2 must be greater than or equal to 0.99.

Selectivity:
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. (TNI)

Sensitivity:
The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (TNI)

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:

The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting NELAC and meets the approval requirements of standard adoption organizations procedures and policies. (TNI)

Standard Operating Procedures (SOPs):
A written document which 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. (TNI)

Storage Blank: A blank matrix stored with field samples of a similar matrix (volatiles only) that measures storage contribution to any source of contamination.

Surrogate:
A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.

Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and shall be reported to the client whose sample produced poor recovery. (QAMS)

Systems Audit (also Technical Systems Audit):
A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Manager: A member of the staff of an environmental laboratory who exercises actual day-to-day supervision of laboratory operations for the appropriate fields of accreditation and reporting of results

Technology: A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Traceability: 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 constants 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. (TNI)

Uncertainty:
A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

Acronyms:

CAR – Corrective Action Report
CCV – Continuing Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations
COC – Chain of Custody
DOC – Demonstration of Capability
DQO – Data Quality Objectives
DUP - Duplicate
EHS – Environment, Health and Safety

EPA – Environmental Protection Agency
GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry
HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma Atomic Emission Spectroscopy
ICP/MS – ICP/Mass Spectrometry
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LIMS – Laboratory Information Management System
LOD – Limit of Detection
LOQ – Limit of Quantitation
MDL – Method Detection Limit
MDLCK – MDL Check Standard
MDLV – MDL Verification Check Standard
MRL – Method Reporting Limit Check Standard
MS – Matrix Spike
MSD – Matrix Spike Duplicate
MSDS - Material Safety Data Sheet
NELAP - National Environmental Laboratory Accreditation Program
PT – Performance Testing
TNI – The NELAC Institute
QAM – Quality Assurance Manual
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RF – Response Factor
RPD – Relative Percent Difference
RSD – Relative Standard Deviation
SD – Standard Deviation
SOP: Standard Operating Procedure
TAT – Turn-Around-Time
VOA – Volatiles
VOC – Volatile Organic Compound

Appendix 3.

Laboratory Certifications, Accreditations, Validations

Pittsburgh maintains certifications, accreditations, certifications, and validations with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the QA Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QA Manual revision, the laboratory has accreditation/certification/licensing with the following organizations:

Organization	Certificate Number Or Laboratory ID Number
Arkansas	88-0690
California	04224CA
Connecticut	PH-0688
DoD ELAP	ADE-1442
Florida	E871008
Illinois	002602
Kansas	E-10350
Louisiana	04041
New Hampshire	203010
New Jersey	PA005
New York	11182
North Carolina	434
Pennsylvania	02-00416
South Carolina	89014002
Utah	STLP
USDA	P330-10-00139
USDA	P-Soil -01
West Virginia	142
Wisconsin	998027800

The certificates and parameter lists (which may differ) are available, upon request, from a laboratory representative. They may be found on the corporate web site, the laboratory's public server and in the QA web page.

Appendix 4.

Pittsburgh Laboratory SOP List

Document No.	Title	Group	Rev. No.	Effective Date
CA-C-S-001	Work Sharing Process	Corp	2	11/23/09
CA-C-S-002	**Complaint Handling and Service Recovery**	Corp	Draft	
CA-I-P-002	Electronic Reporting and Signature Policy	Corp	0	11/01/08
CA-L-P-001	**Ethics Policy**	Corp	3	03/23/09
CA-L-P-002	Contract Compliance Policy	Corp	0	12/03/07
CA-L-S-002	**Subcontracting Procedures**	Corp	2	07/25/11
CA-L-S-001	**Internal Investigation of Potential Data Discrepancies & Determination for Data Recall**	Corp	2	04/08/09
CA-Q-M-002	Corporate Quality Management Plan	Corp	2	11/11/11
CA-Q-QM-002	Policy on GC/MS Tuning for Full Scan Volatile and Semi-Volatile Methods	Corp	NA	03/13/09
CA-Q-QM-003	Technical Guidance on Reporting of Multi-Component Organochlorine Analytes	Corp	NA	09/24/09
CA-Q-QM-004	Technical Guidance on Checking for Spectral Interferences in Optical ICP analysis	Corp	NA	09/24/09
CA-Q-QM-006	Technical Guidelines for Analysis of Complex GC/ECD Chromatograms	Corp	NA	09/14/10
CA-Q-QM-007	Guidance on the Digestion and Final Volumes for CVAA Mercury Methods	Corp	NA	11/02/11
CA-Q-S-001	Solvents and Acids Lots Testing and Approval	Corp	1	07/23/10
CA-Q-S-002	**Acceptable Manual Integration Practices**	Corp	2	05/13/11
CA-Q-S-004	**Internal Auditing**	Corp	2	01/26/11
CA-Q-S-005	Calibration Curves (General)	Corp	3	05/13/11
CA-Q-S-006	**Detection Limits**	Corp	3	10/25/11
CA-Q-S-007	Remote Data Processing	Corp	0	06/30/08
CA-Q-S-008	Management Systems Review	Corp	0	07/06/09
CA-Q-P-001	DoD Quality Approach and Lab Approval Process	Corp	2	10/21/09

Document No.	Title	Group	Rev. No.	Effective Date
CA-Q-WI-015	Work Instruction for Electronic Chromatography File Surveillance using Mint Miner Manual Integration Data Mining Tool	Corp	0	12/01/07
CA-T-P-001	Qualified Products List	Corp	1	06/29/09
CA-T-P-002	Selection of Calibration Points	Corp	1	06/29/09
CA-T-P-003	Reporting Results for Methods that Require Second Column Confirmation	Corp	1	06/29/09
CW-L-P-002	Subpoenas Policy	Corp	0	08/15/07
CW-L-P-003	Organizational Conflicts of Interest	Corp	2.1	07/23/10
CW-Q-S-001	Corporate Document Control and Archiving	Corp	2	11/24/08
CW-Q-S-002	Writing a Standard Operating Procedure	Corp	0	10/02/07
PT-GC-001	Gas Chromatographic and HPLC Analysis Based on Method 8000B, SW-846 8081A, 8082, 8141A, 8151A, 8015, 610 and 8310	GC	19	11/11/11
PT-GC-002	Analysis of Organochlorine Pesticides and PCBs by Method 608	GC	4	08/18/11
PT-GC-004	1,2-Dibromoethane(EDB) and 1,2-Dibromo-3-Chloropropane(DBCP) in Water by Microextraction and Gas Chromatography, Method 8011	GC	9	06/28/10
PT-GC-005	Polychlorinated Biphenyls (PCBs) by GC/ECD - Method: SW-846 8082A	GC	2	08/05/11
PT-GC-006	Chlorinated Pesticides - Method: SW-846 8081B	GC	3	07/15/10
PT-GC-007	Organophosphorus Pesticides by Gas Chromatography - Method: SW-846 8141B	GC	3	11/01/11
PT-GC-009	Determination of Inorganic Anions by Ion Chromatography EPA Method 300 SW-846 Method 9056A	GC	11	07/28/10
PT-GC-010	TOC Analysis for Solids by Lloyd Kahn Method	GC	4	06/23/10
PT-GC-011	Ethylene Glycol - 8015B/C	GC	0	04/22/11
PT-HS-001	Waste Collection, accumulation and Storage	HS	6	04/26/11
PT-IP-002	Acid Digestion of Soils, SW-846 Method 3050B	IP	8	04/28/09
PT-IP-003	Acid Digestion of Aqueous Samples by SW-846 Methods 3005A, 3010A and EPA Methods 200.7 and 200.8	IP	10	06/23/10

Document No.	Title	Group	Rev. No.	Effective Date
PT-IP-004	TVA Kingston Sequential Extraction Procedure	IP	0	03/31/10
PT-IP-005	Acid Digestion of Aqueous Samples SM 20thd Ed, Method 3030C	IP	1	08/18/09
PT-IP-W-001	Metals Prep Guide - TA Pittsburgh	IP	6	05/12/09
PT-IT-001	Work Instruction for Servers Data Back-up	IT	4	04/22/11
PT-MS-001	GCMS Analysis Based on Method 8270C and 625	MS	11	11/17/09
PT-MS-002	Volatile Organics by GC/MS Based on Methods 8260B, 624	MS	17	08/16/11
PT-MS-003	Analysis of Polynuclear Aromatic Hydrocarbons by Selective Ion Monitoring	MS	4	07/20/10
PT-MS-005	VOA Holding Blanks	MS	4	05/24/10
PT-MS-007	GCMS Volatile Organic Analysis by EPA CLP SOW OLM04.2	MS	2	07/28/10
PT-MS-008	GC/MS Analysis, Method: SW-846 8270D	MS	1	07/27/09
PT-MS-009	Analysis of Dissolved Gases in Groundwater Modified Method RSK-175	GC	2	12/08/11
PT-MT-001	Inductively Coupled Plasma-Atomic Emission Spectroscopy, Spectrometric Method for Trace Element Analyses, SW-846 Method 6010B, **6010C** and EPA Method 200.7	MT	12	03/01/11
PT-MT-002	Analysis of Metals by Inductively Coupled Plasma/Mass Spectrometry (ICPMS) for Methods 200.8, 6020, **6020A** & ILM05.2	MT	8	03/01/11
PT-MT-005	Preparation and Analysis of Mercury in Aqueous Samples by Cold Vapor Atomic Absorption, SW-846 7470A and MCAWW 245.1	MT	12	12/06/10
PT-MT-007	Preparation and Analysis of Mercury in Solid Samples by Cold Vapor Atomic Absorption Spectroscopy, SW846 7471A & **7471B**	MT	9	06/23/10
PT-MT-009	Speciated Isotope Dilution Mass Spectrometry, USEPA Method 6800	MT	1	11/25/09

Document No.	Title	Group	Rev. No.	Effective Date
PT-OP-001	Extraction and Cleanup of Organic Compounds from Waters and Solids, Based on SW-846 3500 Series, 3600 Series, 8151A and 600 Series Methods	OP	14	04/22/11
PT-OP-002	Simplified Laboratory Runoff Procedure (SLRP)	OP	2	08/01/11
PT-OP-003	Standard Elutriate Test (SET)	OP	3	05/07/10
PT-OP-004	Toxicity Characteristic Leaching Procedure and Synthetic Precipitation Leaching Procedure	OP	4	01/31/09
PT-OP-005	Modified and Effluent Elutriate Tests (MET and EET)	OP	4	11/01/11
PT-OP-006	Long Tube Column Settling Test	OP	1	06/08/11
PT-OP-007	Illinois Resuspension Tests	OP	2	08/18/09
PT-OP-008	Dredging Elutriate Test (DRET)	OP	3	08/09/11
PT-OP-009	Sequential Batch Leach Test (SBLT) for Freshwater Sediments	OP	1	04/16/10
PT-OP-010	Extraction Procedure Test for Plant Bioaccumulation - DTPA Extraction Procedure	OP	2	10/01/09
PT-OP-011	Extractable Residue (Lipids) from Animal Tissue	OP	4	08/18/09
PT-OP-012	Effluent Elutriate Test (EET) Method: Tierra Project Specific SOP - Based on SOP No. PT-OP-005	OP	1	08/04/09
PT-OP-013	Long Tube Column Settling Test Method: Appendix B, Chapter 4, Main Test of the Upland Testing Manual – Tierra Project Specific SOP - Based on SOP No. PT-OP-006	OP	1	08/04/09
PT-OP-014	Dredging Elutriate Test (DRET) Method: Tierra Project Specific SOP - Based on SOP No. PT-OP-008	OP	1	08/04/09
PT-OP-016	Porewater Generation	OP	0	06/16/11
PT-PM-001	Project Management	PM	3	09/16/10
PT-PM-W-0001	Bottle Kit Guide	PM	2	11/01/11
PT-QA-001	Employee Orientation & Training	QA	5	11/01/11
PT-LQAM	**Pittsburgh Laboratory Quality Assurance Manual**	**QA**	**4**	**12/16/11**
PT-QA-002	Internal Auditing	QA	0	01/22/10
PT-QA-003	Glassware Clean-up for Organic/Inorganic Procedures	QA	5	08/03/11
PT-QA-004	Quarantine Soil Procedure	QA	1	08/16/11
PT-QA-005	Measurement Uncertainty	QA	2	07/29/10
PT-QA-006	Procurement of Standards and Materials; Labeling and Traceability	QA	6	11/01/11

Document No.	Title	Group	Rev. No.	Effective Date
PT-QA-007	Detection Limits	QA	2	11/01/11
PT-QA-008	Thermometer Calibration and Temperature Monitoring	QA	5	05/21/10
PT-QA-009	Rounding and Significant Figures	QA	2	11/01/11
PT-QA-010	Tracking, Review and Revision of SOPs	QA	3	05/22/09
PT-QA-011	Data Recording Requirements	QA	2	11/01/11
PT-QA-012	Selection and Calibration of Balances and Weights	QA	5	11/01/11
PT-QA-013	Independent QA Data Review	QA	2	08/31/11
PT-QA-014	Reporting Limits	QA	2	11/01/11
PT-QA-015	Maintaining Time Integrity	QA	2	11/01/11
PT-QA-016	Nonconformance & Corrective Action System	QA	5	11/01/11
PT-QA-017	Aqueous Pipette Calibration – Gravimetric Method	QA	6	06/28/10
PT-QA-018	Technical Data Review Requirements	QA	2	01/18/10
PT-QA-019	Records Information Management	QA	4	01/27/10
PT-QA-020	Report Production	QA	4	06/08/11
PT-QA-021	Quality Assurance Program	QA	5	11/02/11
PT-QA-022	Equipment Maintenance	QA	4	11/01/11
PT-QA-024	Subsampling	QA	1	01/31/09
PT-QA-025	DoD QSM Version 3 Requirements	QA	4	12/02/11
PT-QA-026	Container Accuracy Verification – Gravimetric	QA	3	05/20/10
PT-QA-027	Sample Receiving and Chain of Custody	QA	16	12/14/11
PT-QA-028	Bottle and Cooler Preparation	QA	6	06/22/11
PT-QA-029	DoD QSM Version 4.2 Requirements	QA	3	12/02/11
PT-QA-030	Sample Management and Tracking for Cold and Warm Storage	QA	0	12/13/11
PT-QA-W-002	SOP List	QA	NA	NA
PT-QA-W-003	BNA Dilution Calculation Table	QA	0	07/22/11
PT-QA-W-004	VOA Dilution Calculation Table	QA	0	07/22/11
PT-QA-W-005	GC Dilution Calculation Table	QA	0	07/22/11
PT-QA-W-006	Metals Dilution Calculation Table	QA	0	07/22/11
PT-QA-W-007	Wet Chem Dilution Calculation Table	QA	0	07/22/11
PT-WC-001	Determination of Solids in Waters and Wastes (Methods 160.1/160.2/160.3/160.4/160.5 & 2540C/2540D/2540B/2540G&E/2540F)	WC	3	06/29/10
PT-WC-002	Color, Method 110.2	WC	5	03/16/11

Document No.	Title	Group	Rev. No.	Effective Date
PT-WC-003	Alkalinity, SM Method 2320B	WC	4	06/04/08
PT-WC-004	Total Hardness (mg/L as CaCO3) by Method SM 2340C; and Hardness by Calculation SM 2340B	WC	7	03/16/11
PT-WC-005	Turbidity by Method 180.1	WC	4	06/30/08
PT-WC-006	Determination of Chlorine Contamination in Used Oil Using CLOR-D-TECT 1000 Used Oil Screening Kit, SW-846 Method 9077 and ASTM Method D5384	WC	1	05/27/10
PT-WC-007	Nitrate/Nitrite, Nitrite, EPA Method 353.2	WC	10	06/24/10
PT-WC-008	Acid Volatile Sulfides (AVS) and Simultaneously Extracted Metals (SEM) in Sediment	WC	4	11/18/11
PT-WC-009	Performance Checks on Spectronic 21 and Model 1001 Spectro-Photometers	WC	3	03/02/11
PT-WC-010	Total Sulfide as Acid Soluble Sulfide, Method 9030B/9034, Standard Method 20th Ed. 4500S-2-F	WC	12	12/16/11
PT-WC-011	Chloride (Automated), Method SM 4500-CL E	WC	10	08/03/11
PT-WC-012	pH, Specific Conductance and Alkalinity (Automatic Titrator)	WC	5	11/30/09
PT-WC-013	Specific Conductance by 120.1, 2510B, and 9050A	WC	3	06/23/10
PT-WC-014	Nitrogen, Ammonia (Automated), Method 350.1	WC	7	03/16/11
PT-WC-015	Chromium, Hexavalent (Colorimetric) by SM3500-Cr-B, SW846 3060A/7196	WC	15	11/11/11
PT-WC-016	Biochemical Oxygen Demand (BOD) and Carbonaceous Biochemical Oxygen Demand (CBOD) by Dissolved Oxygen Probe - SM5210B	WC	10	11/01/11
PT-WC-017	Total Organic Carbon (TOC) and Total Inorganic Carbon (TIC), Methods SM 5310C and SW-846 9060/9060A	WC	11	12/23/11

Document No.	Title	Group	Rev. No.	Effective Date
PT-WC-018	Cyanide – Semi-Automated, Pyridine-Barbituric Acid For Total and Amenable, Cyanide in Water (Methods 335.4) and Soil Analyses (Method 9012A/9012B)	WC	14	08/03/11
PT-WC-020	Percent Moisture, Ash, Organic Matter and Total Solids in Soil Samples - SM 2540G and ASTM D297-84	WC	5	10/14/09
PT-WC-021	Flash Point by Pensky-Martens Closed Tester, SW-846 Method 1010A and ASTM D93-08	WC	7	10/14/09
PT-WC-022	Ignitability of Solids for Waste Characterization EPA SW-846 Chapter 7, Section 7.1	WC	3	03/02/11
PT-WC-023	Chemical Oxygen Demand, Low Level, Method 410.4	WC	4	06/24/10
PT-WC-025	n-hexane extractable material (HEM) in Sludge, Sediment and Soil samples - 9071B	WC	5	08/03/11
PT-WC-026	PH Electrometric by SM 4500 H+B and SW-846 Methods: 9045C/D and 9040B/C	WC	8	03/02/11
PT-WC-027	Salinity by Calculation, Electrical Conductivity Method SM 2520B	WC	3	03/02/11
PT-WC-028	Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated Hexane Extractable Material (SGT-HEM; TPH), Method 1664A and 9070A	WC	10	11/04/10
PT-WC-029	Available Cyanide by Ligand Exchange and Flow Injection Analysis (FIA) Method 1677	WC	9	08/18/11
PT-WC-031	Cyanide Extraction Procedure for Solids and Oils, SW-846 Method 9013	WC	7	11/04/11
PT-WC-032	Total Organic Carbon Analysis for Solid Matrices by Walkley Black	WC	5	06/23/10
PT-WC-033	DI-Leachate Procedure for Solids (1 Hour Routine DI Leachate and 18 Hour ASTM DI Leachate Procedure)	WC	7	04/30/10
PT-WC-034	Paint Filter Liquids Test, SW-846 Method 9095B	WC	2	09/14/10
PT-WC-035	Acidity of Water and Waste Water, SM Method 2310B	WC	4	06/23/10
PT-WC-036	Flash Point of Liquids by Setaflash (Small Scale) Closed-Cup Apparatus, SW-846 Method 1020B and ASTM Standard D	WC	2	03/02/11

Document No.	Title	Group	Rev. No.	Effective Date
	3278-96			
PT-WC-037	Oxidation Reduction Potential, SM 2580B (20th Ed)	WC	2	03/02/11
PT-WC-038	Phenolics (Automated), Method 420.1/420.2, SW-846 9065/9066	WC	8	06/01/10
PT-WC-039	Screening Apparent Specific Gravity and Bulk Density of Waste - Method: ASTM D 5057-90	WC	0	04/07/10
PT-WC-040	Anion Surfactants as MBAS, Standard Methods 5540C	WC	0	01/21/11
PT-WC-041	Compatibility of Screening Analysis of Waste, Method: ASTM D5058 Test Method C – Water Compatibility	WC	0	06/09/11
PT-FS-001	Field Measurement of Dissolved Oxygen (DO) Method: SM 4500-O G	FS	0	04/02/10
PT-FS-002	Field Measurement of Total Residual Chlorine Method: SM 4500-Cl G	FS	1	04/29/10
PT-FS-003	Field Measurement of pH Method: SM 4500 H+B	FS	0	04/02/10
PT-FS-004	Field Measurement of Specific Conductance Method: SM 2510B	FS	0	04/02/10
PT-GT-008	Hydraulic Conductivity of Saturated Porous Materials using a Flexible Wall Permeameter (ASTM D5084– Method C)	GT	0	04/26/11

Note: The SOPs are subject to change, refer to PT-QA-W-002 for current list of SOPs.

QUALITY ASSURANCE MANUAL

Columbia Analytical Services, Inc.

1565 Jefferson Road
Building 300, Suite 360
Rochester, NY 14623
585-288-5380 (phone)
585-288-8475 (fax)

Effective Date: 10/3/2011

Approved by:

Laboratory Director/Technical Director: _____ 10/3/11

Michael K. Perry — Date
MPerry@caslab.com

Quality Assurance Program Manager: _____ 10/3/2011

Lisa Reyes — Date
LReyes@caslab.com

DOCUMENT CONTROL
NUMBER: 11-ADM-01
Initials: VSC Date: 10/4/11

1.0 TABLE OF CONTENTS

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Appendices

Please note that the Appendices provide current information at the time of the revision, but are updated only upon annual review. Please contact the laboratory for up-to-date information.

2.0 INTRODUCTION AND COMPANY QUALITY ASSURANCE POLICY

Columbia Analytical Services, Inc. (CAS) is an employee-owned professional analytical services laboratory which performs chemical and microbiological analyses on a wide variety of sample matrices, including drinking water, groundwater, surface water, wastewater, soil, sludge, sediment, tissue, industrial and hazardous waste, air, and other material. Columbia Analytical operates a network of laboratory facilites located in Arizona, California, Florida, New York, Texas, and Washington.

We recognize that quality assurance requires a commitment to quality by everyone in the organization - individually, within each operating unit, and throughout the entire laboratory. Laboratory management is committed to ensuring the effectiveness of its quality systems and to ensure that all tests are carried out in accordance to customer requirements. Key elements of this commitment are set forth in the Columbia Analytical Services, Inc. Quality and Ethics Policy Statement, March 2009 (Appendix A) and in this Quality Assurance Manual (QAM). Columbia Analytical Services, Inc. is committed to operate in accordance with these requirements and those of regulatory agencies, accrediting authorities, and certifying organizations. The laboratory also strives for improvement through varying continuous improvement initiatives and projects.

Quality Management Systems are established, implemented and maintained by management. Policies and procedures are established in order to meet requirements of accreditation bodies and applicable programs, such as the Department of Defense (DOD) Environmental Laboratory Accreditation Program, as well as client's quality objectives. Systems are designed so that there will be sufficient Quality Assurance (QA) activities conducted in the laboratory to ensure that all analytical data generated and processed will be scientifically sound, legally defensible, of known and documented quality, and will accurately reflect the material being tested. Quality Systems are applicable to all fields of testing in which the laboratory in involved.

Quality Control (QC) procedures are used to continually assess performance of the laboratory and quality systems. Columbia Analytical maintains control of analytical results by adhering to written standard operating procedures (SOPs), using analytical control parameters with all analyses, and by observing sample custody requirements. All analytical results are calculated and reported in units consistent with project specifications to allow comparability of data.

This QAM is applicable to the facility listed on the title page. The information in this QAM has been organized according to requirements found in the National Environmental Laboratory Accreditation Program (NELAP) Quality Systems Standards (2003 and 2009), the EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, USEPA, 2001; and *General Requirements for the Competence of Testing and Calibration Laboratories*, ISO/IEC 17025:2005.

3.0 PROGRAM DESCRIPTION

The purpose of the QA program at Columbia Analytical is to ensure that our clients are provided with analytical data that is scientifically sound, legally defensible, and of known and documented quality. The concept of Quality Assurance can be extended, and is expressed in the mission statement of Columbia Analytical:

> "The mission of Columbia Analytical Services, Inc. is to provide high quality, cost-effective, and timely professional testing services to our customers. We recognize that our success as a company is based on our ability to maintain customer satisfaction. To do this requires constant attention to customer needs, maintenance of state-of-the-art testing capabilities and successful management of our most important asset - our people - in a way that encourages professional growth, personal development and company commitment."

3.1 Quality Management Systems

In support of this mission, the laboratory has developed a Quality Management System to ensure all products and services meet our client's needs. The system is implemented and maintained by the Quality Assurance Program Manager (QA PM) with corporate oversight by the Chief Quality Officer (CQO). These systems are based upon ISO 17025:2005 standards, upon which fundamental programs (NELAC 2003, 2009 and DoD QSM) are based. Implementation and documentation against these standards are communicated in corporate policy statements, this QAM, and SOPs. Actual procedures, actions and documentation are defined in both administrative and technical SOPs. Figure 3-1 shows the relationships of the quality systems and associated documentation. Quality systems include:

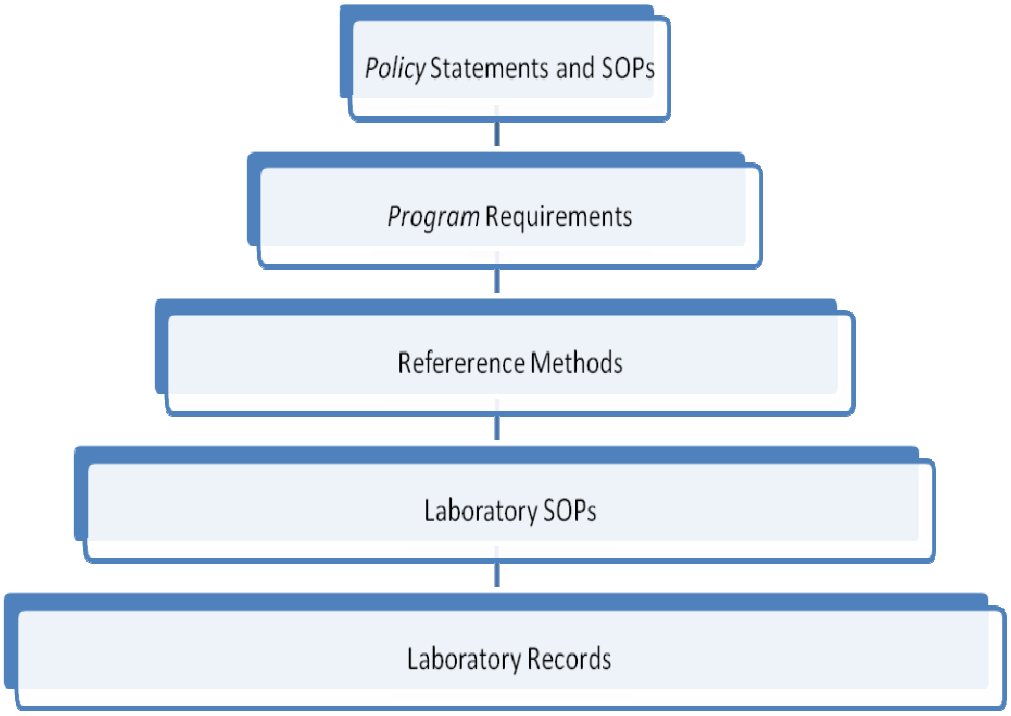
- Standard Operating Procedures
- Sample Management and Chain of Custody procedures
- Statistical Control Charting
- Standards Traceability
- Ethics Training
- Document Control
- Corrective Action Program
- Management Reviews
- Demonstration of Capability

The effectiveness of the quality system is assessed in several ways, including:

- Internal and External Audits covering all aspects of the organization
- Annual Management Reviews
- Analysis of Customer Feedback
- Internal and External Proficiency Testing

Figure 3-1

Relationships of Quality Management Systems and Documentation



3.2 Facilities, Equipment, and Security

Columbia Analytical features 23564 square feet of laboratory and administrative workspace at its Rochester, NY location. The facility is secured using a proximity reader entry system. The laboratory design provides safeguards against cross-contamination of samples and is arranged according to work function, which enhances the efficiency of analytical operations. The ventilation system has been specially designed to meet the needs of the analyses performed in each work space. Columbia Analytical minimizes laboratory contamination sources by employing janitorial and maintenance staff to ensure that good housekeeping and facilities maintenance are performed. In addition, the segregated laboratory areas are designed for safe and efficient handling of a variety of sample types. These specialized areas include:

- Sample Management Office including shipping and receiving
- Separate sample storage areas. See section 7 for further discussion of storage.
- Metals Sample Preparation Laboratory
- Metals Instrumentation Laboratory
- Toxicity Characteristic Leachate Procedure Laboratory
- Water Chemistry & General Chemistry Laboratory
- Semi-volatile Organics Preparations, Gas Chromatography, Gas Chromatography/Mass Spectrometry, and High Performance Liquid Chromatography Laboratory
- Air Laboratory (Volatiles by GC/MS from canisters)
- Volatile Organics Laboratory (Gas Chromatography and Gas Chromatography/Mass Spectrometry including a separate standard preparation laboratory) Laboratory
- Microbiology Laboratory
- Soil Characteristics Laboratory
- Laboratory Deionized Water System
- Field Garage
- Laboratory Management, Client Service, Report Generation and Administration
- Data Archival
- Information Technology (IT) and LIMS
- Hazardous Waste Storage Area

Figure 3-2 shows the facility floor plan. The laboratory is equipped with state-of-the-art analytical and administrative support equipment. The equipment and instrumentation are appropriate for the procedures in use. Appendix C lists the major equipment, illustrating the laboratory's overall capabilities and depth.

3.3 Technical Elements of the Quality Assurance Program

The laboratory's technical procedures are based upon procedures published by various agencies or organizations (See Section 17). The Quality Assurance Program provides to the laboratory organization, procedures, and policies by which the laboratory operates. The necessary certifications and approvals administered by external agencies are maintained by the QA department. This includes method approvals and audit administration. In addition, internal audits are performed to assess compliance with policies and procedures. SOPs are maintained for technical and administrative functions. A document control system is used for SOPs, as well as laboratory notebooks, and this QA Manual. A list of QA Program documents is provided in Appendix A and SOPs in Apppendix F.

Acceptable calibration procedures are defined in the SOP for each test procedure. Calibration procedures for other laboratory equipment (balances, thermometers, etc.) are also defined. Quality Control (QC) procedures are used to monitor the testing performed. Each analytical procedure has associated QC requirements to be achieved in order to demonstrate data quality. The use of method detection limit studies, control charting, technical training and preventive maintenance procedures further ensure the quality of data produced. Proficiency Testing (PT) samples are used as an external means of monitoring the quality and proficiency of the laboratory. PT samples are obtained from qualified vendors and are performed on a regular basis. In addition to method proficiency, documentation of analyst training is performed to ensure proficiency and competency of laboratory analysts and technicians. Sample handling and custody procedures are defined in SOPs. Procedures are also in place to monitor the sample storage areas. The technical elements of the QA program are discussed in further detail in later sections of this QA manual.

3.4 Operational Assessments and Service to the Client

The laboratory uses a number of systems to assess its daily operations. In addition to the routine quality control (QC) measurements, the senior laboratory management examines a number of other indicators to assess the overall ability of the laboratory to successfully perform analyses for its clients including; on-time performance, customer complaints, training reports and non-conformity reports. A frequent, routine assessment must also be made of the laboratory's facilities and resources in anticipation of accepting an additional or increased workload.

Columbia Analytical utilizes a number of different methods to ensure that adequate resources are available for service demands. Senior staff meetings, tracking of outstanding proposals and an accurate, current synopsis of incoming work all assist the senior staff in properly allocating sufficient resources. All Requests for Proposal (RFP) documents are reviewed by the Project Chemist and appropriate managerial staff to identify any project specific requirements that differ from the standard practices of the laboratory. Any requirements that cannot be met are noted and communicated to the client, as well as requesting the client to provide any project specific Quality Assurance Project Plans (QAPPs) if available. Status/production meetings are also conducted regularly with the laboratory and project managers to inform the staff of the status of incoming work, future projects, or project requirements.

When a customer requests a modification to an SOP, policy, or standard specification the Project Manager will discuss the proposed deviation with the Client Services Manager, Laboratory Director, and department manager to obtain approval for the deviation. The QA PM may also be involved. All project-specific requirements must be on-file and with the service request upon logging in the samples. The modification or deviation must be documented. A Project-Specific Communication Form, or similar, may be used to document such deviations.

The laboratory shall afford clients cooperation to clarify the client's request and to monitor the laboratory's performance in relation to the work performed, provided that the laboratory ensures confidentiality to other clients. The laboratory maintains and documents timely communication with the client for the purposes of seeking feedback and clarifying customer requests. Feedback is used and analyzed to improve the quality of services. The *SOP for Handling Customer Feedback* (ADM-FDBK) is in place for these events.

3.5 Document Control and Records

Procedures for control and maintenance of documents are described in the *SOP for Document Control (ADM-DOC_CTRL).* The requirements of the SOP apply to all laboratory logbooks (standards, maintenance, run logbooks, etc), certificates of analysis, SOPs, QAMs, quality assurance project plans (QAPPs), Environmental Health & Safety (EHS) manuals, and other controlled Columbia Analytical documents.

Each controlled copy of a controlled document will be released only after a document control number is assigned and the recipient is recorded on a document distribution list. Filing and distribution is performed by the QA PM, or designee, and ensure that only the most current version of the document is distributed and in use. A document control number is assigned to logbooks. Completed logbooks that are no longer in use are archived in a master logbook file. Logbook entries are standardized following the *SOP for Making Entries into Logbooks and onto Benchsheets* (ADM-DATANTRY). The entries made into laboratory logbooks are reviewed and approved at a regular interval (quarterly).

A records system is used which ensures all laboratory records (including raw data, reports, and supporting records) are retained and available. The archiving system is described in the *SOP for Data Archiving (ADM-ARCH).*

External documents relative to the management system are managed by the QA PM. To prevent the use of invalid and/or outdated external documents, the laboratory maintains a master list of current documents and their availability. The list is reviewed before making the documents available. External documents are not issued to personnel.

3.6 Subcontracting

Analytical services are subcontracted when the laboratory needs to balance workload or when the requested analyses are not performed by the laboratory. Subcontracting is only done with the knowledge and approval of the client and to qualified laboratories. Subcontracting to another Columbia Analytical laboratory is preferred over external-laboratory subcontracting. Further, subcontracting is done using capable and qualified laboratories. Established

procedures are used to qualify external subcontract laboratories. These procedures are described in the *SOP for Qualification of Subcontract Laboratories (ADM-SUBLAB).* The Corporate Quality Assurance staff is responsible for maintaining a list of qualified subcontract laboratories.

3.7 Procurement

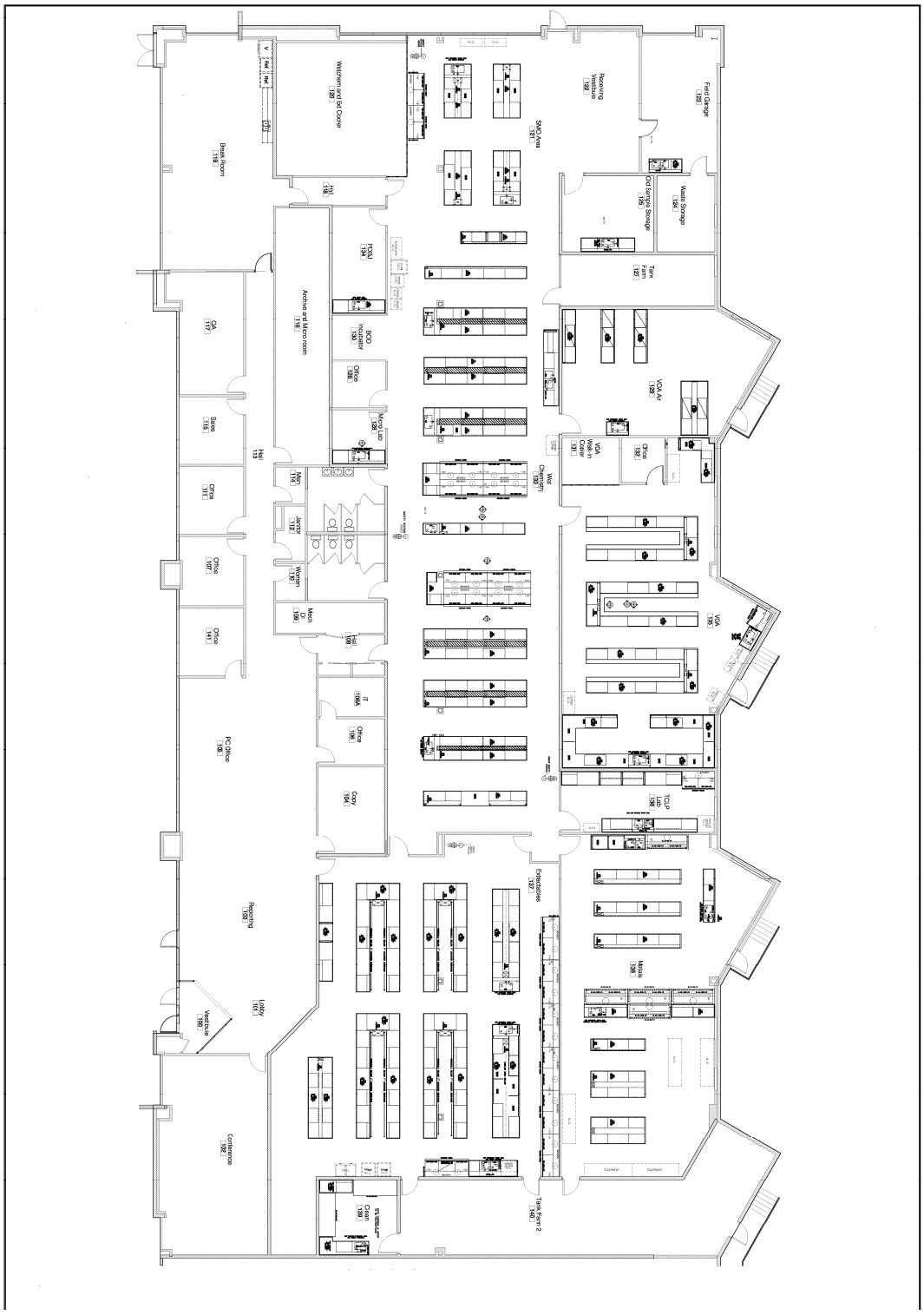
The quality level of reagents and materials (grade, traceability, etc.) required is specified in analytical SOPs. Department supervisors ensure that the proper materials are purchased. Inspection and verification of material ordered is performed at the time of receipt by receiving personnel. The receiving staff labels the material with the date received. Expiration dates are assigned as appropriate for the material. Storage conditions and expiration dates are specified in the analytical SOP. The corporate Policy for Standards and Reagents Expiration Dates provides default expiration requirements. Supplies and services that are critical in maintaining the quality of laboratory testing are procured from pre-approved vendors. The policy and procedure for purchasing and procurement are described in the *SOP for Purchasing and Approval of Vendors* (ADM-PUR). Also, refer to section 9.4 for a discussion of reference materials.

Receipt procedures include technical review of the purchase order/request to verify that what was received is identical to the item ordered. The laboratory checks new lots of reagents for unacceptable levels of contamination prior to use in sample preservation, sample preparation, and sample analysis by following the *SOP for Checking New Lots of Chemicals for Contamination* (ADM-CTMN).

3.8 Review of Requests, Tenders and Contracts (Procedures for Accepting New Work)

Requests for new work are reviewed prior to signing any contracts or otherwise agreeing to perform the work. The specific methods to be used are agreed upon between the laboratory and the client. A capability review is performed to determine if the laboratory has or needs to obtain certification to perform the work, to determine if the laboratory has the resources (personnel, equipment, materials, capacity, skills, expertise) to perform the work, and if the laboratory is able to meet the client's required reporting and QC limits. The results of this review are communicated to the client and any potential conflict, deficiency, lack of appropriate accreditation status, or concerns of the ability to complete the client's work are resolved. Any differences between the request or tender and the contract shall be resolved before any work commences. The client should be notified at this time if work is expected to be subcontracted. Each contract shall be acceptable both to the laboratory and the client. Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work. If a contract needs to be amended after work has commenced, the contract review process is repeated and any amendments are communicated to all affected personnel. Changes in accreditation status affecting ongoing projects must be reported to the client.

Figure 3-2
Columbia Analytical/Rochester Laboratory Floor Plan



4.0 PROFESSIONAL CONDUCT, DATA INTEGRITY, AND ETHICS

One of the most important aspects of the success of CAS is the emphasis placed on the integrity of the data provided and the services rendered. This success is reliant on both the professional conduct of all employees within CAS as well as established laboratory practices. All personnel involved with environmental testing and calibration activities must familiarize themselves with the quality documentation and implement the policies and procedures in their work.

4.1 Professional Conduct

To promote quality, CAS requires certain standards of conduct and ethical performance among employees. The following examples of documented CAS policy are representative of these standards, and are not intended to be limiting or all-inclusive:

- Under no circumstances is the willful act of fraudulent manipulation of analytical data condoned. Such acts are to be reported immediately to senior management for appropriate corrective action.
- Unless specifically required in writing by a client, alteration, deviation or omission of written contractual requirements is not permitted. Such changes must be in writing and approved by senior management.
- Falsification of data in any form will not be tolerated. While much analytical data is subject to professional judgment and interpretation, outright falsification, whenever observed or discovered, will be documented, and appropriate remedies and punitive measures will be taken toward those individuals responsible.
- It is the responsibility of all Columbia Analytical employees to safeguard sensitive company information, client data, records, and information; and matters of national security concern should they arise. The nature of our business and the well being of our company and of our clients is dependent upon protecting and maintaining proprietary company/client information. All information, data, and reports (except that in the public domain) collected or assembled on behalf of a client is treated as confidential. Information may not be given to third parties without the consent of the client. Unauthorized release of confidential information about the company or its clients is taken seriously and is subject to formal disciplinary action. All employees sign a confidentiality agreement upon hire to protect the company and client's confidentiality and proprietary rights.

4.2 Prevention and Detection of Improper, Unethical or Illegal Actions

It is the intention of CAS to proactively prevent and/or detect any improper, unethical or illegal action conducted within the laboratory. This is performed by the implementation of a program designed for not only the detection but also prevention. Prevention consists of educating all laboratory personnel in their roles and duties as employees, company policies, inappropriate practices, and their corresponding implications as described here.

In addition to education, appropriate and inappropriate practices are included in SOPs such as manual integration, data review and specific method procedures. Electronic and hardcopy data audits are performed regularly, including periodic audits of chromatographic electronic data. Requirements are described in the Policy for Internal Quality Assurance Audits and details are listed in laboratory admininstrative SOPs. All aspects of this program are documented and retained on file according to the company policy on record retention.

The CAS Employee Handbook also contains information on the CAS ethics and data integrity program, including mechanisms for reporting and seeking advice on ethical decisions.

4.3 Laboratory Data Integrity and Ethics Training

Each employee receives in-depth (approximately 6-8 hour) core Data Integrity/Ethics Training. New employees are given a QA and Ethics orientation within the first month of hire, followed by the the core training within 1 year of hire. On an ongoing basis, all employees receive semi-annual ethics refresher training. Topics covered are documented in writing and all training is documented. It is the responsibility of the QA PM to ensure that the training is conducted as described.

Key topics covered are the organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting, how and when to report data integrity issues and record keeping. Training includes discussion regarding all data integrity procedures, data integrity training documentation, in-depth data monitoring and data integrity procedure documentation.

Trainees are required to understand that any infractions of the laboratory data integrity procedures will result in a detailed investigation that could lead to very serious consequences including immediate termination, or civil/criminal prosecution.

The training session includes many concepts and topics, numerous examples of improper actions (defined by DoD as deviations from contract-specified or method-specified analytical practices and may be intentional or unintentional), legal and liability implications (company and personal), causes, prevention, awareness, and reporting mechanisms.

4.4 Management and Employee Commitment

Columbia Analytical makes every attempt to ensure that employees are free from any commercial, financial, or other undue pressures that might affect their quality of work. Related policies are described in the Columbia Analytical Employee Handbook. This includes:

- CAS Open Door Policy (CAS Employee Handbook) – Employees are encouraged to bring any work related problems or concerns to the attention of local management or their Human Resources representative. However, depending on the extent or sensitivity of the concern, employees are encouraged to directly contact any member of upper management.
- CAS Corporate Ethics Point Program – An anonymous and confidential reporting system available to all employees that is used to communicate misconduct and other concerns. The program shall help minimize negative morale, promote a positive work place, and encourage reporting suspected misconduct without retribution. Associated upper management is notified and the investigations are documented.
- Use of flexible work hours. Within reason and as approved by supervisors, employees are allowed flexible work hours in order to help ease schedule pressures which could impact decision-making and work quality.
- Operational and project scheduling assessments are continually made to ensure that project planning is performed and that adequate resources are available during anticipated periods of increased workloads. Procedures for subcontracting work are established, and within the Columbia Analytical laboratory network additional capacity is typically available for subcontracting, if necessary.
- Gifts and Favors (CAS Employee Handbook) – To avoid possible conflict of interest implications, employees do not receive unusual gifts or favors to, nor accept such gifts or favors from, persons outside the Company who are, or may be, in any way concerned with the projects on which the Company is professionally engaged.

All employees are required to sign and adhere to the requirements set forth in the Columbia Analytical *Confidentiality and Conflicts of Interest Employee Agreement* and the Columbia Analytical *Commitment to Excellence in Data Quality* (see Appendix A).

5.0 ORGANIZATION AND RESPONSIBILITIES

The Columbia Analytical/Rochester staff, consisting of approximately 50 employees, includes chemists, technicians and support personnel. They represent diverse educational backgrounds and experience, and provide the comprehensive skills that the laboratory requires. During seasonal workload increases, additional temporary employees may be hired to perform specific tasks.

CAS is committed to providing an environment that encourages excellence. All employees share the responsibility for maintaining and improving the quality of our analytical services. The responsibilities of key personnel within the laboratory are described below. Table 5-1 lists the Columbia Analytical/Rochester personnel assigned to these key positions. Managerial staff members are provided the authority and resources needed to perform their duties. An organizational chart of the laboratory, as well as the resumes of these key personnel, can be found in Appendix B. The individuals listed below with the authority to stop work also have the authority to resume work. Only the individual that stopped work may authorize the resumption of work.

- The role of the **Laboratory Director** is to provide technical, operational, and administrative leadership through planning, allocation and management of personnel and equipment resources. The Laboratory Director provides leadership and support for the QA program and is responsible for overall laboratory efficiency and the financial performance of the Rochester facility. The Laboratory Director has the authority to stop work in response to quality problems. The Laboratory Director also provides resources for implementation of the QA program, reviews and approves this QA Manual, reviews and approves standard operating procedures (SOPs), and provides support for business development by identifying and developing new markets through continuing support of the management of existing client activities.

- The responsibility of the **Quality Assurance Program Manager** (QA PM) is to oversee implementation of the quality program and to coordinate QA activities within the laboratory. The QA PM is responsible for ensuring compliance with NELAC standards (and ISO, DoD QSM, etc. as applicable). The QA PM works with laboratory staff to establish effective quality control and assessment plans and has the authority to stop work in response to quality problems. The QA PM is responsible for maintaining the QA Manual and performing an annual review of it; reviewing and approving SOPs and ensuring the annual review of each SOP; maintaining QA records such as metrological records, archived logbooks, PT study results, etc.; document control; conducting PT sample studies; approving nonconformity and corrective action reports; maintaining the laboratory's certifications and approvals; performing internal QA audits; preparing QA activity reports; etc. The QA PM reports directly to the Laboratory Director and also reports indirectly to the Chief Quality Officer. It is important to note that when evaluating data, the QA PM does so in an objective manner and free of outside, or managerial, influence.

  The Chief Quality Officer (CQO) is responsible for the overall QA program at all the Columbia Analytical laboratories. The CQO is responsible for oversight of QA PMs regulatory compliance efforts (NELAC, ISO, DOD, etc). The CQO performs annual internal audits at each laboratory; maintains a database of laboratory certification/accreditation programs; approves company-wide

SOPs; maintains a database of approved subcontract laboratories; provides assistance to the laboratory QA staff and laboratory managers; prepares a quarterly QA activity report; etc.

- In the case of absence of the Laboratory Director or QA PM, deputies are assigned to act in that role. Default deputies for these positions are the Client Services Manager or Organics Department Manager (for the Laboratory Director) and the CQO or Laboratory Director (for the QA PM).

- The **Environmental Health and Safety Officer** (EH&S) is responsible for the administration of the laboratory health and safety policies. This includes the formulation and implementation of safety policies, the supervision of new-employee safety training, the review of accidents, incidents and prevention plans, the monitoring of hazardous waste disposal and the conducting of departmental safety inspections. The EH&S officer is also designated as the Chemical Hygiene Officer. The EH&S Officer has a dotted-line reporting responsibility to Columbia Analytical's EH&S Director.

- The **Client Services Manager** is responsible for the Client Services Department (customer services/project managers, and Electronic Data Deliverables group) and the sample management office/bottle preparation sections. The Client Services Department provides a complete interface with clients from initial project specification to final deliverables. The sample management office handles all the activities associated with receiving, storage, and disposal of samples. The Client Services Manager has the authority to stop subcontractor work in response to quality problems.

- The **Project Manager** is a scientist assigned to each client to act as a technical liaison between the client and the laboratory. The project chemist is responsible for ensuring that the analyses performed by the laboratory meet all project, contract, and regulatory-specific requirements. This entails coordinating with the Columbia Analytical laboratory and administrative staff to ensure that client-specific needs are understood and that the services Columbia Analytical provides are properly executed and satisfy the requirements of the client.

- The Analytical Laboratory is divided into operational units based upon specific disciplines. Each department is responsible for establishing, maintaining and documenting a quality control program meeting department needs. Each **Department Manager and Supervisor** has the responsibility to ensure that quality control functions are carried out as planned, and to guarantee the production of high quality data. Department managers and bench-level supervisors have the responsibility to monitor the day-to-day operations to ensure that productivity and data quality objectives are met. Each department manager has the authority to stop work in response to quality problems in their area. Analysts have the responsibility to carry out testing according to prescribed methods, SOPs, and quality control guidelines particular to the laboratory in which he/she is working.

- The **Sample Management Office** plays a key role in the laboratory QA program by maintaining documentation for all samples received by the laboratory, and by assisting in the archival of all laboratory results. The sample management office staff is also responsible for the proper disposal of samples after analysis.

- **Information Technology** (IT) staff are responsible for the administration of the Laboratory Information Management System (LIMS) and other necessary support services. Other functions of the IT staff include laboratory network maintenance, IT systems development and implementation, education of analytical staff in the use of scientific software, Electronic Data Deliverable (EDD) generation, and data back-up, archival and integrity operations.

Table 5-1
Summary of Technical Experience and Qualifications

Personnel	Years of Experience	Project Role
Michael Perry, B.S.	36	Laboratory Director/Technical Director
Lisa Reyes, B.S.	25	Quality Assurance Program Manager
Janice Jaeger, B.S.	22	Client Services Manager
Christine Kutzer, B.S.	19	Inorganics Department Supervisor
Thomas Walton, B.S.	22	Volatiles Department Supervisor
Gregg LaForce	9	Sample Management Office Supervisor
Meghan Pedro, B.S.	10	Extractables Preparation Supervisor/ Environmental Health and Safety
Michael Cymbal, B.S.	21	Semivolatile Organics Supervisor/ Information Technology
Jeff Christian, B.S.	32	Chief Operations Officer
Lee Wolf, B.S.	26	Chief Quality Officer/Quality Assurance Director
Jim Carlson, B.S.	25	President/CEO

6.0 INFORMATION MANAGEMENT

The generation, compilation, reporting, and archiving of electronic data is a critical component of laboratory operations. In order to generate data of known and acceptable quality, the quality assurance systems and quality control practices for electronic data systems must be complete and comprehensive and in keeping with the overall quality assurance objectives of the organization. CAS management provides the tools and resources to implement electronic data systems and establishes information technology standards and policies. Appendix C lists major computing equipment.

6.1 Software Quality Assurance Plan

Columbia Analytical has defined practices for assuring the quality of the computer software used throughout all laboratory operations to generate, compile, report, and store electronic data. These practices are described in the *CAS Software Quality Assurance Plan (SQAP)*. The purpose of the SQAP is to describe the policies and practices for the procurement, configuration management, development, validation and verification, data security, maintenance, and use of computer software. The policies and practices described in the plan apply to purchased computer software as well as to internally developed computer software. Key components of this plan are policies for software validation and control.

6.2 IT Support

The local Columbia Analytical Information Technology (IT) department is established to provide technical support for all computing systems. The IT department staff continually monitors the performance and output of operating systems. The IT department oversees routine system maintenance and data backups to ensure the integrity of all electronic data. A software inventory is maintained. Additional IT responsibilities are described in the SQAP.

In addition to the local IT department, Columbia Analytical corporate IT provides support for network-wide systems. Columbia Analytical also has personnel assigned to information management duties such as development and implementation of reporting systems; data acquisition, and Electronic Data Deliverable (EDD) generation.

6.3 Information Management Systems

Columbia Analytical has various systems in place to address specific data management needs. The Columbia Analytical Laboratory Information Management System (LIMS) is used to manage sample information, sample tracking, sample workload projections, sample result storage, reporting, and invoicing. The LIMS is used to track the status of a sample and is important in maintaining internal chain of custody. Access is controlled by password.

CAS/Rochester currently uses StarLIMS v.9 throughout the laboratory. This data management and retrieval system is deployed via Metaframe Presentation Server from a centralized application server farm located in Portland, OR. This LIMS system utilizes Oracle 10g R1 as its database server, which runs on a Linux Operating System. The system allows the user to acquire data from instrumentation and to generate ASCII, spreadsheet, database, and/or print files.

6.4 Backup and Security

Columbia Analytical laboratory data is either acquired directly to the centralized acquisition server or acquired locally and then transferred to the server. All data is eventually moved to the centralized data acquisition server for reporting and archiving. Differential and full backups are performed and stored according to ADM-BACKUP.

Access to sample information and data is on a need-to-know basis. Access is restricted to the person's areas of responsibility. Passwords are required on all systems. No direct external, non- Columbia Analytical access is allowed to any of our network systems.

The external e-mail system and Internet access is established via a single gateway to discourage unauthorized entry. Columbia Analytical uses a closed system for company e-mail. Files, such as electronic deliverables, are sent through the external e-mail system only via a trusted agent. The external messaging system operates through a single secure gateway. Email attachments sent in and out of the gateway are subject to a virus scan. Because the Internet is not regulated, we use a limited access approach to provide a firewall for added security. Virus screening is performed continuously on all network systems.

7.0 SAMPLE MANAGEMENT

7.1 Sampling and Sample Preservation

The quality of analytical results is highly dependent upon the quality of the procedures used to collect, preserve and store samples. Columbia Analytical recommends that clients follow sampling guidelines described in 40 CFR 136, 40 CFR 141, USEPA SW-846, and state-specific sampling guidelines, if applicable. Sampling factors that must be taken into account to insure accurate, defensible analytical results include:

- Amount of sample taken
- Type of container used
- Type of sample preservation
- Sample storage time
- Proper custodial documentation

Columbia Analytical uses the sample preservation, container, and holding-time recommendations published in a number of documents. The primary documents of reference are: USEPA SW-846, Third Edition and Updates I, II, IIA, IIB, III, IV for hazardous waste samples; USEPA 600/4-79-020, 600/4-91-010, 600/4-82-057, 600/R-93/100, 600/4-88-039, 600/R-94-111, and Supplements; EPA 40CFR parts 136 and 141; and *Standard Methods for the Examination of Water and Wastewater* for water and wastewater samples (see Section 18 for complete citations). The container, preservation and holding time information for these references is summarized in Table 7-1 for soil, water, and drinking water. The current EPA CLP Statement of Work should be referred to for CLP procedures. Where allowed by project sampling and analysis protocols the holding time for sediment, soil, and tissue samples may be extended for a defined period when stored frozen at -20°C.

Columbia Analytical routinely provides sample containers with appropriate preservatives for our clients. Containers are purchased as precleaned to a level 1 status, and conform to the requirements for samples established by the USEPA. Certificates of analysis for the sample containers are available to clients if requested. Reagent water used for sampling blanks (trip blanks, etc.) and chemical preservation reagents are tested by the laboratory to ensure that they are free of interferences and documented. Our sample kits typically consist of foam-lined, precleaned shipping coolers, (cleaned inside and out with appropriate cleaner, rinsed thoroughly and air-dried), specially prepared and labeled sample containers individually wrapped in protective material, (VOC vials are placed in a specially made, foam holder), chain-of-custody (COC) forms, and custody seals. Container labels and custody seals are provided for each container. See SOP, ADM-CTMN for information about the testing of chemicals added as preservatives. See SOP, SMO-BPS for more specific information regarding the packing and shipping of sample kits. See SOP, SMO-GEN for the Sample Acceptance Policy.

Figure 7-1 shows the chain-of-custody form routinely used at Columbia Analytical and included with sample kits. For large sample container shipments, the containers may be shipped in their original boxes. Such shipments will consist of several boxes of labeled sample containers and sufficient materials (bubble wrap, COC forms, custody seals, shipping coolers, etc.) to allow the sampling personnel to process the sample containers and return them to Columbia Analytical. The proper preservative is added to the sample containers prior to shipment, unless otherwise instructed by the client.

Columbia Analytical keeps client-specific shipping requirements on file and utilizes major transportation carriers to guarantee that sample shipping requirements (same-day, overnight, etc.) are met. Columbia Analytical also provides courier service that makes regularly scheduled trips to the Rochester and Buffalo areas.

When Columbia Analytical ships environmental samples to other laboratories for analysis each sample bottle is wrapped in protective material and placed in a plastic bag (preferably Ziploc®) to avoid any possible cross-contamination of samples during shipping. The sample management office (SMO) follows formalized procedures (SMO-GEN) for maintaining the samples' chain of custody, packaging and shipment.

7.2 Sample Receipt and Handling

Standard Operating Procedures (SMO-GEN) are established for the receiving of samples into the laboratory. These procedures ensure that samples are received and properly logged into the laboratory, and that all associated documentation, including chain of custody forms, is complete and consistent with the samples received.

Once samples are delivered to the Columbia Analytical sample management office (SMO), a Cooler Receipt and Preservation Check Form (CRPF - See Figure 7-2 for an example) is used to assess the shipping cooler and its contents as received by the laboratory personnel. Verification of sample integrity includes the following activities:

- Assessment of custody seal presence/absence;
- Temperature of sample containers upon receipt;
- Chain of custody documents properly used (entries in ink, signature present, etc.);
- Sample containers checked for integrity (broken, leaking, etc.);
- Sample is clearly marked and dated (bottle labels complete with required information);
- Appropriate containers (size, type) are received for the requested analyses;
- Sample container labels and/or tags agree with chain of custody entries (identification, required analyses, etc.);
- Assessment of proper sample preservation (if inadequate, corrective action is employed); and
- VOC containers are inspected for the presence/absence of bubbles. (Assessment of proper preservation of VOC containers is performed by lab personnel).

Samples are logged into a Laboratory Information Management System (LIMS). Any anomalies or discrepancies observed during the initial assessment are recorded on the CRPF and COC documents. Potential problems with a sample shipment are addressed by contacting the client and discussing the pertinent issues. When the Project Chemist and client have reached a satisfactory resolution, the login process may continue and analysis may begin.

During the login process, each sample container is given a unique laboratory code. The laboratory code consists of the local CAS laboratory, the year in which the samples were logged, a folder number unique to the job, and an extension for the sample number within that job. The format of the laboratory code is as follows:

e.g. Lab Code R1103233-001 = R - Rochester
11 - Year 2011
03233- Folder Number (sequential number of jobs logged in that year)
001 – Sample number in that Folder.

The LIMS generates a Service Request Summary that contains client information, sample descriptions, sample matrix information, required analyses, sample collection dates, analysis due dates and other pertinent information. The service request is reviewed by the appropriate Project Chemist for accuracy, completeness, and consistency of requested analyses and for client project objectives.

Samples are stored as per method requirements until they undergo analysis, unless otherwise specified, using various refrigerators or freezers, or designated secure areas. Columbia Analytical/Rochester has two walk-in cold storage units which house the majority of sample containers received at the laboratory. The dedicated storage area for VOC samples are monitored using storage blanks, as described in the *SOP for Volatile Storage Blanks (VOC-BLANK)*. Columbia Analytical also has freezers capable of storing samples at -20° C. The temperature of each sample storage unit is monitored daily and the data recorded in a logbook. Maximum/minimum thermometers have also been placed in the walk-in refrigerators to provide a record of the storage conditions to which samples are exposed.

Columbia Analytical adheres to the method-prescribed or project-specified holding times for all analyses. The sampling date and time are entered into the LIMS system at the time of sample receipt and login. Analysts then monitor holding times by obtaining analysis-specific reports from the LIMS. These reports provide holding time information on all samples for the analysis, calculated from the sampling date and the holding time requirement. To document holding time compliance, the date and time analyzed is printed or written on the analytical raw data. For analyses with a holding time prescribed in hours it is essential that the sample collection time is provided, so holding time compliance can be demonstrated. If not, the sample collection time is assumed as the earliest in the day (i.e. the most conservative).

Unless other arrangements have been made in advance, most aqueous and soil samples are retained at 0-6°C in refrigerators for at least 30 days from receipt. Samples are required to be held for at least 60 days. Samples removed from the refrigerators are moved to an ambient temperature storage room as needed for an additional 30 days. Upon expiration of these time limits, the samples are either returned to the client or disposed of according to approved disposal practices. All samples are characterized according to hazardous/non-hazardous waste criteria and are segregated accordingly. All hazardous waste samples are disposed of according to formal procedures outlined in the Sample Disposal SOP (SMO-SPLDIS). It should be noted that all waste produced at the laboratory, including the laboratory's own various hazardous waste streams, is treated in accordance with all applicable local and Federal laws. The bar coding system used to track samples through the lab, including disposal, produces cradle to grave sample history for each sample aliquot.

7.3 Sample Custody

Sample custody transfer at the time of sample receipt is documented using chain-of-custody (COC) forms accompanying the samples. During sample receipt, it is also noted if custody seals were present. This is described in the *SOP for Sample Receiving (SMO-GEN)*. Figure 7-1 is a copy of the chain-of-custody form routinely used at Columbia Analytical.

Facility security and access is important in maintaining the integrity of samples received at Columbia Analytical/Rochester. Access to the laboratory facility is limited by use of locked exterior doors with a proximity card entry, except for the reception area doors, which are manned during business hours and locked at all other times. The Columbia Analytical facility is equipped with an alarm system.

A barcoding system is used to document internal sample custody. Each person removing or returning samples from/to sample storage while performing analysis is required to document this custody transfer. The system uniquely identifies the sample container and provides an electronic record of the custody of each sample. For sample extracts and digestates the analyst documents custody of the sample extract or digestate by signing on the benchsheet, or custody record, that they have accepted custody. The procedures are described in the *SOP for Sample Tracking and Internal Chain of Custody (SMO-ICOC).*

7.4 Project Setup

The analytical method(s) used for sample analysis are chosen based on the client's requirements. Unless specified otherwise, the most recent versions of reference methods are used. For SW-846 methods, some projects may require the most recent *promulgated* version, and some projects may require the most recent *published* version. The Project Chemist will ensure that the correct method version is used. LIMS codes are chosen to identify the analysis method used for analysis. The Project Chemist ensures that the correct methods are selected for analysis, deliverable requirements are identified, and due dates are specified on the service request. To communicate and specify project-specific requirements, a Project Specific Communication Form is used.

Table 7-1
Sample Preservation and Holding Times

DETERMINATION	METHOD	MATRIX[b]	CONTAINER[c]	PREFERRED VOLUME (mL)	PRESERVATION	MAXIMUM HOLDING TIME[a]
Bacterial Tests						
Coliform, Fecal and Total	SM9223B	W	Sterile P,G	100	Cool, ≤6°C, 0.008% $Na_2S_2O_3$[d]	6-24 hours[e]
Inorganic Tests						
Alkalinity	SM2320B	W	P,G	250	Cool, ≤6°C no headspace	14 days
Ammonia	350.1	W	P,G	250	Cool, ≤6°C, H_2SO_4 to pH<2	28 days
Ammonia	350.1	S, NAq	P,G	8 oz.	Cool, ≤6°C	28 days
Ash, Percent	ASTM D482	NonAq Liq	P,G	8 oz.	Cool, ≤6°C	None Listed
Biochemical Oxygen Demand (BOD/ CBOD)	SM5210B	W	P,G	1000	Cool, ≤6°C	48 hours
Bromide	300.0/9056	W	P,G	250	Cool, ≤6°C (not required)	28 days
Bromide	9056	Naq, S	P,G	4 oz.	Cool, ≤6°C (not required)	None listed
BTU (Heat Content)	ASTM D4809	NAq, S	P,G	250, 4 oz.	Cool, ≤6°C	None listed
Chemical Oxygen Demand (COD)	410.4	W	P,G	250	Cool, ≤6°C, H_2SO_4 to pH<2	28 days
Chemical Oxygen Demand (COD)	410.4	S, NAq	G	4 oz.	Cool, ≤6°C	28 days
Chloride	300.0/ 9056/ SM4500Cl E	W	P,G	250	Cool, ≤6°C (not required)	28 days
Chloride	9056	Naq, S	P,G	4 oz.	Cool, ≤6°C (not required)	None listed
Chlorine, Total Residual	SM4500Cl F	W	P,G	500	None Required- field analysis preferred	15 minutes
Chlorine Demand	SM 409A	W	P,G	500	Cool, ≤6°C	None listed
Chlorophyll a	SM 10200H	W	P,G, or filter	1000 or filter	Filter immediately and freeze filter	3 weeks
Color	SM2120B	W	P,G	100	Cool, ≤6°C	48 hours
Cyanide, Total, Free, and Amenable to Chlorination	335.4/ SM4500CNG /9012A/ D7237/ D7284	W	P,G	250	Cool, ≤6°C, NaOH to pH>12	14 days
Cyanide, Weak Acid Dissociable	SM4500CN G	W	P,G	250	Cool, ≤6°C, NaOH to pH >12	14 days
Cyanide, Total	9012	S	P,G	250	Cool, ≤6 °C	14 days
Density	ASTM D4052	NonAq Liq	P,G	250	None	None listed
Ethylene Glycol	NYSDEC 89-9	W	G	3x40 mL	Cool, ≤6°C	None listed

Table 7-1
Sample Preservation and Holding Times

DETERMINATION	METHOD	MATRIX[b]	CONTAINER[c]	PREFERRED VOLUME (mL)	PRESERVATION	MAXIMUM HOLDING TIME[a]
Fluoride	300.0/9056	W	P,G	250	Cool, ≤6°C (not required)	28 days
Fluoride	9056	Naq, S	P,G	4 oz.	Cool, ≤6°C (not required)	None listed
Hardness	SM2340C	W	P,G	250	HNO_3 to pH<2	6 months
Hydrogen Ion (pH)	SM4500 H+B/ 9040	W	P,G	100	None Required – field analysis preferred	15 minutes
Ignitability – closed cup	1010	Liquid	G	3 x 40mL	Cool, ≤6°C	14 days
Iron, Ferrous	SM 3500 Fe D	W	P,G	250	Cool, ≤6 °C, no headspace	Immediate (24 hours – Field preferred)
Ignitability – open cup	ASTM D92	S	G	4oz.	Cool, ≤6°C	None listed
Iodide	300	W	P,G	250	Cool, ≤6°C	28 days suggested
Kjeldahl and Organic Nitrogen	351.2	W	P,G	250	Cool, ≤6°C, H_2SO_4 to pH<2	28 days
Kjeldahl and Organic Nitrogen	351.2	S, NAq	P,G	4oz.	Cool, ≤6°C	28 days
Nitrate	300.0/9056	W	P,G	250	Cool, ≤6°C	48 hours
Nitrate	9056	Naq, S	P,G	4 oz	Cool, ≤6°C	None listed
Nitrate-Nitrite	353.2	W	P,G	250	Cool, ≤6°C, H_2SO_4 to pH<2	28 days
Nitrite	300.0/9056/ 353.2	W	P,G	250	Cool, ≤6°C	48 hours
Nitrite	9056	S, Naq	P,G	4 oz	Cool, ≤6°C	None listed
Odor	SM 2150B	W	G	300 mL	None	Immediate
Orthophosphate	365.1	W	P,G	250	Filter Immediately, Cool, ≤6°C	48 hours
Perchlorate	6850	W,S	G	2x40 mL, 4 oz. amber	Cool, ≤6°C	28 days
Perchlorate	6850	T	G	4 oz. amber	Freeze, ≤-10°C	28 days
Phenolics, Total	420.4/9066	W	Amber G Only	250	Cool, ≤6°C, H_2SO_4 to pH<2	28 days
Phenolics, Total	9066	S	G	4 oz.	Cool, ≤6°C	28 days
Phenolics, Total	9066	NAq	G	250	Cool, ≤6°C	28 days
Phosphorus, Total	365.1	W	P,G	250	Cool, ≤6°C, H_2SO_4 to pH<2	28 days
Phosphorus, Total	365.1	S, NAq	P,G	4 oz.	Cool, ≤6°C	28 days
Reactive Cyanide and Sulfide	Chpt7/9010	W,S	P,G	10g	Cool, ≤6 °C	None listed
Residue, Total	SM2540B	W	P,G	250 or 1000	Cool, ≤6°C	7 days

Table 7-1
Sample Preservation and Holding Times

DETERMINATION	METHOD	MATRIX[b]	CONTAINER[c]	PREFERRED VOLUME (mL)	PRESERVATION	MAXIMUM HOLDING TIME[a]
Residue, Filterable (TDS)	SM2540C	W	P,G	250	Cool, ≤6°C	7 days
Residue, Nonfilterable (TSS)	SM2540D	W	P,G	1000	Cool, ≤6°C	7 days
Residue, Settleable	SM2540F	W	P,G	1000	Cool, ≤6°C	48 hours
Residue, Volatile (TVS, TVSS, TVDS)	160.4	W	P,G	250	Cool, ≤6°C	7 days
Residue, Volatile	SM 2540G	S	P,G	4 oz.	Cool, ≤6°C	none
Silica, Dissolved	USGS I-2700-85	W	P Only	250	Cool, ≤6°C	28 days
Silicon	CAS SOP	S, Naq	P	250	Cool, ≤6°C	None listed
Specific Conductance	120.1	W	P,G	100	Cool, ≤6°C	28 days
Specific Gravity	ASTM D1475	NonAq Liq	P,G	250	None	None listed
Sulfate	300.0/9056	W	P,G	250	Cool, ≤6°C	28 days
Sulfate	9056	Naq, S	G	4 oz.	Cool, ≤6°C	28 days
Sulfide, Acid Soluble	SM 4500-S F /9034	W	P,G	500	Cool, ≤6°C, Add Zinc Acetate plus Sodium Hydroxide to pH>9 No headspace	7 days
Sulfide, Acid Soluble	9030B/9034	S	P,G	4 oz.	Cool, ≤6°C No headspace	7 days
Sulfide, Acid Volatile (AVS)	EPA Draft 1991	S	G	8 oz.	Cool, ≤6°C No headspace	14 days
Sulfite	SM 4500-SO32-B	W	P,G	250	None Required- field analysis preferred	15 minutes
Sulfur – Peroxide Digestion	300	W,S,Naq	P,G	250	Cool, ≤6°C	None
Sulfuric Acid	8	A impingers	P,G	250	None	None
Surfactants (MBAS)	SM 5540C	W	P,G	500	Cool, ≤6°C	48 hours
Temperature	170.1	W	P,G	50	None Required	Analyze immediately
Turbidity	180.1	W	P,G	100	Cool, ≤6°C	48 hours
UV Absorbing Constituents	SM 5910 B	W	P,G	250	Cool, ≤6°C	48 hours
Water, Percent	ASTM E203	W	P,G	4 oz.	Cool, ≤6°C	None listed

Table 7-1
Sample Preservation and Holding Times

DETERMINATION	METHOD	MATRIX[b]	CONTAINER[c]	PREFERRED VOLUME (mL)	PRESERVATION	MAXIMUM HOLDING TIME[a]
Metals						
Chromium VI	218.6	W (not Drinking Water)	P,G	250	Cool, ≤6°C Buffering = pH 9.3-9.7 with specific solution	24 hours: 28 days if buffered
Chromium VI	218.6	Drinking Water	P,G	250	Cool, ≤6°C Buffering = pH 9.0-9.5 with specific solution	24 hours: 5 days if buffered
Chromium VI	7199	W	P,G	250	Cool, ≤6°C	24 hours
Chromium VI	SM3500CrB	W	P,G	250	Cool, ≤6°C	24 hours
Chromium VI	7196A/ 7199	S	P,G	4 oz.	Cool, ≤6°C	30 days until digestion; 7 days until pH adjustment and analysis
Mercury, Low Level	1631	W	Fluoropolymer bottle and cap	500	5 mL 1:1 HCl Cool ≤6°C until BrCl Room Temp after BrCl	28 days to BrCl 90 days from collection to analysis
Mercury	245.1/7470	W	P,G	250	HNO_3 to pH<2	28 days
Mercury	245.5/7471	S	P,G	4 oz.	Cool, ≤6°C	28 days
Metals, except Chromium VI and Mercury	200.7/200.8/ 6010/06020/ 7010	W	P,G	250	HNO_3 to pH<2	180 days
Metals, except Chromium VI and Mercury	6010/6020/ 7010	S	G, Teflon-Lined Cap	4 oz.	Cool, ≤6°C	180 days
Metals, except Chromium VI and Mercury	6010/6020	Tissue	G, Teflon-Lined Cap	4 oz.	Freeze, ≤-10°C	180 days
Organics						
Oil and Grease	1664A	W	G, Teflon-Lined Cap	1000	Cool, ≤6°C, H_2SO_4 to pH<2	28 days
Organic Carbon, Total (TOC)/ Total Inorganic Carbon (TIC)	SM20 5310C /9060	W	G	3x40	Cool, ≤6°C, H_2SO_4 to pH<2	28 days
Organic Carbon, Total (TOC)/ Total Inorganic Carbon (TIC)	EPA Lloyd Kahn	S	G	4 oz	Cool, ≤6°C, no headspace	14 days
Organic Carbon, Total (TOC)/ Total Inorganic Carbon (TIC	EPA Lloyd Kahn	NAq	G	4 oz	Cool, ≤6°C, no headspace	None listed
Petroleum Hydrocarbons, Total Recoverable (gravimetric)	1664A	W	G, Teflon-Lined Cap	1000	Cool, ≤6°C, HCl or H_2SO_4 to pH<2	28 days
Petroleum Hydrocarbons, Total	310-13	W	G, Teflon-Lined Cap	2000	Cool, ≤6°C,	7 days until extraction; 40 days after extraction
Petroleum Hydrocarbons, Total	310-13	S	G, Teflon-Lined Cap	4 oz.	Cool, ≤6°C	14 days until extraction; 40 days after extraction

Table 7-1
Sample Preservation and Holding Times

DETERMINATION	METHOD	MATRIX[b]	CONTAINER[c]	PREFERRED VOLUME (mL)	PRESERVATION	MAXIMUM HOLDING TIME[a]
Volatile Organics						
Purgeable Halocarbons and Aromatics (including BTEX, Oxygenates)	524.2/ 601/ 602/ 624/ 8021/ 8260	W	G, Teflon-Lined Septum Cap	3x40	**No Residual Chlorine Present**: HCl to pH<2, Cool, ≤6°C, No Headspace **Residual Chlorine Present**: 25mg $Na_2S_2O_3$, HCl to pH<2, Cool, ≤6°C, No Headspace	14 days 7 days if not chemically preserved
Purgeable Halocarbons and Aromatics (including BTEX, Oxygenates)	8021/8260	S	G, Teflon-Lined Cap	2 oz.	Cool, ≤6°C, Minimize Headspace	14 days
Purgeable Halocarbons and Aromatics (including BTEX, Oxygenates)	8021/8260	S - 5035	G, Teflon-Lined, Septum Cap	5g cores in 2x40 DI 1x40 MeOH Or 3 x 5g cores	Cool, ≤6°C or freeze Cool, ≤6°C or freeze, in coring tool, lab transfer to 2x40 DI 1x40 MeOH within 48 hours	14 days
Acrolein	624/8260	W	G, Teflon-Lined Septum Cap	3x40	Adjust pH to 4-5, Cool, ≤6°C, No Headspace or If not pH 4-5	14 days 3 days if not adjusted to pH 4-5
Petroleum Hydrocarbons, Volatile (Gasoline-Range Organics)	8015	W	G, Teflon-Lined Septum Cap	3x40	Cool, ≤6°C, HCl to pH<2 No Headspace	14 days 7 days if not chemically preserved
Petroleum Hydrocarbons, Volatile (Gasoline-Range Organics)	8015	S	G, Teflon-Lined Cap	8 oz.	Cool, ≤6°C Minimize Headspace	14 days
Dissolved Gases	RSK-175	W	G, Teflon-Lined Septum Cap	3x40	Cool, ≤6°C, HCl to pH<2 No Headspace	14 days 7 days if not chemically preserved
Volatiles	TO-15	Air	Canisters Tedlar Bags	6 L 1L or 3L	None Required	30 days recommended 3 days

Table 7-1
Sample Preservation and Holding Times

DETERMINATION	METHOD	MATRIX[b]	CONTAINER[c]	PREFERRED VOLUME (mL)	PRESERVATION	MAXIMUM HOLDING TIME[a]
Semivolatile Organics						
Petroleum Hydrocarbons, Extractable (Diesel-Range Organics)	8015	W	G, Teflon-Lined Cap	2000	Cool, ≤6°C	7 days until extraction 40 days after extraction
Petroleum Hydrocarbons, Extractable (Diesel-Range Organics)	8015	S	G, Teflon-Lined Cap	4 oz.	Cool, ≤6°C	14 days until extraction; 40 days after extraction
EDB and DBCP	504.1	W	G, Teflon-Lined Cap	3x40	Cool, ≤6°C, No Headspace	28 days
EDB and DBCP	8011	W	G, Teflon-Lined Cap	3x40	Cool, ≤6°C, No Headspace	14 days until extraction; 14 days after extraction
Non-Halogenated Organics	8015	W,S, NAq	G, Teflon-Lined Cap	3x40, 4 oz.	Cool, ≤6°C, No Headspace[g]	14 days
Phenols, Phthalate Esters, Nitrosamines, Nitroaromatics and Cyclic Ketones, Haloethers, Chlorinated Hydrocarbons	625/ 8270	W	G, Teflon-Lined Cap	2000.	Cool, ≤6°C, store in dark[g]	7 days until extraction; 40 days after extraction
Phenols, Phthalate Esters, Nitrosamines, Nitroaromatics and Cyclic Ketones, Haloethers, Chlorinated Hydrocarbons	8270	S	G, Teflon-Lined Cap	4 oz.	Cool, ≤6°C, store in dark	14 days until extraction; 40 days after extraction
Polynuclear Aromatic Hydrocarbons	610/625/ 8310/ 8270	W	G, Teflon-Lined Cap	2000.	Cool, ≤6°C, Store in Dark	7 days until extraction; 40 days after extraction
Polynuclear Aromatic Hydrocarbons	8270	S	G, Teflon-Lined Cap	4 oz.	Cool, ≤6°C, Store in Dark	14 days until extraction; 40 days after extraction
Polynuclear Aromatic Hydrocarbons	8270	T	G, Teflon-Lined Cap	4 oz.	Freeze, ≤-10°C, Store in Dark	14 days until extraction; 40 days after extraction
Organochlorine Pesticides	608/ 8081	W	G, Teflon-Lined Cap	2000	Cool, ≤6°C, Adjust pH to 5-9 unless extracted within 72 hours	7 days until extraction; 40 days after extraction
Organochlorine Pesticides	8081	S, NAq	G, Teflon-Lined Cap	4 oz.	Cool, ≤6°C	14 days until extraction; 40 days after extraction
Organochlorine Pesticides	8081	T	G, Teflon-Lined Cap	Hexane rinsed double aluminum foil and double bag	Frozen, ≤-20°C	Check client QAP 14/40 RIM Frozen 1 year for EPA Region 1
PCBs	608/8082	W,S	G, Teflon-Lined Cap	2000, 4 oz.	Cool, ≤6°C	1 year until extraction and analysis
PCB Homologs	680	W	G, Teflon-Lined Cap	2000	Adjust pH to 5-9, Cool, ≤6°C, If not pH 5-9	7 days until extraction 40 days after extraction, 72 hours
PCB Homologs	680	T,S	G, Teflon-Lined Cap	4 oz.	Cool, ≤6°C	None listed
Chlorinated Herbicides	8151	W	G, Teflon-Lined Cap	2000	Cool, ≤6°C	7 days until extraction; 40 days after extraction
Chlorinated Herbicides	8151	S	G, Teflon-Lined Cap	4 oz.	Cool, ≤6°C	14 days until extraction; 40 days after extraction
Metabolic/Fatty/Organic Acids	In house	W	G, Teflon-Lined Cap	2x40mL	Cool, ≤6°C, H_3PO_4	28 days recommended
Carbonyl Compounds (Formaldehyde)	8315	W	G, Teflon-Lined Cap	500	Cool, ≤6°C	3 days until extraction, 3 days after extraction
Carbonyl Compounds (Formaldehyde)	8315	S	G, Teflon-Lined Cap	4 oz.	Cool, ≤6°C	14 days

Table 7-1
Sample Preservation and Holding Times

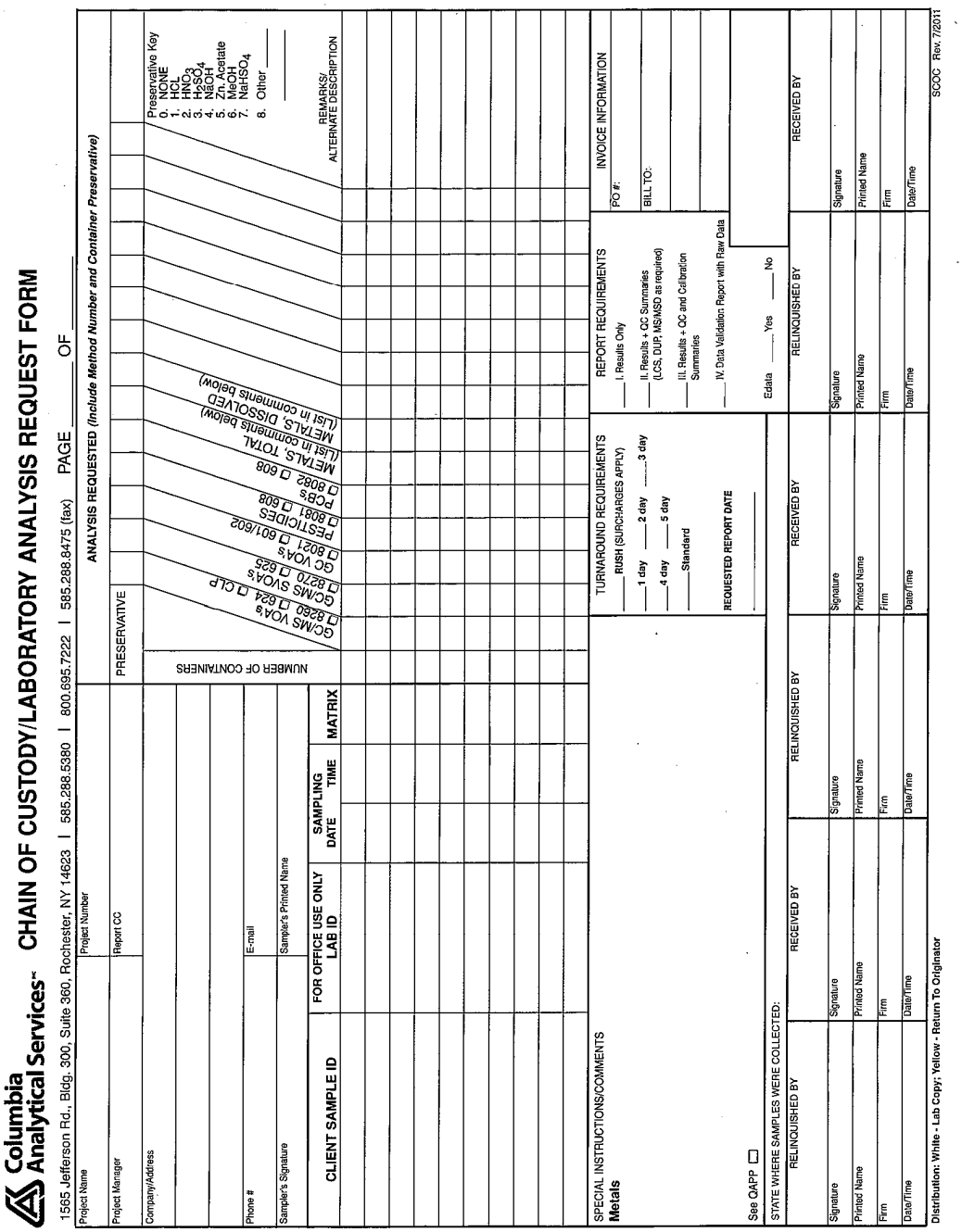
DETERMINATION	METHOD	MATRIX[b]	CONTAINER[c]	PREFERRED VOLUME (mL)	PRESERVATION	MAXIMUM HOLDING TIME[a]
Explosives	8330	W	G, Teflon-Lined Cap	1000	Cool, ≤6°C	7 days until extraction; 40 days after extraction
Explosives	8330	S	G, Teflon-Lined Cap	4 oz.	Cool, ≤6°C	14 days until extraction; 40 days after extraction
1,4-Dioxane	522	W	G, Teflon-Lined Cap	500	Declorinate Na_2SO_3, Cool, ≤6°C, pH <4 Na_2HSO_4	28 days until extraction; 28 days after extraction
Toxicity Characteristic Leaching Procedure (TCLP)						
Mercury	7470	HW	P,G	100g/ 1000mL	Sample: Cool, ≤6°C TCLP extract: HNO_3 to pH<2	28 days until extraction; 28 days after extraction
Metals, except Mercury	6010	HW	P,G	100g/ 1000mL	Sample: Cool, ≤6°C TCLP extract: HNO_3 to pH<2	180 days until extraction; 180 days after extraction
Volatile Organics	8260	HW	G, Teflon-Lined Cap	25g	Sample: Cool, ≤6°C Minimize Headspace TCLP extract: Cool, ≤6°C, HCl to pH<2, No Headspace	14 days until extraction; 14 days after extraction
Semivolatile Organics	8270	HW	G, Teflon-Lined Cap	100g/ 1000mL	Sample: Cool, ≤6°C, Store in Darkg TCLP extract: Cool, ≤6°C, Store in Dark	14 days until TCLP ext'n; 7 days until extraction; 40 days after extraction
Organochlorine Pesticides	8081	HW	G, Teflon-Lined Cap	100g/ 1000mL	Sample: Cool, ≤6°C TCLP extract: Cool, ≤6°C	14 days until TCLP ext'n; 7 days until extraction; 40 days after extraction
Chlorinated Herbicides	8151	HW	G, Teflon-Lined Cap	100g/ 1000mL	Sample: Cool, ≤6°C TCLP extract: Cool, ≤6°C	14 days until TCLP ext'n; 7 days until extraction; 40 days after extraction

Table 7-1
Sample Preservation and Holding Times

DETERMINATION	METHOD	MATRIX[b]	CONTAINER[c]	PREFERRED VOLUME (mL)	PRESERVATION	MAXIMUM HOLDING TIME[a]
CLP						
Cyanide, Total	ILM05.3	W	P,G	500	Cool, ≤6°C, NaOH to pH 12, plus 0.6 g Ascorbic Acid	12 days[h]
	ILM05.3	S	P,G	8 oz.	Cool, ≤6°C	12 days[h]
Mercury	ILM05.3	W	P,G	500	HNO_3 to pH<2	26 days[h]
	ILM05.3	S	P,G	8 oz.	Cool, ≤6°C	26 days[h]
Metals, except Mercury	ILM05.3	W	P,G	500	HNO3 to pH<2	180 days[h]
	ILM05.3	S	P,G	8 oz.	Cool, ≤6°C	180 days[h]
Volatile Organics	OLM04.3	W,S	G, Teflon-Lined Cap	3x40	W-Cool, ≤6°C, Minimize Headspace Soil – see SOP	10 days[h]
Semivolatile Organics	OLM04.3	W,S	G, Teflon-Lined Cap	2000	Cool, ≤6°C, Store in Dark[g]	5 days until extraction;[h,i] 40 days after extraction
Organochlorine Pesticides and PCBs	OLM04.3	W,S	G, Teflon-Lined Cap	2000	Cool, ≤6°C	5 days until extraction;[h,i] 40 days after extraction

a Holding time is from collection to analysis unless otherwise specified
b W=Water, S=Soil or Sediment, A = Air, HW = Hazardous Waste, T=Tissue, NAq = Non-Aqueous Liquid
c P=Polyethylene G=Glass
d For chlorinated water samples
e The recommended maximum holding time is variable, and is dependent upon the geographical proximity of sample source to the laboratory
g If the water sample contains residual chlorine, 10% sodium thiosulfate is used to dechlorinate.
h Number of days following sample receipt at the laboratory
i Ten days until extraction for soil, sediment, and sludge samples.

Figure 7-1
Chain of Custody Form



Columbia Analytical Services

CHAIN OF CUSTODY/LABORATORY ANALYSIS REQUEST FORM

1565 Jefferson Rd., Bldg. 300, Suite 360, Rochester, NY 14623 | 585.288.5380 | 800.695.7222 | 585.288.8475 (fax) PAGE ____ OF ____

Project Name | Project Number | Project Manager | Report CC | Company/Address | Phone # | E-mail | Sampler's Signature | Sampler's Printed Name

ANALYSIS REQUESTED (Include Method Number and Container Preservative)

PRESERVATIVE | NUMBER OF CONTAINERS

GCMS VOA's □ 8260 □ 624 □ CLP
GCMS SVOA's □ 8270 □ 625
GC VOA's □ 8021 □ 601/602
PESTICIDES □ 8081 □ 608
PCB's □ 8082 □ 608
METALS, TOTAL (List in comments below)
METALS, DISSOLVED (List in comments below)

Preservative Key
0. NONE
1. HCL
2. HNO_3
3. H_2SO_4
4. NaOH
5. Zn Acetate
6. MeOH
7. $NaHSO_4$
8. Other ____

CLIENT SAMPLE ID	FOR OFFICE USE ONLY LAB ID	SAMPLING DATE	SAMPLING TIME	MATRIX	REMARKS/ ALTERNATE DESCRIPTION

SPECIAL INSTRUCTIONS/COMMENTS
Metals

TURNAROUND REQUIREMENTS
RUSH (SURCHARGES APPLY)
____1 day ____2 day ____3 day
____4 day ____5 day
____Standard
REQUESTED REPORT DATE
_____

REPORT REQUIREMENTS
____I. Results Only
____II. Results + QC Summaries (LCS, DUP, MS/MSD as required)
____III. Results + QC and Calibration Summaries
____IV. Data Validation Report with Raw Data
Edata ____Yes ____No

INVOICE INFORMATION
PO #:
BILL TO:

See QAPP ☐

STATE WHERE SAMPLES WERE COLLECTED:

RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY
Signature	Signature	Signature	Signature	Signature	Signature
Printed Name	Printed Name	Printed Name	Printed Name	Printed Name	Printed Name
Firm	Firm	Firm	Firm	Firm	Firm
Date/Time	Date/Time	Date/Time	Date/Time	Date/Time	Date/Time

Distribution: White - Lab Copy; Yellow - Return To Originator

SCOC Rev. 7/2011

Figure 7-2

Cooler Receipt And Preservation Check Form

Project/Client_____Folder Number_____.

Cooler received on_____ by:_____**COURIER:** CAS UPS FEDEX VELOCITY CLIENT

1.	Were custody seals on outside of cooler?	YES	NO			
2.	Were custody papers properly filled out (ink, signed, etc.)?	YES	NO			
3.	Did all bottles arrive in good condition (unbroken)?	YES	NO			
4.	Did VOA vials, Alkalinity, or Sulfide have significant* air bubbles?	YES	NO	N/A		
5.	Were **Ice** or **Ice packs** present?	YES	NO			
6.	Where did the bottles originate?	CAS/ROC,	CLIENT			
7.	Temperature of cooler(s) upon receipt:	_____	_____	_____	_____	_____
	Is the temperature within 0° - 6° C?:	Yes	Yes	Yes	Yes	Yes
	If No, Explain Below	No	No	No	No	No

Date/Time Temperatures Taken: _____

Thermometer ID: IR GUN#3 / IR GUN#4 Reading From: Temp Blank / Sample Bottle

If out of Temperature, note packing/ice condition, Client Approval to Run Samples:_____
PC Secondary Review: _____

Cooler Breakdown: Date :_____Time:_____by:_____

1.	Were all bottle labels complete (*i.e.* analysis, preservation, etc.)?	YES	NO
2.	Did all bottle labels and tags agree with custody papers?	YES	NO
3.	Were correct containers used for the tests indicated?	YES	NO
4.	Air Samples: Cassettes / Tubes Intact Canisters Pressurized Tedlar® Bags Inflated		N/A

Explain any discrepancies: _____

pH	Reagent	YES	NO	Lot Received	Exp	Sample ID	Vol. Added	Lot Added	Final pH
≥12	NaOH								
≤2	HNO_3								
≤2	H_2SO_4								
	$NaHSO_4$								<4
Residual Chlorine (-)	For TCN Phenol and 522			If present, contact PM to add ascorbic acid Or sodium sulfite (522)					
	$Na_2S_2O_3$	-	-						
	Zn Aceta	-	-						
	HCl	*	*						

*Not to be tested before analysis – pH tested and recorded by VOAs or GenChem on a separate worksheet

Yes = All samples OK

No = Samples were preserved at lab as listed

PM OK to Adjust: _____

Bottle lot numbers:_____
Other Comments:

PC Secondary Review: _____

*significant air bubbles: VOA > 5-6 mm : WC >1 in. diameter

H:\SMODOCS\Cooler Receipt 4.doc

8.0 ANALYTICAL PROCEDURES

Columbia Analytical employs methods and analytical procedures from a variety of external sources. The primary method references are: USEPA SW-846, Third Edition and Updates I, II, IIA, IIB, III, IVA, IVB, and online updates for hazardous waste samples, and USEPA 600/4-79-020, 600/4-91-010, 600/4-82-057, 600/R-93/100, 600/4-88-039, 600/R-94-111, EPA 40CFR parts 136 and 141, and Supplements; and *Standard Methods for the Examination of Water and Wastewater* for water and wastewater samples. Complete citations for these references can be found in Section 17.0. Other published procedures, such as state-specific methods, program-specific methods, or in-house methods may be used. Several factors are involved with the selection of analytical methods to be used in the laboratory. These include the method detection limit, the concentration of the analyte being measured, method selectivity, accuracy and precision of the method, the type of sample being analyzed, and the regulatory compliance objectives. The implementation of methods by Columbia Analytical is described in SOPs specific to each method. A list of NELAP-accredited methods is given in Appendix G. Further details are described below.

8.1 Standard Operating Procedures (SOPs) and Laboratory Notebooks.

Columbia Analytical maintains SOPs for use in both technical and administrative functions. SOPs are written following standardized format and content requirements as described in the *SOP for Preparation of Standard Operating Procedures*. Each SOP is reviewed and approved by a minimum of two managers (the Technical Director and/or Department Manager and the Quality Assurance Program Manager). All SOPs undergo a documented annual review to make sure current practices are described. The QA PM maintains a comprehensive list of current SOPs. The document control process ensures that only the most currently prepared version of an SOP is being used. The QA Manual, QAPPs, SOPs, standards preparation logbooks, maintenance logbooks, et al., are controlled documents. The procedures for document control are described in the *SOP for Document Control* (ADM-DOC_CTRL). In addition to SOPs, each laboratory department maintains a current file, accessible to all laboratory staff, of the current methodology used to perform analyses. Laboratory notebook entries are standardized following the guidelines in the *SOP for Making Entries into Logbooks and onto Benchsheets* (ADM-DATANTRY). Entries made into laboratory notebooks are reviewed and approved by the appropriate supervisor at a regular interval.

8.2 Deviation from Standard Operating Procedures

When a customer requests a modification to an SOP (such as a change in reporting limit, addition or deletion of target analyte(s), etc.), the project chemist handling that project must discuss the proposed deviation with the department manager in charge of the analysis and obtain their approval to accept the project. The project chemist is responsible for documenting the approved or allowed deviation from the SOP by placing a detailed description of the deviation attached to the quotation or in the project file and also providing an appropriate comment on the service request when the samples are received.

For circumstances when a deviation or departure from company policies or procedures involving any non-technical function is found necessary, approval must be obtained from the appropriate supervisor, manager, the laboratory director, or other level of authority. Frequent departure from policy is not encouraged. However, if frequent departure from any policy is noted, the laboratory director will address the possible need for a change in policy.

8.3 Modified Procedures

Columbia Analytical strives to perform published methods as described in the referenced documents. If there is a material deviation from the published method, the method is cited as a "Modified" method in the analytical report. Modifications to the published methods are listed in the standard operating procedure. Standard operating procedures are available to analysts and are also available to our clients for review, especially those for "Modified" methods. Client approval is obtained for the use of "Modified" methods prior to the performance of the analysis.

8.4 Analytical Batch

The basic unit for analytical quality control is the analytical batch. The definition that Columbia Analytical has adopted for the analytical batch is listed below. The overriding principle for describing an analytical batch is that all the samples in a batch, both field samples and quality control samples are to be handled exactly the same way, and all of the data from each analysis is to be manipulated in exactly the same manner. The minimum requirements of an analytical batch are:

1) The number of (field) samples in a batch is not to exceed 20.
2) All (field) samples in a batch are of the same matrix.
3) The QC samples to be processed with the (field) samples include:
   a) Method Blank (a.k.a. Laboratory Reagent Blank)

      Function: Determination of laboratory contamination.

   b) Laboratory Control Sample

      Function: Assessment of method performance

   c) Matrix Spiked (field) Sample (a.k.a. Laboratory Fortified Sample Matrix)*

      Function: Assessment of matrix bias

   d) Duplicate Matrix Spiked (field) Sample or Duplicate (field) Sample (a.k.a. Laboratory Duplicate)*

      Function: Assessment of batch precision

* A sample identified as a field blank, an equipment blank, or a trip blank is not to be matrix spiked or duplicated.

4) A single lot of reagents is used to process the batch of samples.

5) Each operation within the analysis is performed by a single analyst, technician, chemist, or by a team of analysts/technicians/chemists.

6) Samples are analyzed in a continuous manner over a timeframe not to exceed 24-hours between the start of processing of the first and last sample of the batch.

7) (Field) samples are assigned to batches commencing at the time that sample processing begins. For example: for analysis of metals, sample processing begins when the samples are digested. For analysis of organic constituents, it begins when the samples are extracted.

8) The QC samples are to be analyzed in conjunction with the associated field samples prepared with them. However, for tests which have a separate sample preparation step that defines a batch (digestion, extraction, etc.), the QC samples in the batch do not require analysis each time a field sample within the preparation batch is analyzed (multiple instrument sequences to analyze all field samples in the batch need not include re-analyses of the QC samples).

9) The batch is to be assigned a unique identification number that can be used to correlate the QC samples with the field samples.

10) Batch QC refers to the QC samples that are analyzed in a batch of (field) samples.

11) Project-specific requirements may be exceptions. If project, program, or method requirements are more stringent than these laboratory minimum requirements, then the project, program, or method requirements will take precedence. However, if the project, program, or method requirements are less stringent than these laboratory minimum requirements, these laboratory minimum requirements will take precedence.

8.5 Specialized Procedures

Columbia Analytical not only strives to provide results that are scientifically sound, legally defensible, and of known and documented quality; but also strives to provide the best solution to analytical challenges. Procedures using specialized instrumentation and methodology have been developed to improve sensitivity (provide lower detection limits), selectivity (minimize interferences while maintaining sensitivity), and overall data quality for low concentration applications. Examples at our various locations are trace-level Mercury and Methylmercury analyses, reductive precipitation metals analysis, specialized GC/MS analyses, LC/MS analyses, and ultra-low level organics analyses (including PAHs, pesticides and PCBs).

8.6 Sample Cleanup

Columbia Analytical commonly employs several cleanup procedures to minimize known common interferences prior to analysis. EPA methods (3620, 3640, 3660, and 3665) for cleanup of sample extracts for organics analysis are routinely used to minimize or eliminate interferences that may adversely affect sample results and data usability.

9.0 CALIBRATION PROCEDURES

All equipment and instruments used at Columbia Analytical are operated, maintained and calibrated according to the manufacturer's guidelines and recommendations, as well as to criteria set forth in the applicable analytical methodology. Operation and calibration are performed by personnel who have been properly trained in these procedures. Documentation of calibration information is maintained in appropriate reference files. Brief descriptions of the calibration procedures for our major laboratory equipment and instruments are described below. Calibration is performed according to the applicable analytical methodology. Calibration procedures and criteria are listed in laboratory Standard Operating Procedures. Documentation of calibration is maintained in appropriate reference files. Records are maintained to provide traceability of reference materials.

All analytical measurements generated at Columbia Analytical are performed using materials and/or processes that are traceable to a reference material. Metrology equipment (analytical balances, thermometers, etc.) is verified using reference materials traceable to National Standards of Measurement such as National Institute of Standards and Technology (NIST). These primary reference materials are themselves reverified on an annual basis. Vendors used for metrology support are required to verify compliance to International Standards by supplying the laboratory with a copy of their scope of accreditation.

Equipment subjected to overloading or mishandling, or has been shown by verification to be defective; is taken out of service until it is repaired. The equipment is placed back in service only after verifying, by calibration, that the equipment performs satisfactorily.

9.1 Temperature Control Devices

Temperatures are monitored and recorded for all of the temperature-regulating support equipment such as refrigerators, freezers, ovens, and incubators. Bound record books are kept which contain daily-recorded temperatures, acceptance criteria and the initials of the technician who performed the checks. The procedure for performing these measurements is provided in the *SOP for Calibration Check Procedures for Support Equipment (SOP ADM-DALYCK).* The SOP also includes the use of acceptance criteria and correction factors. Refrigerators and freezers containing samples are monitored continuously with max/min thermometers.

Where the operating temperature is specified as a test condition the temperature is recorded on the raw data. All thermometers are uniquely identified and the calibration is checked annually (or quarterly for digital devices) against a thermometer traceable to National Standards of Measurement such as National Institute of Standards and Technology (NIST). The traceable thermometer is recertified by a vendor accredited to A2LA or ISO/IEC 17025:2005 International Standard every two years. Calibration records are maintained by the QAPM.

9.2 Analytical Balances

Analytical balances are serviced on an annual basis by a professional metrology organization. New certificates of calibration for each balance are issued to the laboratory on an annual basis. The calibration of each analytical balance is checked by the user each day of use with Class-1 verified weights bracketing the working range. The reference weights are verified annually by the metrology organization. Bound record books are kept which contain the recorded measurements, identification and location of equipment, acceptance criteria and the initials of the user who performed the checks. See SOP SMO-DALYCK for instructions and further information.

9.3 Water Purification Systems

Columbia Analytical uses a water purification systems designed to produce deionized water meeting method specifications. The system consists of a series of pumps, filters, and resin beds designed to yield deionized water meeting the specifications of ASTM Type II water, and *Standard Methods for the Examination of Water and Wastewater* (SM1080, 20th Ed.) *High Quality* water. The conductivity and pH are checked by the laboratory every business day using meters calibrated according to GEN-9040/SM4500H+B and GEN-120.1. Other checks are performed regularly by the subcontracted water system service. These checks are discussed further in ADM-DALYCK. The laboratory may use the results of laboratory method blanks for impromptu checks of TOC, TDS, and chloroform if a problem is suspected. The water in the volatiles department is further purified by a Millipore polishing system.

9.4 Source and Preparation of Standards and Reference Materials

Consumable reference materials routinely purchased by the laboratories (e.g., analytical standards) are purchased from nationally recognized, reputable vendors. All vendors have fulfilled the requirements for ISO 9001 certification and/or are accredited by A_2LA. Columbia Analytical relies on a primary vendor for the majority of its analytical supplies. Consumable primary stock standards are obtained from certified commercial sources or from sources referenced in a specific method. Supelco, Ultra Scientific, AccuStandard, Chem Services, Inc., Aldrich Chemical Co., Baker, Spex, etc. are examples of the vendors used. Reference material information is recorded in the appropriate logbook(s) and materials are stored under conditions that provide maximum protection against deterioration and contamination. The logbook entry includes such information as an assigned logbook identification code, the source of the material (i.e. vendor identification), solvent (if applicable) and concentration of analyte(s), reference to the certificate of analysis and an assigned expiration date. The date that the standard is received in the laboratory is marked on the container. See ADM-DATANTRY for more detailed information.

Stock solutions and calibration standard solutions are prepared fresh as often as necessary according to their stability. All standard solutions are properly labeled with standard name, analyte concentration, solvent, date, preparer, and expiration date; these entries are also recorded in the appropriate notebook(s) following the *SOP for Making Entries into Logbooks and onto Benchsheets* (SOP No. ADM-DATANTRY). To ensure traceability, all standards are labeled with an in-house code that can be traced back to the original stock standard received by the vendor and thus, the certificate of analysis. Prior to introduction into the analytical system/process, reference materials are verified for accuracy with a second, independent source of the material. In addition, the independent source of reference material is also used to check the calibration standards for signs of deterioration. All standards, reagents and reference materials shall be stored per analytical SOP requirements to ensure their integrity. Safe handling and transportation of these materials are discussed in the respective analytical SOP and/or Laboratory Safety Manual.

9.5 Inductively Coupled Plasma-Atomic Emission Spectrograph (ICP-AES)

Each emission line on the ICP is calibrated daily against a blank and three standards. Analyses of calibration standards, initial and continuing calibration verification standards, and inter-element interference check samples are carried out as specified in the applicable method SOP and analytical method (i.e. EPA 200.7, 6010C, CLP SOW, etc.). Calibration policies are described in the *SOP for Initial Calibration (SOP ADM-ICAL).*

9.6 Inductively Coupled Plasma-Mass Spectrometer (ICP-MS)

Each element of interest is calibrated daily against a blank and three standards. Analyses of calibration standards, initial and continuing calibration verification standards, and inter-element interference check samples are carried out as specified in the applicable method SOP and analytical method (i.e. EPA 200.8, 6020A, CLP SOW, etc.). Calibration policies are described in the *SOP for Initial Calibration (SOP ADM-ICAL).*

9.7 Atomic Absorption Spectrophotometers (AAS)

These instruments are calibrated daily using a minimum of four standards and a blank. Calibration is validated using reference standards, and is verified at a minimum frequency of once every ten samples. Calibration policies are described in the *SOP for Initial Calibration (SOP ADM-ICAL).*

9.8 GC/MS Systems

All GC/MS instruments are calibrated at a minimum of five different concentration levels for the analytes of interest or at a number of levels as prescribed by the method (e.g. The 600 numbered methods require a minimum of three levels), using procedures outlined in Standard Operating Procedures (SOPs) and/or appropriate USEPA method citations. All SRMs used for this function are "EPA-Certified." Compounds selected as system performance check compounds (SPCCs) must show a method-specified response factor in order for the calibration to be considered valid. Calibration check compounds (CCCs) must also meet method specifications for percent difference from the multipoint calibration. Method-specific instrument tuning is regularly checked using bromofluorobenzene (BFB) for volatile organic chemical (VOC) analysis, or decafluorotriphenylphosphine (DFTPP) for semi-volatile analysis. Mass spectral peaks for the tuning compounds must conform both in mass numbers and in relative intensity criteria before analyses can proceed. Calibration policies are described in the *SOP for Initial Calibration (SOP ADM-ICAL).*

9.9 Gas Chromatographs and High Performance Liquid Chromatographs

Calibration and standardization follow SOP guidelines and/or appropriate USEPA method citations. All GC and HPLC instruments are calibrated at a minimum of five different concentration levels for the analytes of interest (unless specified otherwise). The lowest standard is equivalent to the method reporting limit; additional standards define the working range of the GC or LC detector. Results are used to establish response factors (or calibration curves) and retention-time windows for each analyte. Calibration is verified at a minimum frequency of once every ten samples, unless otherwise specified by the reference method. Calibration policies are described in the *SOP for Initial Calibration (SOP ADM-ICAL).*

9.10 LC/MS Systems

Calibration and tuning procedures are included in analytical SOPs written specifically for these tests. In general, multiple concentration levels for the analytes of interest are used to generate calibration curves. All reference materials used for this function are vendor-certified standards. Calibration and tuning verification is performed at SOP-defined intervals. Any other system performance checks are described in the applicable SOP. Calibration policies are described in the *SOP for Initial Calibration (SOP ADM-ICAL).*

9.11 UV-Visible Spectrophotometer (manual colorimetric analyses)

Routine calibrations for colorimetric analyses involve generating a 5-point calibration curve including a blank. Correlation coefficients must meet method or SOP specifications before analysis can proceed. Independent calibration verification standards (ICVs) are analyzed with each batch of samples. Continuing calibration is verified at a minimum frequency of once every ten samples.

9.12 Flow Injection Analyzer (automated colorimetric analysis)

A minimum of five standards and a blank (unless otherwise specified in the applicable SOP) are used to calibrate the instrument daily. Standard CAS acceptance limits are used to evaluate the calibration curve prior to sample analysis. All linear regressions must have a correlation coefficient of 0.995 or better before analysis may proceed.

9.13 Ion Chromatographs

Calibration of the ion chromatograph (IC) involves generating a minimum of a 5-point calibration curve. A correlation coefficient of 0.995 or better for the curve is required before analysis can proceed. Quality Control (QC) samples that are routinely analyzed include blanks and laboratory control samples. The target analytes typically determined by the IC include nitrate, chloride, fluoride, and sulfate.

9.14 Turbidimeter

Calibration of the turbidimeter requires analysis of formazin and polymer standards measured as NTU. Quality Control samples that are routinely analyzed include blanks, and duplicates.

9.15 Ion-selective electrode

The method-prescribed numbers of standards are used to calibrate the electrodes before analysis. The slope of the curve must be within acceptance limits before analysis can proceed. Quality Control samples that are routinely analyzed include blanks, LCSs and duplicates.

9.16 Pipets

The calibration of pipets and autopipettors used to make critical-volume measurements is verified following the *SOP Use and Calibration of Mechanical Volumetric Dispensing Devices (ADM-PCAL)*. Both accuracy and precision verifications are performed, at intervals applicable to the pipet and use. The results of all calibration verifications are recorded in bound logbooks.

9.17 Other Instruments

Calibration for the total organic carbon (TOC), and other instruments is performed following manufacturer's recommendations and applicable SOPs.

10.0 QUALITY CONTROL

A primary focus of Columbia Analytical's QA Program is to ensure the accuracy, precision and comparability of all analytical results. Prior to using a procedure for the analysis on field samples, acceptable method performance is established by performing demonstration of capability analyses. Performance characteristics are established by performing method detection limit studies and assessing accuracy and precision according to the reference method. Columbia Analytical has established Quality Control (QC) objectives for precision and accuracy that are used to determine the acceptability of the data that is generated. These QC limits are either specified in the test methodology or are statistically derived based on the laboratory's historical data. Quality Control objectives are defined below.

10.1 Quality Control Objectives

10.1.1 Demonstration of Capability - A demonstration of capability (DOC) is made prior to using any new test method or when a technician is new to the method. This demonstration is made following regulatory, accreditation, or method specified procedures. In general, this demonstration does not test the performance of the method in real world samples, but in the applicable clean matrix free of target analytes and interferences.

A quality control sample material may be obtained from an outside source or may be prepared in the laboratory. The analyte(s) is (are) diluted in a volume of clean matrix (for analytes which do not lend themselves to spiking, e.g., TSS, the demonstration of capability may be performed using quality control samples). Where specified, the method-required concentration levels are used. Four aliquots are prepared and analyzed according to the test procedure. The mean recovery and standard deviations are calculated and compared to the corresponding acceptance criteria for precision and accuracy in the test method or laboratory-generated acceptance criteria (if there are not established mandatory criteria). All parameters must meet the acceptance criteria. Where spike levels are not specified, actual Laboratory Control Sample results may be used to meet this requirement, provided acceptance criteria is met.

10.1.2 Accuracy - Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Accuracy is determined by calculating the mean value of results from ongoing analyses of laboratory-fortified blanks, standard reference materials, and standard solutions. In addition, laboratory-fortified (i.e. matrix-spiked) samples are also measured; this indicates the accuracy or bias in the actual sample matrix. Accuracy is expressed as percent recovery (% REC.) of the measured value, relative to the true or expected value. If a measurement process produces results whose mean is not the true or expected value, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis (e.g., extraction efficiencies) or caused by an artifact of the measurement system (e.g., contamination).

Columbia Analytical utilizes several quality control measures to eliminate analytical bias, including systematic analysis of method blanks, laboratory control samples and independent calibration verification standards. Because bias can be positive or negative, and because several types of bias can occur simultaneously, only the net, or total, bias can be evaluated in a measurement.

10.1.3 Precision - Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability, or random error, in sampling, sample handling and in laboratory analysis. The American Society of Testing and Materials (ASTM) recognizes two levels of precision: repeatability - the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory, with the same apparatus, under constant operating conditions, and reproducibility - the random error associated with measurements made by different test operators, in different laboratories, using the same method but different equipment to analyze identical samples of test material.

"Within-batch" precision is measured using replicate sample or QC analyses and is expressed as the relative percent difference (RPD) between the measurements. The "batch-to-batch" precision is determined from the variance observed in the analysis of standard solutions or laboratory control samples from multiple analytical batches.

10.1.4 Control Limits - The control limits for accuracy and precision originate from two different sources. For analyses having enough QC data, control limits are calculated at the 99% confidence limits. For analyses not having enough QC data, or where the method is prescriptive, control limits are taken from the method on which the procedure is based. If the method does not have stated control limits, then control limits are assigned method-default or reasonable values. Control limits are updated periodically when new statistical limits are generated for the appropriate surrogate, laboratory control sample, and matrix spike compounds (typically once a year) or when method prescribed limits change. The updated limits are reviewed by the QA PM. The new control limits replace the previous limits and data is assessed using the new values. Current acceptance limits for accuracy and precision are available from the laboratory. For inorganics, the precision limit values listed are for laboratory duplicates. For organics, the precision limit values listed are for duplicate laboratory control samples or duplicate matrix spike analyses. Procedures forestablishing control limits are found in the *SOP for Control Limits* (ADM-CTRL_LIM).

10.1.5 Representativeness - Representativeness is the degree to which the field sample, being properly preserved, free of contamination, and analyzed within holding time, represents the overall sample site or material. This can be extended to the sample itself, in that representativeness is the degree to which the subsample that is analyzed represents the entire field sample submitted for analysis. Columbia Analytical has sample handling procedures to ensure that the sample used for analysis is representative of the entire sample. See the *SOP for Sample Preparation, Compositing and Subsampling ADM-SPLPREP.* Further, analytical SOPs specify appropriate sample handling and sample sizes to further ensure the sample aliquot that is analyzed is representative in entire sample.

10.1.6 Comparability – Comparability expresses the confidence with which one data set can be compared to another and is directly affected by data quality (accuracy and precision) and sample handling (sampling, preservation, etc). Only data of known quality can be compared. The objective is to generate data of known quality with the highest level of comparability, completeness, and usability. This is achieved by employing the quality controls listed below and standard operating procedures for the handling and analysis of all samples. Data is reported in units specified by the client and using Columbia Analytical or project-specified data qualifiers.

10.1.7 Completeness - Completeness is a measure of the amount of valid data that is obtained, compared to the amount that is expected. It is expected that all analyses conducted in accordance with the approved analytical methods and standard laboratory operating procedures will meet QC acceptance criteria for 95% of the samples tested, however, the CAS objective for completeness is 100%.

$$\text{Completeness (\%)} = \frac{\text{valid data obtained}}{\text{total data planned}} \times 100$$

10.2 Method Detection Limits, Method Reporting Limits, and Limits of Detection/Quantitation

Method Detection Limits (MDL) for methods performed at Columbia Analytical/Rochester are determined during initial method set up and if any significant changes are made. If an MDL study is not performed annually, the established MDL is verified by performing a limit of detection (LOD) verification on every instrument used in the analysis. The MDLs are determined by following the *SOP for Performing Method Detection Limits Studies and Establishing Limits of Detection and Quantitation (ADM-MDL),* which is based on the procedure in 40 CFR Part 136, Appendix B. As required by NELAP and DoD protocols, the validity of MDLs is verified using LOD verification samples.

The Method Reporting Limit (MRL) is the lowest amount of an analyte in a sample that can be quantitatively determined with stated, acceptable precision and accuracy under stated analytical conditions (i.e. limit of quantitation- LOQ). LOQ are analyzed on an annual basis and cannot be lower than the lowest calibration standard. Current MDLs and MRLs are available from the laboratory.

10.3 Quality Control Procedures

The specific types, frequencies, and processes for quality control sample analysis are described in detail in method-specific standard operating procedures and listed below. These sample types and frequencies have been adopted for each method and a definition of each type of QC sample is provided below.

10.3.1 Method Blank (a.k.a. Laboratory Reagent Blank)

The method blank is an analyte-free matrix (water, soil, etc.) subjected to the entire preparation and analytical process. When analyte-free soil is not available, anhydrous sodium sulfate, organic-free sand, glass beads, Teflon chips or an acceptable substitute is used. The method blank is analyzed to demonstrate that the analytical system itself does not introduce contamination. The method blank results should be below the Method Reporting Limit (MRL) or, if required for DoD projects, < ½ MRL for the analyte(s) being tested. Otherwise, corrective action must be taken. A method blank is included with the analysis of every sample preparation batch, every 20 samples, or as stated in the method, whichever is more frequent.

10.3.2 Calibration Blanks

For some methods, calibration blanks are prepared along with calibration standards in order to create a calibration curve. Calibration blanks are free of the analyte of interest and, where applicable, provide the zero point of the calibration curve. Additional project-specific requirements may also apply to calibration blanks.

10.3.3 Continuing Calibration Blanks

Continuing calibration blanks (CCBs) are solutions of either analyte-free water, reagent, or solvent that are analyzed in order to verify the system is contamination-free. The frequency of CCB analysis is either once every ten samples or as indicated in the method, whichever is greater. Additional project-specific requirements may also apply to continuing calibration blanks.

10.3.4 Calibration Standards

Calibration standards are solutions of known concentration prepared from primary standard or stock standard materials. Calibration standards are used to calibrate the instrument response with respect to analyte concentration. Standards are analyzed in accordance with the requirements stated in the particular method being used.

10.3.5 Initial (or Independent) Calibration Verification Standards

Initial (or independent) calibration verification standards (ICVs) are standards that are analyzed *after* calibration but *prior to* sample analysis, in order to verify the validity and accuracy of the standards used for calibration. Once it is determined that there is no defect or error in the calibration standard(s), standards are considered valid and may be used for subsequent calibrations and quantitative determinations (as expiration dates and methods allow). The ICV standards are prepared from materials obtained from a source independent of that used for preparing the calibration standards ("second-source"). ICVs are also analyzed in accordance with method-specific requirements.

10.3.6 Continuing Calibration Verification Standards

Continuing calibration verification standards (CCVs) are midrange standards that are analyzed in order to verify that the calibration of the analytical system is still acceptable. The frequency of CCV analysis is either once every ten samples, or as indicated in the method.

10.3.7 Internal Standards

Internal standards are known amounts of specific compounds that are added to each sample prior to instrument analysis. Internal standards are generally used for GC/MS and ICP-MS procedures to correct sample results that have been affected by changes in instrument conditions or changes caused by matrix effects. The requirements for evaluation of internal standards are specified in each method and SOP.

10.3.8 Surrogates

Surrogates are organic compounds which are similar in chemical composition and chromatographic behavior to the analytes of interest, but which are not normally found in environmental samples. Depending on the analytical method, one or more of these compounds is added to method blanks, calibration and check standards, and samples (including duplicates, matrix spike samples, duplicate matrix spike samples and laboratory control samples) prior to extraction and analysis in order to monitor the method performance on each sample. The percent recovery is calculated for each surrogate, and the recovery is a measurement of the overall method performance.

$$Recovery\ (\%) = (M/T) \times 100$$

Where: M = The measured concentration of analyte,
T = The theoretical concentration of analyte added.

10.3.9 Laboratory Control Samples

The laboratory control sample (LCS) is an aliquot of analyte-free water or analyte-free solid (or anhydrous sodium sulfate or equivalent) to which known amounts of the method analyte(s) is (are) added. A reference material of known matrix type, containing certified amounts of target analytes, may also be used as an LCS. An LCS is prepared and analyzed at a minimum frequency of one LCS per 20 samples, with every analytical batch or as stated in the method, whichever is more frequent. The LCS sample is prepared and analyzed in exactly the same manner as the field samples.

The percent recovery of the target analytes in the LCS is compared to established control limits and assists in determining whether the methodology is in control and whether the laboratory is capable of making accurate and precise measurements at the required reporting limit. Comparison of batch-to-batch LCS analyses enables the laboratory to evaluate batch-to-batch precision and accuracy.

$$Recovery\ (\%) = (M/T) \times 100$$

Where: M = The measured concentration of analyte,
T = The theoretical concentration of analyte added.

10.3.10 Laboratory Fortified Blanks - LFB

A laboratory blank fortified at the MRL used to verify the minimum reporting limit. The LFB is carried through the entire extraction and analytical procedure. A LFB is required with every batch of drinking water samples.

10.3.11 Matrix Spikes (a.k.a. Laboratory Fortified Sample Matrix)

Matrix spiked samples are aliquots of samples to which a known amount of the target analyte (or analytes) is (are) added. The samples are then prepared and analyzed in the same analytical batch, and in exactly the same manner as are routine samples. For the appropriate methods, matrix spiked samples are prepared and analyzed and at a minimum frequency of one spiked sample (and one duplicate spiked sample, if appropriate) per twenty samples. The spike recovery measures the effects of interferences caused by the sample matrix and reflects the accuracy of the method for the particular matrix in question. Spike recoveries are calculated as follows:

$$Recovery\ (\%) = (S - A) \times 100 \div T$$

Where: S = The observed concentration of analyte in the spiked sample,
A = The analyte concentration in the original sample, and
T = The theoretical concentration of analyte added to the spiked sample.

10.3.12 Laboratory Duplicates and Duplicate Matrix Spikes

Duplicates are additional replicates of samples that are subjected to the same preparation and analytical scheme as the original sample. Depending on the method of analysis, either a duplicate analysis (and/or a matrix spiked sample) or a matrix spiked sample and duplicate matrix spiked sample (MS/DMS) are analyzed. The relative percent difference between duplicate analyses or between an MS and DMS is a measure of the precision for a given method and analytical batch. The relative percent difference (RPD) for these analyses is calculated as follows:

$$\textit{Relative Percent Difference (RPD)} = (S1 - S2) \times 100 \div S_{ave}$$

Where S1 and S2 = The observed concentrations of analyte in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike, and

S_{ave} = The average of observed analyte concentrations in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike.

Depending on the method of analysis, either duplicates (and/or matrix spikes) or MS/DMS analyses are performed at a minimum frequency of one set per 20 samples. If an insufficient quantity of sample is available to perform a laboratory duplicate or duplicate matrix spikes, duplicate LCSs will be prepared and analyzed.

10.3.13 Interference Check Samples

An interference check sample (ICS) is a solution containing both interfering and analyte elements of known concentration that can be analyzed to verify background and interelement correction factors in metals analyses. The ICS is prepared to contain known concentrations (method or program specific) of elements that will provide an adequate test of the correction factors. The ICS is analyzed at the beginning and end of an analytical run or at a method-specified frequency. Results must meet method criteria and any project-specific criteria.

10.3.14 Post Digestion Spikes

Post digestion spikes are samples prepared for metals analyses that have an analyte spike added to determine if matrix effects may be a factor in the results. The spike addition should produce a method-specified minimum concentration above the method reporting limit. A post digestion spike is analyzed with each batch of samples and recovery criteria are specified for each method.

10.3.15 Control Charting

The generation of control charts is routinely performed at Columbia Analytical. Surrogate, Matrix Spike and LCS recoveries are all monitored and charted using Quality Analyst software. Control charts are available to monitor the data and to identify various trends in the analytical results. If trends in the data are perceived, various means of corrective action may then be employed in order to prevent future problems with the analytical system(s). Data quality reports using control charts are generated for specific clients and projects pursuant to contract requirements (every 6 months for state specific and method specific requirements - all other methods are monitored every 12 months). The Quality Assurance Program Manager compares the newly generated statistical limits to the old and determines whether the new acceptance criteria is to replace the previous criteria. Investigative action may be taken if charts reveal a potential problem with data quality. See SOP for *Determination of Statistical Control Limits* (ADM-CRTL-LIM). Old charts are archived for a period of 5 years.

10.3.16 Glassware Washing

Glassware washing and maintenance play a crucial role in the daily operation of a laboratory. The glassware used at Columbia Analytical undergoes a rigorous cleansing procedure prior to every usage. A number of SOPs have been generated that outline the various procedures used at Columbia Analytical; each is specific to the end-use of the equipment as well as to the overall analytical requirements of the project. In addition, other equipment that may be routinely used at the laboratory is also cleaned following instructions in the appropriate SOP.

11.0 DATA PROCESSING, VALIDATION, AND REPORTING

Columbia Analytical reports the analytical data produced in its laboratories to the client via the certified analytical report. This report includes a transmittal letter, a case narrative, client project information, specific test results, quality control data, chain of custody information, and any other project-specific support documentation. The following procedures describe our data reduction, validation and reporting procedures.

11.1 Data Reduction and Review

Results are generated by the analyst who performs the analysis and works up the data. All data is initially reviewed and processed by analysts using appropriate methods (e.g., chromatographic software, instrument printouts, hand calculation, etc.). Equations used for calculation of results are found in the applicable analytical SOPs. The resulting data set is either manually entered into LIMS (e.g., field data), manually entered into an electronic spreadsheet and electronically transferred into LIMS (e.g., titrimetric or microbiological data) or is electronically transferred into LIMS from the software used to process the original data set (e.g., chromatographic software). Once the complete data set has been transferred into LIMS, it is reviewed by the analyst for accuracy. Once the primary analyst has checked the data for accuracy and acceptability, the data is forwarded to the supervisor or second qualified analyst, who performs a full secondary review of the data. Where calculations are not performed using a validated software system, the reviewer rechecks a minimum of 10% of the calculations. When the entire data set has been found to be acceptable, the laboratory supervisor, departmental manager or designated laboratory staff approves the data in LIMS. Once approved, the reporting department generates the appropriate hardcopy and/or electronic copy of the final report. An electronic copy is saved for archival. The final report is reviewed and by the Project Manager for client specifications and completeness. Data review procedures are described in the *SOP for Laboratory Data Review Process.*

Policies and procedures for manual editing of data are established. The analyst making the change must initial and date the edited data entry, without obliteration of the original entry. The policies and procedures are described in the *SOP for Making Entries into Logbooks and onto Benchsheets* (ADM-DATANTRY).

Policies and procedures for electronic manual integration of chromatographic data are established. The analyst performing the integration must document the integration change by printing both the “before” and “after” integrations and including them in the raw data records. The policies and procedures are described in the *SOP for Manual Integration of Chromatographic Peaks* (ADM-INT).

11.2 Confirmation Analysis

11.2.1 Gas Chromatographic and Liquid Chromatographic Analyses

For gas chromatographic (GC) and liquid chromatographic (LC) analyses, all positive results are confirmed by a second column, a second detector, a second wavelength (HPLC/UV), or by GC/MS analysis, unless exempted by one of the following situations:

- The analyte of interest produces a chromatogram containing multiple peaks exhibiting a characteristic pattern, which matches appropriate standards. This is limited to petroleum hydrocarbon analyses (e.g., gasoline and diesel) and does not include polychlorinated biphenyls.
- The sample meets all of the following requirements:
    1. All samples (liquid or solid) come from the same source (e.g., groundwater samples from the same well) for continuous monitoring. Samples of the same matrix from the same site, but from different sources (e.g., different sampling locations) are not exempt.
    2. All analytes have been previously analyzed in sample(s) from the same source, identified and confirmed by a second column or by GC/MS. The chromatogram is largely unchanged from the one for which confirmation was carried out. The documents indicating previous confirmation must be available for review.

11.2.2 Confirmation Data

Confirmation data will be provided as specified in the method. Identification criteria for GC, LC or GC/MS methods are summarized below:

- GC and LC Methods
    1. The analyte must fall within plus or minus three times the standard deviation (established for the analyte/column) of the retention time of the daily midpoint standard in order to be qualitatively identified. The retention-time windows will be established and documented, as specified in the appropriate Standard Operating Procedure (SOP).
    2. When sample results are confirmed by two dissimilar columns or detectors, the agreement between quantitative results must be evaluated. The relative percent difference between the two results is calculated and evaluated against SOP and/or method criteria.
- GC/MS Methods - Two criteria are used to verify identification:
    1. Elution of the analyte in the sample will occur at the same relative retention time (RRT) as that of the analyte in the standard.
    2. The mass spectrum of the analyte in the sample must, in the opinion of a qualified analyst or the department manager, correspond to the spectrum of the analyte in the standard or the current GC/MS reference library.

11.3 Data Review and Validation of Results

The integrity of the data generated is assessed through the evaluation of the sample results, calibrations, and QC samples (method blanks, laboratory control samples, sample duplicates, matrix spikes, trip blanks, etc.). A brief description of the evaluation of these analyses is described below, with details listed in applicable SOPs. The criteria for evaluation of QC samples are listed within each method-specific SOP. Other data evaluation measures may include (as necessary) a check of the accuracy check of the QC standards and a check of the system sensitivity. Data transcriptions and calculations are also reviewed.

Note: Within the scope of this document, all possible data assessment requirements for various project protocols cannot be included in the listing below. This listing gives a general description of data evaluation practices used in the laboratory in compliance with NELAP Quality Systems requirements. Additional requirements exist for certain programs, such as projects under the DoD QSM protocols, and project-specific QAPPs.

- Method Calibration – Following the analysis of calibration blanks and standards according to the applicable SOP, the calibration correlation coefficient, average response factor, etc. is calculated and compared to specified criteria. If the calibration meets criteria, analysis may continue. If the calibration fails, any problems are isolated and corrected and the calibration standards reanalyzed. Following calibration and analysis of the independent calibration verification standard(s) the percent difference for the ICV is calculated. If the percent difference is within the specified limits the calibration is complete. If not, the problem associated with the calibration and/or ICV are isolated and corrected and verification and/or calibration is repeated.
- Continuing Calibration Verification (CCV) – Following the analysis of the CCV standard the percent difference is calculated and compared to specified criteria. If the CCV meets the criteria analysis may continue. If the CCV fails, routine corrective action is performed and documented and a 2nd CCV is analyzed. If this CCV meets criteria, analysis may continue, including any reanalysis of samples that were associated with a failing CCV. If the routine corrective action failed to produce an immediate CCV within criteria, then either acceptable performance is demonstrated (after additional corrective action) with two consecutive calibration verifications or a new initial calibration is performed.
- Method Blank – Results for the method blank are calculated as performed for samples. If results are less than the MRL (<½ MRL for DoD projects), the blank may be reported. If not, associated sample results are evaluated to determine the impact of the blank result. If possible, the source of the contamination is determined. If the contamination has affected sample results, the blank and samples are reanalyzed. If positive blank results are reported, the blank (and sample) results are flagged with an appropriate flag, qualifier, or footnote.

- Sample Results (Inorganic) – Following sample analysis and calculations (including any dilutions made due to the sample matrix) the result is verified to fall within the calibration range. If not, the sample is diluted and analyzed to bring the result into calibration range. When sample and sample duplicates are analyzed for precision, the calculated RPD is compared to the specified limits. The sample and duplicate are reanalyzed if the criteria are exceeded. The samples may require re-preparation and reanalysis. For metals, additional measures as described in the applicable SOP may be taken to further evaluate results (dilution tests and/or post-digestion spikes). Results are reported when within the calibration range, or as estimates when outside the calibration range. When dilutions are performed, the MRL is elevated accordingly and qualified. Efforts are made to meet the project MRL's including alternative analysis.
- Sample Results (Organic) – For GC/MS analyses, it is verified that the analysis was within the prescribed tune window. If not, the sample is reanalyzed. Following sample analysis and calculations (including any dilutions made due to the sample matrix) peak integrations, retention times, and spectra are evaluated to confirm qualitative identification. Internal standard responses and surrogate recoveries are evaluated against specified criteria. If internal standard response does not meet criteria, the sample is diluted and reanalyzed. Results outside of the calibration range are diluted to within the calibration range. For GC and HPLC tests, results from confirmation analysis are evaluated to confirm positive results and to determine the reported value. The procedure to determine which result to report is described in the SOP for *Confirmation of Organic Analyte Identification and Quantitation (ADM-CONFIRM).* If obvious matrix interferences are present, additional cleanup of the sample using appropriate procedures may be necessary and the sample is reanalyzed. When dilutions are performed, the MRL is elevated accordingly and qualified. Efforts are made to meet the project MRL's including additional cleanup.
- Surrogate Results (Organic) – The percent recovery of each surrogate is compared to specified control limits. If recoveries are acceptable, the results are reported. If recoveries do not fall within control limits, the sample matrix is evaluated. When matrix interferences are present or documented, the results are reported with a qualifier that matrix interferences are present. If no matrix interferences are present and there is no cause for the outlier, the sample is reprepared and reanalyzed. However, if the recovery is above the upper control limit with non-detected target analytes, the sample may be reported. All surrogate recovery outliers are appropriately qualified on the report.
- Duplicate Sample and/or Duplicate Matrix Spike Results – The RPD is calculated and compared to the specified control limits. If the RPD is within the control limits the result is reported. If not, an evaluation of the sample is made to verify that a homogenous sample was used. Despite the use of homogenizing procedures prior to sample preparation or analysis, the sample may not be homogenous or duplicate sample containers may not have been sampled consistently. If non-homogenous, the result is reported with a qualifier about the homogeneity of the sample. Also, the results are compared to the MRL. If the results are less than five times the MRL, the results are reported with a qualifier that the high RPD is due to the results being near the MRL.

- Laboratory Control Sample Results – The LCS percent recovery is calculated and compared to specified control limits. If the recovery is within control limits, the analysis is in control and results may be reported. If not, this indicates that the analysis is not in control. Samples associated with the 'out of control' LCS, shall be considered suspect and the samples re-extracted or re-analyzed or the data reported with the appropriate qualifiers.
- Matrix Spike Results – The MS percent recovery is calculated and compared to specified control limits. If the recovery is within control limits the results are reported. If not, and the LCS is within control limits, this indicates that the matrix potentially biases analyte recovery. It is verified that the spike level is at least five times the background level. If not, the results are reported with a qualifier that the background level is too high for accurate recovery determination. If matrix interferences are present or results indicate a potential problem with sample preparation, steps may be taken to improve results; such as performing any additional cleanups, dilution and reanalysis, or re-preparation and reanalysis. Results that do not meet acceptance limits are reported with an appropriate qualifier.

11.4 Data Reporting

When an analyst determines that a data package has met the data quality objectives (and/or any client-specific data quality objectives) of the method and has qualified any anomalies in a clear, acceptable fashion, the data package is reviewed by a trained chemist. Prior to release of the report to the client, the project chemist reviews and approves the entire report for completeness and to ensure that any and all client-specified objectives were successfully achieved. The original raw data, along with a copy of the final report, is filed in project files by service request number for archiving. Columbia Analytical maintains control of analytical results by adhering to standard operating procedures and by observing sample custody requirements. All data are calculated and reported in units consistent with project specifications, to enable easy comparison of data from report to report.

To the extent possible, samples shall be reported only if all QC measures are acceptable. If a QC measure is found to be out of control, and the data is to be reported, all samples associated with the failed quality control measure shall be reported with the appropriate data qualifier(s). The *SOP for Data Reporting and Report Generation* addresses the flagging and qualification of data. The Columbia Analytical-defined data qualifiers, state-specific data qualifiers, or project-defined data qualifiers are used depending on project requirements. A case narrative may be written by the project chemist to explain problems with a specific analysis or sample, etc.

For subcontracted analyses, the Project Chemist verifies that the report received from the subcontractor is complete. This includes checking that the correct analyses were performed, the analyses were performed for each sample as requested, a report is provided for each analysis, and the report is signed. The Project Chemist accepts the report if all verification items are complete. Acceptance is demonstrated by forwarding the report to the client.

11.5 Documentation

Columbia Analytical maintains a records system which ensures that all laboratory records of analysis data retained and available. Analysis data is retained for 5 years from the report date unless contractual terms or regulations specify a longer retention time. The archiving system is described in the *SOP for Data Archiving*. In the event that the laboratory transfers ownership or goes out of business, laboratory records shall be retained for the contracted period and clients shall be notified prior to early destruction or disposal of samples or data.

11.5.1 Documentation and Archiving of Sample Analysis Data

The archiving system includes the following items for each set of analyses performed:

- Benchsheets describing sample preparation (if appropriate) and analysis;
- Instrument parameters (or reference to the data acquisition method);
- Sample analysis sequence;
- Instrument printouts, including chromatograms and peak integration reports for all samples, standards, blanks, spikes and reruns;
- Logbook ID number for the appropriate standards;
- Copies of report sheets submitted to the work request file; and
- Copies of Nonconformity and Corrective Action Reports, if necessary.

Individual sets of analyses are identified by analysis date and service request number. Since many analyses are performed with computer-based data systems, the final sample concentrations can be automatically calculated. If additional calculations are needed, they are written on the integration report or securely stapled to the chromatogram, if done on a separate sheet.

For organics analysis, data applicable to all analyses within the batch, such as GCMS tunes, CCVs, batch QC, and analysis sequences; are kept using a separate documentation system. This system is used to archive data on a batch-specific basis and is segregated according to the date of analysis. This system also includes results for the most recent calibration curves, as well as method validation results.

11.6 Deliverables

In order to meet individual project needs, Columbia Analytical provides several levels of analytical reports. Standard specifications for each level of deliverable are described in Table 11-1. Variations may be provided based on client or project specifications. This includes (but is not limited to) the following specialized deliverables:

- ADEC – Alaska Department of Conservation specified data package
- ACOE/HTRW – Army Corps of Engineers specified data package and reporting requirements (HTRW, CERP, FUDS, etc.)
- AFCEE – Air Force Center for Environmental Excellence project-specific reporting

When requested, Columbia Analytical provides Electronic Data Deliverables (EDDs) in the format specified by client need or project specification. Columbia Analytical is capable of generating EDDs with many different formats and specifications. The EDD is prepared by report production staff using the electronic version of the laboratory report to minimize transcription errors. User guides and EDD specification outlines are used in preparing the EDD. The EDD is reviewed and compared to the hard-copy report for accuracy.

Table 11-1
Descriptions of Columbia Analytical Standard Data Deliverables

Tier I. Routine Certified Analytical Report (CAR) includes the following:

1. Transmittal letter
2. Chain of custody documents and sample/cooler receipt documentation
3. Sample analytical results
4. Method blank results
5. Surrogate recovery results and acceptance criteria for applicable organic methods
6. Dates of sample preparation and analysis for all tests
7. Case narrative - **optional**

Tier II. In addition to the Tier I Deliverables, this CAR includes the following:

1. Matrix spike result(s) with calculated recovery and including associated acceptance criteria
2. Duplicate or duplicate matrix spike result(s) (as appropriate to method), with calculated relative percent difference
3. Laboratory Control Sample result(s) with calculated recovery and including associated acceptance criteria
4. Case narrative - **optional**

Tier III. Data Validation Package. In addition to the Tier II Deliverables, this CAR includes the following:

1. Case narrative - **required**
2. Summary forms for all associated QC and Calibration parameters, with associated control criteria/acceptance limits

Note: Other summary forms specified in QAPPs or project/program protocols, or those related to specialized analyses such as HRGC/MS will be included.

Tier IV. Full Data Validation Package.

1. All raw data associated with the sample analysis, including but not limited to:
   a. Preparation and analysis bench sheets and instrument printouts,
   b. For organics analyses, all applicable chromatograms, spectral, confirmation, and manual integration raw data. For GC/MS this includes tuning results, mass spectra of all positive hits, and the results and spectra of TIC compounds when requested.
   c. QC data,
   d. Calibration data (initial, verification, continuing, etc),
   e. Calibration blanks or instrument blanks (as appropriate to method).
2. If a project QAPP or program protocol applies, the report will be presented as required by the QAPP.

12.0 PERFORMANCE AND SYSTEM AUDITS*

Quality audits are an essential part of Columbia Analytical/Rochester's quality assurance program. There are two types of audits used at the facility: System Audits are conducted to qualitatively evaluate the operational details of the QA program, while Performance Audits are conducted by analyzing proficiency testing samples in order to quantitatively evaluate the outputs of the various measurement systems.

12.1 System Audits

The system audit examines the presence and appropriateness of laboratory systems. External system audits of Columbia Analytical/Rochester are conducted regularly by various regulatory agencies and clients. Appendix G lists the certification and accreditation programs in which Columbia Analytical/Rochester participates. Programs and certifications are added as required. Additionally, internal system audits of Columbia Analytical/Rochester are conducted regularly under the direction of the Quality Assurance Program Manager. The internal audit procedures are described in the *SOP for Internal Audits*. The internal audits are performed as follows:

- Comprehensive lab-wide system audit – performed annually. This audit is conducted such that systems, technical operations, hardcopy data, and electronic data are assessed.
- Technical/method audits – minimum of 3 per quarter
- Hardcopy report audits – minimum of 2 per quarter.
- Chromatographic electronic data audits – each applicable instrument per quarter.

All audit findings, and corrective actions are documented. The results of each audit are reported to the Laboratory Director and Department Managers for review. Any deficiencies identified are summarized in the audit report. Managers must respond with corrective actions correcting the deficiency within a defined timeframe. Should problems impacting data quality be found during an internal audit, any client whose data is adversely impacted will be given written notification within the corrective action period (if not already provided).

Electronic data audits may be performed in conjunction with hardcopy data audits. The electronic audits focus on organic chromatographic data and include an examination of audit trails, peak integrations, calibration practices, GCMS tuning data, peak response data, use of appropriate files, and other components of the analysis. The audit also verifies that the electronic data supports the hardcopy reported data.

Additional internal audits or data evaluations may be performed as needed to address any potential data integrity issues that may arise.

*Please note that many SOPs reference Section 12 of the Quality Assurance Manual for Figures for Corrective Action. This information is now found in the text of Section 11 of this Manual.

12.2 Performance Audits

Columbia Analytical/Rochester also participates in the analysis of interlaboratory proficiency testing (PT) samples. Participation in PT studies is performed on a regular basis and is designed to evaluate all analytical areas of the laboratory. General procedures for these analyses are described in the SOP for Proficiency Sample Testing Analysis (ADM-PTS). Columbia Analytical routinely participates in the following studies:

- Water Pollution (WP) and additional water parameters, 2 per year.
- Water Supply (WS) PT studies, 2 per year.
- Hazardous Waste/Soil PT studies, 2 per year.
- Underground Storage Tank PT studies, 2 per year.
- Microbiology (WS and WP) PT studies, 2 per year.
- Other studies as required for specific certifications, accreditations, or validations.

PT samples are processed by entering them into the LIMS system as samples (assigned Service Request, due date, testing requirements, etc.) and are processed the same as field samples. The laboratory sections handle samples the same as field samples, performing the analyses following method requirements and performing data review. The laboratory sections submit results to the QA Program Manager for subsequent reporting to the appropriate agencies or study provider. Results of the performance evaluation samples and audits are reviewed by the QA PM, Laboratory Director, the laboratory staff, and the Chief Quality Officer. For any results outside acceptance criteria, the analysis data is reviewed to identify a root cause for the deficiency, and corrective action is taken and documented through nonconformance (NCAR) procedures.

13.0 PREVENTIVE MAINTENANCE

Preventive maintenance is a crucial element of the Quality Assurance program. Instruments at Columbia Analytical (e.g., ICP/MS and ICP systems, GC/MS systems, atomic absorption spectrometers, analytical balances, gas and liquid chromatographs, etc.) are maintained under commercial service contracts or by qualified, in-house personnel. All instruments are operated and maintained according to the instrument operating manuals. All routine and special maintenance activities pertaining to the instruments are recorded in instrument maintenance logbooks. The maintenance logbooks used at Columbia Analytical contain extensive information about the instruments used at the laboratory.

An initial demonstration of analytical control is required on every instrument used at Columbia Analytical before it maybe used for sample analysis. If an instrument is modified or repaired, a return to analytical control is required before subsequent sample analyses can occur. When an instrument is acquired at the laboratory, the following information is noted in a bound maintenance notebook specifically associated with the new equipment:

- Instrument Name, manufacturer, make, model and type
- The equipment's serial number;
- Date the equipment was received;
- Date the equipment was placed into service;
- Condition of equipment when received (new, used, reconditioned, etc.); and
- Prior history of damage, malfunction, modification or repair (if known).

Preventive maintenance procedures, frequencies, etc. are available for each instrument used at Columbia Analytical. They may be found in the various SOPs for routine methods performed on an instrument and may also be found in the operating or maintenance manuals provided with the equipment at the time of purchase.

Responsibility for ensuring that routine maintenance is performed lies with the section supervisor. The supervisor may perform the maintenance or assign the maintenance task to a qualified bench level analyst who routinely operates the equipment. In the case of non-routine repair of capital equipment, the section supervisor is responsible for providing the repair, either by performing the repair themselves with manufacturer guidance or by acquiring on-site manufacturer repair. Each laboratory section maintains a critical parts inventory. The parts inventories include the items needed to perform the preventive maintenance procedures listed in Appendix D.

This inventory or “parts list” also includes the items needed to perform any other routine maintenance and certain in-house non-routine repairs such as gas chromatography/mass spectrometry jet separators and electron multipliers and ICP/MS nebulizer. When performing maintenance on an instrument (whether preventive or corrective), additional information about the problem, attempted repairs, etc. is also recorded in the notebook. Typical logbook entries include the following information:

- Details and symptoms of the problem;
- Repairs and/or maintenance performed;
- Description and/or part number of replaced parts;
- Source(s) of the replaced parts;
- Analyst's signature and date; and
- Demonstration of return to analytical control.

See the table in Appendix E for a list of preventive maintenance activities and frequency for each instrument.

14.0 CORRECTIVE AND PREVENTIVE ACTION

The laboratory takes all appropriate steps necessary to ensure all sample results are reported with acceptable quality control results. When sample results do not conform to established quality control procedures, responsible management will evaluate the significance of the nonconforming work and take corrective action to address the nonconformance.

Nonconforming events such as errors, deficiencies, deviations from SOP, proficiency (PT) failure or results that fall outside of established QC limits are documented using a *Nonconformity and Corrective Action Report* form (See Figure 14-1). The procedure and responsibilities for addressing nonconforming work is defined in the SOP ADM-CA *Corrective Action.* Nonconformances are reported to the client using various means (voice, email, narrative, etc). When a nonconformance occurs that casts doubt on the validity of the test results or additional client instructions are needed, the Prjoject Chemist notifies the client the within 10 business days of the discovery. This gives the laboratory time to ascertain the extent and significance of the problem. The QA PM reviews each problem, ensuring that appropriate corrective action has been taken by the appropriate personnel. The Nonconformity and Corrective Action Report (NCAR) is filed in the associated service request file and a copy is kept by the QA PM. The QA PM periodically reviews all NCARs looking for chronic, systematic problems that need more in-depth investigation and alternative corrective action consideration. In addition, the appropriate project chemist is promptly notified of any problems in order to inform the client and proceed with any action the client may want to initiate.

If a quality control measure is found to be out of control, and the data is to be reported, all samples associated with the failed quality control measure shall be reported with the appropriate data qualifier(s). Failure to meet established analytical controls, such as the quality control objectives, prompts corrective action. Corrective action may take several forms and may involve a review of the calculations, a check of the instrument maintenance and operation, a review of analytical technique and methodology, and reanalysis of quality control and field samples. If a potential problem develops that cannot be solved directly by the responsible analyst, the supervisor, team leader, the department manager, and/or the QA PM may examine and pursue alternative solutions. In addition, the appropriate project chemist is notified in order to ascertain if the client needs to be notified.

Part of the corrective action process involves determining the root cause. Identifying the root cause of a nonconformance can be difficult, but important for implementing effective corrective action. Root cause principles are used to determine assignable causes, which leads to corrective action taken to prevent recurrence. Various preventive action processes are used for eliminating a potential problem or averting a problem before it occurs. This is explained in the *SOP for Preventive Action* (ADM-PA).

In addition to internal communication of data issues, the laboratory also maintains a system for dealing with customer complaints. The person who initially receives the feedback (typically the project chemist) is responsible for documenting the complaint. If the project chemist is unable to satisfy the customer, the complaint is brought to the attention of the Client Services Manager, Laboratory Director, or QA PM for final resolution. The complaint and resolution are documented. The procedure is described in the *SOP for Handling Customer Feedback* (ADM-FDBK).

Figure 14-1

Nonconformity and Corrective Action Report

NCAR No: *Assigned by QA*

PROCEDURE (SOP or METHOD): EVENT DATE: _____

EVENT:
- ☐ Missed Holding Time
- ☐ Method Blank Contamination
- ☐ Equipment Failure
- ☐ SOP Deviation
- ☐ QC Failure
- ☐ Login Error
- ☐ Unacceptable PT Sample Result
- ☐ Other (describe):
- ☐ Lab Error (spilled sample, spiking error, etc.)
- ☐ Project Management Error

INCLUDE NUMBER OF SAMPLES / PROJECTS / CUSTOMERS / SYSTEMS AFFECTED

DETAILED DESCRIPTION

ORIGINATOR: _____ DATE: _____

PROJECT MANAGER(S): _____ NOTIFIED BY: _____ DATE: _____

ROOT CAUSE OF NON-CONFORMITY (POTENTIAL CAUSES COULD BE TRAINING, COMMUNICATION, SPECIFICATIONS, EQUIPMENT, KNOWLEDGE)

What is the cause of the error or finding:

CORRECTIVE ACTION AND OUTCOME

Re-establishment of conformity must be demonstrated and documented. Describe the steps that were taken, or are planned to be taken, to correct the particular Nonconformity and prevent its reoccurrence. Include Project Manager Instructions here.

Is the data to be flagged in the Analytical Report with an appropriate qualifier? ☐ **No** ☐ **Yes**

APPROVAL AND NOTIFICATION

Supervisor Verification and Approval of Corrective Action _____ Date: _____
Comments:

QA PM Verification and Approval of Corrective Action _____ Date: _____
Comments:

Project Manager Verification and Approval of Corrective Action _____ Date: _____
Comments:

Customer Notified by ☐ Telephone ☐ Fax ☐ E-mail ☐ Narrative ☐ Not notified

(Attach record or cite reference where record is located.)

15.0 QUALITY ASSURANCE REPORTS AND MANAGEMENT REVIEW*

Quality assurance requires an active, ongoing commitment by Columbia Analytical personnel at all levels of the organization. Communication and feedback mechanisms are designed so that analysts, supervisors and managers are aware of QA issues in the laboratory. Analysts performing routine testing are responsible for generating a data quality narrative or data review document with every analytical batch processed. This report also allows the analyst to provide appropriate notes and/or a narrative if problems were encountered with the analyses. A Non-Conformity and Corrective Action Report (NCAR) (see Section 14.0) may also be attached to the data prior to review. Supervisors or qualified analysts review all of the completed analytical batches to ensure that all QC criteria have been examined and any deficiencies noted and addressed.

It is the responsibility of each laboratory unit to provide the project chemist with a final report of the data, accompanied by signature approval. Footnotes and/or narrative notes must accompany any data package if problems were encountered that require further explanation to the client. Each data package is submitted to the appropriate project chemist, who in turn reviews the entire collection of analytical data for completeness and to ensure that any and all client-specified objectives were successfully achieved. A case narrative is written by the project chemist to explain any unusual problems with a specific analysis or sample, etc.

- The QA PM provides overview support to the project chemists as required (e.g., contractually specified, etc.). The QAPM is also responsible for the oversight of all internal and external audits, for all proficiency testing sample and analysis programs, and for all laboratory certification/accreditation responsibilities. The QAPM provides the Laboratory Director with quarterly reports that summarize the various QA/QC activities that occurred during the previous quarter.

An annual management review of the quality and testing systems is perfomed as described in the *SOP for Managerial Reviews of the Laboratory's Quality Systems and Testing Activities* (ADM-MGMTRVW). This is done to identify any necessary changes or improvements to the quality system or quality assurance policies. This review is documented in a Managerial Review of the Laboratory's Quality Systems and Testing Activities and sent to senior management.

*Please note that many SOPs reference Section 15 of the Quality Assurance Manual for handling out of control data. This information is now found in the text of Section 14 of this Manual.

16.0 PERSONNEL TRAINING

Technical position descriptions are available for all employees, regardless of position or level of seniority. These documents are maintained by the Human Resources personnel and are available for review. In order to assess the technical capabilities and qualifications of a potential employee, all candidates for employment at Columbia Analytical are evaluated, in part, against the appropriate technical description.

Training begins the first day of employment at Columbia Analytical when the company policies are presented and discussed. Safety and QA/QC requirements are integral parts of all technical SOPs and, consequently, are integral parts of all training processes at Columbia Analytical. Safety training begins with the reading of the *Environmental Health and Safety Manual.* Employees are also required to attend periodic safety meetings where additional safety training may be performed by the Environmental, Health and Safety Officer.

Employees are responsible for complying with the requirements of the QA Manual and QA/QC requirements associated with their function(s). Quality Systems training begins with Quality Assurance orientation for new employees and reading the Quality Assurance Manual. During the employees first year, the employee attends Core Ethics training and learns about Columbia Analytical Services quality systems. Each employee participates in annual Ethics Refresher training, which is part of the Columbia Analytical Improper Practices Prevention Program.

Columbia Analytical also encourages its personnel to continue to learn and develop new skills that will enhance their performance and value to the Company. Ongoing training occurs for all employees through a variety of mechanisms. The corporate, company-wide training and development program, external and internal technical seminars and training courses, and laboratory-specific training exercises are all used to provide employees with professional growth opportunities.

All technical training is documented and records are maintained in the QA department. Training requirements and its documentation are described in the *SOP for Documentation of Training.* (ADM-TRANDOC). A training plan is developed whenever an employee starts a new procedure to new position. The training plan includes a description of the step-by-step process for training an employee and for initial demonstration of capability. Where the analyst performs the entire procedure, a generic training plan may be used.

16.1 Initial Demonstration of Capability (IDOC)

Training in analytical procedures typically begins with the reading of the Standard Operating Procedure (SOP) for the method. Hands-on training begins with the observation of an experienced analyst performing the method, followed by the trainee performing the method under close supervision, and culminating with independent performance of the method on quality control samples. Successful completion of the applicable Demonstration of Capability analysis qualifies the analyst to perform the method independently. Demonstration of Capability is performed by one of the following:

- Successful completion of an Initial Precision and Recovery (IPR) study (required where mandated by the method).
- Analysis of 4 consecutive Laboratory Control Samples, with acceptable accuracy and precision.
- Where spiking is not possible but QC standards are used ("non-spiked" Laboratory Control Samples), analysis of 4 consecutive Laboratory Control Samples with acceptable accuracy and precision.
    - Where one of the three above is not possible, see the special requirements in ADM-TRANDOC.

A flowchart identifying the Demonstration of Proficiency requirements is given in Figure 16-1. The flowchart identifies allowed approaches to assessing Demonstration of Capability when a 4-replicate study is not mandated by the method, when spiking is not an option, or when QC samples are not readily available.

16.2 Continuing Demonstration of Proficiency

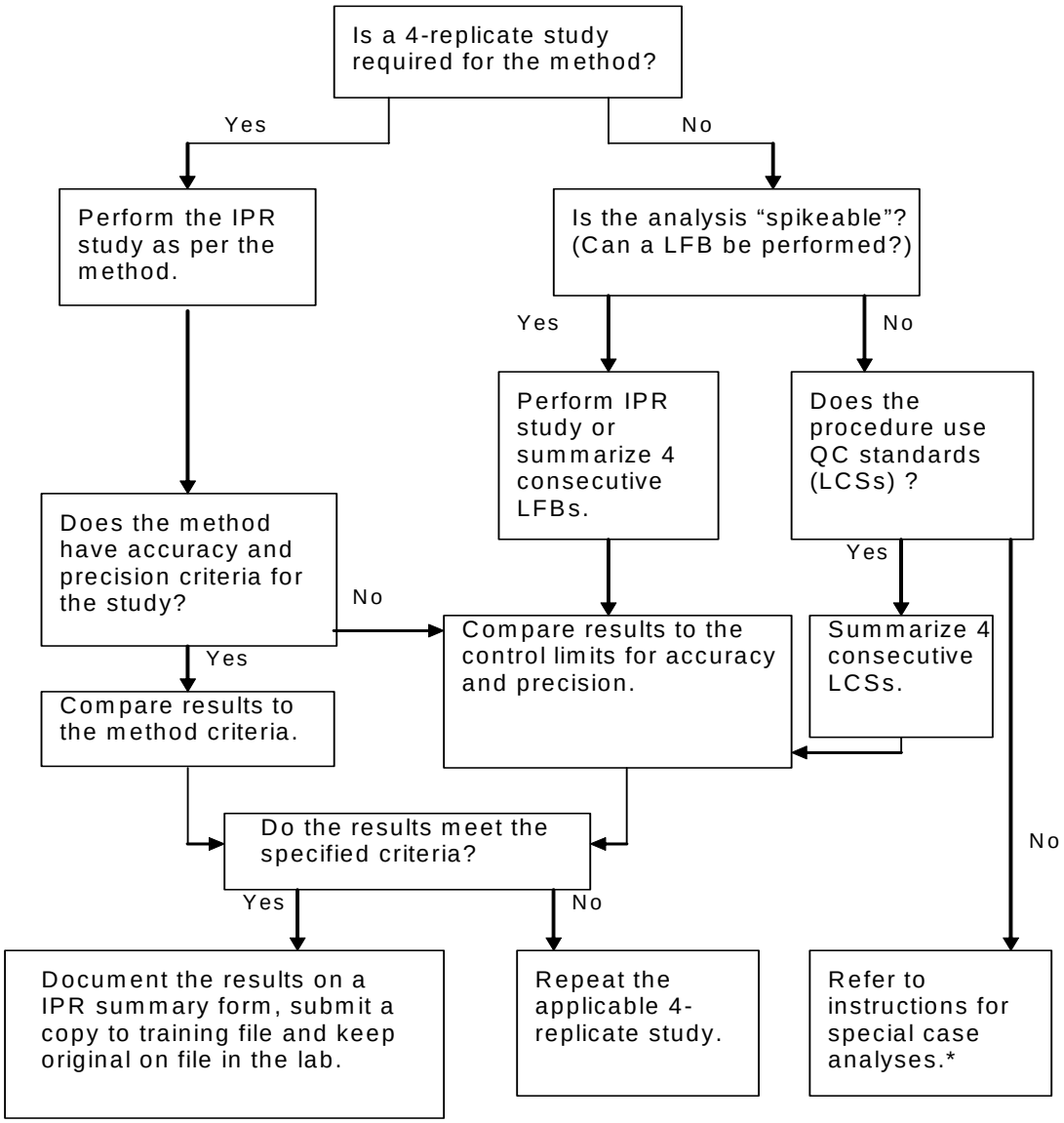
A periodic demonstration of proficiency is required to maintain continuing qualification. Continuing Demonstration of Proficiency is required each year, and may be performed one of the following ways:

- Successful performance on external (independent) single-blind sample analyses using the test method, or a similar test method using the same technology. I.e. PT sample or QC sample blind to the analyst.
- Performing Initial Demonstration of Capability as described above, with acceptable levels of precision and accuracy.
- Analysis of at least 4 consecutive LCSs with acceptable levels of accuracy and precision from in-control analytical batches.
- If the above cannot be performed,see the special requirements in ADM-TRANDOC.

16.3 Documentation of Training

Records are maintained to indicate the employee has the necessary training, education, and experience to perform their functions. Information of previously acquired skills and abilities for a new employee is maintained in Human Resources personnel files and Columbia Analytical resumes. QA maintains a database to record the various technical skills and training acquired while employed by Columbia Analytical. Information includes the employee's name, a description of the skill including the appropriate method and SOP reference, the mechanism used to document proficiency, and the date the training was completed. General procedures for documenting technical training are described in the *SOP for Documentation of Training* (ADM-TRANDOC).

Figure 16-1
Initial Demonstration of Capability Requirements[a]



[a] For IDOC IPR or LFB studies, "second-source" reference materials are used, as per NELAP requirements

* Refer to the SOP for Documentation of Training for details.

17.0 REFERENCES FOR QUALITY SYSTEMS, EXTERNAL DOCUMENTS, MANUALS, STANDARDS, AND ANALYTICAL PROCEDURES

The analytical methods used at Columbia Analytical generally depend upon the end-use of the data. Since most of our work involves the analysis of environmental samples for regulatory purposes, specified federal and/or state testing methodologies are used and followed closely. Typical methods used at Columbia Analytical are taken from the following references:

- National Environmental Laboratory Accreditation Program (NELAP), 2003 Quality Standards.
- TNI Standard, The NELAC Institute, 2009.
- American National Standard *General requirements for the competence of testing and calibration laboratories,* ANSI/ISO/IEC 17025:2005(E)
- *DoD Quality Systems Manual for Environmental Laboratories,* Version 4.1, 4/22/2009.
- *DoD Quality Systems Manual for Environmental Laboratories,* Version 4.2, 10/25/2010.
- *Good Automated Laboratory Practices, Principles and Guidance to Regulations For Ensuring Data Integrity In Automated Laboratory Operations*, EPA 2185 (August 1995).
- *Manual for the Certification of Laboratories Analyzing Drinking Water*, 4th Edition, EPA 815-B-97-001 (March 1997).
- *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Third Edition, (September 1986) and Updates I (July 1992), II (September 1994), IIA (August 1993), IIB (January 1995), III (December 1996), Final Update IV (February 2007), and updates posted online at http://www.epa.gov/epaoswer/hazwaste/test/sw846.htm. See Chapters 1, 2, 3, and 4.
- *Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020, (Revised March 1983).
- *Methods for the Determination of Inorganic Substances in Environmental Samples*, EPA/600/R-93/100 (August 1993).
- *Methods for the Determination of Metals in Environmental Samples*, EPA/600/4-91/010 (June 1991) and Supplements.
- *Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater*, EPA 600/4-82-057 (July 1982) and 40 CFR Part 136, Appendix A.
- *Methods for the Determination of Organic Compounds in Drinking Water*, EPA/600/4-88/039 (December 1988) and Supplements.
- *Standard Methods for the Examination of Water and Wastewater*, 18th Edition (1992); 19th Edition (1995), 20th Edition (1998). See Introduction in Part 1000.
- 40 CFR Part 136, Guidelines for Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act.

- 40 CFR Part 141, National Primary Drinking Water Regulations.
- State-specific total petroleum hydrocarbon methods for the analysis of samples for gasoline, diesel, and other petroleum hydrocarbon products.
- Annual Book of ASTM Standards, Part 31, Water.
- EPA Contract Laboratory Program, Statement of Work for Organic Analysis, SOW Nos. OLM03.1, OLM03.2, OLM04.2, and OLM04.3.
- EPA Contract Laboratory Program, Statement of Work for Inorganic Analysis, SOW No. ILM05.3.
- *U. S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA-540/R-94/012 (February 1993).
- *U. S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA-540/R-94/013 (February 1994).

APPENDIX A

LIST OF QA PROGRAM DOCUMENTS AND STANDARD OPERATING PROCEDURES

Please note that the Appendices provide current information at the time of the revision, but are updated only upon annual review. Please contact the laboratory for up-to-date information.

Please also note that many SOPs reference this Appendix (A) for the Equipment List. The Equipment List is now found in Appendix C of this Quality Assurance Manual.

CAS QUALITY AND ETHICS POLICY STATEMENT

Columbia Analytical Services

CAS Quality and Ethics Policy Statement
September 2010

Columbia Analytical Services (CAS) is committed to excellence and superior performance in everything we do. This includes ethics and professional practice where CAS is committed to the highest standards of ethical behavior and quality of its analytical testing. We will not sacrifice our ethical principles in order to achieve business success, because unethical behavior carries a heavy price - one that we do not want to bear. This includes diminished self respect, loss of reputation, loss of business, civil and criminal penalties, and government and customer sanctions.

This means we will always strive to conduct business honestly and with integrity. We will always follow and obey the laws and statutes applicable to the operation of our business. We will always follow, to the best of our ability, standard operating procedures, rules and regulations that apply to our industry and specifically to our laboratory operations. Our customers, employees, suppliers and communities that we serve expect and deserve nothing less than the highest standards of conduct and compliance.

The following are the critical elements of the Quality and Ethics program at CAS.

- The Executive Management and Board of Directors of CAS sponsor and support the Quality and Ethics program through their personal commitment and by providing the necessary resources to promote this program throughout the organization.
- Chief Quality and Ethics Officer. The position is responsible for the quality and ethics program, ensures that appropriate resources are provided, reviews and recommends changes in the program, and resolves ethical and quality issues brought to management attention. This Officer periodically provides a quality and ethics report directly to the Board of Directors.
- Core Values. The CAS Statement of Core Values was developed internally with input from the entire company. We are committed to ensuring the integrity and quality of data, and meeting the needs of our clients, while conducting business with high ethical standards. We hold strong to the core values of Honor, Truth, and Fairness. We are committed to these values and rely on them when confronted by difficult choices.
- Code of Conduct. CAS supports the ethical codes established for the laboratory industry by the American Council of Independent Laboratories (ACIL) and is committed to meeting the data integrity and ethics requirements of accreditation bodies; including NELAP and the Department of Defense (DOD). The "CAS Commitment to Excellence in Data Quality" statement must be acknowledged and signed by all employees; and all employees are expected to comply with standards outlined in Section 6, Employee Conduct, of our Employee Handbook. All personnel concerned with analytical testing activities within the laboratory are required to be familiar with the quality documentation and to implement these policies and procedures in their work.

CAS QUALITY AND ETHICS POLICY STATEMENT CONT.

Columbia Analytical Services

- Open Door Policy. CAS will maintain a work environment where employees have the right and obligation for open communications to ask questions, seek guidance, and report incorrect practices and wrong doing without fear of retribution. This is described in the CAS Open Door Policy in the Employee Handbook. CAS believes that using the chain-of-command channels for this dialogue is generally most appropriate. However, if there is apprehension or a concern that using this approach is not appropriate, employees are free to take their concerns to the President/CEO, the Director of Human Resources, or the Chief Quality Officer. Employees may do so without fear of retribution.
- Ombudsman Program. In addition to the Open Door Policy, CAS has implemented an external ombudsman/hotline program through EthicsPoint, a phone and internet-based reporting system. This is another mechanism available to enhance communication and empower employees to promote quality, data integrity, and ethical behavior. Employees can file a report anonymously to address ethics, data integrity, or improper conduct issues in the workplace.
- Internal Audits. Policies are established to ensure that internal systems and data audits are conducted periodically in addition to external agency and client audits. The data audits include assessments of both hardcopy data and electronic data to ensure on-going data integrity and compliance with the CAS Quality program.
- Certification/Accreditation Compliance. CAS management is committed to ensuring compliance with the accreditation or certification standards applicable to each CAS laboratory, including NELAP accreditations at laboratories conducting environmental testing and DOD ELAP accreditation at laboratories performing testing for the DOD. Required quality systems are documented in QA Manuals, administrative Standard Operating Procedures (SOPS) and policies; and technical SOPs.
- Ethics Training. CAS provides training to its employees with respect to quality, ethics, data integrity, and business conduct. This includes introductory training on employment policies, quality, and ethics at the time of hire; in-depth "core" ethics training within one year of hire, and on-going ethics refresher training on a semi-annual basis.

The CAS Quality and Ethics Program has been in place for several years. However, this is a "living" program that will change and improve as the company grows and changes.

Jim Carlson, President/CEO — 9-28-10 Date

Lee Wolf, Chief Quality and Ethics Officer — 9-21-10 Date

COLUMBIA ANALYTICAL/ROCHESTER APPROVED SIGNATORIES

The following Columbia Analytical/Rochester employees are authorized to issue certified analytical reports and sign other critical documents (such as QAPPs, other program protocols, etc.). In the event that these individuals are not available, an assigned designee or the Chief Operating Officer may approve these documents.

Employee:	Position:
Michael Perry	Laboratory Director/Technical Director
Lisa Reyes	Quality Assurance Program Manager
Janice Jaeger	Client Services Manager
Karen Bunker	Project Manager
Carl Beechler	Project Manager
Deb Patton	Project Manager
Vicky Collom	Quality Assurance Assistant (QA documents)

Columbia Analytical/Rochester QA Program Documents

Software Quality Assurance Plan	7/11/05 QA Office
Master Logbook of Laboratory Logbooks	QA-1 and QA-12 QA Office
Thermometer Calibration Logbook	QA-2 QA Office
Signature Log	QA Office
Balance Service Records	QA Office
Spectrophotometer Verification Records	QA Office
Internal, External, and Performance Audits	QA Office
Management Reports	QA Office
Training Records	QA Office
QC Charts	QA Office
Non-Conformities	QA Office
SOP Master Copies	QA Office
Data Quality Objective Table	P:\QAQC\QA_DOCUM\QCLIMITS\QAMTBLS\2011\Revised ROC DQO 07012011.xls
Data Quality Checklists	P:\INTRANET\QAQC\DQChecklists
Training Database	P:\QAQC\QA_DOCUM\TRAINING\DATABASE\TrainApp.mdb
Training Plans	P:\INTRANET\QAQC\TRAINING\FORMS
DOC Templates	P:\QAQC\TRAINING\Template_IDC
MDL Summaries	P:\QAQC\MDLs\Client Copies Scanned MDL Summaries-LOCKED 2010
Method Development Form	P:\INTRANET\QAQC\SOPS\Method Development.doc
Certificates and Accreditations	P:\INTRANET\QAQC\CAS Rochester Certs
Certification Summary Table	P:\QAQC\QA_DOCUM\Qam\QAM 22\Certs 09222011.DOC
Certification Master Table	P:\QAQC\QA_DOCUM\CERT\Certification Master.xls
SOP Tracking List	P:\QAQC\QA_DOCUM\SOP\2010toc.xls
PT Tracking List	P:\QAQC\QA_DOCUM\PE\Tracking\PT tracking master.xls
PE Study Schedule	P:\QAQC\QA_DOCUM\PE\PESCHED.XLS
MDL Schedule	P:\QAQC\MDLs\MDL Schedule 2010.xls
NCAR Tracking	H:\NCAR TRACKING\NCAR Assignment and Tracking.xls
Organization Charts	Available through Corporate Intranet
Resumes	Available through Corporate Human Resources
Equipment List	P:\QAQC\QA_DOCUM\Qam\QAM 22\EquipList1032011.xls
Data Qualifiers	H:\FORMS\QUALIF_routine.DOC
Preventive Maintenance Table	P:\QAQC\QA_DOCUM\Qam\QAM 20\PM_TBL.XLS
PT Reports	P:\QAQC\QA_DOCUM\PE\Results
Lab Acronyms	Available through Corporate Intranet
Other Corporate Forms (see later in this Appendix)	Available through Corporate Intranet

Columbia Analytical Job Descriptions

Analyst I

Entry level analyst position within the laboratory. Employee performs routine tasks in the lab under close supervision or by following detailed instructions. Progressively learning methods and procedures commonly used. Entry level skills performed at this level include titrations, gravimetric, and volumetric measurements, and routine small instrument use. Duties performed are routine in nature with a limited number of alternatives available. Work is closely supervised and reviewed.

Analyst II

Analyst at this position is progressively developing a proficiency performing a variety of analyses including instrumental and wet chemistry techniques. He/she has a mastery of the basic laboratory skills and has the ability to work with moderate supervision following project assignment. Able to identify problems and take corrective action on own work within the range of alternatives available.

Analyst III

Analyst at this position is progressively developing a proficiency performing a variety of analysPosition requires a complete level of knowledge and understanding in a specific application of laboratory principles and practices. An analyst at this level should be proficient in applicable scientific procedures and techniques to independently conduct tests or experiments for scientific projects as assigned and provide initial analyses of results for the supervisor.
Performs non-routine assignments of substantial variety and complexity under general supervisory direction. Receives objectives and technical advice from supervisor of project scientist. Compiles data and computes results on a variety of scientific procedures and techniques according to standard operation procedures. May assist in the training of junior analysts and technical assistants.es including instrumental and wet chemistry techniques. He/she has a mastery of the basic laboratory skills and has the ability to work with moderate supervision following project assignment. Able to identify problems and take corrective action on own work within the range of alternatives available.

Senior Analyst

Position requires an advanced level of knowledge and understanding of vocational field containing recognized formal principles and practices, complete knowledge in multiple fields, or full competence in a specialized skill or field encompassing the major business function of the Company. Examples of such skill areas would include gas chromatography, mass spectrometry, emissions spectrometry, AA, TOC, and TOX.
Position may direct work of other analyst, as lead analyst on an on-going basis, or as a project analyst on a project basis.
Performs non-routine and complex technical assignments involving responsibility for planning and conducting a complete project of limited scope or a portion of a larger and more diverse project.
Requires well-developed interpersonal skills in training junior analysts and assisting scientists with assigned tasks.

Scientist I

As an entry-level scientist, the focus is on developing basic laboratory skills, learning routine tests, and using some instrumentation. Progressively learning and utilizing entry level applications of specialized methods, techniques, and instrumentation, including AA, IPC, and GC. Performs competently with entry-level scientific instrumentation and methods and is responsible for data interpretation, quality control, and reporting of own work. May prepare, or assist in preparing, standard operating procedures, and specifications for process and test. Handles routine maintenance and troubleshooting of instrumentation. Develops quality assurance skills, supervisory responsibilities, technical report writing, and project managements skills. May assist in training of analysts and technical assistants, and instruct lower level staff on routine project set-ups. Will assist the supervisor and/or senior scientists in setting up more complex procedures.
Requires moderately close supervision by experienced staff.

Scientist II

Performs work requiring the application of a specialized field of chemical analysis and ingenuity in the independent evaluation, selection, and adaptation of standard methods and techniques. Progressively learning and utilizing intermediate applications of specialized methods techniques. Performs competently with entry-level scientific instrumentation and methods and is responsible for data interpretation, quality control, and reporting of own work. Prepares standard operating procedures and specifications for process and test. Handles routine maintenance and troubleshooting of instrumentation.
Progressively developing quality assurance and project management skills, becoming involved with more complex analytical systems, technical report writing, and possible client interface. May assist in training of analyst and technical assistants, and instruct lower level staff on more complex project set-ups. Will assist the supervisor and/or senior scientists in setting up more complex procedures.
Works independently with only moderate supervision by experienced staff.

Scientist III

Performs work requiring the application of a specialized field of chemical analysis and ingenuity in the independent evaluation, selection, and adaptation of standard methods and techniques. Progressively learning and utilizing intermediate applications of specialized methods techniques. Performs competentlyPerforms work requiring the application of a specialized field of chemical analysis and ingenuity in the independent evaluation, selection, and adaptation of standard methods and techniques. May have expertise in several areas of analytical chemistry or have specific skills in a highly specialized, technical operation, such as GC/MS or metals analysis. Performs competently with intermediate to advanced interments and methods and is responsible for data interpretation, quality control and reporting of own work. Prepares standard operating procedures and specifications for process and test. Handles routine maintenance and troubleshooting of instrumentation.
Progressively developing quality assurance skills, supervisory responsibilities, and project management skills, becoming involved with more complex analytical systems, technical report writing, and client interface. May assist in training of analysts and technical assistants, and instruct lower level staff on more complex project set-ups. Will assist the supervisor and/or senior scientists in setting up more complex procedures.
May serve as a team leader, or back up supervisor, overseeing three to eight employees. As such, will be responsible for ensuring conformance to company policies and applicable laws and

regulations. Responsibilities may include interviewing, selecting and training employees; planning, assigning and directing work; evaluating performance; rewarding and disciplining employees; and addressing complaints and resolving problems. May be asked to perform other duties of a similar nature or level of responsibility.
Works independently, with only moderate supervision by experienced staff. with entry-level scientific instrumentation and methods and is responsible for data interpretation, quality control, and reporting of own work. Prepares standard operating procedures and specifications for process and test. Handles routine maintenance and troubleshooting of instrumentation.
Progressively developing quality assurance and project management skills, becoming involved with more complex analytical systems, technical report writing, and possible client interface. May assist in training of analyst and technical assistants, and instruct lower level staff on more complex project set-ups. Will assist the supervisor and/or senior scientists in setting up more complex procedures.
Works independently with only moderate supervision by experienced staff.

Scientist IV

Typically viewed as the department or laboratory technical specialist for particular area of expertise. At this level, the laboratory scientist's career path begins to fork in two directions. Those exhibiting both the desire and ability for management will enter the management track, while those whose strength and interests lie more in the scientific realm will follow this one. There may, however, be lateral movement between the two tracks.
A senior level scientist performs work requiring the application of a specialized field of chemical analysis and ingenuity in the independent evaluation, selection, and adaptation of standard methods and techniques. Performs competently with complex instruments and methods and is responsible for data interpretation, quality control and reporting of own work. Plans, conducts, and supervises (as a lead) complex analyses requiring advanced instrumentation such as IPC/MS, GC/MS, and GC. Handles routine and advanced maintenance and troubleshooting of instrumentation.
Works comfortably with complex analytical systems, technical report writing, and client interface. Assists in training of staff scientist, analysts and technical assistants, and instructing entry level staff on more complex project set ups. Will assist the supervisor and/or other senior scientists in setting up more complex procedures. Serves as technical advisor for teams and projects. May be asked to perform other duties of a similar nature or level of responsibility. May present formal technical training seminars to both clients and staff.
Works independently, under little supervision.

Project Manager

A project manager is an individual who works with customers to determine their analytical needs, coordinates with CAS laboratory and administrative staff to ensure that these needs are understood, and ensures that the service CAS provides adequately meets these defined needs.

1. Client Responsibilities
   - Establish a working relationship with client.
   - Identify clients analytical needs and how the lab can address these needs.
   - Plan analytical program to meet these needs.
   - Keep client informed of progress of work.
   - Report findings and results back to client.
   - Communicate client concerns/issues to lab management.
   - Keep client informed of new developments and lab services.
   - Provides quotations and job specifications for specific work.
2. Project Responsibilities
   - Work with client and lab to define project specifications.
   - Communicate project schedule to lab.
   - Work with Sample Management to ensure proper type and number containers are provided.
   - Review incoming work to ensure work requests are properly specified according to project requirements.
   - Track as required projects through the lab keeping client and lab personnel appraised of progress.
   - Prepare, review, and approve invoices for specific work orders.
3. Reporting and QA/QC Responsibilities
   - Ensure consistent reporting formats for clients.
   - Review reported data against historical results for consistency.
   - Responsible for meeting QA objectives for specified projects.
   - Approves certified analytical reports.
   - Brings problems or issues relative to work to the QA Coordinator, Lab Operations, or Lab Management for study and resolution.
   - At times may be involved with QAP development.
   - May participate in specific marketing activities (i.e., trade show booths), if appropriate.
   - Identifies and communicates to management on new marketing opportunities and other issues.
   - Works closely with SMO, Lab Operations, QA/QC, and administrative staff to keep everyone informed as appropriate on client issues and projects.

Business Development Manager

Responsible for supporting the marketing efforts of a region's upper management, sales force, and technical staff. Accountable for the quality and timeliness of all work produced and for coordinating client development efforts with other branch offices. Establishes and maintains contact with smaller clients to market the company's services. Creates client awareness of company services and their applications. Develops and maintains a staff client orientation through training and team-building exercises. Conducts local market research, coordinates and recommends marketing strategies, identifies target markets, and is responsible for consolidating marketing plans into the branch business development plan. Budgets and controls annual business development expenditures while reviewing and approving branch activities and budgets to minimize redundancy and waste.
Prepares and updates an accurate Business Portfolio Analysis and Client Market Profile by branch. Coordinates and assists in developing strategic and tactical marketing plans for the region as well as for other local operations. Prepares standardized market information collection, distribution and utilization formats, and procedures for regional marketing staff use. Also conducts market analysis.

Quality Assurance Program Manager

Accountable for the conduct of the Quality Assurance (QA) program for a branch laboratory. Is generally responsible for all branch laboratory QA activities and maintaining QA related documents. Accountable for obtaining and maintaining certifications and accreditations and maintaining laboratory proficiency testing programs.
Responsible for the overall coordination of the laboratory QA program and for ensuring that quality objectives established by management, certification programs, and project plans are met. Responsible for Quality Assurance functions including the Quality Assurance Manual, documentation of certifications, documenting standard operating procedures, and maintaining proficiency testing records. Oversees balance calibration and sample storage temperature control. Maintains certifications/accreditations for regulatory agencies and client certification or approval programs. Acts as primary point of contact during laboratory audits and coordinates the audit schedule with laboratory and audit staff. Provides audit responses and initiates any changes in procedures resulting from an audit. Coordinates the analysts of proficiency testing samples required for certification/accreditation programs. Reports and reviews result s for these analyses. Conducts informal audits and makes recommendations for corrective action. Provides technical assistance to laboratory staff on QA/QC issues, project feasibility, and methods interpretation/development. Receives operational supervision from the Laboratory Direction; may receive general administrative supervision and guidance from the Corporate Chief Quality Officer.

Technical Director

Accountable for timely performance and quality of work assigned, and may be responsible for the work of a small department, including profit and loss responsibility for the unit. Under minimal direction, plans and manages all activities relating to specific laboratory operations or may operate within a key functional area such as client services. Assist in identifying project opportunities, developing proposals, and developing and maintaining client relationships. Manages administration and project schedules, provides technical consultation services to project teams, government agencies, and clients. Responsible for quality control of laboratory work including final review of all reports for specific area of responsibility or as required. Assures that work is being performed using appropriate technology. Attends trade shows and gives marketing and client presentations as required. Encourages and directs development and application of state-of-the-art methodologies and techniques.

Personnel responsibilities include coordination of unit workloads, conducting employee performance reviews, recommending personnel changes, additions, and participation in recruiting process. Marketing responsibilities may include attending trade shows and professional conferences, authoring technical papers, and contacting existing clients and new clients to market company's capabilities.

Has high level role in data evaluation and report responsibility. Supervises, trains and develops scientists, supervisors, analysts, and technician assistants. Monitors work load and project flow through self or assigned team leaders. Monitors adherence to corporate safety plans and policies. High level client and regulatory agency contact. Participation in internal and external meetings involving project strategy and major technical issues. Monitors and reviews budget and schedule status of projects with supervisors. High financial responsibility for profit and loss considerations. Works with regional senior management in short- and long-range planning, e.g., staff requirements, primary areas of technical development, marketing program. May be asked to perform other duties of a similar nature or level of responsibility.

Laboratory Director

Accountable for the growth and profitability of a medium-sized branch office. Is generally responsible for all branch office staff, client relations, and marketing. Accountable for the quality and timeliness of all work produced and for coordinating work efforts with other branch offices.
Responsible for all operations within assigned region, including personnel, scheduling, coordination of daily project field and office activities. Supervised operations normally include SMO, facilities, administration, laboratory operations, and related activities. Maintains close working relationships with clients and staff and plays a key role in conflict resolution.
Directs and monitors the activities of the branch office through the appropriate supervisors, technical and administrative managers. Formulates and recommends to the Regional Regional Managers and/or President policies, procedures, plans and programs for the branch office that are commensurate with the overall objective of the region. Formulates and recommends to the Regional Regional Managers and/or President an annual operating budget for the branch office and conducts operations within approved budget limits.
Reviews and approves organizational and key staffing assignments within the branch office. Directs periodic status reviews of major projects to ensure that technical and quality standards are being met and that the performance is within budget and schedule. Participates, as required, in project and management reviews of proposals, reports, and client contract negotiations, including final pricing of proposals. Provides counsel and information about the project's feasibility.
Responsible for branch office programs and procedures, including staff planning and development, personnel administration, and compliance with corporate policies and procedures. Stays abreast of technological developments and trends which could lead to new applications or markets, Responsible for maintaining proper and timely controls over all branch office work, ensuring that billability targets and overall profitability goals are met. Maintains good client relations and actively pursues expansion of new clients and business lines in conjunction with regional and corporate marketing goals.
Receives operational supervision from the Regional Managers and/or President; may receive general administrative supervision and guidance from the regional CAO.

Columbia Analytical Services, Inc.

Corporate QA Standard Operating Procedures, Policies, and Forms

Page 1 – SOPs

SOP TITLE	SOP Code	Rev	SOP Date	Date of Last
SOP for Checking New Lots of Chemicals for Contamination	ADM-CTMN	5	5/2/11	5/4/11
SOP for Control Limits	ADM-CTRL_LIM	7	12/14/09	12/22/10
SOP for Corrective Action	ADM-CA	6	9/15/09	9/22/10
SOP for Data Recall	ADM-DATARECALL	0	9/21/07	11/22/10
SOP for Document Control	ADM-DOC_CTRL	8	9/15/09	9/22/10
SOP for Documentation of Training	ADM-TRANDOC	12	4/28/11	5/15/11
SOP for Estimation of Uncertainty of Measurements	ADM-UNCERT	6	9/23/10	9/29/10
SOP for Handling Customer Feedback	ADM-FDBK	5	12/14/09	12/22/10
SOP for Making Entries into Logbooks and onto Analytical Records	ADM-DATANTRY	9	9/27/10	9/29/10
SOP for Managerial Review of the Laboratory's Quality Systems and Testing Activities	ADM-MGMTRVW	4	5/2/11	5/5/11
SOP for Manual Integration of Chromatographic Peaks	ADM-INT	4	10/5/10	10/9/10
SOP for Method Development, Investigation, and Transfer	ADM_MDEV	0	6/16/11	6/16/11
SOP for Performing Method Detection Limit Studies and Establishing Limits of Detection and Quantitation	ADM-MDL	9	9/8/09	9/21/10
SOP for Preparation of Electronic-data for Organic Analyses for Electronic-data Audits	ADM-E_DATA	3	8/29/07	11/22/10
SOP for Preparation of SOPs	ADM-SOP	10	12/20/10	12/22/10
SOP for Preventive Action	ADM-PA	1	12/14/09	12/22/10
SOP for Proficiency Testing Sample Analysis	ADM-PTS	3	9/22/10	9/29/10
SOP for Purchasing and Approval of Vendors	ADM-PUR	4	10/15/09	10/5/10
SOP for Qualification of Subcontract Laboratories	ADM_SUBLAB	5	9/15/09	9/22/10
SOP for Significant Figures	ADM-SIGFIG	8	1/28/09	1/13/10

Columbia Analytical Services, Inc.

Corporate QA Standard Operating Procedures, Policies, and Forms

Page 2 – Policies

POLICY TITLE	POLICY DATE	DATE APPROVED	DATE EFFECTIVE
CAS Quality and Ethics Policy Statement	September 2010	9/28/10	9/28/10
Policy for Data Review and Validation	September 2010	9/9/10	9/10/10
Policy for Internal Quality Assurance Audits	May 2009	5/5/09	7/1/09
Policy for Standards and Reagents Expiration Dates	September 2009	9/15/09	9/28/09
Policy for Use of Accreditation Organization's Name, Symbols, and Logos	September 2009	9/21/09	10/1/09
Policy for Conducting Research, Method Development, and Method Investigations	December 2009	12/15/09	12/17/09 Replaced by SOP 7/1/11

Columbia Analytical Services, Inc.

Corporate QA Standard Operating Procedures, Policies, and Forms

Page 3 – Forms

FORM	FILE NAME	DATE
Audit Finding Response Form	Audit Finding Response Form_r042110	4/21/10
CASED Employee Development Plan Template	CAS EDP Template_033011_form only.doc	3/30/11
Complaint Report	Complaint Report_r121509	12/15/09
Critical Job Function Authorization Statement	Critical Job Function Authorization Statement_r071206	7/12/06
Data Re-submittal Request Form	Data Resubmittal Request Form_r112107	11/21/07
Demonstration of Capability Certification Statement (no table version)	DOC Certification Statement_r071206-	7/12/06
Demonstration of Capability Certification Statement	IDC Certification Statement_r032503	3/25/03
Extraction Solvent Critical Consumables Evaluation	Extraction Solvent Critical Consumables Evaluation_r050311.doc	5/3/11
Laboratory Training Certification	LAB-TRNG_r092109	9/21/09
Metals Critical Consumables Evaluation	Metals Critical Consumables Evaluation_r050311.doc	5/3/11
Method Detection Limit Study Calculation Spreadsheet	MDL_FORMR4_r030510	3/5/10
New Vendor Evaluation	Vendor Evaluation Form_r101509	10/15/09
Nonconformity and Corrective Action Report	NCAR09_r092109	9/21/09
Quarterly QA Report to Management Template	Quarter QAReport Template 012511r1	1/25/11
Preventive Action Report	PA Report_r072108	7/21/08
Procedure Change Form	Procedure Change Form_r121610	12/16/10
Reagent/Consumable Critical Consumables Evaluation	Reagent Critical Consumables Evaluation_r050311.doc	5/3/11

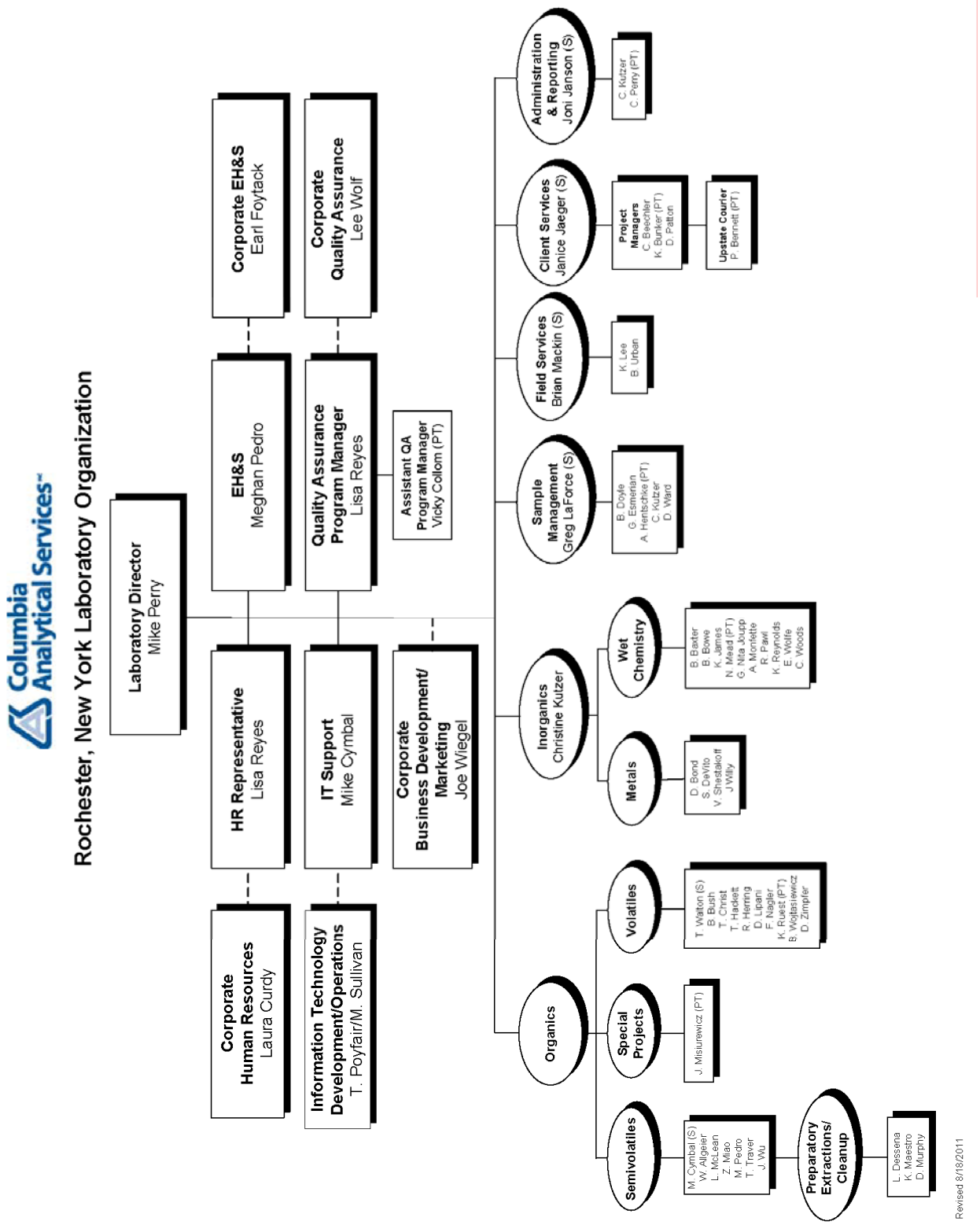
Columbia Analytical Services, Inc.

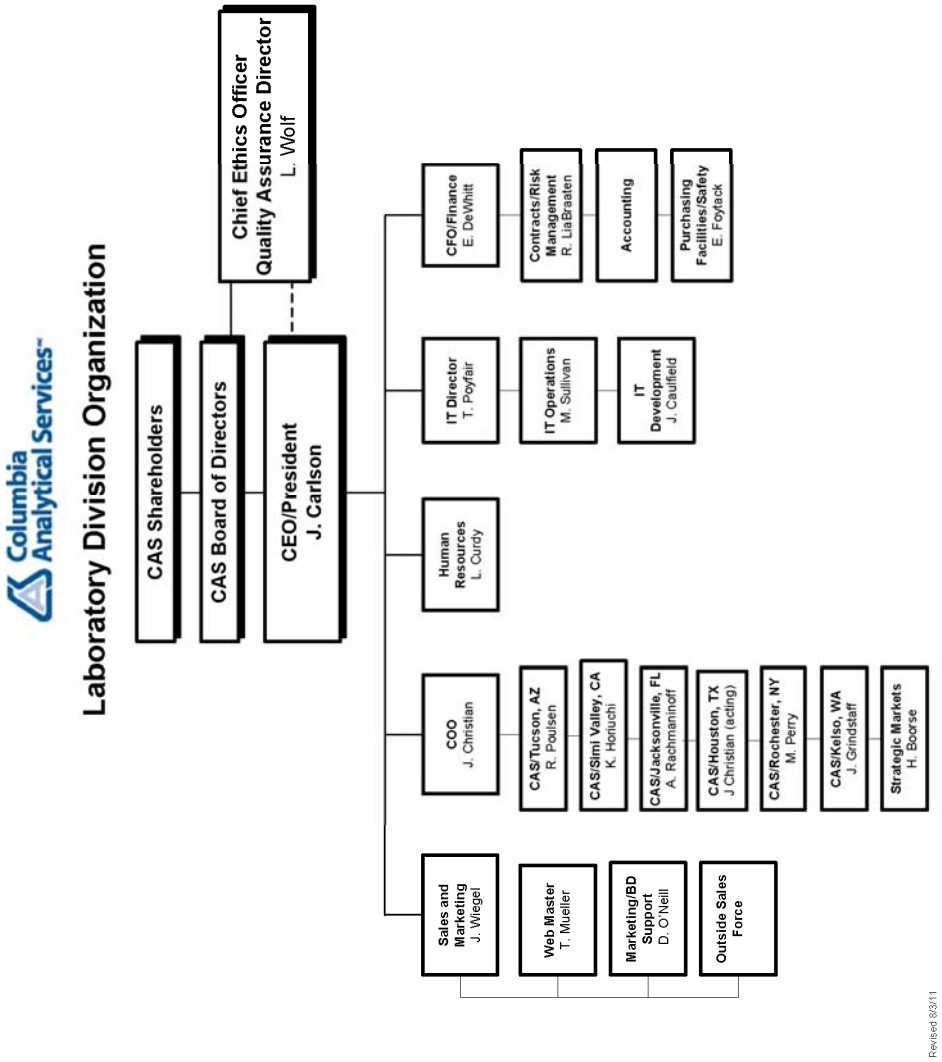
Corporate QA Standard Operating Procedures, Policies, and Forms

Standard Operating Procedure Change Form	SOP Change Form_r092109	9/21/09

APPENDIX B
ORGANIZATIONAL CHART AND RESUMES OF KEY PERSONNEL

Please note that the Appendices provide current information at the time of the revision, but are updated only upon annual review. Please contact the laboratory for up-to-date information.





MICHAEL K. PERRY

1996 TO PRESENT

Columbia Analytical Services, Inc., 1 Mustard St., Suite 250, Rochester, NY 14609 (585) 288-5380

Current Position Responsibilities

LABORATORY DIRECTOR/TECHNICAL DIRECTOR – 1996 to Present

Primary responsibilities include management of all laboratory departments, scheduling, productivity, reporting and evaluation of analytical methodologies, project planning and Quality Assurance/Quality Control protocols. In addition, other responsibilities include direct responsibility for contracts and consultants relating to the EPA SITE program, ACOE remediation program and the technical interface for the New York State ASP CLP program and other large national based clients.

Documentation of Demonstration of Capabilities is available for review.

Experience

Project Chemist, *General Testing Corporation, Rochester, New York*, 1995-1996. In addition to the duties of Laboratory Director listed below, responsibilities expanded to include the supervision of four teams of Project Chemists. Production management was shifted to the Laboratory Supervisors in order to increase client contact. Directly responsible for contracts and consultants relating to the EPA SITE program, ACOE remediation program and the New York State ASP CLP program.

Laboratory Director, *General Testing Corporation, Rochester, New York*, 1985-1995. Primary responsibilities included management of all laboratory departments, scheduling, productivity, reporting and evaluation of analytical methodologies and Quality Assurance/Quality Control protocols.

Instrument Manager, *General Testing Corporation, Rochester, New York*, 1979-1985. Responsibilities included operation and maintenance of all laboratory instruments and supervision of personnel associated with the instrumentation laboratory. Analyses included metals, volatile organics, pesticides/PCBs, and semi-volatile organics.

Senior Quality Assurance Technician, *Coca-Cola Corporation, Atlanta, Georgia*, 1976-1979. Responsible for analysis of raw materials and finished product using both wet chemistry and instrumentation techniques.

Laboratory Technician, *Penwalt Pharmaceutical Company, Rochester, New York*, 1975. Worked in the Quality Control Department.

Education

Coursework toward MS, Chemistry, *Rochester Institute of Technology, Rochester, New York*, 1983-1986
GC/MS, *ACS Short Course*, 1986
Effective Management of Chemical Analysis Laboratories, *ACS Short Course*, 1985
BS, Chemistry, *Georgia State University, Atlanta, Georgia*, 1979
AAS, Chemistry, *State University of New York at Alfred, Alfred, New York*, 1975

Affiliations

American Chemical Society

LISA M. REYES

1997 TO PRESENT

Columbia Analytical Services, Inc., 1 Mustard St., Suite 250, Rochester, NY 14609 (585) 2285380

Current Position / Responsibilities

QUALITY ASSURANCE/QUALITY CONTROL PROGRAM MANAGER – 1997 to Present

Responsible for the overall coordination of the laboratory QA program and for ensuring implementation and compliance with established quality objectives and quality systems at all times. Responsible for Quality Assurance functions including the Quality Assurance Manual, certifications, documenting standard operating procedures, and maintaining performance evaluation records. Oversees balance calibration and sample storage temperature control. Maintains certifications/accreditations for regulatory agencies and client certifications or approval programs. Acts as primary point of contact during laboratory audits. Provides audit responses and initiates any changes in procedures resulting from an audit. Ensures continuous process improvement through the use of control charts, performance evaluation samples and preventive action. Conducts internal audits and makes recommendations for corrective action and improving effective quality assurance and quality control. Ensures that all personnel understand their contributions to the quality system and that communication takes place at all levels within the laboratory regarding the effectiveness of the quality system, and evaluating the effectiveness of training.

Provides technical assistance to laboratory staff on QA/QC issues, project feasibility, and methods interpretation/development.

Documentation of Demonstration of Capabilities is available for review.

Experience

Environmental Chemist, *TreaTek-CRA Company/Conestoga-Rovers & Associates, Niagara Falls, New York,* 1992-1997. Data quality, assessments and validations of ASP, CLP, and SW-846 organic and inorganic analytical data. Liaison with analytical contract laboratories, CRA field personnel, and state and federal agencies. Prepared QAPPs, laboratory bidding documents, and contracts. Also responsible for performance of laboratory audits

Manager of Quality Management Office, *Huntingdon Analytical Services, Middleport, New York,* 1989-1992. Manager of QA for Environmental, Agrochemical, Asbestos, and Engineering Soil laboratories. Responsible for in-house QA/QC programs, inspections, and instrument maintenance. Also responsible for employee safety and hazardous waste training, as well as manifesting hazardous waste. Routinely performed inorganic analyses, and reviewed analytical data, reports, and CLP packages.

Research Assistant, *Research Foundation, State University of New York College at Brockport, Brockport, New York,* 1986-1989. Performed routine sampling of surface water and lakes. Also did inorganic analyses on water and soil matrices. Assisted in graduate projects dealing with fish, plankton, water chemistry, and crayfish.

Education

CLP Inorganic Data Validation, *US EPA Region II, Westchester Community, Westchester, New York,* 1993.
CLP Organic Data Validation, *US EPA Region II, Westchester Community, Westchester, New York,* 1992.
BS, Biology, *State University of New York at Brockport, Brockport, New York,* 1988

Affiliations

American Chemical Society

JANICE M. JAEGER

1996 TO PRESENT

Columbia Analytical Services

Columbia Analytical Services, Inc., 1 Mustard St., Ste. 250, Rochester, NY 14609 585.288.5380

Current Position	**CLIENT SERVICES MANAGER I**, 2004-Present
Responsibilities	Responsible for the supervision of Project Managers, Sample Management Office (SMO) and Reporting Departments. Assist clients to determine what analyses are required. Oversee projects from quote initiation to final report submission. Act as liaison between client requirements and laboratory capabilities for projects. Update clients on progress if their project and answer any questions they may have. Respond promptly to client requests and develop new client contacts within and outside of our current client base. **Documentation of Demonstration of Capabilities is available for review.**
Experience	**Project Manager III**, *Columbia Analytical Services, Rochester, NY*. 1996-2004. Assist clients to determine what analyses are required. Responsibilities primarily as above without the supervisory role. **Customer Service Representative/Sample Receiving**, *General Testing Corporation, Rochester, New York*, 1989-1996. Primary responsibilities included client services as listed above. Also responsible for sample receipt, log in and distribution as well as bottle preparation. **Surgical Assistant**, *Penfield Veterinary Hospital Rochester, New York*, 1984-1989. Primary responsibilities included preparation of instruments, surgical area, and animal for surgery. Also responsible for monitoring the animal before and after surgery.
Education	**BA, Pre-Veterinary Medicine and Pre-Professional Zoology (double Major)**, *Ohio Wesleyan University, Delaware, Ohio*, 1983.

CHRISTINE M. KUTZER

1996 TO PRESENT

Columbia Analytical Services™

Columbia Analytical Services, Inc., 1 Mustard St., Ste. 250, Rochester, NY 14609 585.288.5380

Current Position	**TECHNICAL MANAGER II, INORGANICS LABORATORY** – 2004 to Present
Responsibilities	Plans and manages all activities in the Inorganics Department, including Metals and General Chemistry. Responsible for coordinating the workload and scheduling employees' daily activities. Assist in the operation, troubleshooting, and maintenance of instrumentation. Responsible for scheduling samples. Accountable for analytical data entry, analytical data approval and High Level metals package generation through MARRS. **Documentation of Demonstration of Capabilities is available for review.**
Experience	**Technical Manager II, Metals and Organics Prep Laboratories,** *Columbia Analytical Services, Inc., Rochester, New York,* 2002-2004. Duties as above for Metals Department. Responsible for coordinating the workload and scheduling employees' daily activities and troubleshooting in the organics preparation laboratory. **Technical Manager I, Metals Laboratory,** *Columbia Analytical Services, Inc., Rochester, New York,* 1996-2002. Duties as above for Metals Department. **Analyst III,** *Columbia Analytical Services, Rochester, New York,* 1996. Responsible for instrument troubleshooting and maintenance, digestion of samples, and TCLP extractions. Also responsible for data entry, approval, and package review. **Chemist,** *General Testing Corporation, Rochester, New York,* 1992-1996. Duties were as listed above.
Education	**BS, Chemistry,** *St. Bonaventure University, Olean, New York,* 1992

Revised: 2/26/2008

MICHAEL W. CYMBAL

1996 TO PRESENT

Columbia Analytical Services

Columbia Analytical Services, Inc., 1 Mustard St., Ste. 250, Rochester, NY 14609 585.288.5380

Current Position	**TECHNICAL MANAGER I** - Information Technology 1998 to Present - Extractables Department Supervisor 2004 to Present
Responsibilities	Responsible for computer systems (Novel Lan, Starlims) and instrument analysis of software. Also responsible for client spreadsheets and disk deliverables, computer maintenance and upgrades. Responsible for the oversight of the extractables department including extactions and instrumental analysis (HPLC, GC, and GC/MS). **Documentation of Demonstration of Capabilities is available for review.**
Experience	**Systems Analyst III,** *Columbia Analytical Services, Inc., Rochester, New York,* 1997-1998. Duties primarily as above. **Systems Analyst I,** *Columbia Analytical Services, Inc., Rochester, New York,* 1996-1997. Duties primarily as above. **Computer Administration,** *General Testing Corporation, Rochester, New York,* 1995-1996. Oversaw computer systems (Novel Lan, StarLIMS, Seven Reporting Systems) and created client spreadsheets and disk deliverables. **Analyst,** *General Testing Corporation, Rochester, New York,* 1990-1995. Responsible for Organic Analyses (Volatile and Semi-Volatile Pesticides) for GC and GC/MS. Also responsible for Instrument Maintenance and Sample Preparation.
Education	**BS, Chemistry,** *Robert's Wesleyan College, Rochester, New York,* 1990.

Revised: 2/26/2008

THOMAS WALTON

2006 TO PRESENT

Columbia Analytical Services

Columbia Analytical Services, Inc., 1 Mustard St., Ste. 250, Rochester, NY 14609 585.288.5360

Current Position	**TECHNICAL MANAGER I, GC/VOA LABORATORY** – 2009 to Present
Responsibilities	Responsible for the daily operations of the GC/MS laboratory, including the scheduling of department analyses, instrument calibration, and troubleshooting/maintenance activities. Accountable for personnel training, data approval, quality program support.
	Documentation of Demonstration of Capabilities is available for review.
Experience	**Scientist IV**, *Columbia Analytical Services, Rochester, New York*. 2006-2009. Responsible for GC/MS analysis of air for presence of volatile organic compounds, data reduction and preparation of data for reporting. Also responsible for instrument maintenance as needed.
	Chemist, *Eastman Kodak Company, Rochester, New York*, 1989-2005. Analytical Chemist supporting environmental and industrial hygiene testing, equipment and process monitoring; method development, and quality control; and experience with EPA methods TO-15, 8015, 8260, and 8270.
Education	**BS, Chemistry**, *Suny at Cortland, Cortland, New York*, 1985.

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MEGHAN D. PEDRO

2001 TO PRESENT

Columbia Analytical Services

Columbia Analytical Services, Inc., 1 Mustard St., Ste. 250, Rochester, NY 14609 585.288.5380

Current Position	**SCIENTIST III** – 2004 to Present
	Environmental Health and Safety Program Manager – 2009 to Present
Responsibilities	Supervision of the organics prep lab. Analysis of, and generation of reports, pesticides/PCBs, herbicides, and other miscellaneous analyses/extractions using GC/ECD. Prepares standards, surrogates and spikes.
	Administration of the laboratory health and safety policies, including formulation and implementation, supervision of new employee safety training, review of accidents, incidents and prevention plans, and the conducting of departmental safety inspections.
	Documentation of Demonstration of Capabilities is available for review.
Experience	**Scientist II**, *Columbia Analytical Services, Inc., Rochester, NY*, 2003-2004. Responsibilities were primarily as above without the supervisory role. Analysis of, and generation of reports, pesticides/PCBs, herbicides, and other miscellaneous analyses/extractions using GC/ECD. Prepares standards, surrogates and spikes.
	Scientist I, *Columbia Analytical Services, Inc., Rochester, NY*, 2002-2003. Analysis of, and generation of reports for, pesticides/PCBs, herbicides, and other miscellaneous analyses/extractions using GC/ECD. Prepares standards, surrogates and spikes.
	Senior Analyst, *Columbia Analytical Services, Inc., Rochester, New York*, 2001-2002. Extraction, concentration, and clean-up of water, soil and oil samples for Semi-VOA compounds using EPA methodologies.
	Prior work history is not relevant to laboratory position.
Education	**BS, Chemistry,** *Nazareth College, Rochester, New York*, 2000.

Revised: 8/14/2009

MARK WILSON
1996 TO PRESENT

Columbia Analytical Services

Columbia Analytical Services, Inc., 1 Mustard St., Ste. 250, Rochester, NY 14609 585.288.5380

Current Position	**SENIOR ACCOUNT MANAGER/DIRECTOR OF BUSINESS DEVELOPMENT II**– 2004 to Present
Responsibilities	Responsible for Large Account Management. Responsible for sales maintenance for the Rochester laboratory territory including coordination of marketing and sales with national sales team.
	Documentation of Demonstration of Capabilities is available for review.
Experience	**Client Services Manager**, *Columbia Analytical Services, Rochester, NY*, 1996-2004. Responsible for supervision of Project Chemists, sales staff, Sample Management Office (SMO) and reporting departments. Responsible for project management and client interface regarding analytical services.
	Laboratory Manager, *Columbia Analytical Services, Rochester, New York*, 1996. Responsible for supervision of laboratory staff, scheduling of projects, evaluations of analytical QC procedures, and review of all analytical data.
	Laboratory Manager, *General Testing Corporation, Rochester, New York*, 1992-1996. Responsibilities were primarily same as above.
	Assistant Laboratory Director, *General Testing Corporation, Rochester, New York*, 1988-1992. Was responsible for assisting lab director with supervision of lab staff, scheduling of projects, evaluations of analytical and QC procedures, and review of all analytical data.
	Organics Department Manager, *General Testing Corporation, Rochester, New York*, 1986-1996. Responsible for supervising all organics analyses including GC/MS, GC volatile organics, and GC extractables, and coordinating production and method development.
	Organic Extractables Manager, *General Testing Corporation, Rochester, New York*, 1985-1992. Was responsible for GC operation and analysis, GC maintenance, trouble shooting, development, and GC/MS operation and start up.
	Staff Technician II, *Medical Center University of Kentucky, Lexington, Kentucky*, 1979-1985. Was responsible for GC and AA analysis on biological fluids, drug screening and monitoring, heavy metals analysis, thin-layer chromatography, HPLC, and water testing.
Education	**BS, Medical Technology with 32 hours of Chemistry**, *State University of New York at Buffalo, Buffalo, New York*, 1978.

JAMES M. CARLSON

1999 TO PRESENT

Columbia Analytical Services

Columbia Analytical Services, Inc., 1317 South 13th Ave., Kelso, WA 98632 360.577.7222

Current Position

PRESIDENT AND CHIEF EXECUTIVE OFFICER – 2010 to Present

Responsibilities

Responsible for overall management direction and coordination of all business activities, develops and implements business plans. Works closely with Branch Managers, and support staff, including Financial and Administration. Approves all policies, procedures, plans, and programs for the company and ensures their conformity with corporate guidelines and policies. Approves annual operating budgets for the branch offices and ensures operations perform within approved budget limits. Stays abreast of technological developments and trends, which could lead to new applications or markets. Maintains good client relations and actively pursues expansion of new clients and business lines in conjunction with regional and corporate marketing goals.

Experience

CHIEF OPERATING OFFICER (COO), *Columbian Analytical Services, Kelso, Washington,* 1999-2010. Responsible for oversight of operating units of Columbia Analytical Services, inc. with all Laboratory Directors reporting to the COO. Primary responsibilities include establishment of consistent quality, technical, and client service enhancements across the company, as well as the financial performance of the individual operating units. In addition, a significant role is to represent operations as a member of the Senior Management Team (SMT) consisting of the Chief Executive Officer, Chief Financial Officer, Chief Quality Officer, and the Director of Information Technology

Financial Services Manager, *BHP Coated Steel Corporation, Kalama, Washington,* 1997-1999. Developed and managed the financial accounting and services department for a two-plant facility with revenues exceeding $200 million. Supervised a staff of 11 and provided shared services for five organizations. Responsible for all internal and external financial reporting and audit requirements. Additional duties included supporting the general management team as relief CFO and acting as a meeting and process facilitator.

Finance and Administration Manager, *BHP Diamonds, Inc., Yellowknife, Northwest Territory, Canada,* 1993-1997. Developed and managed effective accounting, financial reporting, purchasing, and logistics systems for the start up of the BHP/Blackwater NWT Diamond Project in the high Arctic. Negotiated and administered contracts related to the supply of goods, services, and facilities for the construction and administration of the 100 person camp, including the development of HR, safety, and security systems. Participated in the general management team, including extensive public relations regarding the project's environmental and socioeconomic impacts. Participated in negotiations involving aboriginal, provincial, and the Canadian federal government.

Accounting and Administration Manager, *BHP Exploration, Herndon, Virginia,* 1992-1993. Controller and administration manager for BHP's world coal and industrial minerals programs. Oversight of 12 international office locations, including the 40-person office in Herndon, Virginia, and 30 international exploration and geophysical projects. Responsible for all aspects of office and accounting administration, including international and domestic staffing. Retained local external accounting and legal services in foreign locations and negotiated foreign labor agreements.

Senior Accountant, *BHP Western US Mining, Farmington, New Mexico,* 1989-1992. Responsible for general ledger, equipment, and fixed asset accounting for three coal mines with a combined annual revenue exceeding $300 million. Also responsible for administration of royalties, taxes, and land lease obligations with external entities, including governments, tribes, and individual landowners; preparation of monthly business reports; annual budgets; and ten-year forecasts. Trained developing accountants in major mining accounting and administration.

Management Trainee, *Financial Management Development Program, BHP Utah International, San Francisco, California,* 1986-1989. Performed three one-year training assignments within the BHP Minerals San Francisco office. One year of consolidation accounting, one year of exploration accounting, and one year of financial planning and analysis.

Education

Leading Organizational Change Program, *BHP, Kalama, Washington,* 1998.
Global Leadership Program 2, *BHP, Kota Kinabalu, Malaysia,* 1995.
Resident Management Course I, *BHP, Melbourne, Australia,* 1993.
BS, Business Administration/Accounting, *California State University, San Jose, California,* 1986.

JEFFREY D. CHRISTIAN

1989 TO PRESENT

Columbia Analytical Services

Columbia Analytical Services, Inc., 1317 South 13th Ave., Kelso, WA 98626 360.577.7222

Current Position	**CHIEF OPERATING OFFICER (COO)** – 2010 to Present
Responsibilities	Responsible for oversight of operating units of Columbia Analytical Services, inc. with all Laboratory Directors reporting to the COO. Primary responsibilities include establishment of consistent quality, technical, and client service enhancements across the company, as well as the financial performance of the individual operating units. In addition, a significant role is to represent operations as a member of the Senior Management Team (SMT) consisting of the Chief Executive Officer, Chief Financial Officer, Chief Quality Officer, and the Director of Information Technology.
Experience	**Vice President/Laboratory Director, Kelso Laboratory,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1993-2010. Responsible for all phases of laboratory operations, including project planning, budgeting, and quality assurance. **Operations Manager, Kelso Laboratory,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1992-1993. Responsibilities included directing the daily operation of the Kelso laboratory. Other responsibilities and duties included functioning as a technical consultant to clients, providing assistance in developing and planning analytical schemes to match client objectives, and writing and developing analytical procedures/methods. Also, served as Project Manager for State of Alaska Department of Environmental Conservation contract and Coordinator for EPA Special Analytical Services (SAS) contracts. **Project Chemist and Manager, Metals Analysis Laboratory,** *Columbia Analytical Services, Kelso, Washington,* 1989-1992. Responsible for directing the daily operation of the Metals Laboratory, including the sample preparation, AAS, ICP-OES, and ICP-MS Laboratories. **Scientist,** *Weyerhaeuser Technology Center, Federal Way, Washington,* 1986-1989. Responsibilities included supervising atomic spectroscopy laboratory which included flame and furnace AAS, ICP-OES, and sample preparation capabilities to handle a wide variety of sample types. Interfaced with internal and external clients to provide technical support. Wrote and developed analytical procedures/methods. **Lead Technician, Metals Lab,** *Weyerhaeuser Technology Center, Federal Way, Washington,* 1981-1986. Responsibilities included primary ICP and AAS analyst for EPA-CLP contract work. Extensive experience in wide variety of environmental and product-related testing. **Research Assistant,** *ITT Rayonier, Olympic Research Division, Shelton, Washington,* 1978-1981. Responsibilities included performing water quality tests, product-related analytical tests, corrosion tests (i.e., potentiometric polarization techniques), and operated pilot equipment specific to the pulp and paper industry.
Education	**B.S., Chemistry,** *Evergreen State College, Olympia, Washington,* 1993. **Coursework,** *Pacific Lutheran University, Tacoma, Washington.* 1988-1989. **Coursework,** *Tacoma Community College, Tacoma, Washington.* 1970-1971, 1988-1989. **CERTIFICATION, Chemistry,** *L.H. Bates Technical, Tacoma, Washington,* 1976-1978. **Coursework,** *Central Washington University, Ellensburg, Washington.* 1969-1970. **Numerous Training/Educational Activities via Conferences, Professional Seminars, and Factory Training,** 1989-2010.
Publications/ Presentations	*Mr. Christian has a number of publications and presentations. For a list of these publications and presentations, please contact CAS.*

LEE E. WOLF

1988 TO PRESENT

Columbia Analytical Services

Columbia Analytical Services, Inc., 1317 South 13th Ave., Kelso, WA 98626 360.577.7222

Current Position	**QUALITY ASSURANCE DIRECTOR AND CHIEF QUALITY OFFICER** – 2008 to Present
Responsibilities	Directing the overall corporate-wide quality systems and ethics programs for all CAS facilities. Responsible for ensuring that CAS quality systems and data integrity standards are implemented at all facilities. Act as liaison with government entities involving quality, technical and operational issues. Provide QA input and policy as needed for operations, development initiatives, special projects, planning, and information technology implementation. Provide assistance to QA Program Managers.
Experience	**Technical Manager IV, Quality Assurance Program Manager,** *Columbia Analytical Services, Inc., Kelso, Washington* – 2002 to 2008. As part of the management team, responsibilities included the overall management and implementation of the laboratory QA program. This included maintaining accreditations and certifications, and maintaining all necessary documents (QA Manual, SOPs, and QA records). Acted as primary point of contact during laboratory audits and provided audit responses and corrective actions. Coordinated performance audits (PE/PT testing) and conducted internal audits. **Scientist IV, Quality Assurance Program Manager,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1996-2002. Duties primarily as listed above. **Project Chemist/Principal Organic Scientist,** *Columbia Analytical Services, Inc., Kelso, Washington,* 1994-1996. Responsibilities included GC and GC/MS method development and special projects coordination. Acts as technical advisor to the GC and GC/MS laboratories and GC/MS interpretation specialist and CLP organics specialist. Also responsible for Project Chemist functions, including management of projects for clients, identifying client needs, and preparation of data reports. **Semivolatile Organics Department Manager,** *Columbia Analytical Services*, 1988-1994. Responsibilities included overall management of the department. Supervised GC/MS analyses, data review, reporting and related QA/QC functions. Responsible for supervision of staff, training, and scheduling. Beginning in 1992, responsibilities included being a Project Chemist for organics EPA-SAS and other clients. This involved scheduling projects for clients, identifying client requirements, and preparing data reports. **GC/MS Chemist,** *U.S. Testing Co., Richland, Washington*, 1985-1988. Responsibilities included GC and GC/MS analysis of water and soil samples for volatiles and semivolatiles by EPA protocol, including Methods 8240, 8270 and CLP. Coordinated extraction and GC-GC/MS areas to manage sample/data flow through the lab. Also performed HPLC analysis and pesticide analysis by GC using EPA Methods. **Laboratory Assistant,** *Eastern Washington University, Cheney, Washington,* 1985. Responsibilities included supervision and instruction of organic chemistry labs. Experience with GC and IR operation. Responsible for lab safety.
Education	**Pharmaceutical Laboratory Control Systems,** *Univ. of Wisconsin Short Course, Las Vegas*, 2004 **Test Method Validation in Pharmaceutical Development and Production,** *Univ. of Wisconsin Short Course, Las Vegas*, 2004 **Documenting Your Quality System**, *A2LA Short Course, Las Vegas, Nevada*, 1998. **Internal Laboratory Audits,** *A2LA Short Course, Las Vegas, Nevada*, 1998. **Mass Spectra Interpretation**, *ACS Short Course, Denver, Colorado*, 1992. **BS, Chemistry,** *Eastern Washington University, Cheney, Washington*, 1985.
Publications/ Presentations	*Selected Ion Monitoring: Issues for Method Development*, Panel Discussion, Association of Official Analytical Chemists, (AOAC) Pacific Northwest Regional Meeting, 1995. *Method Enhancement Techniques for Achieving Low level Detection of Butyl Tin in Marine Sediments and Tissues*, Association of Official Analytical Chemists (AOAC) Pacific Northwest Regional Meeting, 1994. *The Determination of Low-Level Concentrations of Polynuclear Aromatic Hydrocarbons (PAHs) in Soil and Water Using Gas Chromatography/Mass Spectroscopy Selected Ion Monitoring (GC/MS SIM)*, HazMat West, Long Beach, California, 1992.
Affiliations	American Chemical Society.

Revised: 2/26/2008

APPENDIX C
MAJOR ANALYTICAL EQUIPMENT

Please note that the Appendices provide current information at the time of the revision, but are updated only upon annual review. Please contact the laboratory for up-to-date information.

Please also note that many SOPs reference this Appendix (C) for control limits. These limits are now found in the Data Quality Objectives Table, as referenced in the Columbia Analytical/Rochester QA Program Documents Table in Appendix A.

Columbia Analytical Services
Rochester, NY

EQUIPMENT LIST

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
MASS SPECTROMETERS - VOAs					
GC/MS #5 (R-MS-05)	Gas Chromatograph	HP 5890II	3121A35679	VOAs	1991
	Mass Spec Detector	HP 5971	3118A02532		
	AutoSampler	Archon	12727		
	Concentrator	Tekmar 3000	98125008		
	Computer Workstation	Gateway P5-133	5360356		
	Computer Workstation	Dell Optiplex GX280	5M7KM71		
	Analytical Software Gateway	Enviroquant Chemstation G1032C v.c.01.00			
	Analytical Software Dell	Enviroquant Chemstation E.01.00.237			
GC/MS #6 (R-MS-06)	Gas Chromatograph	HP 6890	US00023178	VOAs	1998
	Mass Spec Detector	HP 5973	US82311143		
	AutoSampler	Archon			
	Concentrator	EST Encon	261043003		
	Computer Workstation	Gateway GP6-400	0013029323		
	Analytical Software	Enviroquant Chemstation G1701BA v.B.01.00			
GC/MS #7 (R-MS-07)	Gas Chromatograph	HP 5890II	3235A43994	VOAs	2001
	Mass Spec Detector	HP 5971	323A03964		
	AutoSampler	Archon	13589		
	Concentrator	Tekmar 2000	91267022		
	Computer Workstation	Compaq DeskPro	6124FR4ZD257		
	Analytical Software	Enviroquant Chemstation G1701BA v.B.01.00			

Columbia Analytical Services
Rochester, NY

EQUIPMENT LIST

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
GC/MS #8 (R-MS-08)	Gas Chromatograph	HP 5890II	3126A36850	VOAs	2004
	Mass Spec Detector	HP 5972	3435A01975		
	AutoSampler	EST Centurion	CENT145061104		
	Concentrator	EST Encon	374062504		
	Computer Workstation	Compaq DeskPro	6946CJM7M878		
	Analytical Software	Enviroquant Chemstation G1701BA v.B.01.00			
GC/MS #9 (R-MS-09)	Gas Chromatograph	HP 6890	US00029263	VOAs in air TO-15	2004
	Mass Spec Detector	HP 5973	US91922619		
	AutoSampler	Enteck 7016CA	00156		
	Concentrator	Enteck 7100	0088		
	Computer Workstation	HP Kayak XA	92181198		
	Analytical Software	Enviroquant Chemstation G1701BA v.B.01.00 Enteck Smart Lab 2000 v3.32			
GC/MS #10 (R-MS-10)	Gas Chromatograph	Agilent 6890N	CN10633045	VOAs	2006
	Mass Spec Detector	Agilent 5975B	US62723782		
	Purge and Trap	EST-Varian Archon	14702		
	Concentrator	EST Encon	ELEC-523103006E PATH-523103006P		
	Computer Workstation	Dell E520	8PT52C1		
	Analytical Software	Chemstation	D.03.00.552		
GC/MS #11 (R-MS-11)	Instrument	EST Markelov+R[46]C HS9000	HS137042108	VOAs	2008
	Gas Chromatograph	Agilent 6890N	US00033857		
	Mass Spec Detector	Agilent 5973	US94212218		
	Concentrator				
	Computer Workstation	HP Kayak xA	FR94720557		
	Analytical Software	HP Enviroquant 61701BA	B.0100		

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Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
GC/MS #12 (R-MS-12)	Gas Chromatograph	Agilent 6890	US00026365	VOAs	2008
	Mass Spec Detector	Agilent 5973	US71191002		
	Purge & Trap	Archon	15104		
	Concentrator	EST Encon	Elec-444071905E Path-444071905P		
	Computer Workstation	Dell	B78K571		
	Analytical Software	Chemstation	W6G86-222ZT-YK65P-N82JA		
GC/MS #13 (R-MS-13)	Gas Chromatograph	Agilent 7890A	CN10945114	VOAs in Air	2010
	Mass Spec Detector	Agilent 5975C	US94333887		
	Autosampler	Entech 7016CA	1262		
	PreConcentrator	Entech 7100A	1533		
	Computer Workstation	IBM 8212KUE	LKTAK9B		
	Analytical Software	Enviroquant Chemstation Core Software Software Upgrade Entech Smartlab v4.17b	USK0104163 91701EA		
Digital Display 1-Channel	Mass Flow Controller Digital Display	MKS Instruments 247C	92290101A	VOAs	2006
Digital Display 4-Channel		MKS Instruments 246B	94200203A	VOAs	2006
Flow Controller #1	Mass Flow Controllers	Model 1359C-10000SK	0258C10583442	VOAs	2006
Flow Controller #2		Model 1359C-00200SK	0258C10598442	VOAs	2006
Flow Controller #3		Model 1359C-000205SK	0258C15231304	VOAs	2006
Flow Controller #4		Model 1359C-00010SK	0258C10581442	VOAs	2006
SRI 8610C GC/FID #40 (R-GC-40)	Gas Chromatograph	SRI-8610C	N1813	TO-3 VOAs in AIR	2009
	Computer Workstation	Gateway GP6-400	0011809646		
	Analytical Software	Peak Simple v.3.78	N553W		
	Hydrogen Generator	Chrysalis II Hydrogen 100	TNM060615566		

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Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
MASS SPECTROMETERS -SVOAs					
GC/MS 5973A (R-MS-51)	Gas Chromatograph	HP 6890	US00024148	SemiVOAs/CLP	1998
	Mass Spec Detector	HP 5973	US82311266		
	AutoSampler	HP 7683	CN23021382		
	Injector	Agilent 7683	US10301831		
	Computer Workstation	Gateway GP7-600	17904248		
	Analytical Software	HP Chemstation B.02.05 EnviroQuant G1701BA v.B.01.00			
GC/MS 5973B (R-MS-52)	Gas Chromatograph	HP 6890	US00029105	SemiVOAs/CLP	1999
	Mass Spec Detector	HP 5973	US91911849		
	AutoSampler	HP7683	CN60738562		
	Injector	HP7683	CN23126455		
	Computer Workstation	HP Kayak XA6/400	US92280466		
	Analytical Software	HP Chemstation B.02.05 EnviroQuant G1701BA v.B.01.00			
GC/MS 5973C (R-MS-53)	Gas Chromatograph	Agilent 6890N (G1530N)	US10232036	SemiVOAs	2002
	Mass Spec Detector	Agilent 5973 (G2578A)	US21853642		
	AutoSampler	Agilent 7683 (G2614A)	US00307019		
	Injector	Agilent 7683 (G2613A) Agilent LVI being installed	US81501041		
	Computer Workstation	Gateway P7-450	13645026		
	Analytical Software	HP Chemstation Enviroquant G1701 v.D.00.00.38			

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Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
GC/MS 5973D (R-MS-54)	Gas Chromatograph	HP6890	US00025479	SemiVOAs	2008
	Mass Spec Detector	HP5973	DE82320565		
	AutoSampler	HP7683	CN74245816		
	Injector	HP7683	CN74143962		
	Computer Workstation	IBM Think Center	LKH2F83		
	Analytical Software	Chemstation G1701DA			
GC/MS 5975E (R-MS-56)	Gas Chromatograph	7890A	CN10391141	SemiVOAs	2010
	Mass Spec Detector	HP5975C	US1037615		
	AutoSampler	HP7693	CN10340022		
	Injector	HP7693	CN10340059		
	Computer Workstation	IBM Think Center	MXL0340NKM		
	Analytical Software	Chemstation G1701EA			

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Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
GAS CHROMATOGRAPHS - EXTRACTABLES					
HP5890(II)-B (R-GC-52)	Gas Chromatograph	HP 5890	2728A14298	Petroleum Hydrocarbons	1988
	Detector	FID	(integrated)		
	Autosampler	HP7673	3417A35264		
	Injector	HP7673	CN34222775		
	Controller	HP7673	CN00005087		
	Computer Workstation	HP KAYAK XA	US8345093		
	Analytical Software	HPChemstation B.02.05 EnviroQuant G1701BA v.B.01.00			
HP6890- D (R-GC-54)	Gas Chromatograph	HP 6890	22174	Pest/PCB/8011	1998
	Detector	Dual ECD			
	Injector	HP7683	US93408790		
	Autosampler	G2614A	US81800809		
	Computer Workstation	DELL	7BQRS71		
	Analytical Software	Enviroquant MSD Chemstation D.01.02.16 15 June 2001			
HP5890(II)- F (R-GC-55)	Gas Chromatograph	HP 5890II	2950A26574	Prop 65	1989
	Detector	Dual ECD			
	Autosampler	18596B	3032A22303		
	Injector	HP7673	3205A29661		
	Computer Workstation	HP Vectra XA 5/233	US81450241		
	Analytical Software	HP Chemstation v.B.02.05 EnviroQuant G1701BA v.B.01.00			
6890N- G (R-GC-58)	Gas Chromatograph	Agilent 6890N	US10520018	Herb/PCB	2005
	Detector	Micro ECD			
	Injector	Agilent G2913A	CN51624717		
	Autosampler	Agilent G2614A	CN51032422		
	Computer Workstation	DELL	7BQRS71		
	Analytical Software	Enviroquant MSD Chemstation D.01.02.16 15 June 2001			

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Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
HP5890(II)-H (R-GC-57)	Gas Chromatograph	HP 5890II	3336A56596	Alcohols/ WAPA	2005
	Detector	FID	(integrated)		
	Autosampler	18596C	US22508151		
	Injector	Agilent 6890			
	Controller	G1512A			
	Computer Workstation	HP KAYAK XA	US8345093		
	Analytical Software	HP Chemstation B.02.05 EnviroQuant G1701BA v.B.01.00			
6890N- I (R-GC-59)	Gas Chromatograph	Agilent 6890N	US10552066	Petroleum Hydrocarbons	2008
	Detector	FID			
	Injector	Agilent G2913A_7683B	CN60931630		
	Autosampler	Agilent G2614A	US92005373		
	Computer Workstation	DELL	818W761		
	Analytical Software	Chemstation D.02.00.275			
HP6890-J (R-GC-60)	Gas Chromatograph	Agilent 6890	US00039730	Method 18	2008
	Detector	FID			
	Injector	7683 Tower	de82400931		
	Autosampler	Agilent G2613A_7683	US04910055		
	Computer Workstation	Windows XP			
	Analytical Software	Agilent Chemstation 1701 H V2.00			
HP6890-K (R-GC-61)	Gas Chromatograph	Agilent 6890	US00008526	8015B	2008
	Detector	FID			
	Injector	7673 Tower	US72102123		
	Controller	G1512A	US72002014		
	Computer Workstation	Windows XP			
	Analytical Software	Agilent Chemstation 1701 A U2.00			

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Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
HP5890(II)-L (R-GC-56)	Gas Chromatograph	HP 5890II	2950A27718	Herb/PCB	1989
	Detector	Dual ECD			
	Autosampler	18596C	US3400814		
	Injector	Agilent 6890	CN22321966		
	Computer Workstation	HP Vectra XA 5/233	US81450241		
	Analytical Software	HP Chemstation v.B.02.05 EnviroQuant G1701BA v.B.01.00			

EXTRACTABLES SUPPORT EQUIPMENT

GPC	GPC	OI Analytical AP2000	A122330318	Cleanups	2002
RapidVap #1	Nitrogen Evaporation System	LabConco RapidVap	11296345E	Concentrations	2001
RapidVap #2	Nitrogen Evaporation System	LabConco RapidVap	20998065F	Concentrations	2002
RapidVap #3	Nitrogen Evaporation System	LabConco RapidVap	70975713	Concentrations	2007
N-EVAP	Organomation N-EVAP	Model 112	7531	Concentrations	

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Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
Hot Orbital Shaker		Armalab OR200	3560	Extractions	2004
Automated Soxhlet #1	Automated Soxhlet	Gerhardt SOX416	1/8465080006	Extractions	2008
Automated Soxhlet #2	Automated Soxhlet	Gerhardt SOX416	1/8465080007	Extractions	2008
Automated Soxhlet #3	Automated Soxhlet	Gerhardt SOX416	1/8465090004	Extractions	2009
Automated Soxhlet #4	Automated Soxhlet	Gerhardt SOX416	1/8465090005	Extractions	2009
Autoshaker#1	Lab-Line Extraction Mixer	Model 6000	0904-3735	Extractions	2004
Autoshaker#2	Lab-Line Extraction Mixer	Model 6000	0904-3736	Extractions	2004
Autoshaker#3	Lab-Line Extraction Mixer	Model 6000	0904-3737	Extractions	2004
SPE-DEX 4790#1	Solid Phase Extractor	Horizon	05-0593	Extractions	2005
SPE-DEX 4790#2	Solid Phase Extractor	Horizon	05-0595	Extractions	2005
SPE-DEX 4790#3	Solid Phase Extractor	Horizon	05-0594	Extractions	2005
Tekmar 500		TM-500	7460E	Sonication	
Tekmar 600		TM-600	13232	Sonication	
VibraCell #1		VC375	15144E	Sonication	
VibraCell#2		VC505	37629G	Sonication	

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Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
GAS CHROMATOGRAPHS - VOLATILES					
V2 (R-GC-02)	Gas Chromatograph	Varian 3300	4130	Alcohols/Gases	1999
	Detector	FID	(integrated)		
	Computer Workstation	Gateway 2000	0009092536		
	Analytical Software	Varian System Control v.4.51	D57543610		
V3 (R-GC-03)	Gas Chromatograph	Varian 3400	5442	VOAs	1999
	PID Controller	OIA 5200	A240213		
	PID Detector	OI 4430			
	ELCD Detector	OI 5220	C515520175		
	ELCD Controller	OI 5300	C449553665		
	AutoSampler	Varian Archon	13316		
	Concentrator	Tekmar 3000	98124003		
	Computer Workstation	Gateway 2000	10221502		
	Analytical Software	Varian System Control v.4.51	D57543610		
V4 (R-GC-04)	Gas Chromatograph	Varian 3400	15248	VOAs	2001
	PID Detector	OI 4436	OI1000		
	PID Controller	OI 5200	A218047		
	ELCD Detector	OI 5220	C515520175		
	ELCD Controller	OI 5300	C449553665		
	AutoSampler	Archon	13596		
	Concentrator	Encon	130122900 E/P		
	Computer Workstation	GP6-233	9767125		
	Analytical Software	Varian System Control v.4.5.2	D57543610		
HP1 (R-GC-05)	Gas Chromatograph	HP5890II	3121A35575	VOAs	2001
	PID Detector	OIA 4430	31030		
	FID Detector	(integrated)	-		
	AutoSampler	Tekmar 2016	89220008		
	Concentrator	Tekmar 2000	89013002		
	Sample Heater	Tekmar	91065008		
	Computer Workstation	Gateway GP5-233	9352344		
	Analytical Software	Varian System Control v.4.5.2	00159-1908-cd1-22bd		

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Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
T6 (R-GC-06)	Gas Chromatograph	Varian 3400	4143	VOAs/VPH/GRO	1998
	PID Detector	OI 4430	OI1006		
	FID Detector	Integrated	-		
	AutoSampler	Varian	12050		
	Concentrator	Tekmar 3100	US01225010		
	Computer Workstation	Gateway GP5-233	9352344		
	Analytical Software	Varian System Control v.4.5.2	00159-1a08-cd1-22bd		

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Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
HPLC					
HPLC02 (LC/MS) (R-HPLC-02)	Binary Pump	Agilent 1100	DE11108496	Perchlorate	2005
	Column Thermostat	Agilent 1100	DE11120893		
	Wellplate Autosampler	Agilent 1100	DE11300879		
	Sample Thermostat	Agilent 1100	DE82207519		
	MSD	Agilent G1946D	US12411208		
	Computer Workstation	HP Vectra	US12475439		
	Analytical Software	Chemstation for HPLC Rev.A.10.02			
HPLC03 (R-HPLC-03)	Binary Pumps	Shimadzu LCD10ADVP	1(A) C20963851348US 2(B) C20963851344US	Metabolic Acids Hydroquinone Tolytriazole PAHs	2005
	UV/VIS Detector	Shimadzu SPD10AVVP	C21004050470US		
	Fluorescence Detector	Waters 470	470-00067		
	Electrochemical Detector	BAS LC4C/CC5	LC-4C 7014		
	AutoSampler	Shimadzu SIL10ADVP	C21053850511US		
	System Controller	Shimadzu SCL10AVP	C21013851302US		
	Degasser	Shimadzu DGU 14A	101076		
	Temperature Control Module	Waters	TCM-001304		
	Computer Workstation				
	Analytical Software				
HPLC04 (R-HPLC-04)	Solvent Delivery System	HP1050	3019A00475	Formaldehyde UV-MISC	2007
	Variable Wavelength UV Detector	HP1050	3225J01126		
	Scanning Fluorescence Detector	HP1046A			
	AutoSampler	HP1050	LR47359C		
	Quaternary Pump	HP1050			
	Column Thermostat	HP1050			
	Analytical Software	Chemstation for HPLC Rev A.09.0E1206	Data Acquisition and Instrument Control		

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Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
HPLC05 (R-HPLC-05)	Degasser	Degasser G1322A	JP 7305035	Metabolic Acids/client specific	2007
	Binary Pump	Agilent 1100/G1312A	US70600653		
	Diode Array Detector	Agilent 1100/G1315B	DE11112376		
	AutoSampler	Agilent 1100/G1313A ALS	DE72003859		
	Analytical Software	Chemstation for HPLC Rev A 09.051206	Data Acquisition and Instrument Control		
HPLC06 (R-HPLC-06)	Detector	Agilent 1100/G1315A	US74901960	Explosives	2011
	Degasser	Agilent 1100/G1322A	JP73010194		
	AutoSampler	Agilent 1100/G1313A	US80603194		
	Quaternary Pump	Agilent 1100/G1310A	DE33206020		
	Temperature Control Module	Agilent 1100/G1316A	US54000565		
	Analytical Software	Chemstation for HPLC Rev A.09.03[1417]	Data Acquisition and Instrument Control		

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Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
METALS					
FIMS (R-CVAA-01)	CVAA-FIMS	Perkin Elmer	1258	Mercury	1997
	Computer Workstation	Soyata			
	Analytical Software	PE AA WinLab for Windows v.2.50			
4100ZL #2 (R-GFAA-01)	AA	Perkin Elmer AA 4100ZL	6245	Furnace Metals	1998
	Computer Workstation	Gateway GP6-400			
	Analytical Software	PE AA WinLab for Windows v.2.50			
Leeman Hydra AFG+ (R-CVAF-01)	CVAF	Leeman Hydra AFG+	112-00067-1	Low Level Mercury (Method 1631)	2004
	Computer Workstation	Dell Dimension 2400	35180912881		
	Analytical Software	WinHg Runner 1.5 CT Rev0.286	-		
ICP #1 (R-ICP-AES-01)	Instrument	Perkin Elmer Optima 3000XL	069N4060401	Metals	1994
	Computer Workstation	Gateway GP5-233	10221500		
	Analytical Software	PE ICP WinLab v.1.42			
ICP #3 (R-ICP-AES-03)	Instrument	Perkin Elmer 5300DV	077N5112802	Metals	2006
	Computer Workstation	Dell Optiplex GX620			
	Analytical Software	PE ICP WinLab v.3.1			
ICP #4 (R-ICP-AES-04)	Instrument	Perkin Elmer 5300DV	077N6052202	Metals	2010
	Computer Workstation	Dell Optiplex GX620			
	Analytical Software	PE ICP WinLab v.3.1			
ICPMS (R-ICP-MS-01)	SCIEX ICP/MS	Perkin Elmer Elan 9000	PO370203	Metals	2002
	Autosampler	PE AS93Plus			
	Computer Workstation	Dell Optiplex GX150			
	Analytical Software	ELAN v.2.4			

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Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
HOTBLOCKS - METALS					
Hotblock #1		Environmental Express		Metals Digestions	2001
Hotblock #2		Environmental Express		Metals Digestions	2001
Hotblock #3		Environmental Express		Metals Digestions	2005
Hotblock #4		Environmental Express		Metals Digestions	2005
Hotblock #5		Environmental Express		Metals Digestions	
Hotblock #6		Environmental Express		Metals Digestions	
ModBlock A		CPI		Metals Digestions	2003
ModBlock B		CPI		Metals Digestions	2003

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Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
GENERAL CHEMISTRY					
TOC#1 (R-TOC-01)	TOC Analyzer	OI Model 1010	J245710349	TOC - waters	2003
	Autosampler	OI Model 1051	B247751184		
	Computer Workstation	Gateway GP6-300	10709094		
	Analytical Software	OI WinTOC for 1010 v.01 Rev 225	-		
TOC#2 (R-TOC-02)	TOC Analyzer	Dohrman DC190	9507646	TOC - soils	2001
	Boat Sampler	Dohrman 183 s/s1	9507610		
Lachat 8000 (R-FIA-01)	Flow Injection System	Lachat 8000		Chloride, TKN, NO2/NO3, NH3, Alkalinity, Hardness, Phosphorus, Silica, Cr6+	1999
	Colorimeter	Lachat	A83000-1286		
	Pump	Lachat	A82000-525		
	Autosampler	Lachat	A81010-168		
	Computer Workstation	Gateway GP6-233	9767124		
	Analytical Software	Omnion FIA v.2	-		
Lachat 8500 (R-FIA-06)	Flow Injection System	Lachat 8500		Chloride, TKN, NO2/NO3, NH3, Alkalinity, Hardness, Phosphorus, Silica, Cr6+	2011
	Colorimeter		110100001295		
	Amperometric Detector	BASi CC-5e	5966		
	Cell	BASi CC-3D	11314		
	Pump	14951	0595996-2		
	Autosampler	ASX-260	021109A260		
	Computer Workstation	Dell Optiplex 780			
	Analytical Software	Omnion FIA v.3.0	-		
Technicon #2 (R-FIA-04)	Flow Injection System	Technicon		Phenol	Pre-1982
	Colorimeter	Technicon	20060911		
	Pump	Technicon			
	Chart Recorder	Technicon	41685B		
	Autosampler	Technicon	681-Rest worn off		
	Module	Technicon	83035		
AquaKem (R-Discrete-01)	Instrument	AquaKem 200	A0419913	Nitrite, Ammonia, Phosphate, Chloride, Hexavalent Chromium, Cyanide	2005
	Computer Workstation	Sell SX280	3KSDF1J		
	Analytical Software	6.5.AQ1 rc4			

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Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
IC#3 (R-IC-03)	Ion Chromatograph	Metrohm 861 Advanced Compact IC		Anions	2005
	Basic Chromatography Module	Metrohm	861-02114		
	Pump	Metrohm	62824100s20		
	Conductivity Detector	Metrohm	integrated		
	Autosampler	Metrohm	838-04105		
	Computer Workstation	Dell OptiPlex GX520	6VRC581		
	Analytical Software	IC NET 2.3 SR2	A.701.0016		
IC # 4 (R-IC-04)	Ion Chromatograph	Dionex 500DX		ANIONS	2007
	Basic Chromatography Module	LC20-1	97110393		
	Gradient Pump	GP40-1	97110534		
	Conductivity Detector	ED40-1	97110074		
	Autosampler	AS40-1	97110671		
	Computer Workstation	Gateway 2000 GP6-266	10239250		
	Analytical Software	Peaknet 5.21	192-994-1564		
IC # 5 (R-IC-05)	Ion Chromatograph	Dionex ICS-1000	7090145	Cr6+ ANIONS	2007
	Gradient Pump	GP40			
	Conductivity Detector	DS6	7081071		
	Autosampler	AS40	7090325		
	Computer Workstation	Dell Optiplex 745	1441DAA99		
	Analytical Software	Chromeleon 6.80	56276		

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Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
IC # 6 (R-IC-06)	Ion Chromatograph	DX-120	10169	ANIONS	2008
	Conductivity Detector	DS4-1	10133		
	Autosampler	AS40	4070066		
	Computer Workstation	Dell Optiplex GX110	5ZBVK01		
	Analytical Software	Peaknet 5.11	147-994-3278		
IC # 7 (R-IC-07)	Ion Chromatograph	DX500		ANIONS	2008
	Basic Chromatography Module	LC20	99050321		
	Gradient Pump	GP50	99050419		
	Conductivity Detector	CD20	99050289		
	Autosampler	AS40	99011702		
	Computer Workstation	Dell Optiplex GX110	5ZBVK01		
	Analytical Software	Peaknet 5.11	147-994-3278		
Isoperibol Calorimeter (R-Calorimeter-02)	Isoperibol Calorimeter	Parr 6300	27187	BTU, Combustion Prep	2004
Autoclave	Tutternauer	3870m	2801669	Micro/TPO4	2011

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Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
Midi A	Midi Cyanide Distillation System	BSL Co	none	Cyanide/Phenol/ Sulfide Distillation	1997
Midi B	Midi Cyanide Distillation System	BSL Co	none	Cyanide/Phenol/ Sulfide Distillation	1997
Midi C	Midi Cyanide Distillation System			Cyanide/Phenol/ Sulfide Distillation	2004
Bullwinkle (R-pH-02)	pH Meter	Orion SA520	2305	pH	1990
Rocky (R-pH-02)	pH Meter	Orion 720A	5012		1992
	pH Electrode	Orion 915600			
	Fluoride Electrode	Orion 9409			
	Reference Electrode	Orion 90-01-00			
SympHony (R-pH-05)	pH/Conductivity Meter	SympHony SB80PC	D00582	ph/Conductivity	2008
Turbidimeter (R-Turbidimeter-02)	Turbidimeter	HF Scientific Micro 100	609246	Turbidity	2000
MR 21 (R-UV-VIS-01)	Spectro-photometer	Milton Roy Spectronic 21	1225601	COD, MBAS, Cr6+, Ferrous Iron	1989

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EQUIPMENT LIST

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
DO Meter #1 (R-DOMeter-01)	Dissolved Oxygen Meter	YSI Model 58	07M100226	DO, BOD	
DO Meter #2 (R-DOMeter-02)	Dissolved Oxygen Meter	YSI Model 58	06J2457	DO, BOD	
Open Cup (R-Flash-01)	Open Cup Flashpoint Tester	Koehler Instru.Co. Model 420	none	Ignitability - solids	1989
Closed Cup (R-Flash-02)	Closed Cup Flashpoint Tester	Boekel Model 152800	none	Ignitability - liquids	1993
Aquameter (R-KF-01)	Aquameter	Beckman KF4B	101414	% Water	
Density Meter (R-Density-01)	Density Meter	DE40	MPJ17625	Density	2007

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EQUIPMENT LIST

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
Autotitrator (R-Titrator-01)	Robotic Titrosampler	Metrohm 855		Photoprocessing Samples	2007
	Pump Unit	Metrohm 772			
	Dosing Interface	Metrohm 846			
	Dosino	(7) Metrohm 800			
	Computer Workstation	Dell Optiplex 745			
	Analytical Software				
TKN Digestion Blocks	Technicon	Technicon block	206	TKN digest	<1997
		Omega CN 2110 Temperature Controller	-		
	AIM600	AI Scientific Pty Ltd AIM600	4726A12136	TKN digest	2007
R-Sieve-01	Tyler-RO Tap	RX-29	10-2155	Grain Size	2010
Vacuum Pumps		Gast DOL-101-AA	787	1664	
		Gast DOA-P704-AA		1664	
		Gast 0522-U31-G18DX	687	General Filtration	
R-Balance-01	**Top Loading Balances**	American Scientific DTL2500-1	20466	Wetchem	<1997
R-Balance-03		Mettler Toledo PB602-S	1118331281	Metals	<2002
R-Balance-04		Cole Parmer Symmetry	ED1200	SMO	2009
R-Balance-05		Mettler Toledo PB602-S	1125322050	Extractables	2004
R-Balance-06		Fisher XL 500	7384	Metals	<1997
R-Balance-07		Ohaus Adventure Pro AV412	8026261026	Volatiles	2005
R-Balance-14		Ohaus ScoutPro SP6001	7/31340865	SMO (soil lab)	2010
R-Balance-02	**Analytical Balances**	Mettler AE240	F96727	Wetchem	1996 used
R-Balance-08		Fisher XA200	8887	Volatiles	1990
R-Balance-09		Mettler AE160	D25222	Wetchem	2008 used
R-Balance-10		Mettler AE200	J29745	Wetchem	2008 used
R-Balance-11		Mettler AG204	120330501	Wetchem	2001
R-Balance-13		Mettler AE160	D40689	Extractables	2008 used
Muffle Furnace	**Thermolyne**	F48025-60	150440201110801	Wetchem	2011

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EQUIPMENT LIST

Instrument ID	Instrument Configuration	Manufacturer Part	Serial Number	Analyses Performed	Year Acquired
C-1	Sample Cooler	Bally Engineered Structures, Inc.	VOA	Sample Storage	
C-2	Sample Cooler	American Cooler Technologies		Sample Storage	2011
BOD Incubator	Incubator	Shultz		BOD Closet	
R-4	Reagent Fridge	Revco Scientific	TY90605E	WC Reagents	
R-5	Standards Fridge	General Motors	CAS03991	WC Standards	
R-6	Micro Fridge	General Motors	CAS03992	Micro Reagents	
R-7	Fridge (Mini)	GE		Wetchem	
R-8	Standards Fridge	NuCool	28VS201001-006630	FID Standards	2010
R-9	Sample Fridge	Jordon Scientific	S7649999E	Extractables	2011
F-2	Extract Freezer	Baxter Cryo-Fridge	CAS06056	Extractables	
Freezer 5	Sample Freezer	Maytag	12377439GV	SMO Sample Storage	
F-6	Extract Freezer	GE	SH175743	Extractables	
F-7	Standards Freezer	GE	FL171960	Extractables	
F-08	Standard Freezer	Signature	23429-1	VOA Standards	
Freezer 9	Sample Freezer	GE	MS145661	VOA Sample Storage	
F-10	Tissue Storage	Labline		SMO Sample Storage	

Note that the computers listed with the instruments are dedicated to that instrument for data aquisition, but the data files are saved to a lab-wide network and data may be accessed by any computer with the correct software - provided the user is authorized to do so.

APPENDIX D
DATA QUALIFIERS AND ACRONYMS

Please note that the Appendices provide current information at the time of the revision, but are updated only upon annual review. Please contact the laboratory for up-to-date information.

Columbia Analytical Services™

REPORT QUALIFIERS

U	Analyte was analyzed for but not detected. The sample quantitation limit has been corrected for dilution and for percent moisture, unless otherwise noted in the case narrative.
J	Estimated value due to either being a Tentatively Identified Compound (TIC) or that the concentration is between the MRL and the MDL. Concentrations are not verified within the linear range of the calibration. For DoD: concentration >40% difference between two GC columns (pesticides/Arclors).
B	Analyte was also detected in the associated method blank at a concentration that may have contributed to the sample result.
E	Inorganics- Concentration is estimated due to the serial dilution was outside control limits.
E	Organics- Concentration has exceeded the calibration range for that specific analysis.
D	Concentration is a result of a dilution, typically a secondary analysis of the sample due to exceeding the calibration range or that a surrogate has been diluted out of the sample and cannot be assessed.
*	Indicates that a quality control parameter has exceeded laboratory limits.
#	Spike was diluted out.
+	Correlation coefficient for MSA is <0.995.
N	Inorganics- Matrix spike recovery was outside laboratory limits.
N	Organics- Presumptive evidence of a compound (reported as a TIC) based on the MS library search.
S	Concentration has been determined using Method of Standard Additions (MSA).
W	Post-Digestion Spike recovery is outside control limits and the sample absorbance is <50% of the spike absorbance.
P	Concentration >40% (25% for CLP) difference between the two GC columns.
C	Confirmed by GC/MS
Q	DoD reports: indicates a pesticide/Aroclor is not confirmed (≥100% Difference between two GC columns).
X	See Case Narrative for discussion.

ACCREDITED IN ACCORDANCE WITH nelac

CAS/Rochester Lab ID # for State Certifications[1]

NELAP Accredited	Nevada ID # NY-00032
Delaware Accredited	New Jersey ID # NY004
Connecticut ID # PH0556	New York ID # 10145
Florida ID # E87674	New Hampshire ID # 294100 A/B
Illinois ID #200047	Pennsylvania ID# 68-786
Maine ID #NY0032	Rhode Island ID # 158
Nebraska Accredited	West Virginia ID # 292
Navy Facilities Engineering Service Center Approved	

[1] Analyses were performed according to our laboratory's NELAP-approved quality assurance program and any applicable state requirements. The test results meet requirements of the current NELAP standards or state requirements, where applicable, except as noted in the laboratory case narrative provided. For a specific list of accredited analytes, refer to the certifications section at www.caslab.com.

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Columbia Analytical Services™

REPORT QUALIFIERS

U	Analyte was analyzed for but not detected. The sample quantitation limit has been corrected for dilution and for percent moisture, unless otherwise noted in the case narrative.
J	Estimated value due to either being a Tentatively Identified Compound (TIC) or that the concentration is between the MRL and the MDL. Concentrations are not verified within the linear range of the calibration. For DoD: concentration >40% difference between two GC columns (pesticides/Arclors).
B	Analyte was also detected in the associated method blank at a concentration that may have contributed to the sample result.
E	Inorganics- Concentration is estimated due to the serial dilution was outside control limits.
E	Organics- Concentration has exceeded the calibration range for that specific analysis.
D	Concentration is a result of a dilution, typically a secondary analysis of the sample due to exceeding the calibration range or that a surrogate has been diluted out of the sample and cannot be assessed.
*	Indicates that a quality control parameter has exceeded laboratory limits.
#	Spike was diluted out.
+	Correlation coefficient for MSA is <0.995.
N	Inorganics- Matrix spike recovery was outside laboratory limits.
N	Organics- Presumptive evidence of a compound (reported as a TIC) based on the MS library search.
S	Concentration has been determined using Method of Standard Additions (MSA).
W	Post-Digestion Spike recovery is outside control limits and the sample absorbance is <50% of the spike absorbance.
P	Concentration >40% (25% for CLP) difference between the two GC columns.
C	Confirmed by GC/MS
Q	DoD reports: indicates a pesticide/Aroclor is not confirmed (≥100% Difference between two GC columns).
X	See Case Narrative for discussion.

ACCREDITED IN ACCORDANCE WITH THE nelac

CAS/Rochester Lab ID # for Massachusetts Certification
M-NY032

Analyses were conducted in accordance with Massachusetts Department of Environmental Protection certification standards, except as noted in the laboratory case narrative provided. A copy of the current Department issued parameter list is included in this report.

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Laboratory Acronyms

The following is a list of laboratory acronyms commonly used in environmental testing:

ACRONYM	DEFINITION
AA	Atomic Absorption Spectrometry (aka AAS) instrument used to measure concentration of metals in samples
ACS	American Chemical Society
APG	Analytical Products Groups (manufacturer of PE Samples)
ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
BFB	4-Bromofluorobenzene
BNA	Base Neutral Acid organic compounds (aka SOC or SVOCs)
BOD	Biochemical Oxygen Demand
BTEX/BETX	Benzene, Toluene, Ethylbenzene, Xylenes
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service Registry Number
CCB	Continuing Calibration Blank sample
CCC	Continuing Calibration Check sample
CCV	Continuing Calibration Verification sample
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
CLP	Contract Laboratory Program (through USEPA)
COC	Chain-of-Custody
COD	Chemical Oxygen Demand
DCM	Dichloromethane (aka Methylene Chloride)
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality

DHS	Department of Health Services
DOE	Department of Ecology (state or federal)
DOH	Department of Health
EPA	U. S. Environmental Protection Agency (aka USEPA)
EPCRA	Emergency Planning & Community Right-to-Know Act
ERA	Environmental Resource Associates
ELAP	Environmental Laboratory Accreditation Program
FAA	Flame Atomic Absorption Spectrophotometry
FDA	Food & Drug Administration
FIA	Flow Injection Analysis
FID	Flame Ionization Detector
FIFRA	Federal Insecticide, Fungicide & Rodenticide Act
FR	Federal Register
GAO	General Accounting Office
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
GFAA	Graphite Furnace Atomic Absorption Spectrometry
HECD/ELCE	Hall Electrolytic Conductivity Detector
HP	Hewlett-Packard (mfg. GC instruments)
HPLC	High Pressure Liquid Chromatography
IC	Ion Chromatography
ICB	Initial Calibration Blank sample
ICP-AES	Inductively Coupled Plasma Atomic Emission Spectrometry (aka ICPAES)
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
ICV	Initial Calibration Verification sample
IFB	Invitation for Bid
IR	Infrared Spectrophotometer
LCS	Laboratory Control Sample
LIMS	Laboratory Information Management System

LUFT	Leaking Underground Fuel Tank
MB	Method Blank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
MS	Matrix Spike
NA	Not Applicable
NAN	Not Analyzed
NAS	National Academy of Sciences
NC	Not Calculated
NCASI	National Council for Air and Stream Improvement (for the Paper Industry)
NCI	National Cancer Institute
ND	Not Detected (at or above MRL)
NIH	National Institute of Health
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NPD	Nitrogen Phosphorus Detector
NPDES	National Pollutant Discharge Elimination System
NSF	National Science Foundation
NTIS	National Technical Information System
NTP	National Toxicology Program
ORB	Original Record Book (aka raw data books)
OSHA	Occupational Safety and Health Administration
PCBs	Polychlorinated Biphenyls
PE	Performance Evaluation sample
PID	Photoionization Dectector

PQL	Practical Quantitation Limit
QA	Quality Assurance
QC	Quality Control
RAS	Routine Analytical Services (contracts through USEPA)
RCRA	Resource Conservation and Recovery Act
RFP	Request for Proposal
RPD	Relative Percent Difference
SAS	Special Analytical Services (contracts through USEPA)
SIE	Selective Ion Electrode
SIM	Selected Ion Monitoring
SMO	Sample Management Office (aka Sample Receiving)
SOC	Semi-Volatile Organic Compounds
SOQ	Statement of Qualifications
SOW	Statement of Work
SVOAs	Semi-Volatile Organic Analytes
SVOCs	Semi-Volatile Organic Compounds
SW-846	Test Methods for Evaluating Solid Waste, Physical/Chemical Methods
TOC	Total Organic Carbon (test to determine organic content)
TOX	Total Organic Halides (test to determine organic halide content)
TPH	Total Petroleum Hydrocarbons
tr	Trace level in the concentration of an analyte that is less than the PQL but greater than or equal to the MDL
TSCA	Toxic Substances Control Act
UST	Underground Storage Tank
UV	Ultraviolet Spectrophotometer
VOA	Volatile Organic Analyte
VOC	Volatile Organic Compounds
WP	Water Pollution
WS	Water Supply

UNITS	
mg/kg	Milligrams per Kilogram (same as ppm)
mg/L	Milligrams per Liter (same as ppm)
ug/L	Micrograms per liter (same as ppb)
ppb	Parts Per Billion
ppm	Parts Per Million

APPENDIX E
PREVENTIVE MAINTENANCE PROCEDURES

Please note that the Appendices provide current information at the time of the revision, but are updated only upon annual review. Please contact the laboratory for up-to-date information.

Preventive Maintenance Procedures

Instrument	Activity	Laboratory or Vendor Performed	Frequency
Refrigerators and Coolers	Record temperatures	Laboratory	Daily
	Clean coils	Vendor	As needed
	Check coolant	Vendor	As needed or if temperature outside limit
Fume Hoods	Face velocity measured	Laboratory	Quarterly
	Sash operation	Laboratory	As needed
Ovens	Clean	Laboratory	As needed or if temperature outside limit
Incubators	Record temperatures	Laboratory	Daily, morning and evening
Water Baths	Wash with disinfectant solution	Laboratory	When water is murky, dirty, or growth appears
Autoclave	Check temperature	Laboratory	Every month
	Clean	Laboratory	When mold or growth appears
Top Loading Balances	Check calibration	Laboratory	Before every use
	Check alignment	Laboratory	Before every use
	Cleaning, calibration, adjustment, and spec compliance	Vendor	Annually
	Repair	Vendor	As needed
Analytical Balances	Check alignment	Laboratory	Before every use
	Check calibration	Laboratory	Before every use
	Clean pans and compartment	Laboratory	After every use
	Cleaning, calibration, adjustment, and spec compliance	Vendor	Annually
	Repair	Vendor	As needed
Dissolved Oxygen Meter	Change membrane	Laboratory	When fluctuations occur
pH probes	Condition probe	Laboratory	When fluctuations occur
UV-visible Spectrophotometer	Wavelength check	Vendor	Every 6 Months

Preventive Maintenance Procedures

Instrument	Activity	Laboratory or Vendor Performed	Frequency
Discrete Analyzer	Review Water Check	Laboratory	Daily
	Empty Waste Bin	Laboratory	Daily
	Fill Diluent with fresh DI	Laboratory	Daily
	Check Waste Container	Laboratory	Daily
	Print or save results to file	Laboratory	Daily
	Clear Daily Files	Laboratory	Daily
	Empty Liquid Waste	Laboratory	Weekly
	Clean wash wells and tubing	Laboratory	Weekly
	Clean off any chemical residue	Laboratory	Weekly
	Check syringe tip	Laboratory	Weekly
	Run Dichromate test at 480nm	Laboratory	Weekly
	Restore adjustments from disk	Laboratory	Monthly
	Save database to CD	Laboratory	Monthly
	Print then delete messages	Laboratory	Monthly
	Print water check	Laboratory	Monthly
	Clean and lube incubator rod	Laboratory	Monthly
	Clean and lube fetched rod	Laboratory	Monthly
Total Organic Carbon Analyzers	Check IR zero	Laboratory	Weekly
	Check digestion/condensation vessels	Laboratory	Each use
	Clean digestion chamber	Laboratory	Every 2000 hours, or as needed
	Clean permeation tube	Laboratory	Every 2000 hours, or as needed
	Clean six-port valves	Laboratory	Every 200 - 2000 hours, or as needed
	Clean sample pump	Laboratory	Every 200 - 2000 hours, or as needed
	Clean carbon scrubber	Laboratory	Every 200 - 2000 hours, or as needed
	Clean IR cell	Laboratory	Every 2000 - 4000 hours, or as needed
Flow Injection Analyzer	Check valve flares	Laboratory	Quarterly
	Check valve ports	Vendor	As needed
	Check pump tubing	Laboratory	Daily
	Check flow cell flares	Laboratory	Quarterly
	Change bulb	Laboratory	As needed
	Check manifold tubing	Laboratory	Every six months
	Check T's and connectors	Laboratory	Every six months
Ion Chromatograph	Change column bed supports	Laboratory	Monthly or as needed
	Clean column	Laboratory	Monthly or as needed
	Change column	Laboratory	Every six months or as needed
	Change tubing	Laboratory	Annually or as needed
	Eluent pump	Laboratory	Annually

Preventive Maintenance Procedures

Instrument	Activity	Laboratory or Vendor Performed	Frequency
Atomic Absorption Spectro-photometers - CVAA	Check gases	Laboratory	Daily
	Check aspiration tubing	Laboratory	Daily
	Empty waste container	Laboratory	Weekly
Atomic Absorption Spectro-photometers - GFAA	Check gases	Laboratory	Daily
	Check argon dewar	Laboratory	Daily, or as needed
	Change graphite tube	Laboratory	Daily, or as needed
	Clean furnace windows	Laboratory	Monthly or as needed
ICP-AES	Check argon dewar	Laboratory	Daily
	Replace peristaltic pump tubing	Laboratory	Daily, or as needed
	Empty waste container	Laboratory	Daily, or as needed
	torch	Laboratory	Every two weeks, or as needed
	Replace water filter	Laboratory	Quarterly, or as needed
	Replace or vacuum air filters	Laboratory	Monthly, or as needed
ICP-MS	Check argon dewar	Laboratory	Daily
	Replace peristaltic pump tubing	Laboratory	Daily, or as needed
	Empty waste container	Laboratory	Daily, or as needed
	Clean nebulizer, spray chamber, and torch	Laboratory	Every two weeks, or as needed
	Clean Cone	Laboratory	As needed
	Check air filters	Laboratory	Annually or as needed
	Check rotary pump oil	Laboratory	Quarterly, or as needed
	Clean ion lens stack	Laboratory	Annually or as needed

Preventive Maintenance Procedures

Instrument	Activity	Laboratory or Vendor Performed	Frequency
Chromatographs	Clean and repack column	Laboratory	As needed
	Backflush valves	Laboratory	As needed
Gas Chromatographs, Semivolatiles	Check gas supplies	Laboratory	Daily, replace when pressure reaches 250 psi
	Change in-line filters	Laboratory	Quarterly or after 30 tanks of gas
	Change injection port liner	Laboratory	Daily or as needed
	Clip first foot of capillary column	Laboratory	As needed
	Change guard column	Laboratory	As needed
	Replace analytical column	Laboratory	As needed when peak resolution fails
	Check system for gas leaks	Laboratory	After changing columns
	Clean FID	Laboratory	As needed
	Leak test ECD	Laboratory	Annually
Gas Chromatograph/Mass Spectrometers, Semivolatiles	Check gas supplies	Laboratory	Daily, replace when pressure reaches 50 psi
	Change in-line filters	Laboratory	Quarterly or after 30 tanks of gas
	Change septum	Laboratory	Daily
	Change injection port liner	Laboratory	Weekly or as needed
	Clip first foot of capillary column	Laboratory	As needed
	Change guard column	Laboratory	As needed
	Replace analytical column	Laboratory	As needed when peak resolution fails
	Clean jet separator	Laboratory	As needed
	Clean source	Laboratory	As needed when tuning problems
	Change pump oil	Laboratory	Every six months
	Oil wick	Laboratory	Every six months

Preventive Maintenance Procedures

Instrument	Activity	Laboratory or Vendor Performed	Frequency
Purge and Trap Concentrators	Change trap	Laboratory	As needed
	Change transfer lines	Laboratory	As needed
	Clean purge vessel	Laboratory	As needed
Gas Chromatographs, Volatiles	Check gas supplies	Laboratory	Daily, replace when pressure reaches 200 psi
	Change in-line filters	Laboratory	When indicator changes color
	Change septum	Laboratory	As needed
	Clip first foot of capillary column	Laboratory	As needed
	Change guard column	Laboratory	As needed
	Replace analytical column	Laboratory	As needed when peak resolution fails
	Check system for gas leaks	Laboratory	After changing columns or as needed
	Replenish ELCD solvents	Laboratory	Weekly
	Clean PID lamp	Laboratory	As needed
	Clean FID	Laboratory	As needed
	Change ion exchange resin	Laboratory	As needed
	Replace nickel tubing	Laboratory	As needed
Gas Chromatograph/Mass Spectrometers, Volatiles	Check gas supplies	Laboratory	Weekly, replace when pressure reaches 200 psi
	Change in-line filters	Laboratory	When indicator changes color
	Change septum	Laboratory	Daily, depending on use and component recovery
	Clip first foot of capillary column	Laboratory	As needed
	Change guard column	Laboratory	As needed
	Replace analytical column	Laboratory	As needed when peak resolution fails
	Clean jet separator	Laboratory	As needed
	Clean source	Laboratory	As needed when tuning problems
	Change pump oil	Laboratory	Annually
HPLC	Check gas supplies	Laboratory	Daily, replace when pressure reaches 200 psi
	Change guard column	Laboratory	As needed
	Change analytical column	Laboratory	As needed
	Change inlet filters	Laboratory	As needed
TCLP/SPLP Extractors	Monitor Room Temperature	Laboratory	Daily
	Monitor RPM of Rotators	Laboratory	Bi-weekly
	Grease fittings	Laboratory	As needed
	O-ring replacement	Laboratory	As needed

APPENDIX F
LABORATORY SOP LIST

Please note that the Appendices provide current information at the time of the revision, but are updated only upon annual review. Please contact the laboratory for up-to-date information.

STANDARD OPERATING PROCEDURES AND CONTROLLED DOCUMENTS

SOP NAME	FILE NAME
ANALYTICAL BATCHES AND SEQUENCES	ADM-BATCH
CONFIRMATION OF ORGANIC ANALYTE IDENTIFICATION AND QUANTITATION	ADM-CONFIRM
MECHANICAL VOLUME DISPENSING DEVICES, VOLUMETRIC AND NON-VOLUMETRIC LABWARE	ADM-PCAL
INITIAL CALIBRATION	ADM-ICAL
PREPARING SAMPLE DILUTIONS	ADM-DIL
GENERATION OF ELECTRONIC DATA DELIVERABLES USING EDDGE	ADM-EDD
LABORATORY DATA REVIEW PROCESS	ADM-DREV
PROJECT CHEMIST DUTIES AND REPORT REVIEW	ADM-PCR
REPORT GENERATION	ADM-RG
DATA ARCHIVING	ADM-ARCH
ELECTRONIC DATA ARCHIVING	ADM-BACKUP
INTERNAL QUALITY ASSURANCE AUDITS	ADM-IAUD
DAILY BALANCE CALIB. AND TEMP. CHECKS	ADM-DALYCK
PH MEASUREMENTS FOR SUPPORT OF OTHER METHODS - CALIBRATION, USE, AND DOCUMENTATION	ADM-PhSUPPORT
SAMPLE PREPARATION, COMPOSITING, AND SUBSAMPLING	ADM-SPLPREP
CARBON DIOXIDE BY CALCULATION	ADM-4500 CO2 D
TOTAL HARDNESS BY CALCULATION	GEN-2340B
LANGELIER INDEX CALCULATION	ADM-2230B
UNIONIZED SULFIDE BY CALCULATION	ADM-H2SCALC
FIELD SAMPLING	FLD-SAMPLE
FIELD CHLORINE RESIDUAL	FLD-4500Cl-G
TEMPERATURE - FIELD	FLD-2550B
OXYGEN - FIELD	FLD-4500-OG
BOTTLE PREPARATION, PACKING, AND SHIPPING	SMO-BPS
SAMPLE RECEIVING	SMO-GEN
INTERNAL CHAINS OF CUSTODY	SMO-ICOC
SAMPLE DISPOSAL	SMO-SPLDIS
pH IN WATER AND AQUEOUS WASTE	GEN-9040B/SM4500H+I
TURBIDITY	SMO-180.1
SETTEABLE SOLIDS	GEN-160.5
CONDUCTIVITY IN WATER	GEN-120.1
CORROSIVITY	GEN-9045C
COLOR	GEN-110.2
DENSITY OR SPECIFIC GRAVITY BY WEIGHT PER GALLON CUP	GEN-D1475Cup
MULTI-INCREMENTAL SAMPLING (MIS)	GEN-MIS
REACTIVITY BY OBSERVATION	GEN-ReactObs
REDOX	GEN-REDOX
PAINT FILTER TEST	SMO-9095
PASSIVE DIFFUSION BAGS	SMO-PDB
PIPELINE SOIL SAMPLE ANALYSIS	GEN-PIPELINE
TISSUE SAMPLE PREPARATION	SMO-TISP
WKI PREPARATION	GEN-WKI
JAPANESE INDUSTRIAL STANDARD DESICCATOR METHOD FOR FORMALDEHYDE IN WALLPAPER	GEN-JISA6921

STANDARD OPERATING PROCEDURES AND CONTROLLED DOCUMENTS

SOP NAME	FILE NAME
ALKALINITY, TOTAL	GEN-2320B
ALKALINITY FOR PHOTOPROCESSING SAMPLES	GEN-ALK-CARE
AMMONIA	GEN-350.1
AMMONIA IN SEDIMENTS BY SALICYLIC COLORIMETRY	GEN-I-6522-90
ASH, DETERMINATION OF	GEN-ASH
BIOCHEMICAL OXYGEN DEMAND	GEN-5210B
BOMB CALORIMETRY PREP AND HEAT OF COMBUSTION	GEN-BOMB
BROMIDE BY AUTOMATED TITRATOR	GEN-BROMIDE-CARE
CATION EXCHANGE CAPACITY OF SOILS USING SODIUM ACETATE	GEN-9081
CHEMICAL OXYGEN DEMAND-Soils	GEN-CODS
CHEMICAL OXYGEN DEMAND-Waters	GEN-410.4
CHLORIDE	GEN-4500ClE
CHLORINE DEMAND	GEN-409A
CHLORINE RESIDUAL	GEN-4500ClF
CHLOROPHYLL A	GEN-10200H
CHLORINE IN OIL BY CHLOR-D-TECT Q KIT	GEN-9077
COLILERT AND VERIFICATION OF E.COLI IN MUG CULTURES	GEN-9223B
CYANIDE, AMENABLE TO CHLORINE	GEN-4500 CN G
CYANIDE, MIDI DISTILLATION	GEN-9012
CYANIDE, TOTAL AMPEROMETRIC	GEN-D7842
CYANIDE, FREE AMPEROMETRIC	GEN-D7237
CYANIDE, ILM05.3	GEN-ILM5.3CN
CYANIDE, WEAK ACID DISSOCIABLE	GEN-WADCN
DENSITY BY OSCILLATING CELL METER	GEN-D4052
CORROSION DEPOSIT SAMPLE ANALYSIS	GEN-DEPOSITS
DISSOLVED OXYGEN	GEN-4500OG
ETHYLENE GLYCOL	GEN-89-9
FERROUS IRON	GEN-3500Fe
FIXER TITRATION OF PHOTOPROCESSING SAMPLES FOR HYPO INDEX AND THIOSULFATE	GEN-FIXER-TITR-CAR
HARDNESS, TOTAL	GEN-2340C
ALKALINE DIGESTION FOR HEXAVALENT CHROMIUM IN SOIL	GEN-3060A
COLORIMETRIC DETERMINATION OF HEXAVALENT CHROMIUM IN SOIL	GEN-7196A
HEXAVALENT CHROMIUM BY IC	GEN-7199
HEXAVALENT CHROMIUM - WATERS	GEN-CR+6
HYDROGEN PEROXIDE BY MANUAL COLORIMETRY WITH TITANIUM(IV)SULFATE	GEN-HP
HYPO (FIXER) CONTAMINATION IN PHOTOPROCESSING SAMPLES	GEN-HYPO-CARE
IGNITABILITY - CLOSED CUP	GEN-CCIGN
IGNITABILITY - OPEN CUP	GEN-OCIGN
IN-LAB FILTRATION	GEN-FILTER
IODIDE BY ION CHROMATOGRAPHY	GEN-IODIDE
ION CHROMATOGRAPHY, DETERMINATION OF ANIONS BY	GEN-300.0
LIPIDS, PERCENT	GEN-LIPID
NITRATE AND NITRITE	GEN-353.2
NITROGEN, TOTAL KJELDAHL	GEN-351.2
ODOR	GEN-2150B
OIL AND GREASE HEXANE EXTRACTION	GEN-1664A

STANDARD OPERATING PROCEDURES AND CONTROLLED DOCUMENTS

SOP NAME	FILE NAME
PERCENT WATER BY KARL FISCHER	GEN-%W
PHENOLICS, TOTAL	GEN-420.4/9066
PHOSPHORUS, ORTHC	GEN- OPO4
PHOSPHORUS, TOTAL	GEN-365.1
REACTIVITY, SULFIDE AND CYANIDE	GEN-RS/RCN
SILICA	GEN-I-2700-85
SILICON, GRAVIMETRIC	GEN-SILICON
SOLIDS, PERCENT	GEN-DWPS
SOLIDS, TOTAL	GEN-2540B
SOLIDS, TOTAL DISSOLVED	GEN-2540C
SOLIDS, TOTAL SUSPENDED	GEN-2540D
SOLIDS, VOLATILE AND FIXED (TOTAL, DISSOLVED, and SUSPENDED)	GEN-160.4
SOLIDS, PERCENT VOLATILE	GEN-2540G
SULFIDE, ACID SOLUBLE	GEN-9030B/9034
SULFIDE, ACID VOLATILE	GEN-AVS/SEM
SULFIDE, TOTAL AND DISSOLVED IN WATERS	GEN-4500S2F
SULFITE	GEN-4500SO3B
SULFURIC ACID BY METHOD 8	GEN-8
SURFACTANTS (MBAS)	GEN-5540C
THIOCYANATE	GEN-4500 CN M
THIOSULFATE BY TITRETS	GEN-S2O3
TMA and TMAH IN SORBENT TUBES AND WATER USNG IC	GEN-TMA(H)
TOTAL ORGANIC CARBON OR TIC B Y LLOYD KAHN/9060	GEN-TOCLK/9060
TOTAL ORGANIC CARBON-WATERS	GEN-5310C/9060
TOTAL INORGANIC CARBON - WATERS	GEN-TICW
UV-ABSORBING CONSTITUENTS	GEN-5910B
WET CHEMISTRY GLASSWARE CLEANING	GEN-GC

STANDARD OPERATING PROCEDURES AND CONTROLLED DOCUMENTS

SOP NAME	FILE NAME
DETERMINATION OF METALS AND TRACE ELEMENTS BY ICP	MET-200.7/6010B
DETERMINATION OF METALS AND TRACE ELEMENTS BY ICP-MS	MET-6020A
DETERMINATION OF METALS ANG TRACE ELEMENTS BY ICP-MS BY ILM05.3	MET-ILM05.3MS
DETERMINATION OF METALS AND TRACE ELEMENTS BY ICP BY ILM05.3	MET-ILM5.3AES
DETERMINATION OF TRACE METALS BY GFAA	MET-GFAA
MERCURY IN WATER BY COLD VAPOR ATOMIC ABSORPTION SPEC.	MET-7470A/245.1
MERCURY IN SOLID OR SEMISOLID BY COLD VAPOR ATOMIC ABSORPTION SPEC.	MET-7471B/245.5
MERCURY IN WATER BY OXIDATION, P&T, AND CVAFS	MET-1631
MERCURY IN WATER BY COLD VAPOR ATOMIC ABSORPTION SPEC.CLP	MET-HgILM-W
MERCURY IN SOLID OR SEMISOLID BY COLD VAPOR ATOMIC ABSORPTION SPEC.	MET-HgILM-S
METALS DIGESTION, WATERS FOR ICP	MET-3010A
METALS DIGESTION, WATERS FOR GFAA ANALYSIS	MET-3020A
METALS DIGESTION, SOIL, SEDIMENT, SLUDGE FOR ICP AND GFAA ANALYSIS	MET-3050B
SPLP EXTRACTION FOR METALS AND SEMIVOLATILES	MET-SPLP
SPLP ZHE EXTRACTION	MET-SPLPZHE
SULFUR FOR ION CHROMATOGRAPHY	MET-ICS
METALS AND SEMIVOLATILES TCLP EXTRACTION (METHOD 1311)	MET-TCLP
ZERO HEADSPACE EXTRACTION (EPA METHOD 1311)	MET-TZHE
DEIONIZED WATER EXTRACTION OF SOIL FOR CLIENT USING ROTATING EXTRACTORS	MET-ClientDI Extraction
SAMPLE PREPARATION OF BIOLOGICAL TISSUE FOR METALS ANALYSIS	MET-TDIG
CLP DIGESTION TECHNIQUES FOR WATERS AND SOILS	MET-CLPDIG
METALS GLASSWARE CLEANING	MET-GC

STANDARD OPERATING PROCEDURES AND CONTROLLED DOCUMENTS

SOP NAME	FILE NAME
VOLATILE SCREENING	VOC-SCREEN
VOA STORAGE BLANKS	VOC-BLAN
PURGEABLE VOLATILES BY GC	VOC-601/602
MINERIAL SPIRITS	VOC-8015MS
ANALYSIS OF WATER, SOLIDS, AND SOLUBLE WASTES FOR TOTAL PETROLEUM HYDROCARBONS AS GASOLINE RANGE ORGANICS	VOC-8015GRO
AROMATIC AND HALOGENATED VOCS BY GC	VOC-8021B
MIXED GASES BY RSK-175M	VOC-8015/RSK175
CLOSED SYSTEM PURGE AND TRAP	VOC-5035
DRINKING WATER VOLATILES BY GC/MS	VOC-524.2
PURGEABLE VOLATILES BY GC/MS	VOC-624
VOLATILE ORGANIC COMPOUNDS BY GC/MS	VOC-8260B
CLP VOLATILE ORGANICS COMPOUNDS BY GC/MS SOW OLM04.3/95.1	VOC-CLP4.3
LOW CONC WATER FOR VOCS BY OLC02.1 AND OLC03.2 SOW	VOC-OLC
VARIOUS COMPOUNDS BY FID BY MODIFIED EPA TO-3	VOC-TO-3
VOCs IN AIR COLLECTED IN CANs AND GAS COLLECTION BAGS BY GC/MS	VOC-TO-15
1,4-DIOXANE IN PERSONAL CARE PRODUCTS BY HEADSPACE GC/MS	VOC-p-Dioxane

STANDARD OPERATING PROCEDURES AND CONTROLLED DOCUMENTS

SOP NAME	FILE NAME
DETERMINATION OF POLYAROMATIC HYDROCARBONS BY HPLC	HPLC-8310
DETERMINATION OF CARBONYL COMPOUNDS BY HPLC	HPLC-8315A
NITROAROMATICS AND NITRAMINES (EXPLOSIVES) BY HPLC	HPLC-8330
ANALYSIS OF WATER SAMPLES FOR METABOLIC ACIDS	HPLC-METACIDS
PERCHLORATE IN WATER, SOIL, SOLID WASTE USING HPLC/ESI/MS	HPLC-6850
DETERMINATION OF HYDROQUINONE BY HPLC/ECD FOR "Client'	HPLC-"Client"Hyd
MISCELLANEOUS ANALYTES BY ULTRAVIOLET DETECTOR	HPLC-UV-MISC
HPLC DETERMINATION OF PMT in PHOTOGRAPHIC DEVELOPERS BY ULTRAVIOLET DETECTOR	HPLC-PMT
SEPARATORY FUNNEL LIQUID-LIQUID EXTRACTION	EXT-3510C
CONTINUOUS LIQUID LIQUID EXTRATION	EXT-3520C
AUTOMATED SOXHLET EXTRACTION	EXT-3541
ULTRASONIC EXTRACTION	EXT-3550B
WASTE DILUTION	EXT-3580A
ADDITION OF SPIKES AND SURROGATES	EXT-SAS
PREPARATION OF ANHYDROUS SODIUM SULFATE	EXT-SUL
CONCENTRATION OF EXTRACTS	EXT-CONC
FLORISIL CLEANUP	EXT-3620B
SILICA GEL CLEANUP	EXT-3630
GEL PERMEATION CLEANUP	EXT-3640A
SULFUR CLEANUP	EXT-3660B
SULFURIC ACID CLEANUP OF PCB EXTRACTS	EXT-3665A
CARBON CLEANUP	EXT-CARCU
ORGANIC EXTRACTIONS GLASSWARE CLEANING	EXT-GC
DIAZOMETHANE PREPARATION	EXT-DIAZ
GASEOUS ORGANIC COMPOUNDS ON MEDIA BY GC/FID	SOC-18
PETROLEUM PRODUCTS IN WATER (HYDROCARBON SCAN)-NYSDOH Mtd	SOC-310-13
1,2 DIBROMO-3-CHLOROPROPANE & 1,2-DIBROMOETHANE IN WATER	SOC-504/8011
1,4-DIOXANE IN WATER BY SPE AND GC/MS SIM	SOC-522
ORGANOCHLORINE PESTICIDES AND PCBs IN WATERS AND SOILS	SOC-608
BASE NEUTRALS AND ACIDS	SOC-625
PCBs BY GC/MS	SOC-680
NONHALOGENATED ORGANICS BY GC/FID	SOC-8015B
PETROLEUM HYDROCARBONS AS DIESEL IN WATERS, SOILS, AND WASTE INCLUDING MODS FOR MAINE AND CONNECTICUT	SOC-8015B DRO
ORGANOCHLORINE PESTICIDES AND PCBs IN WATERS AND SOILS	SOC-8081A
PCBs IN WATERS and SOILS	SOC-8082
CHLORINATED HERBICIDES	SOC-8151A
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS	SOC-8270
EXTENDED POLYCYCLIC AROMATIC HYDROCARBONS (PARENT AND ALKYL HOMOLOGS) BY GC/MS SELECTIVE ION MONITORING	SOC-8270alkPAH
1,3-DICHLORO-2-PROPANOL AND 3-CHLORO-1,2-PROPANEDIOL IN PAPER	SOC-PROP65

APPENDIX G

CERTIFICATIONS, ACCREDITATIONS, AND PRIMARY NELAP ACCREDITED METHODS

Please note that the Appendices provide current information at the time of the revision, but are updated only upon annual review. Please contact the laboratory for up-to-date information.

CAS/Rochester Certifications/Accreditations/Contracts

Federal, National, and International Programs

- NELAP Accreditation, since January 2001.
  Primary Accreditation with New York (see below).
  Secondary Accreditation with Florida, New Jersey, New Hampshire, Pennsylvania, Virginia and Illinois (see below).
- United States Department of Defense Environmental Laboratory Accreditation Program (DOD-ELAP) since January 2010.
  Expires 1/21/2012.
- ISO/IEC 17025:2005 since January 2010. Expires 1/21/2012.

State and Local Programs

- State of Connecticut, Department of Health Services, Approved Public Health Laboratory.
  Certified Laboratory for Potable Water, Waste Water, Solid Waste and Soil.
  Examination for Inorganic Chemicals and Organic Chemicals. Registration No. PH-0556.
  Exp. 06/30/2012.
- State of Delaware, Department of Natural Resources and Environmental Control. Approved for Delaware Hazardous Substance Cleanup Act.
- State of Florida, Department of Health.
  Drinking water, Wastewater, Solid Hazardous Waste. Certification No. E87674. Expires 06/30/2012.
- State of Illinois, Environmental Protection Agency.
  Inorganic and Organic Hazardous and Solid Waste. Certification No. 200047. Expires 11/17/2011.
- State of Maine, Department of Health and Human Services.
  Drinking Water, Wastewater, and Solid Waste. Certification No.NY0032. Expires 11/12/2011.
- The Commonwealth of Massachusetts, Department of Environmental Protection.
  Non-Potable Water. Certification No. M-NY032. Exp. 06/30/2012.
- State of Nevada, Department of Conservation and Natural Resources, Division of Environmental Protection.
  Non-Potable Water and Solid and Hazardous Waste. Lab ID number NY-00032. Expires 9/30/11.
- State of New Jersey, Department of Environmental Protection
  State Certified Environmental Laboratory for Drinking Water, Waste Water, and Solid Waste.
  Certification No. NY004. Exp. 06/30/2012.
- State of New York, Department of Health, Environmental Laboratory Approval Program.
  Potable Water, Air, Non-Potable Water, and Solid and Hazardous Waste.
  Certification No. 10145. Exp. 04/01/2012.
- State of New Hampshire, Department of Environmental Services
  Non-Potable Water, Drinking Water, Solid Waste. Certification No. 294102. Exp. 10/14/2011.
- Pennsylvania Department of Environmental Protection.
  Non-Potable Water. Lab ID No. 68-00786. Expires 6/30/2012.

CAS/Rochester Certifications/Accreditations/Contracts

- State of Rhode Island, Department of Health
  Approved for Surface Water, WasteWater, and Sewage. License No. 158. Exp. 12/30/2011.

- Virginia Department of General Services Division of Consolidated Laboratory Services.
  Drinking Water, Non-potable Water, and Solid and Chemical Materials. ID# 460167. Exp. 6/14/2012.

Unregulated State Programs

- State of Georgia Environmental Protection Division
  Reciprocal Approval for Non-Potable/Environmental Waters and Wastes.

- State of Indiana Hazardous Waste Division
  Reciprocal Approval for Non-Potable/Environmental Waters and Wastes.

- State of Michigan - Reciprocal Approval for Non-Potable/Environmental Waters and Wastes.

- State of Mississippi - Reciprocal Approval for Non-Potable/Environmental Waters and Wastes.

- State of Maryland - Reciprocal Approval for Non-Potable/Environmental Waters and Wastes.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2012
Issued April 01, 2011
Revised July 21, 2011

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. MICHAEL PERRY
COLUMBIA ANALYTICAL SERVICES
1565 JEFFERSON ROAD BUILDING 300, SUITE 360
ROCHESTER, NY 14623

NY Lab Id No: 10145
EPA Lab Code: NY00032

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards for the category ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:

Disinfection By-products	
Free Residual Chlorine	SM 18-21 4500-Cl F (00)
Total Residual Chlorine	SM 18-21 4500-Cl F (00)
Drinking Water Bacteriology	
Coliform, Total / E. coli (Qualitative)	SM 18-21 9223B (97) (Colilert)
Drinking Water Metals I	
Arsenic, Total	EPA 200.8 Rev. 5.4
	SM 18-19, 21 3113B (99 & 04)
Barium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Cadmium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Chromium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Copper, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Iron, Total	EPA 200.7 Rev. 4.4
Lead, Total	EPA 200.8 Rev. 5.4
	SM 18-19, 21 3113B (99 & 04)
Manganese, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Mercury, Total	EPA 245.1 Rev. 3.0
Selenium, Total	EPA 200.8 Rev. 5.4
	SM 18-19, 21 3113B (99 & 04)
Silver, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Drinking Water Metals I	
Zinc, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Drinking Water Metals II	
Antimony, Total	EPA 200.8 Rev. 5.4
Beryllium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Nickel, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Thallium, Total	EPA 200.8 Rev. 5.4
Drinking Water Metals III	
Sodium, Total	EPA 200.7 Rev. 4.4
Drinking Water Miscellaneous	
Organic Carbon, Total	SM 18-21 5310C (00)
Turbidity	EPA 180.1 Rev. 2.0
UV 254	SM 19-21 5910B
Drinking Water Non-Metals	
Alkalinity	SM 18-21 2320B (97)
Calcium Hardness	EPA 200.7 Rev. 4.4
Chloride	EPA 300.0 Rev. 2.1
	SM 18-21 4500-Cl- E (97)
Color	SM 18-21 2120B (01)
Cyanide	EPA 335.4 Rev. 1.0
Fluoride, Total	EPA 300.0 Rev. 2.1
Hydrogen Ion (pH)	SM 18-21 4500-H B (00)

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EPA Lab Code: NY00032

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Drinking Water Non-Metals	
Nitrate (as N)	EPA 300.0 Rev. 2.1
	EPA 353.2 Rev. 2.0
Nitrite (as N)	EPA 300.0 Rev. 2.1
	EPA 353.2 Rev. 2.0
Orthophosphate (as P)	EPA 365.1 Rev. 2.0
Silica, Dissolved	SM 18-19 4500-Si F
	USGS I-2700-85
Solids, Total Dissolved	SM 18-21 2540C (97)
Specific Conductance	EPA 120.1 Rev. 1982
Sulfate (as SO4)	EPA 300.0 Rev. 2.1
Drinking Water Trihalomethanes	
Bromodichloromethane	EPA 524.2
Bromoform	EPA 524.2
Chloroform	EPA 524.2
Dibromochloromethane	EPA 524.2
Fuel Additives	
Methyl tert-butyl ether	EPA 524.2
Naphthalene	EPA 524.2
Microextractibles	
1,2-Dibromo-3-chloropropane	EPA 504.1
1,2-Dibromoethane	EPA 504.1
Volatile Aromatics	
1,2,3-Trichlorobenzene	EPA 524.2
1,2,4-Trichlorobenzene	EPA 524.2
Volatile Aromatics	
1,2,4-Trimethylbenzene	EPA 524.2
1,2-Dichlorobenzene	EPA 524.2
1,3,5-Trimethylbenzene	EPA 524.2
1,3-Dichlorobenzene	EPA 524.2
1,4-Dichlorobenzene	EPA 524.2
2-Chlorotoluene	EPA 524.2
4-Chlorotoluene	EPA 524.2
Benzene	EPA 524.2
Bromobenzene	EPA 524.2
Chlorobenzene	EPA 524.2
Ethyl benzene	EPA 524.2
Hexachlorobutadiene	EPA 524.2
Isopropylbenzene	EPA 524.2
n-Butylbenzene	EPA 524.2
n-Propylbenzene	EPA 524.2
p-Isopropyltoluene (P-Cymene)	EPA 524.2
sec-Butylbenzene	EPA 524.2
Styrene	EPA 524.2
tert-Butylbenzene	EPA 524.2
Toluene	EPA 524.2
Total Xylenes	EPA 524.2
Volatile Halocarbons	
1,1,1,2-Tetrachloroethane	EPA 524.2
1,1,1-Trichloroethane	EPA 524.2
1,1,2,2-Tetrachloroethane	EPA 524.2

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All approved analytes are listed below:

Volatile Halocarbons

1,1,2-Trichloroethane	EPA 524.2
1,1-Dichloroethane	EPA 524.2
1,1-Dichloroethene	EPA 524.2
1,1-Dichloropropene	EPA 524.2
1,2,3-Trichloropropane	EPA 524.2
1,2-Dichloroethane	EPA 524.2
1,2-Dichloropropane	EPA 524.2
1,3-Dichloropropane	EPA 524.2
2,2-Dichloropropane	EPA 524.2
Bromochloromethane	EPA 524.2
Bromomethane	EPA 524.2
Carbon tetrachloride	EPA 524.2
Chloroethane	EPA 524.2
Chloromethane	EPA 524.2
cis-1,2-Dichloroethene	EPA 524.2
cis-1,3-Dichloropropene	EPA 524.2
Dibromomethane	EPA 524.2
Dichlorodifluoromethane	EPA 524.2
Methylene chloride	EPA 524.2
Tetrachloroethene	EPA 524.2
trans-1,2-Dichloroethene	EPA 524.2
trans-1,3-Dichloropropene	EPA 524.2
Trichloroethene	EPA 524.2
Trichlorofluoromethane	EPA 524.2
Vinyl chloride	EPA 524.2

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All approved analytes are listed below:

Acrylates	
Acrolein (Propenal)	EPA 624
	EPA 8260B
	EPA 8260C
Acrylonitrile	EPA 624
	EPA 8260B
	EPA 8260C
Ethyl methacrylate	EPA 8260B
	EPA 8260C
Methyl acrylonitrile	EPA 8260B
	EPA 8260C
Methyl methacrylate	EPA 8260B
	EPA 8260C
Amines	
1,2-Diphenylhydrazine	EPA 8270C
	EPA 8270D
1,4-Phenylenediamine	EPA 8270C
	EPA 8270D
1-Naphthylamine	EPA 8270C
	EPA 8270D
2-Naphthylamine	EPA 8270C
	EPA 8270D
2-Nitroaniline	EPA 8270C
	EPA 8270D
3-Nitroaniline	EPA 8270C
	EPA 8270D

Amines	
4-Chloroaniline	EPA 8270C
	EPA 8270D
4-Nitroaniline	EPA 8270C
	EPA 8270D
5-Nitro-o-toluidine	EPA 8270C
	EPA 8270D
Aniline	EPA 8270C
	EPA 8270D
Carbazole	EPA 8270C
	EPA 8270D
Diphenylamine	EPA 8270C
	EPA 8270D
Methapyrilene	EPA 8270C
	EPA 8270D
Pronamide	EPA 8270C
	EPA 8270D
Propionitrile	EPA 8260B
	EPA 8260C
Pyridine	EPA 625
	EPA 8270C
	EPA 8270D
Benzidines	
3,3'-Dichlorobenzidine	EPA 625
	EPA 8270C
	EPA 8270D

Serial No.: 45345

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All approved analytes are listed below:

Benzidines	
3,3'-Dimethylbenzidine	EPA 8270C
	EPA 8270D
Benzidine	EPA 625
	EPA 8270C
	EPA 8270D
Chlorinated Hydrocarbon Pesticides	
4,4'-DDD	EPA 608
	EPA 8081A
	EPA 8081B
4,4'-DDE	EPA 608
	EPA 8081A
	EPA 8081B
4,4'-DDT	EPA 608
	EPA 8081A
	EPA 8081B
Aldrin	EPA 608
	EPA 8081A
	EPA 8081B
alpha-BHC	EPA 608
	EPA 8081A
	EPA 8081B
alpha-Chlordane	EPA 8081A
	EPA 8081B
beta-BHC	EPA 608
	EPA 8081A
Chlorinated Hydrocarbon Pesticides	
beta-BHC	EPA 8081B
Chlordane Total	EPA 608
	EPA 8081A
	EPA 8081B
Chlorobenzilate	EPA 8270C
	EPA 8270D
delta-BHC	EPA 608
	EPA 8081A
	EPA 8081B
Diallate	EPA 8270C
	EPA 8270D
Dieldrin	EPA 608
	EPA 8081A
	EPA 8081B
Endosulfan I	EPA 608
	EPA 8081A
	EPA 8081B
Endosulfan II	EPA 608
	EPA 8081A
	EPA 8081B
Endosulfan sulfate	EPA 608
	EPA 8081A
	EPA 8081B
Endrin	EPA 608
	EPA 8081A

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ROCHESTER, NY 14623

NY Lab Id No: 10145
EPA Lab Code: NY00032

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Chlorinated Hydrocarbon Pesticides	
Endrin	EPA 8081B
Endrin aldehyde	EPA 608
	EPA 8081A
	EPA 8081B
Endrin Ketone	EPA 8081A
	EPA 8081B
gamma-Chlordane	EPA 8081A
	EPA 8081B
Heptachlor	EPA 608
	EPA 8081A
	EPA 8081B
Heptachlor epoxide	EPA 608
	EPA 8081A
	EPA 8081B
Isodrin	EPA 8270C
	EPA 8270D
Kepone	EPA 8081A
	EPA 8081B
Lindane	EPA 608
	EPA 8081A
	EPA 8081B
Methoxychlor	EPA 608
	EPA 8081A
	EPA 8081B
PCNB	EPA 8270C

Chlorinated Hydrocarbon Pesticides	
PCNB	EPA 8270D
Toxaphene	EPA 608
	EPA 8081A
	EPA 8081B
Chlorinated Hydrocarbons	
1,2,3-Trichlorobenzene	EPA 8260B
	EPA 8260C
1,2,4,5-Tetrachlorobenzene	EPA 8270C
	EPA 8270D
1,2,4-Trichlorobenzene	EPA 625
	EPA 8270C
	EPA 8270D
2-Chloronaphthalene	EPA 625
	EPA 8270C
	EPA 8270D
Hexachlorobenzene	EPA 625
	EPA 8081A
	EPA 8081B
	EPA 8270C
	EPA 8270D
Hexachlorobutadiene	EPA 625
	EPA 8270C
	EPA 8270D
Hexachlorocyclopentadiene	EPA 625
	EPA 8270C

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2012
Issued April 01, 2011
Revised September 19, 2011

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. MICHAEL PERRY
COLUMBIA ANALYTICAL SERVICES
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Chlorinated Hydrocarbons	
Hexachlorocyclopentadiene	EPA 8270D
Hexachloroethane	EPA 625
	EPA 8270C
	EPA 8270D
Hexachloropropene	EPA 8270C
	EPA 8270D
Pentachlorobenzene	EPA 8270C
	EPA 8270D
Chlorophenoxy Acid Pesticides	
2,4,5-T	EPA 1978 p.115
	EPA 8151A
2,4,5-TP (Silvex)	EPA 1978 p.115
	EPA 8151A
2,4-D	EPA 1978 p.115
	EPA 8151A
Dicamba	EPA 1978 p.115
	EPA 8151A
Dinoseb	EPA 8151A
	EPA 8270C
	EPA 8270D
Demand	
Biochemical Oxygen Demand	SM 18-21 5210B (01)
Carbonaceous BOD	SM 18-21 5210B (01)
Chemical Oxygen Demand	EPA 410.4 Rev. 2.0

Dissolved Gases	
Acetylene	RSK-175
Ethane	RSK-175
Ethene (Ethylene)	RSK-175
Methane	RSK-175
Propane	RSK-175
Fuel Oxygenates	
Di-isopropyl ether	EPA 8015 B
	EPA 8015C
	EPA 8260B
	EPA 8260C
Ethanol	EPA 8015 B
	EPA 8015C
Methyl tert-butyl ether	EPA 8021B
	EPA 8260B
	EPA 8260C
tert-amyl methyl ether (TAME)	EPA 8260B
	EPA 8260C
tert-butyl alcohol	EPA 8260B
	EPA 8260C
tert-butyl ethyl ether (ETBE)	EPA 8260B
	EPA 8260C
Haloethers	
4-Bromophenylphenyl ether	EPA 625
	EPA 8270C
	EPA 8270D

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Haloethers	
4-Chlorophenylphenyl ether	EPA 625
	EPA 8270C
	EPA 8270D
Bis (2-chloroisopropyl) ether	EPA 625
	EPA 8270C
	EPA 8270D
Bis(2-chloroethoxy)methane	EPA 625
	EPA 8270C
	EPA 8270D
Bis(2-chloroethyl)ether	EPA 625
	EPA 8270C
	EPA 8270D
Low Level Polynuclear Aromatics	
Acenaphthene	EPA 610
	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
	EPA 8310
Acenaphthylene	EPA 610
	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
	EPA 8310
Anthracene	EPA 610
	EPA 8270C

Low Level Polynuclear Aromatics	
Anthracene	EPA 8270D
	EPA 8270D SIM
	EPA 8310
Benzo(a)anthracene	EPA 610
	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
	EPA 8310
Benzo(a)pyrene	EPA 610
	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
	EPA 8310
Benzo(b)fluoranthene	EPA 610
	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
	EPA 8310
Benzo(g,h,i)perylene	EPA 610
	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
	EPA 8310
Benzo(k)fluoroanthene	EPA 610
	EPA 8270C

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Low Level Polynuclear Aromatics	
Benzo(k)fluoroanthene	EPA 8270D
	EPA 8270D SIM
	EPA 8310
Chrysene	EPA 610
	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
	EPA 8310
Dibenzo(a,h)anthracene	EPA 610
	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
	EPA 8310
Fluoranthene	EPA 610
	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
	EPA 8310
Fluorene	EPA 610
	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
	EPA 8310
Indeno(1,2,3-cd)pyrene	EPA 610
	EPA 8270C

Low Level Polynuclear Aromatics	
Indeno(1,2,3-cd)pyrene	EPA 8270D
	EPA 8270D SIM
	EPA 8310
Naphthalene	EPA 610
	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
	EPA 8310
Phenanthrene	EPA 610
	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
	EPA 8310
Pyrene	EPA 610
	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
	EPA 8310
Mineral	
Alkalinity	SM 18-21 2320B (97)
Calcium Hardness	EPA 200.7 Rev. 4.4
	SM 18-21 2340B (97)
Chloride	EPA 300.0 Rev. 2.1
	EPA 9056A
	SM 18-21 4500-Cl- E (97)

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Mineral	
Fluoride, Total	EPA 300.0 Rev. 2.1
	EPA 9056A
Hardness, Total	EPA 200.7 Rev. 4.4
	SM 18-21 2340B (97)
	SM 18-21 2340C (97)
Sulfate (as SO4)	EPA 300.0 Rev. 2.1
	EPA 9056A
Nitroaromatics and Isophorone	
1,3,5-Trinitrobenzene	EPA 8270C
	EPA 8270D
	EPA 8330B
1,3-Dinitrobenzene	EPA 8270C
	EPA 8270D
	EPA 8330B
1,4-Naphthoquinone	EPA 8270C
	EPA 8270D
2,4,6-Trinitrotoluene	EPA 8330B
2,4-Dinitrotoluene	EPA 625
	EPA 8270C
	EPA 8270D
	EPA 8330B
2,6-Dinitrotoluene	EPA 625
	EPA 8270C
	EPA 8270D
	EPA 8330B
Nitroaromatics and Isophorone	
2-Amino-4,6-dinitrotoluene	EPA 8330B
2-Nitrotoluene	EPA 8330B
3,5-Dinitroaniline	EPA 8330B
3-Nitrotoluene	EPA 8330B
4-Amino-2,6-dinitrotoluene	EPA 8330B
4-Nitrotoluene	EPA 8330B
Hexahydro-1,3,5-trinitro-1,3,5-triazine	EPA 8330B
Isophorone	EPA 625
	EPA 8270C
	EPA 8270D
Methyl-2,4,6-trinitrophenylnitramine	EPA 8330B
Nitrobenzene	EPA 625
	EPA 8270C
	EPA 8270D
	EPA 8330B
Nitroglycerine	EPA 8330B
Nitroquinoline-1-oxide	EPA 8270D
Octahydro-tetranitro-tetrazocine	EPA 8330B
Pentaerythritol tetranitrate	EPA 8330B
Nitrosoamines	
N-Nitrosodiethylamine	EPA 8270C
	EPA 8270D
N-Nitrosodimethylamine	EPA 625
	EPA 8270C
	EPA 8270D

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Nitrosoamines	
N-Nitrosodi-n-butylamine	EPA 8270C
	EPA 8270D
N-Nitrosodi-n-propylamine	EPA 625
	EPA 8270C
	EPA 8270D
N-Nitrosodiphenylamine	EPA 625
	EPA 8270C
	EPA 8270D
N-nitrosomethylethylamine	EPA 8270D
N-nitrosomorpholine	EPA 8270D
N-nitrosopiperidine	EPA 8270C
	EPA 8270D
N-Nitrosopyrrolidine	EPA 8270C
	EPA 8270D
Nutrient	
Ammonia (as N)	EPA 350.1 Rev. 2.0
Kjeldahl Nitrogen, Total	EPA 351.2 Rev. 2.0
Nitrate (as N)	EPA 300.0 Rev. 2.1
	EPA 353.2 Rev. 2.0
	EPA 9056A
Nitrite (as N)	EPA 300.0 Rev. 2.1
	EPA 353.2 Rev. 2.0
	EPA 9056A
Orthophosphate (as P)	EPA 365.1 Rev. 2.0
Phosphorus, Total	EPA 365.1 Rev. 2.0
Organophosphate Pesticides	
Atrazine	EPA 8270C
	EPA 8270D
Dimethoate	EPA 8270C
	EPA 8270D
Disulfoton	EPA 8270C
	EPA 8270D
Parathion ethyl	EPA 8270C
	EPA 8270D
Parathion methyl	EPA 8270C
	EPA 8270D
Phorate	EPA 8270C
	EPA 8270D
Thionazin	EPA 8270D
Phthalate Esters	
Benzyl butyl phthalate	EPA 625
	EPA 8270C
	EPA 8270D
Bis(2-ethylhexyl) phthalate	EPA 625
	EPA 8270C
	EPA 8270D
Diethyl phthalate	EPA 625
	EPA 8270C
	EPA 8270D
Dimethyl phthalate	EPA 625
	EPA 8270C

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Phthalate Esters	
Dimethyl phthalate	EPA 8270D
Di-n-butyl phthalate	EPA 625
	EPA 8270C
	EPA 8270D
Di-n-octyl phthalate	EPA 625
	EPA 8270C
	EPA 8270D
Polychlorinated Biphenyls	
PCB-1016	EPA 608
	EPA 8082
	EPA 8082A
PCB-1221	EPA 608
	EPA 8082
	EPA 8082A
PCB-1232	EPA 608
	EPA 8082
	EPA 8082A
PCB-1242	EPA 608
	EPA 8082
	EPA 8082A
PCB-1248	EPA 608
	EPA 8082
	EPA 8082A
PCB-1254	EPA 608
	EPA 8082

Polychlorinated Biphenyls	
PCB-1254	EPA 8082A
PCB-1260	EPA 608
	EPA 8082
	EPA 8082A
PCB-1262	EPA 8082
	EPA 8082A
PCB-1268	EPA 8082
	EPA 8082A
Polynuclear Aromatics	
2-Acetylaminofluorene	EPA 8270D
3-Methylcholanthrene	EPA 8270C
	EPA 8270D
7,12-Dimethylbenzyl (a) anthracene	EPA 8270C
	EPA 8270D
Acenaphthene	EPA 625
	EPA 8270C
	EPA 8270D
Acenaphthylene	EPA 625
	EPA 8270C
	EPA 8270D
Anthracene	EPA 625
	EPA 8270C
	EPA 8270D
Benzo(a)anthracene	EPA 625
	EPA 8270C

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Polynuclear Aromatics	
Benzo(a)anthracene	EPA 8270D
Benzo(a)pyrene	EPA 625
	EPA 8270C
	EPA 8270D
Benzo(b)fluoranthene	EPA 625
	EPA 8270C
	EPA 8270D
Benzo(ghi)perylene	EPA 625
	EPA 8270C
	EPA 8270D
Benzo(k)fluoranthene	EPA 625
	EPA 8270C
	EPA 8270D
Chrysene	EPA 625
	EPA 8270C
	EPA 8270D
Dibenzo(a,h)anthracene	EPA 625
	EPA 8270C
	EPA 8270D
Fluoranthene	EPA 625
	EPA 8270C
	EPA 8270D
Fluorene	EPA 625
	EPA 8270C
	EPA 8270D

Polynuclear Aromatics	
Indeno(1,2,3-cd)pyrene	EPA 625
	EPA 8270C
	EPA 8270D
Naphthalene	EPA 625
	EPA 8270C
	EPA 8270D
Phenanthrene	EPA 625
	EPA 8270C
	EPA 8270D
Pyrene	EPA 625
	EPA 8270C
	EPA 8270D
Priority Pollutant Phenols	
2,3,4,6 Tetrachlorophenol	EPA 8270C
	EPA 8270D
2,4,5-Trichlorophenol	EPA 625
	EPA 8270C
	EPA 8270D
2,4,6-Trichlorophenol	EPA 625
	EPA 8270C
	EPA 8270D
2,4-Dichlorophenol	EPA 625
	EPA 8270C
	EPA 8270D
2,4-Dimethylphenol	EPA 625

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Priority Pollutant Phenols	
2,4-Dimethylphenol	EPA 8270C
	EPA 8270D
2,4-Dinitrophenol	EPA 625
	EPA 8270C
	EPA 8270D
2,6-Dichlorophenol	EPA 8270C
	EPA 8270D
2-Chlorophenol	EPA 625
	EPA 8270C
	EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 625
	EPA 8270C
	EPA 8270D
2-Methylphenol	EPA 8270C
	EPA 8270D
2-Nitrophenol	EPA 625
	EPA 8270C
	EPA 8270D
3-Methylphenol	EPA 8270C
	EPA 8270D
4-Chloro-3-methylphenol	EPA 625
	EPA 8270C
	EPA 8270D
4-Methylphenol	EPA 8270C
	EPA 8270D

Priority Pollutant Phenols	
4-Nitrophenol	EPA 625
	EPA 8270C
	EPA 8270D
Cresols, Total	EPA 8270C
	EPA 8270D
Pentachlorophenol	EPA 625
	EPA 8151A
	EPA 8270C
	EPA 8270D
Phenol	EPA 625
	EPA 8270C
	EPA 8270D
Residue	
Settleable Solids	SM 18-21 2540 F (97)
Solids, Total	SM 18-21 2540B (97)
Solids, Total Dissolved	SM 18-21 2540C (97)
Solids, Total Suspended	SM 18-21 2540D (97)
Semi-Volatile Organics	
1,1'-Biphenyl	EPA 8270C
	EPA 8270D
1,2-Dichlorobenzene, Semi-volatile	EPA 8270C
	EPA 8270D
1,3-Dichlorobenzene, Semi-volatile	EPA 8270C
	EPA 8270D
1,4-Dichlorobenzene, Semi-volatile	EPA 8270C

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Semi-Volatile Organics	
1,4-Dichlorobenzene, Semi-volatile	EPA 8270D
2-Methylnaphthalene	EPA 8270C
	EPA 8270D
2-Picoline	EPA 8270D
4-Amino biphenyl	EPA 8270C
	EPA 8270D
Acetophenone	EPA 8270C
	EPA 8270D
Benzaldehyde	EPA 8270C
	EPA 8270D
Benzoic Acid	EPA 8270C
	EPA 8270D
Benzyl alcohol	EPA 8270C
	EPA 8270D
Caprolactam	EPA 8270C
	EPA 8270D
Dibenzofuran	EPA 8270C
	EPA 8270D
Ethyl methanesulfonate	EPA 8270C
	EPA 8270D
Isosafrole	EPA 8270C
	EPA 8270D
Methyl methanesulfonate	EPA 8270C
	EPA 8270D
O,O,O-Triethyl phosphorothioate	EPA 8270C

Semi-Volatile Organics	
O,O,O-Triethyl phosphorothioate	EPA 8270D
p-Dimethylaminoazobenzene	EPA 8270C
	EPA 8270D
Phenacetin	EPA 8270C
	EPA 8270D
Safrole	EPA 8270C
	EPA 8270D
Volatile Aromatics	
1,2,4-Trichlorobenzene, Volatile	EPA 8260B
	EPA 8260C
1,2,4-Trimethylbenzene	EPA 8021B
	EPA 8260B
	EPA 8260C
1,2-Dichlorobenzene	EPA 601
	EPA 602
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
1,3,5-Trimethylbenzene	EPA 8021B
	EPA 8260B
	EPA 8260C
1,3-Dichlorobenzene	EPA 601
	EPA 602
	EPA 624

Serial No.: 45345

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2012
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Revised September 19, 2011

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE
Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. MICHAEL PERRY
COLUMBIA ANALYTICAL SERVICES
1565 JEFFERSON ROAD BUILDING 300, SUITE 360
ROCHESTER, NY 14623

NY Lab Id No: 10145
EPA Lab Code: NY00032

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Volatile Aromatics	
1,3-Dichlorobenzene	EPA 8021B
	EPA 8260B
	EPA 8260C
1,4-Dichlorobenzene	EPA 601
	EPA 602
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
2-Chlorotoluene	EPA 8260C
4-Chlorotoluene	EPA 8260C
Benzene	EPA 602
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
Bromobenzene	EPA 8260B
	EPA 8260C
Chlorobenzene	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
Ethyl benzene	EPA 602
	EPA 624

Volatile Aromatics	
Ethyl benzene	EPA 8021B
	EPA 8260B
	EPA 8260C
Isopropylbenzene	EPA 8021B
	EPA 8260B
	EPA 8260C
Naphthalene, Volatile	EPA 8260B
	EPA 8260C
n-Butylbenzene	EPA 8021B
	EPA 8260B
	EPA 8260C
n-Propylbenzene	EPA 8021B
	EPA 8260B
	EPA 8260C
p-Isopropyltoluene (P-Cymene)	EPA 8021B
	EPA 8260B
	EPA 8260C
sec-Butylbenzene	EPA 8021B
	EPA 8260B
	EPA 8260C
Styrene	EPA 624
	EPA 8260B
	EPA 8260C
tert-Butylbenzene	EPA 8260C
Toluene	EPA 602

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Volatile Aromatics	
Toluene	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
Total Xylenes	EPA 602
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
Volatile Chlorinated Organics	
Benzyl chloride	EPA 8260B
	EPA 8260C
Volatile Halocarbons	
1,1,1,2-Tetrachloroethane	EPA 8260B
	EPA 8260C
1,1,1-Trichloroethane	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
1,1,2,2-Tetrachloroethane	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
Volatile Halocarbons	
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260B
	EPA 8260C
1,1,2-Trichloroethane	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
1,1-Dichloroethane	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
1,1-Dichloroethene	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
1,1-Dichloropropene	EPA 8260B
	EPA 8260C
1,2,3-Trichloropropane	EPA 8260B
	EPA 8260C
1,2-Dibromo-3-chloropropane	EPA 8011
	EPA 8260B
	EPA 8260C
1,2-Dibromoethane	EPA 8011

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Volatile Halocarbons	
1,2-Dibromoethane	EPA 8260B
	EPA 8260C
1,2-Dichloro-1,1,2-Trifluoroethane	EPA 8260C
1,2-Dichloroethane	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
1,2-Dichloropropane	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
1,3-Dichloropropane	EPA 8260B
	EPA 8260C
2,2-Dichloropropane	EPA 8260B
	EPA 8260C
2-Chloro-1,3-butadiene (Chloroprene)	EPA 8260B
	EPA 8260C
2-Chloroethylvinyl ether	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
3-Chloropropene (Allyl chloride)	EPA 8260B

Volatile Halocarbons	
3-Chloropropene (Allyl chloride)	EPA 8260C
Bromochloromethane	EPA 8260B
	EPA 8260C
Bromodichloromethane	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
Bromoform	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
Bromomethane	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
Carbon tetrachloride	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
Chloroethane	EPA 601
	EPA 624

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Volatile Halocarbons	
Chloroethane	EPA 8021B
	EPA 8260B
	EPA 8260C
Chloroform	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
Chloromethane	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
cis-1,2-Dichloroethene	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
cis-1,3-Dichloropropene	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
Dibromochloromethane	EPA 601
	EPA 624
	EPA 8021B

Volatile Halocarbons	
Dibromochloromethane	EPA 8260B
	EPA 8260C
Dibromomethane	EPA 8260B
	EPA 8260C
Dichlorodifluoromethane	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
Hexachlorobutadiene, Volatile	EPA 8260B
	EPA 8260C
Methyl iodide	EPA 8260B
	EPA 8260C
Methylene chloride	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
Tetrachloroethene	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
trans-1,2-Dichloroethene	EPA 601
	EPA 624

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Volatile Halocarbons	
trans-1,2-Dichloroethene	EPA 8021B
	EPA 8260B
	EPA 8260C
trans-1,3-Dichloropropene	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
trans-1,4-Dichloro-2-butene	EPA 8260B
	EPA 8260C
Trichloroethene	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
Trichlorofluoromethane	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C
Vinyl chloride	EPA 601
	EPA 624
	EPA 8021B
	EPA 8260B
	EPA 8260C

Volatiles Organics	
1,4-Dioxane	EPA 8260B
	EPA 8260C
2-Butanone (Methylethyl ketone)	EPA 8260B
	EPA 8260C
2-Hexanone	EPA 8260B
	EPA 8260C
2-Nitropropane	EPA 8260B
	EPA 8260C
4-Methyl-2-Pentanone	EPA 8260B
	EPA 8260C
Acetone	EPA 8260B
	EPA 8260C
Acetonitrile	EPA 8260B
	EPA 8260C
Carbon Disulfide	EPA 8260B
	EPA 8260C
Cyclohexane	EPA 8260B
	EPA 8260C
Di-ethyl ether	EPA 8260B
	EPA 8260C
Ethyl Acetate	EPA 8015 B
	EPA 8015C
	EPA 8260B
	EPA 8260C
Isobutyl alcohol	EPA 8015 B

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Volatiles Organics	
Isobutyl alcohol	EPA 8015C
	EPA 8260B
	EPA 8260C
Isopropanol	EPA 8260B
	EPA 8260C
Methyl acetate	EPA 8260B
	EPA 8260C
Methyl cyclohexane	EPA 8260B
	EPA 8260C
	EPA 8270D
n-Butanol	EPA 8260B
	EPA 8260C
o-Toluidine	EPA 8260B
	EPA 8260C
	EPA 8270C
	EPA 8270D
Vinyl acetate	EPA 8260B
	EPA 8260C
Wastewater Metals I	
Barium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Wastewater Metals I	
Cadmium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Calcium, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
	EPA 6010C
Chromium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Copper, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Iron, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
	EPA 6010C
Lead, Total	EPA 200.7 Rev. 4.4

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Wastewater Metals I	
Lead, Total	EPA 200.8 Rev. 5.4
	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
	EPA 7010
	SM 18-19, 21 3113B (99 & 04)
Magnesium, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
	EPA 6010C
Manganese, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Nickel, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Potassium, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
	EPA 6010C

Wastewater Metals I	
Silver, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Sodium, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
	EPA 6010C
Strontium, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
	EPA 6010C
Wastewater Metals II	
Aluminum, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
	EPA 6010C
Antimony, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Arsenic, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010B

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Wastewater Metals II	
Arsenic, Total	EPA 6010C
	EPA 6020
	EPA 6020A
	EPA 7010
	EPA 7060A
	SM 18-19, 21 3113B (99 & 04)
Beryllium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Chromium VI	EPA 218.6 Rev. 3.3
	EPA 7196A
	EPA 7199
	SM 18-19 3500-Cr D
	SM 20-21 3500-Cr B (01)
Mercury, Low Level	EPA 1631E
Mercury, Total	EPA 245.1 Rev. 3.0
	EPA 7470A
Selenium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010B
	EPA 6010C
	EPA 6020

Wastewater Metals II	
Selenium, Total	EPA 6020A
	EPA 7010
	SM 18-19, 21 3113B (99 & 04)
Vanadium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Zinc, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Wastewater Metals III	
Cobalt, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Gold, Total	EPA 200.7 Rev. 4.4
Molybdenum, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4

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Wastewater Metals III	
Molybdenum, Total	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Palladium, Total	EPA 200.7 Rev. 4.4
Thallium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 279.2 Rev. 1978
	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
	EPA 7010
	SM 18-19, 21 3113B (99 & 04)
Tin, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
	EPA 6010C
Titanium, Total	EPA 200.7 Rev. 4.4
	EPA 6010B
	EPA 6010C
Uranium (Mass)	EPA 6020
	EPA 6020A
Wastewater Miscellaneous	
Boron, Total	EPA 200.7 Rev. 4.4
	EPA 6010B

Wastewater Miscellaneous	
Boron, Total	EPA 6010C
Bromide	EPA 300.0 Rev. 2.1
	EPA 9056A
Color	SM 18-21 2120B (01)
Corrosivity	SM 18-19 2330
Cyanide, Total	EPA 335.4 Rev. 1.0
	EPA 9012A
	EPA 9012B
	SM 18-21 4500-CN E (99)
	SM 18-21 4500-CN G (99)
Formaldehyde	EPA 8315
Hydrogen Ion (pH)	EPA 9040B
	EPA 9040C
	SM 18-21 4500-H B (00)
Oil & Grease Total Recoverable (HEM)	EPA 1664A
Organic Carbon, Total	EPA 9060
	SM 18-21 5310C (00)
Perchlorate	EPA 6850
Phenols	EPA 420.4 Rev. 1.0
	EPA 9066
Silica, Dissolved	USGS I-2700-85
Specific Conductance	EPA 120.1 Rev. 1982
	EPA 9050
Sulfide (as S)	EPA 9034
	SM 18 4500-S E

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Wastewater Miscellaneous

Sulfide (as S)	SM 19-21 4500-S F (00)
Surfactant (MBAS)	SM 18-21 5540C (00)
Temperature	SM 18-21 2550B (00)
Total Chlorine Residual, Low Level	SM 18-21 4500-Cl G (00)
Total Petroleum Hydrocarbons	EPA 1664A
Total Residual Chlorine	SM 18-21 4500-Cl F (00)
	SM 18-21 4500-Cl G (00)
Turbidity	EPA 180.1 Rev. 2.0

Sample Preparation Methods

EPA 3010A
EPA 3020A
EPA 3510C
EPA 3520C
EPA 3535A
EPA 5030B
EPA 9030B

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1565 JEFFERSON ROAD BUILDING 300, SUITE 360
ROCHESTER, NY 14623

NY Lab Id No: 10145
EPA Lab Code: NY00032

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Acrylates	
Acrolein (Propenal)	EPA 8260B
	EPA 8260C
Acrylonitrile	EPA 8260B
	EPA 8260C
Ethyl methacrylate	EPA 8260B
	EPA 8260C
Methyl acrylonitrile	EPA 8260B
	EPA 8260C
Methyl methacrylate	EPA 8260B
	EPA 8260C
Amines	
1,2-Diphenylhydrazine	EPA 8270C
	EPA 8270D
1,4-Phenylenediamine	EPA 8270C
	EPA 8270D
1-Naphthylamine	EPA 8270C
	EPA 8270D
2-Naphthylamine	EPA 8270C
	EPA 8270D
2-Nitroaniline	EPA 8270C
	EPA 8270D
3-Nitroaniline	EPA 8270C
	EPA 8270D
4-Chloroaniline	EPA 8270C
	EPA 8270D
Amines	
4-Nitroaniline	EPA 8270C
	EPA 8270D
5-Chloro-2-methylaniline	EPA 8270C
	EPA 8270D
5-Nitro-o-toluidine	EPA 8270C
	EPA 8270D
Aniline	EPA 8270C
	EPA 8270D
Carbazole	EPA 8270C
	EPA 8270D
Diphenylamine	EPA 8270C
	EPA 8270D
Methapyrilene	EPA 8270C
	EPA 8270D
Pronamide	EPA 8270C
	EPA 8270D
Benzidines	
3,3'-Dichlorobenzidine	EPA 8270C
	EPA 8270D
3,3'-Dimethylbenzidine	EPA 8270C
	EPA 8270D
Benzidine	EPA 8270C
	EPA 8270D
Characteristic Testing	
Corrosivity	EPA 9045C

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2012
Issued April 01, 2011
Revised September 19, 2011

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Characteristic Testing	
Corrosivity	EPA 9045D
Free Liquids	EPA 9095A
	EPA 9095B
Ignitability	EPA 1010
Reactivity	SW-846 Ch7 Sec. 7.3

Chlorinated Hydrocarbon Pesticides	
4,4'-DDD	EPA 8081A
	EPA 8081B
4,4'-DDE	EPA 8081A
	EPA 8081B
4,4'-DDT	EPA 8081A
	EPA 8081B
Aldrin	EPA 8081A
	EPA 8081B
alpha-BHC	EPA 8081A
	EPA 8081B
alpha-Chlordane	EPA 8081A
	EPA 8081B
Atrazine	EPA 8270C
	EPA 8270D
beta-BHC	EPA 8081A
	EPA 8081B
Chlordane Total	EPA 8081A
	EPA 8081B
Chlorobenzilate	EPA 8270C

Chlorinated Hydrocarbon Pesticides	
Chlorobenzilate	EPA 8270D
delta-BHC	EPA 8081A
	EPA 8081B
Diallate	EPA 8270C
	EPA 8270D
Dieldrin	EPA 8081A
	EPA 8081B
Endosulfan I	EPA 8081A
	EPA 8081B
Endosulfan II	EPA 8081A
	EPA 8081B
Endosulfan sulfate	EPA 8081A
	EPA 8081B
Endrin	EPA 8081A
	EPA 8081B
Endrin aldehyde	EPA 8081A
	EPA 8081B
Endrin Ketone	EPA 8081A
	EPA 8081B
gamma-Chlordane	EPA 8081A
	EPA 8081B
Heptachlor	EPA 8081A
	EPA 8081B
Heptachlor epoxide	EPA 8081A
	EPA 8081B

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Chlorinated Hydrocarbon Pesticides	
Isodrin	EPA 8270D
Kepone	EPA 8081A
	EPA 8081B
Lindane	EPA 8081A
	EPA 8081B
Methoxychlor	EPA 8081A
	EPA 8081B
Pentachloronitrobenzene	EPA 8270C
	EPA 8270D
Toxaphene	EPA 8081A
	EPA 8081B
Chlorinated Hydrocarbons	
1,2,3-Trichlorobenzene	EPA 8260C
1,2,4,5-Tetrachlorobenzene	EPA 8270C
	EPA 8270D
1,2,4-Trichlorobenzene	EPA 8270C
	EPA 8270D
1-Chloronaphthalene	EPA 8270C
	EPA 8270D
2-Chloronaphthalene	EPA 8270C
	EPA 8270D
Hexachlorobenzene	EPA 8270C
	EPA 8270D
Hexachlorobutadiene	EPA 8270C
	EPA 8270D

Chlorinated Hydrocarbons	
Hexachlorocyclopentadiene	EPA 8270C
	EPA 8270D
Hexachloroethane	EPA 8270C
	EPA 8270D
Hexachlorophene	EPA 8270C
	EPA 8270D
Hexachloropropene	EPA 8270C
	EPA 8270D
Pentachlorobenzene	EPA 8270C
	EPA 8270D
Chlorophenoxy Acid Pesticides	
2,4,5-T	EPA 8151A
2,4,5-TP (Silvex)	EPA 8151A
2,4-D	EPA 8151A
Dicamba	EPA 8151A
Dinoseb	EPA 8270C
	EPA 8270D
Haloethers	
4-Bromophenylphenyl ether	EPA 8270C
	EPA 8270D
4-Chlorophenylphenyl ether	EPA 8270C
	EPA 8270D
Bis (2-chloroisopropyl) ether	EPA 8270C
	EPA 8270D
Bis(2-chloroethoxy)methane	EPA 8270C

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Haloethers	
Bis(2-chloroethoxy)methane	EPA 8270D
Bis(2-chloroethyl)ether	EPA 8270C
	EPA 8270D
Low Level Polynuclear Aromatic Hydrocarbons	
Acenaphthene	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
Acenaphthylene	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
Anthracene	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
Benzo(a)anthracene	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
Benzo(a)pyrene	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
Benzo(b)fluoranthene	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
Benzo(g,h,i)perylene	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
Low Level Polynuclear Aromatic Hydrocarbons	
Benzo(k)fluoroanthene	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
Chrysene	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
Dibenzo(a,h)anthracene	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
Fluoranthene	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
Fluorene	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
Indeno(1,2,3-cd)pyrene	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
Naphthalene	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
Phenanthrene	EPA 8270C
	EPA 8270D
	EPA 8270D SIM
Pyrene	EPA 8270C

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Low Level Polynuclear Aromatic Hydrocarbons	
Pyrene	EPA 8270D
	EPA 8270D SIM
Metals I	
Barium, Total	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Cadmium, Total	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Calcium, Total	EPA 6010B
	EPA 6010C
Chromium, Total	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Copper, Total	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Iron, Total	EPA 6010B
	EPA 6010C
Lead, Total	EPA 6010B
	EPA 6010C
Metals I	
Lead, Total	EPA 6020
	EPA 6020A
	EPA 7010
Magnesium, Total	EPA 6010B
	EPA 6010C
Manganese, Total	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Nickel, Total	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Potassium, Total	EPA 6010B
	EPA 6010C
Silver, Total	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Sodium, Total	EPA 6010B
	EPA 6010C
Strontium, Total	EPA 6010B
	EPA 6010C
Metals II	
Aluminum, Total	EPA 6010B

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Metals II	
Aluminum, Total	EPA 6010C
Antimony, Total	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Arsenic, Total	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
	EPA 7010
	EPA 7060A
Beryllium, Total	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Chromium VI	EPA 7196A
	EPA 7199
Lithium, Total	EPA 6010B
	EPA 6010C
Mercury, Total	EPA 7471A
	EPA 7471B
Selenium, Total	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A

Metals II	
Selenium, Total	EPA 7010
Vanadium, Total	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Zinc, Total	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Metals III	
Cobalt, Total	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Molybdenum, Total	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
Silica, Dissolved	EPA 6010B
	EPA 6010C
Thallium, Total	EPA 6010B
	EPA 6010C
	EPA 6020
	EPA 6020A
	EPA 7010

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Metals III	
Tin, Total	EPA 6010B
	EPA 6010C
Titanium, Total	EPA 6010C
Minerals	
Bromide	EPA 9056A
Chloride	EPA 9056A
Fluoride, Total	EPA 9056A
Sulfate (as SO4)	EPA 9056A
Miscellaneous	
Boron, Total	EPA 6010B
	EPA 6010C
Cyanide, Total	EPA 9012A
	EPA 9012B
Formaldehyde	EPA 8315
Hydrogen Ion (pH)	EPA 9040B
	EPA 9040C
	EPA 9045C
	EPA 9045D
Organic Carbon, Total	Lloyd Kahn Method
Perchlorate	EPA 6850
Phenols	EPA 9066
Sulfide (as S)	EPA 9034
Nitroaromatics and Isophorone	
1,3,5-Trinitrobenzene	EPA 8270C

Nitroaromatics and Isophorone	
1,3,5-Trinitrobenzene	EPA 8270D
	EPA 8330
	EPA 8330B
1,3-Dinitrobenzene	EPA 8270C
	EPA 8270D
	EPA 8330
	EPA 8330B
1,4-Naphthoquinone	EPA 8270C
	EPA 8270D
2,4,6-Trinitrotoluene	EPA 8330
	EPA 8330B
2,4-Dinitrotoluene	EPA 8270C
	EPA 8270D
	EPA 8330
	EPA 8330B
2,6-Dinitrotoluene	EPA 8270C
	EPA 8270D
	EPA 8330
	EPA 8330B
2-Amino-4,6-dinitrotoluene	EPA 8330
	EPA 8330B
2-Nitrotoluene	EPA 8330
	EPA 8330B
3,5-Dinitroaniline	EPA 8330B
3-Nitrotoluene	EPA 8330

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Nitroaromatics and Isophorone	
3-Nitrotoluene	EPA 8330B
4-Amino-2,6-dinitrotoluene	EPA 8330
	EPA 8330B
4-Dimethylaminoazobenzene	EPA 8270C
	EPA 8270D
4-Nitrotoluene	EPA 8330
	EPA 8330B
Hexahydro-1,3,5-trinitro-1,3,5-triazine	EPA 8330
	EPA 8330B
Isophorone	EPA 8270C
	EPA 8270D
Methyl-2,4,6-trinitrophenylnitramine	EPA 8330
	EPA 8330B
Nitrobenzene	EPA 8270C
	EPA 8270D
	EPA 8330
	EPA 8330B
Nitroglycerine	EPA 8330B
Nitroquinoline-1-oxide	EPA 8270C
	EPA 8270D
Octahydro-tetranitro-tetrazocine	EPA 8330
	EPA 8330B
Pentaerythritol tetranitrate	EPA 8330B
Pyridine	EPA 8270C
	EPA 8270D

Nitrosoamines	
N-Nitrosodiethylamine	EPA 8270C
	EPA 8270D
N-Nitrosodimethylamine	EPA 8270C
	EPA 8270D
N-Nitrosodi-n-butylamine	EPA 8270C
	EPA 8270D
N-Nitrosodi-n-propylamine	EPA 8270C
	EPA 8270D
N-Nitrosodiphenylamine	EPA 8270C
	EPA 8270D
N-nitrosomethylethylamine	EPA 8270C
	EPA 8270D
N-nitrosomorpholine	EPA 8270C
	EPA 8270D
N-nitrosopiperidine	EPA 8270C
	EPA 8270D
N-Nitrosopyrrolidine	EPA 8270C
	EPA 8270D
Nutrients	
Nitrate (as N)	EPA 9056A
Nitrite (as N)	EPA 9056A
Organophosphate Pesticides	
Dimethoate	EPA 8270C
	EPA 8270D
Disulfoton	EPA 8270C

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Organophosphate Pesticides	
Disulfoton	EPA 8270D
Parathion ethyl	EPA 8270C
	EPA 8270D
Parathion methyl	EPA 8270C
	EPA 8270D
Phorate	EPA 8270C
	EPA 8270D
Sulfotepp	EPA 8270C
	EPA 8270D
Thionazin	EPA 8270C
	EPA 8270D
Petroleum Hydrocarbons	
Diesel Range Organics	EPA 8015 B
	EPA 8015C
Gasoline Range Organics	EPA 8015 B
	EPA 8015C
Phthalate Esters	
Benzyl butyl phthalate	EPA 8270C
	EPA 8270D
Bis(2-ethylhexyl) phthalate	EPA 8270C
	EPA 8270D
Diethyl phthalate	EPA 8270C
	EPA 8270D
Dimethyl phthalate	EPA 8270C
	EPA 8270D

Phthalate Esters	
Di-n-butyl phthalate	EPA 8270C
	EPA 8270D
Di-n-octyl phthalate	EPA 8270C
	EPA 8270D
Polychlorinated Biphenyls	
PCB-1016	EPA 8082
	EPA 8082A
PCB-1221	EPA 8082
	EPA 8082A
PCB-1232	EPA 8082
	EPA 8082A
PCB-1242	EPA 8082
	EPA 8082A
PCB-1248	EPA 8082
	EPA 8082A
PCB-1254	EPA 8082
	EPA 8082A
PCB-1260	EPA 8082
	EPA 8082A
PCB-1262	EPA 8082
	EPA 8082A
PCB-1268	EPA 8082
	EPA 8082A
Polynuclear Aromatic Hydrocarbons	
2-Acetylaminofluorene	EPA 8270D

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Polynuclear Aromatic Hydrocarbons	
3-Methylcholanthrene	EPA 8270C
	EPA 8270D
7,12-Dimethylbenzyl (a) anthracene	EPA 8270C
	EPA 8270D
Acenaphthene	EPA 8270C
	EPA 8270D
Acenaphthylene	EPA 8270C
	EPA 8270D
Anthracene	EPA 8270C
	EPA 8270D
Benzo(a)anthracene	EPA 8270C
	EPA 8270D
Benzo(a)pyrene	EPA 8270C
	EPA 8270D
Benzo(b)fluoranthene	EPA 8270C
	EPA 8270D
Benzo(ghi)perylene	EPA 8270C
	EPA 8270D
Benzo(k)fluoranthene	EPA 8270C
	EPA 8270D
Chrysene	EPA 8270C
	EPA 8270D
Dibenzo(a,h)anthracene	EPA 8270C
	EPA 8270D
Fluoranthene	EPA 8270C

Polynuclear Aromatic Hydrocarbons	
Fluoranthene	EPA 8270D
Fluorene	EPA 8270C
	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 8270C
	EPA 8270D
Naphthalene	EPA 8270C
	EPA 8270D
Phenanthrene	EPA 8270C
	EPA 8270D
Pyrene	EPA 8270C
	EPA 8270D
Priority Pollutant Phenols	
2,3,4,6 Tetrachlorophenol	EPA 8270C
	EPA 8270D
2,4,5-Trichlorophenol	EPA 8270C
	EPA 8270D
2,4,6-Trichlorophenol	EPA 8270C
	EPA 8270D
2,4-Dichlorophenol	EPA 8270C
	EPA 8270D
2,4-Dimethylphenol	EPA 8270C
	EPA 8270D
2,4-Dinitrophenol	EPA 8270C
	EPA 8270D
2,6-Dichlorophenol	EPA 8270C

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2012
Issued April 01, 2011
Revised September 19, 2011

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. MICHAEL PERRY
COLUMBIA ANALYTICAL SERVICES
1565 JEFFERSON ROAD BUILDING 300, SUITE 360
ROCHESTER, NY 14623

NY Lab Id No: 10145
EPA Lab Code: NY00032

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Priority Pollutant Phenols	
2,6-Dichlorophenol	EPA 8270D
2-Chlorophenol	EPA 8270C
	EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 8270C
	EPA 8270D
2-Methylphenol	EPA 8270C
	EPA 8270D
2-Nitrophenol	EPA 8270C
	EPA 8270D
3-Methylphenol	EPA 8270C
	EPA 8270D
4-Chloro-3-methylphenol	EPA 8270C
	EPA 8270D
4-Methylphenol	EPA 8270C
	EPA 8270D
4-Nitrophenol	EPA 8270C
	EPA 8270D
Pentachlorophenol	EPA 8151A
	EPA 8270C
	EPA 8270D
Phenol	EPA 8270C
	EPA 8270D

Semi-Volatile Organics	
1,1'-Biphenyl	EPA 8270C
	EPA 8270D

Semi-Volatile Organics	
1,2-Dichlorobenzene, Semi-volatile	EPA 8270C
	EPA 8270D
1,3-Dichlorobenzene, Semi-volatile	EPA 8270C
	EPA 8270D
1,4-Dichlorobenzene, Semi-volatile	EPA 8270C
	EPA 8270D
2-Methylnaphthalene	EPA 8270C
	EPA 8270D
2-Picoline	EPA 8270D
4-Amino biphenyl	EPA 8270C
	EPA 8270D
Acetophenone	EPA 8270C
	EPA 8270D
Aramite	EPA 8270C
	EPA 8270D
Benzaldehyde	EPA 8270C
	EPA 8270D
Benzoic Acid	EPA 8270C
	EPA 8270D
Benzyl alcohol	EPA 8270C
	EPA 8270D
Caprolactam	EPA 8270C
	EPA 8270D
Dibenzofuran	EPA 8270C
	EPA 8270D

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Semi-Volatile Organics	
Ethyl methanesulfonate	EPA 8270C
	EPA 8270D
Isosafrole	EPA 8270C
	EPA 8270D
Methyl methanesulfonate	EPA 8270C
	EPA 8270D
O,O,O-Triethyl phosphorothioate	EPA 8270C
	EPA 8270D
Phenacetin	EPA 8270C
	EPA 8270D
Safrole	EPA 8270C
	EPA 8270D
Volatile Aromatics	
1,2,4-Trichlorobenzene, Volatile	EPA 8260B
	EPA 8260C
1,2,4-Trimethylbenzene	EPA 8021B
	EPA 8260B
	EPA 8260C
1,2-Dichlorobenzene	EPA 8260B
	EPA 8260C
1,3,5-Trimethylbenzene	EPA 8021B
	EPA 8260B
	EPA 8260C
1,3-Dichlorobenzene	EPA 8260B
	EPA 8260C

Volatile Aromatics	
1,4-Dichlorobenzene	EPA 8260B
	EPA 8260C
2-Chlorotoluene	EPA 8260B
	EPA 8260C
4-Chlorotoluene	EPA 8260B
	EPA 8260C
Benzene	EPA 8021B
	EPA 8260B
	EPA 8260C
Bromobenzene	EPA 8260B
	EPA 8260C
Chlorobenzene	EPA 8021B
	EPA 8260B
	EPA 8260C
Ethyl benzene	EPA 8021B
	EPA 8260B
	EPA 8260C
Isopropylbenzene	EPA 8021B
	EPA 8260B
	EPA 8260C
Naphthalene, Volatile	EPA 8260B
	EPA 8260C
n-Butylbenzene	EPA 8021B
	EPA 8260B
	EPA 8260C

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Volatile Aromatics	
n-Propylbenzene	EPA 8021B
	EPA 8260B
	EPA 8260C
p-Isopropyltoluene (P-Cymene)	EPA 8021B
	EPA 8260B
	EPA 8260C
sec-Butylbenzene	EPA 8021B
	EPA 8260B
	EPA 8260C
Styrene	EPA 8260B
	EPA 8260C
tert-Butylbenzene	EPA 8021B
	EPA 8260B
	EPA 8260C
Toluene	EPA 8021B
	EPA 8260B
	EPA 8260C
Total Xylenes	EPA 8021B
	EPA 8260B
	EPA 8260C
Volatile Chlorinated Organics	
Benzyl chloride	EPA 8260C
Volatile Halocarbons	
1,1,1,2-Tetrachloroethane	EPA 8260B
	EPA 8260C

Volatile Halocarbons	
1,1,1-Trichloroethane	EPA 8260B
	EPA 8260C
1,1,2,2-Tetrachloroethane	EPA 8260B
	EPA 8260C
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260B
	EPA 8260C
1,1,2-Trichloroethane	EPA 8260B
	EPA 8260C
1,1-Dichloroethane	EPA 8260B
	EPA 8260C
1,1-Dichloroethene	EPA 8260B
	EPA 8260C
1,1-Dichloropropene	EPA 8260B
	EPA 8260C
1,2,3-Trichloropropane	EPA 8260B
	EPA 8260C
1,2-Dibromo-3-chloropropane	EPA 8260B
	EPA 8260C
1,2-Dibromoethane	EPA 8260B
	EPA 8260C
1,2-Dichloroethane	EPA 8260B
	EPA 8260C
1,2-Dichloropropane	EPA 8260B
	EPA 8260C
1,3-Dichloropropane	EPA 8260B

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Volatile Halocarbons	
1,3-Dichloropropane	EPA 8260C
2,2-Dichloropropane	EPA 8260B
	EPA 8260C
2-Chloro-1,3-butadiene (Chloroprene)	EPA 8260B
	EPA 8260C
2-Chloroethylvinyl ether	EPA 8260B
	EPA 8260C
3-Chloropropene (Allyl chloride)	EPA 8260B
	EPA 8260C
Bromochloromethane	EPA 8260B
	EPA 8260C
Bromodichloromethane	EPA 8260B
	EPA 8260C
Bromoform	EPA 8260B
	EPA 8260C
Bromomethane	EPA 8260B
	EPA 8260C
Carbon tetrachloride	EPA 8260B
	EPA 8260C
Chloroethane	EPA 8260B
	EPA 8260C
Chloroform	EPA 8260B
	EPA 8260C
Chloromethane	EPA 8260B
	EPA 8260C

Volatile Halocarbons	
cis-1,2-Dichloroethene	EPA 8260B
	EPA 8260C
cis-1,3-Dichloropropene	EPA 8260B
	EPA 8260C
Dibromochloromethane	EPA 8260B
	EPA 8260C
Dibromomethane	EPA 8260B
	EPA 8260C
Dichlorodifluoromethane	EPA 8260B
	EPA 8260C
Hexachlorobutadiene, Volatile	EPA 8260B
	EPA 8260C
Methyl iodide	EPA 8260C
Methylene chloride	EPA 8260B
	EPA 8260C
Tetrachloroethene	EPA 8260B
	EPA 8260C
trans-1,2-Dichloroethene	EPA 8260B
	EPA 8260C
trans-1,3-Dichloropropene	EPA 8260B
	EPA 8260C
trans-1,4-Dichloro-2-butene	EPA 8260B
	EPA 8260C
Trichloroethene	EPA 8260B
	EPA 8260C

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Volatile Halocarbons	
Trichlorofluoromethane	EPA 8260B
	EPA 8260C
Vinyl chloride	EPA 8260B
	EPA 8260C
Volatile Organics	
1,4-Dioxane	EPA 8260B
	EPA 8260C
2-Butanone (Methylethyl ketone)	EPA 8260B
	EPA 8260C
2-Hexanone	EPA 8260B
	EPA 8260C
2-Nitropropane	EPA 8260B
	EPA 8260C
4-Methyl-2-Pentanone	EPA 8260B
	EPA 8260C
Acetone	EPA 8260B
	EPA 8260C
Acetonitrile	EPA 8260B
	EPA 8260C
Carbon Disulfide	EPA 8260B
	EPA 8260C
Cyclohexane	EPA 8260B
	EPA 8260C
Di-ethyl ether	EPA 8260B
	EPA 8260C
Volatile Organics	
Ethyl Acetate	EPA 8260B
	EPA 8260C
Ethylene Glycol	EPA 8015 B
	EPA 8015C
Isobutyl alcohol	EPA 8260B
	EPA 8260C
Isopropanol	EPA 8260B
	EPA 8260C
Methyl acetate	EPA 8260B
	EPA 8260C
Methyl cyclohexane	EPA 8260B
	EPA 8260C
Methyl tert-butyl ether	EPA 8021B
	EPA 8260B
	EPA 8260C
n-Butanol	EPA 8260B
	EPA 8260C
o-Toluidine	EPA 8260B
	EPA 8260C
	EPA 8270C
	EPA 8270D
Propionitrile	EPA 8260B
	EPA 8260C
tert-butyl alcohol	EPA 8260B
	EPA 8260C

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All approved analytes are listed below:

Volatile Organics	
Vinyl acetate	EPA 8260B
	EPA 8260C
Sample Preparation Methods	
	EPA 1311
	EPA 1312
	EPA 3050B
	EPA 3060A
	EPA 3541
	EPA 3550C
	EPA 3580A
	EPA 5030B
	EPA 5035
	EPA 5035A
	EPA 9030B

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ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved subcategories and/or analytes are listed below:

Miscellaneous		
Lead in Dust Wipes	EPA 6010B	
	EPA 6010C	
Sample Preparation Methods		
	EPA 3050B	

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Acrylates	
Acrylonitrile	EPA TO-15
Ethyl acrylate	EPA TO-15
Methyl methacrylate	EPA TO-15
Chlorinated Hydrocarbons	
1,2,4-Trichlorobenzene	EPA TO-15
Hexachlorobutadiene	EPA TO-15
Miscellaneous Air	
Sulfuric Acid	40 CFR 60 Method 8
Purgeable Aromatics	
1,2,4-Trimethylbenzene	EPA TO-15
1,2-Dichlorobenzene	EPA TO-15
1,3,5-Trimethylbenzene	EPA TO-15
1,3-Dichlorobenzene	EPA TO-15
1,4-Dichlorobenzene	EPA TO-15
Benzene	EPA TO-15
Chlorobenzene	EPA TO-15
Ethyl benzene	EPA TO-15
m/p-Xylenes	EPA TO-15
o-Xylene	EPA TO-15
Styrene	EPA TO-15
Toluene	EPA TO-15
Total Xylenes	EPA TO-15
Purgeable Halocarbons	
1,1,1-Trichloroethane	EPA TO-15
Purgeable Halocarbons	
1,1,2,2-Tetrachloroethane	EPA TO-15
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA TO-15
1,1,2-Trichloroethane	EPA TO-15
1,1-Dichloroethane	EPA TO-15
1,1-Dichloroethene	EPA TO-15
1,2-Dibromoethane	EPA TO-15
1,2-Dichloro-1,1,2,2-tetrafluoroethane	EPA TO-15
1,2-Dichloroethane	EPA TO-15
1,2-Dichloropropane	EPA TO-15
Bromodichloromethane	EPA TO-15
Bromoform	EPA TO-15
Bromomethane	EPA TO-15
Carbon tetrachloride	EPA TO-15
Chloroethane	EPA TO-15
Chloroform	EPA TO-15
Chloromethane	EPA TO-15
cis-1,2-Dichloroethene	EPA TO-15
cis-1,3-Dichloropropene	EPA TO-15
Dibromochloromethane	EPA TO-15
Dichlorodifluoromethane	EPA TO-15
Methylene chloride	EPA TO-15
Tetrachloroethene	EPA TO-15
trans-1,2-Dichloroethene	EPA TO-15
trans-1,3-Dichloropropene	EPA TO-15
Trichloroethene	EPA TO-15

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All approved analytes are listed below:

Purgeable Halocarbons	
Trichlorofluoromethane	EPA TO-15
Vinyl chloride	EPA TO-15
Volatile Chlorinated Organics	
Benzyl chloride	EPA TO-15
Volatile Organics	
1,3-Butadiene	EPA TO-15
2,2,4-Trimethylpentane	EPA TO-15
2-Butanone (Methylethyl ketone)	EPA TO-15
4-Methyl-2-Pentanone	EPA TO-15
Acetone	EPA TO-15
Carbon Disulfide	EPA TO-15
Cyclohexane	EPA TO-15
Hexane	EPA TO-15
Methyl iodide	EPA TO-15
Methyl tert-butyl ether	EPA TO-15
n-Heptane	EPA TO-15
Vinyl acetate	EPA TO-15

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parratt wolff inc

- About Us
- Office Locations/Contact Us
- Management Team
- Careers

"To be honest, I never thought I'd meet drillers I actually enjoy being around... until last week! The drillers from Parratt -Wolff answered my numerous questions about well installation and I truly felt like I learned more in one week with them than in months of reading or hearing about what happens during a well installation." - *Allison Fang, Geologist*

About Us

Parratt-Wolff is now in its second generation of management. Having grown, matured and evolved into an employee-owned company, we are proudly continuing the service and know-how that has been our trademark since our founding.

Our technical expertise allows us to provide services unimagined when the firm was launched in 1969. Since that time, our company has evolved into a well-known, highly respected provider of specialty contract drilling services. All of our geotechnical drilling is performed under strict compliance with ASTM Standards.

We have grown to a company of three offices, 55 employees and we now own over 40 major pieces of field equipment. We service clients from Maine to Florida and as far west as Michigan. Our growth is the result of solid management, dedicated field professionals and the repeat business of our many, satisfied clients.

Despite all the changes some things remain the same at Parratt-Wolff....an unwavering commitment to delivering consistently high quality work, on schedule and at a competitive price.

» **East Syracuse, New York:**
5879 Fisher Road, P.O. Box 56, East Syracuse, New York 13057 P: 800-782-7260 or 315-437-1429 Email: info@pwinc.com
» **Hillsborough, North Carolina:**
501 Millstone Drive, P.O. Box 1029, Hillsborough, North Carolina 27278 P: 800-627-7920 or 919-644-2814 Email: info@pwnc.com
» **Lewisburg, Pennsylvania:**
PO Bx 608, Suite 230, 4650 Westbranch Highway, Lewisburg, Pennsylvania 17837 P: 570-523-8913

QUALITY ASSURANCE PLAN

The enclosed quality assurance plan (QAP) is based on proper training and the strict adherence to either accepted standards and/or the client-prepared scope of work.

Training

All field personnel are trained prior to the initiation of field tasks. New employees are assigned to tasks where they can observe first and help second in acquiring new skills. For example, a new driller's helper is first assigned to a two-man crew where he can learn his trade by observing the crew in action. As the drilling manager sees fit, the helper is included in field tasks. Only when fully competent in his/her task is the crew reduced to a driller and the new helper. Also, within the first year of employment, all new helpers attend Loss Prevention System and 40-hour OSHA hazardous site worker training.

Before becoming a driller, a helper must show a full grasp of the driller's duties and demonstrate the ability and attitude necessary to assume the increased responsibility. Once working as a driller, the employee's performance is continuously monitored by the PWI management team and additional training is provided as needed. Each driller is also afforded the opportunity to attend a course, school or trade shows. This combination of both field and classroom training keeps all employees properly trained and abreast of changes in technology and standards. Additionally, all hazardous site workers receive OSHA refresher training once a year.

Backhoe operators are hired from the construction field and have previous experience and training prior to working as operators for PWI.

License/Registration/Certification

Once promoted to driller, each employee is encouraged to seek professional recognition for his skills. PWI drillers hold individual licenses in Connecticut, Delaware, Georgia, Maryland, Massachusetts, Mississippi, New Hampshire, New Jersey, New York, North Carolina and South Carolina. PWI drillers are also certified by the National Ground Water Association and the National Drilling Association. Three professional geologists are on-staff as drillers or as managers.

Standard and Technical Approaches

All field work is completed in general conformance with either accepted standards (i.e., ASTM) or to a client's work plan. Our field crews are familiar with the ASTM standards for their particular task, whether it is test borings or monitoring well installations. Unless directed otherwise, ASTM standards guide all applicable field operations. In the case where the standards conflict with a client's requirements, the client's approach is always followed. For example, clients often specify that split spoon samplers be driven a full 2.0' rather than the ASTM standard 1.5'. In this case, the client's direction is followed.

Conclusion

All tasks performed by PWI personnel are done with consistency and integrity. All crews perform tasks in a similar fashion and according to accepted protocols. This level of consistency and emphasis on integrity affords our clients opportunity to work with any of our field crews and receive the same high quality product.

Facility Audit: Baltimore, MD

CleanHarbors

Table of Contents

1.0 General Company Information

Introduction

Clean Harbors is North America's leading provider of environmental, energy and industrial services serving over 50,000 customers, including a majority of the Fortune 500 companies, thousands of smaller private entities and numerous federal, state, provincial and local governmental agencies.

Within Clean Harbors Environmental Services, the company offers Technical Services and Field Services. Technical Services provide a broad range of hazardous material management and disposal services including the collection, packaging, recycling, treatment and disposal of hazardous and non-hazardous waste. Field Services provide a wide variety of environmental cleanup services on customer sites or other locations on a scheduled or emergency response basis.

Within Clean Harbors Energy & Industrial Services, the company offers Industrial Services and Exploration Services. Industrial Services provide industrial and specialty services, such as high-pressure and chemical cleaning, catalyst handling, decoking, material processing and industrial lodging services to refineries, chemical plants, pulp and paper mills, and other industrial facilities. Exploration Services provide exploration, rental, oil and gas field services, and directional boring services to the energy sector serving oil and gas exploration, production, and power generation.

Headquartered in Norwell, Massachusetts, Clean Harbors has more than 175 locations, including over 50 waste management facilities, throughout North America in 38 U.S. states, seven Canadian provinces, Mexico and Puerto Rico. The Company also operates international locations in Bulgaria, China, Sweden, Singapore, Thailand and the United Kingdom. For more information, visit www.cleanharbors.com.

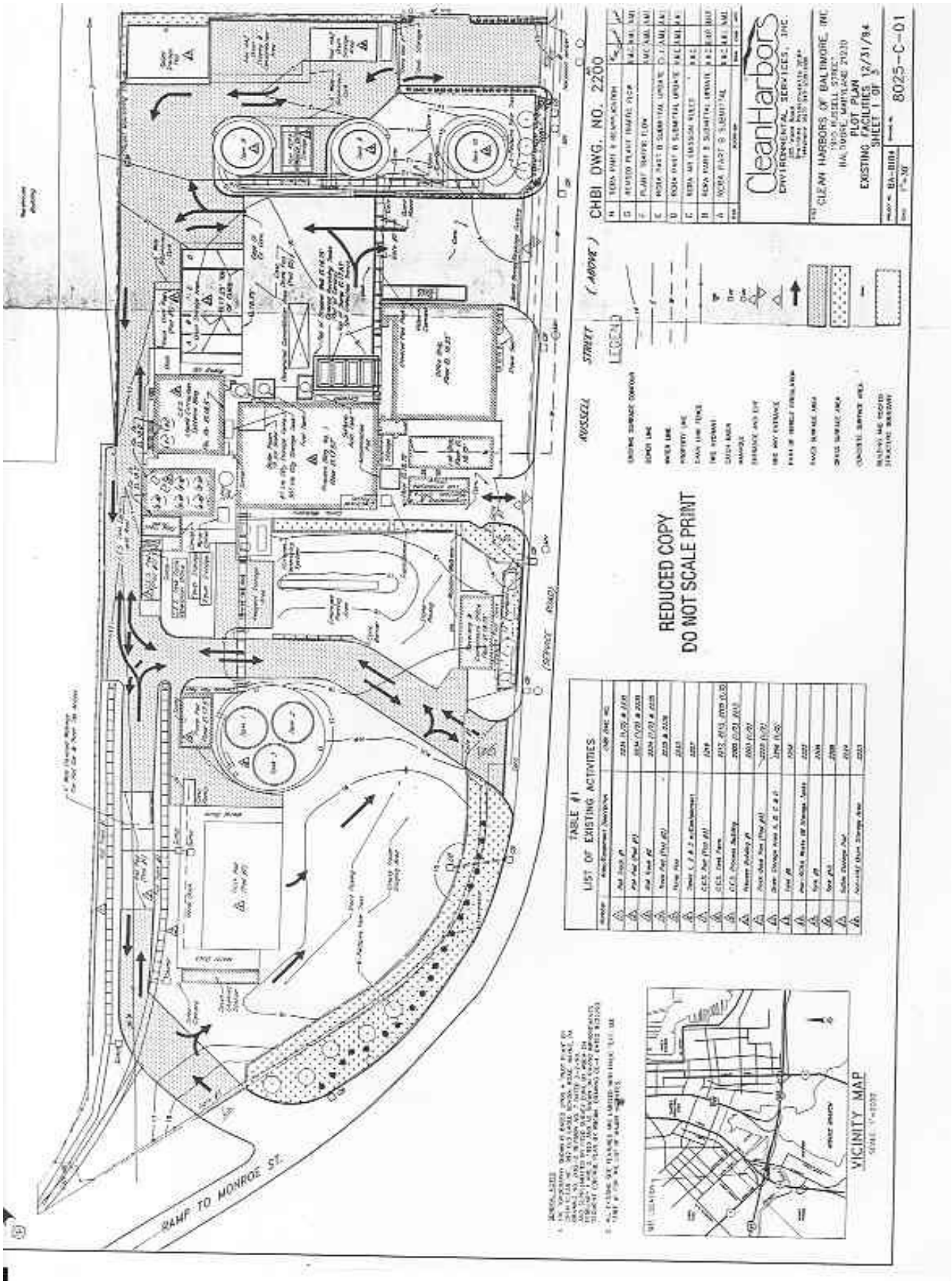
2.0 Facility Information

Facility Overview

Clean Harbors of Baltimore, Inc., a subsidiary of Clean Harbors, Inc. headquartered in Norwell, Massachusetts, owns and operates a hazardous waste storage, treatment and disposal facility located in Baltimore, Maryland. This facility has been permitted by the Maryland Department of the Environment to receive, store, treat and transfer a variety of waste streams. The treatment methods utilized at this facility reduce the volume and or toxicity of waste materials or make it suitable for further treatment, reuse, or disposal.

Facility Name:	Clean Harbors of Baltimore, Inc.
Location:	1910 Russell Street Baltimore, MD 21230
County:	Baltimore City
Facility Owner:	Clean Harbors of Baltimore, Inc. 1910 Russell Street Baltimore, MD 21230
Property Owner:	Clean Harbors of Baltimore, Inc. 1910 Russell Street Baltimore, MD 21230
Facility I.D. No.:	MDD980555189
Permit Type	RCRA Part B Permit No. A-151, Issued 09/10/08 Expires 09/09/18.
Waste Description:	Industrial pretreatment aqueous organic and inorganic wastes.
Services Provided:	Inorganic aqueous waste treatment Chemical precipitation Phase separation Organic aqueous waste treatment Liquefied carbon dioxide extraction Activated carbon adsorption Oil recover Container storage/transfer Transportation and disposal

Facility Site Plan



Facility History

According to information contained in the RCRA facility assessment performed by A.T. Kearney for the USEPA in 1991, a 1896 topographical map shows the site was once a marsh. Documented ownership dates back to 1932. Sun Oil owned and operated the site as an oil storage and transfer facility until 1972. Skyline Terminals operated the site a paint transfer facility from 1972 till 1979. The City of Baltimore owned the property from October 1979 till April 1986. During this time, ChemClear conducted an aqueous waste treatment operation at the site. Ownership of the property was transferred to ChemClear in May 1986 and in January of 1989 Clean Harbors purchased ChemClear and this property.

Site Characterization

Clean Harbors of Baltimore, Inc. is located in an area zoned heavy industrial.

Security

A chain link fence topped with barbwire secures the premises of this site. Access is restricted through locked gates. Security and fire systems are monitored twenty-four hours a day and seven days a week.

Directions to Facility

Facility Address

Clean Harbors of Baltimore, Inc.
1910 Russell Street
Baltimore, MD 21230
410.244.8200

From the North

1. Take 1-95 South through the Fort McHenry Tunnel to I-395
2. Take Exit 53 following signs to Martin Luther King Blvd.
3. Take the Russell Street exit.
4. At the end of the ramp turn left.
5. At the light, turn left onto Russell Street.
6. Continue on Russell Street and take Monroe Street/Route 1 Exit on the right.
7. The facility is located on the right (look for the large gray tanks). Parking is available in the front of the office building.

From the South

1. Take I-95 North to Exit 52, Russell Street.
2. After the light, turn right onto Haines Street
3. Take a left onto Warner Street.
4. Turn Left onto Bayard Street.
5. At the light, turn left onto Russell Street and stay to the right.
6. Go through the first light; veer off to the Route 1, Monroe Street exit.
7. The facility will be on the right.

From the BWI Airport

1. Take 295 North (Baltimore Washington Expressway) to the first light.
2. Turn right onto Haines Street.
3. Take a left onto Warner Street.
4. Turn left onto Bayard Street.
5. At the light, turn left onto Russell Street and stay to the right.
6. Go through the first light; veer off to the Route 1, Monroe Street exit.
7. The facility will be on the right.

NOTE: As a point of reference, we are directly across from the "Baltimore" Resco trash incinerator which has a large smoke stack with blinking white strobe lights.

3.0 Operating Licenses and Permits

Permit Summary

Clean Harbors of Baltimore, Inc. is currently permitted by the Maryland Department of the Environment and the City of Baltimore Bureau of Water and Wastewater for the collection, storage, analysis, treatment of wastewaters and for container storage of a variety of hazardous waste for consolidation and subsequent transfer off-site.

Permit Type/Governing Agency	Permit No.	Expiration. Date
Hazardous Waste Operating (TSDF) Department of the Environment State of Maryland	A-151	09/09/18
Industrial Pretreatment Department of Public Works Bureau of Water and Wastewater City of Baltimore	1-01818	05/31/14
Air Quality Air Management Administration Department of the Environment State of Maryland	510-2260	7/31/2014
Flammable Storage Permit Fire Department, City of Baltimore	98742	12/14/11
Oil Operations Department of Environment	2000-0PT-3063	06/03/10
Oil Operations Department of Environment	2010-OPT-3063	5/18/2015

Principal Operating Licenses/Permits

Copies of existing permits which detail types of waste management licensed capacities and waste types accepted are available for inspection upon request at the site. Selected permit pages may be found at the end of this audit under Appendix 8.0.

Principal Contacts/Agencies

The list of contacts below can provide additional information regarding Clean Harbors of Baltimore's facility operations or compliance:

Operations:	Ed Romeo, General Manager Clean Harbors of Baltimore, Inc. 1910 Russell Street Baltimore, MD 21230 410.244.8200
Regulatory:	Susan Richardson, Facility Compliance Manager Clean Harbors of Baltimore, Inc. 1910 Russell Street Baltimore, MD 21230 410.244.8200
RCRA Compliance & Permitting:	Amin Yazdanian Permitting Maryland Department of the Environment 1800 Washington Boulevard Baltimore, MD 21230 410.537.3345
RCRA Enforcement:	Olga Patov RCRA Enforcement Maryland Department of the Environment 1800 Washington Boulevard Baltimore, MD 21230 410.537.3345
Water Quality POTW:	Mark Courtney, Pollution Control Analyst Department of Public Works City of Baltimore 8201 Eastern Avenue Baltimore, MD 212247 410.396.9695
Air Pollution:	Gregory Franzoni, Sr. Public Health Engineer Air management Administration Maryland Department of the Environment 1800 Washington Boulevard Baltimore, MD 21230 410.537.3231

4.0 Process Description

Organic Aqueous Waste Treatment

The facility utilizes highly refined processes that remove heavy metals, suspended solids and organics from liquid wastes and render the effluents safe for discharge into municipal sewer systems.

Clean Extraction System - Aqueous waste streams containing upwards of 30 percent organics are detoxified with the Clean Extraction System (CES) process. CES extracts organic chemicals from aqueous streams utilizing high pressure liquefied Carbon Dioxide in a counter current extraction column. Organics, which are soluble in liquefied Carbon Dioxide, are separated from the water phase resulting in a clean effluent and a liquid CO2/organic extract. The extract is slightly reduced in pressure and heated, vaporizing the CO2 and leaving an extremely concentrated organic stream that can be recycled as a hazardous waste fuel or incinerated off-site. The vaporized Carbon Dioxide is recompressed and recycled through the process. The aqueous effluent of the process is polished as necessary to remove any residual organics and metals with granular activated carbon and filters and subsequently discharged into the POTW sewer system.

Inorganic Aqueous Waste Treatment

The facility utilizes highly refined, multi-stage, chemical precipitation processes that remove heavy metals, suspended solids and residual organics from liquid wastes and render the effluents safe for discharge into municipal sewer systems. Resulting precipitated residues are dewatered with a filter press, and then disposed of in an approved landfill.

Chemical Precipitation - All aqueous wastes are eventually mixed together and processed on a continuous flow basis through a multi-compartmental specially designed treatment unit, where predetermined amounts of treatment chemicals are added and thoroughly mixed to effect precipitation of heavy metals and coagulation of suspended particles. Coagulated solids are removed in the form of sludge by gravity separation through high efficiency clarifiers.

Clarified effluent is stored in effluent storage tanks and is discharged into the City of Baltimore Sewer System upon confirmation of discharge permit parameters from independent certified laboratory analysis. Additionally, the City of Baltimore Sewer District continuously monitors discharge.

Chemical Oxidation/Reduction - Waste needing pretreatment to remove specific contaminants prior to its mixing with other wastes, is batch processed into a specially designed reactor vessel fitted with dual scrubbing towers. Adding chemical reagents specific to the batch as determined by the laboratory simulation as achieves the desired reaction. Upon completion of the reaction, each batch is tested to confirm the end result of the treatment, prior to its transfer into storage tanks for final precipitation treatment. Types of reactions carried out are: oxidation of cyanides and phenols, ammonia removal, chelating agent removal from wastes such as boiler cleaning solutions, reduction of hexavalent chromium to trivalent chromium, acid/base neutralization, etc.

Acid/Base Neutralization - Although this can be a final treatment method, neutralization is often used in conjunction with other treatment processes such as chemical precipitation, phase separation and oxidation/reduction treatment processes.

Neutralization involves the addition of an acid or a base to a solution to adjust the pH, usually to a level between 6 and 9. Alkaline neutralization usually involves the addition of Sodium Hydroxide, Potassium Hydroxide or slaked lime to an acidic wastewater to adjust the pH. Likewise, acidic neutralization involves the addition of a concentrated acid (such as Sulfuric Hydrochloric or Nitric) to an alkaline wastewater.

Storage and Transfer of Waste Oils

Waste industrial lubricating and fuel oils are stored on-site. Once a sufficient quantity is accumulated, the waste oil is shipped off-site for reclamation.

Container/Tank Storage/Transfer

A wide variety of wastes not acceptable for on-site treatment can be received for consolidation and transfer to other Clean Harbors' sites or select audited and approved non company-owned sites. The facility includes storage areas for tanks and containers meeting all RCRA requirements.

Railcar Storage/Transfer

The facility has the ability to receive, store and ship railcars of hazardous waste. The storage area meets all RCRA requirements.

Stabilization/Solidification of Characteristic Waste

The facility is authorized to solidify non hazardous waste and stabilize D004 - D011 wastes. The resulting de-characterized waste is then subject to management in accordance with subtitle D of RCRA. The physical absorption method of solidification utilizes clay based absorbents and/or synthetic polymers to absorb liquids. Cement type stabilization is the process of blending high calcium-oxide limes with liquids/ solids to generate a gypsum-like solid. The process enables the hazardous waste to be contained in the gypsum-like matrix. These processes are performed in drums and other bulk containers.

Container Management

Methods of treatment in containers may include neutralization, solidification, product adulteration, carbon adsorption and blending compatible wastes. RCRA regulated liquids are consolidated and shipped off-site for incineration. Container treatment and storage occurs in several permitted areas throughout the facility.

Waste Analysis

The Waste Analysis Plan for the facility outlines pre-qualification and on-site acceptance analysis requirements.

- **Pre-Qualification**

Prior to acceptance and treatment of a specific waste, Waste Material Profile Sheet must be submitted to and approved by Clean Harbors prior to any waste shipment. Waste profile can be completed and submitted online on Clean Harbors' website at www.cleanharbors.com. Once the waste material is accepted for treatment/disposal, this information becomes part of the permanent record in the generator's file and the waste may be scheduled for shipment.

- **On-Site Analysis/Acceptance**

With each delivery of approved waste, a sample is taken from the load and tested to determine whether the waste is the same as the previously submitted sample. If this analysis differs significantly from the advance sample, the waste will be deemed non-conforming. All non-conforming wastes are further analyzed to determine the best treatment alternatives, whether on-site handling at an adjusted price or transshipment to an alternative treatment facility. The customer is contacted regarding any non-conforming waste and given the option for alternate handling or return of their waste. On specification shipments are processed with one or more of the storage or treatment operations previously identified.

5.0 Closure Plan

A comprehensive facility closure plan has been developed in accordance with RCRA requirements and is available at the site for inspection upon request. A Certificate of Insurance guarantees financial assurance for closure.

6.0 Insurance

Clean Harbors and its subsidiaries maintain General Liability and Automobile Liability insurance with aggregate limits of $30,000,000. The Company purchases Environmental Impairment Liability insurance for its' waste facilities with limits of $30,000,000 insuring the Company against liability for sudden and accidental occurrences from the time waste is picked up from a customer, while being handled at the Company's treatment and transfer facilities, through its delivery to a disposal site. See attached copy of Certificate of Liability Insurance.

Clean Harbors purchases an insurance program for Closure (Post-Closure and Corrective Action where so required) in amounts that meet regulatory requirements.

Clean Harbors Casualty Insurance Program Summary

Policy	Limits of Liability
Workers Compensation & Employer's Liability	Statutory $1,000,000 Each Accident
Business Automobile Liability (Includes MCS-90 Endorsement)	$1,000,000 Each Occurrence $5,000,000 MCS-90
Comprehensive General Liability	$1,000,000 Each Occurrence $3,000,000 Aggregate
Excess (Umbrella) Liability (Follow Form)	$30,000,000 Each Occurrence $30,000,000 Aggregate
Wharfingers Liability	$10,000,000 Any one Vessel/Any one Accident
Contractor's Pollution Liability (Off-Site)	$10,000,000 Each Occurrence $10,000,000 Aggregate
Protection and Indemnity	$1,000,000 Each Occurrence/Any one Vessel
Environmental Impairment Liability (Coverage for Clean Harbors Facilities)	$3,000,000 Each Occurrence $6,000,000 Aggregate
Excess Pollution Liability (Sudden and Accidental Occurrences)	$30,000,000 Each Occurrence $30,000,000 Aggregate
Total coverage for Pollution incidences that occur during transportation related activities	$30,000,000 Limit

For more detail concerning Clean Harbors coverage, please contact the Clean Harbors Risk Management Department at 781.792.5000.

Facility Closure Certificate

http://clark.cleanharbors.com/tt/sl.ashx?z=219847c5&dataid=640&ft=1

Certificate of Liability Insurance

http://clark.cleanharbors.com/tt/sl.ashx?z=219847c5&dataid=98&ft=1

7.0 Financial Information

Financial information on Clean Harbors and its subsidiaries are available from the Clean Harbors website in the Investor Relations section.

http://www.cleanharbors.com/investor_relations/investment_materials.html

8.0 Appendix

If applicable, supporting facility documentation will follow.

Facility Audit: Bristol, CT

CleanHarbors

Table of Contents

1.0 General Company Information

Introduction

Clean Harbors is North America's leading provider of environmental, energy and industrial services serving over 50,000 customers, including a majority of the Fortune 500 companies, thousands of smaller private entities and numerous federal, state, provincial and local governmental agencies.

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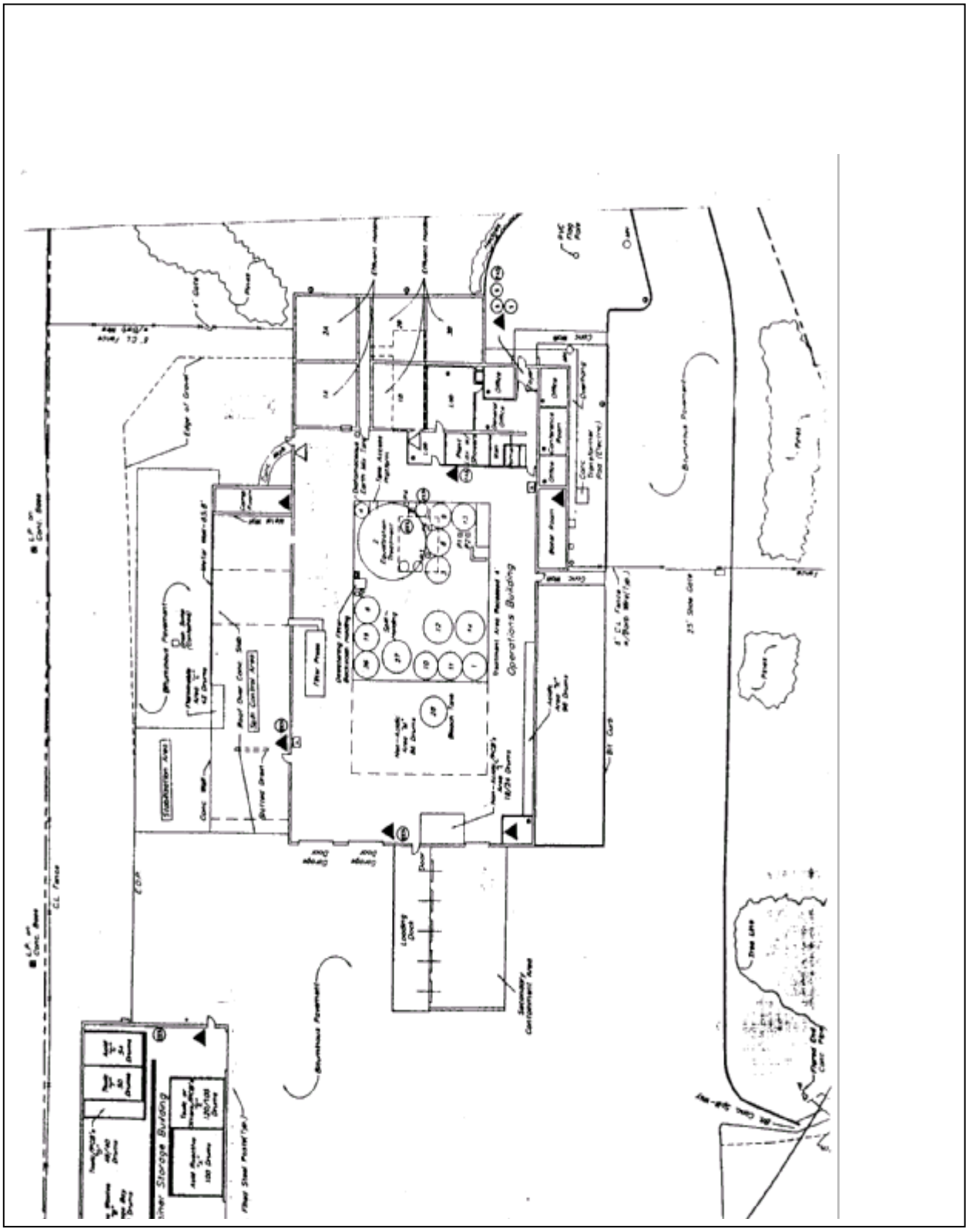
2.0 Facility Information

Facility Overview

Clean Harbors of Connecticut, Inc., a subsidiary of Clean Harbors, Inc. headquartered in Norwell, Massachusetts, owns and operates a hazardous waste storage, treatment and disposal facility located in Bristol, Connecticut. This facility is a RCRA Part B and Clean Water Act permitted facility, which has been permitted by the Connecticut Department of Environmental Protection to receive, store, treat and transfer a variety of waste streams. The treatment methods utilized at this facility reduce the volume and or toxicity of waste materials or make them suitable for further treatment, reuse, or disposal.

Facility Name	Clean Harbors of Connecticut, Inc.
Location	51 Broderick Road Bristol, CT 06010
County	Hartford
Facility Owner	Clean Harbors of Connecticut, Inc. 51 Broderick Road Bristol, CT 06010
Property Owner	Clean Harbors of Connecticut, Inc. 51 Broderick Road Bristol, CT 06010
Facility I.D. No.	CTD000604488
Permit Type	Part B Hazardous Waste and Connecticut Regulated Waste Facility, with Clean Water Act Discharge Permitting
Waste Description	Most organic and inorganic waste
Services Provided	Wastewater Treatment Stabilization Storage/Transfer Dismantling Process

Facility Site Plan



Facility History

The Clean Harbors of Connecticut, Inc. facility was constructed in 1980-81. Prior to the purchase, the site had been undeveloped. The facilities original developer and owner, who had initiated the present operating permits, sold the facility to CECOS, Inc. (Browning-Ferris Industries', or BFI's, hazardous waste division) in March, 1984. CECOS renamed the facility CECOS Treatment Corporation. On July 1st, 1990, most of CECOS, Inc.'s operations (including the Bristol facility) were purchased from BFI by Southdown, Inc. Southdown renamed the facility as the Connecticut Treatment Corporation and operated the facility until its acquisition by Clean Harbors on July 1, 1992.

Site Characterization

The facility property is approximately 3.5 acres in size and is located in a light industrial park on the eastern edge of Bristol, Connecticut. The facility site is located upon an outwash deposit zone consisting of generally light brown, fine to coarse sand with silt, to a depth of approximately 52 feet. At that depth, a glacial till zone consisting of reddish-brown fine to coarse sand/gravel, with 20-50% silt content, is encountered. Approximately ten feet below the till zone is bedrock.

A groundwater aquifer begins at approximately ten-foot depth and continues to bedrock. No drinking water wells are located within a half-mile of the facility. Until 2002, the facility had been required (by its State Discharge Permit) to conduct quarterly/annual sampling and analyses of four groundwater monitoring wells. This monitoring has been conducted since 1981, and no detectable release(s) attributable to the site's operations have been found. In 1988, in accordance with provisions of the facility's HSWA (Hazardous and Solid Waste Amendments of 1984) Permit, the facility had installed eight additional monitoring wells, from which several years of extensive quarterly monitoring analyses had also been conducted. No detectable groundwater releases or contamination attributable to Clean Harbors were found. In 1998, the U.S. EPA had published a Public Notice of the agency's preliminary determination to issue a No Further Action decision regarding the facility's HSWA status. No negative comments had been received by the EPA. As of March 2003 the EPA awaits the expected concurrence of the Connecticut Department of Environmental Protection with this conclusion, following which the EPA intends to render a final No Further Action decision.

A small stream runs along the southeast line of the facility, 200 feet away from any of the facilities building. The stream is an un-named tributary of the Eight Mile River, a quarter mile away. The stream receives stormwater run-off from Clean Harbors. The facility's discharge is permitted and monitored under Connecticut's General Permit for the Discharge of Stormwater Associated with Industrial Activity.

The plant is not located within a 100-year floodplain or a coastal high hazard zone, the southeast corner of the site (where the present stream runs) is located in the 100-year floodplain. The site has never received any past flood damage.

All waste management operations performed at the facility are conducted indoors or within a contained area; any resulting stormwaters are collected from outdoor process areas, tested and treated onsite through routine treatment processes.

The facility is located at least one mile from any sensitive receptor (ie., school, hospital).

Security

The Clean Harbors of Connecticut facility is surrounded by a six foot high chain-link fence topped with barbed wire. Access into the facility is controlled by a gate that is maintained in the closed position, except when temporarily opened by a compliance guard, working within a reception area in the adjacent building. Drivers and all other visitors are prohibited from entering the facility until they have produced appropriate identification, received a visitor badge, and signed into a visitor log. All the facility's employees have been trained in these sign-in requirements, as well as in the need to ensure facility access only to authorized personnel. Every employee has his/her own walkie-talkie radio as a means by which to immediately communicate any unusual findings, as well as to monitor routine activities underway within the facility.

Directions to Facility

Visitor entry at administrative building;
761 Middle Street,
Bristol, CT 06010
(860) 583-8917

From the North (Western Massachusetts Area)

1. Take Route 90 east to Route 91 South to Route 84 West.
2. Take Exit 31 off of 84 West.
3. At end of Exit 31, take a right (onto Route 229).
4. Go approximately 2.5 miles until you see ESPN on the right.
5. Go another 1/8th of a mile. Clean Harbors will be on the right at the bottom of a small hill.

From the North (Eastern Massachusetts Area)

1. Take Route 90 West to Route 84 West.
2. Continue with directions as stated above in steps 2-5.

From the West

1. Take Route 84 East to Exit 31.
2. At end of exit, take left.
3. Continue with directions as stated above in steps 4-5.

From the South (Stamford, CT Area)

1. Take Route 95 North to Route 8 North to Route 84 East to Exit 31.
2. At end of exit, take a left.
3. Continue with directions as stated above in steps 4-5.

From the East

1. Take Route 6 West to Route 395 South to Route 2 North to Route 84 West.
2. Take Exit 31. At end of exit take a right.
3. Continue with directions as stated above in steps 4-5.

3.0 Operating Licenses and Permits

Permit Summary

Clean Harbors of Connecticut, Inc. is currently permitted by the U.S. Environmental Protection Agency and the Connecticut Department of Environmental Protection for the collection, analysis, storage and treatment of hazardous waste with subsequent transfer off-site.

Permit Type/Governing Agency	Permit No.	Expiration Date
Hazardous Waste Treatment, Storage and Disposal facility (TSDF) - Part B Permit; Connecticut Department of Environmental Protection, U.S. Environmental Protection Agency	CTD000604488	01/02/2012
Connecticut Regulated Waste Facility Permit; Connecticut Department of Environmental Protection	DEP/HWM 017-069	9/07 **
Hazardous and Solid Waste Amendments (HSWA) Permit; U.S. Environmental Protection Agency	CTD000604488	N/A **
State Wastewater Discharge Permit; Connecticut Department of Environmental Protection	SP0000109	01/19/14
Registration under Connecticut's General Permit for Stormwater Discharge	GSI000726	10/01/07 *
TSCA Interim Storage Permit – U.S. Environmental Protection Agency	CTD000604488	None
General Permit to Construct and Operate Limited Processing Recycling Facility	Application No. 200501674	9/27/07

* Currently under Review

** Combined into Part B (TSDF)

Principal Operating Licenses/Permits

Copies of existing permits which detail types of waste management licensed capacities and waste types accepted are available for inspection upon request at the site. Selected permit pages may be attached at the end of this audit under Appendix 8.0.

Principal Contacts/Agencies

The list of contacts below can provide additional information regarding Clean Harbors of Connecticut's facility operations or compliance:

Operations	Eric Congdon, General Manager Clean Harbors of Connecticut, Inc. 761 Middle Street Bristol, Connecticut 06010 (860) 583-8917 – ext. 359
Regulatory	AnnMarie Drugonis, Facility Compliance Manager Clean Harbors of Connecticut, Inc. 761 Middle Street Bristol, Connecticut 06010 (860) 583-8917 – ext. 306
(RCRA Compliance)	Juston Williams, Sanitary Engineer II Engineering and Enforcement Division, Bureau of Waste Management Connecticut Department of Environmental Protection 79 Elm Street Hartford, Connecticut 06106 (860) 424-3113
(RCRA Permitting)	Lauren Kostjack, Sanitary Engineer II Engineering and Enforcement Division, Bureau of Waste Management Connecticut Department of Environmental Protection 79 Elm Street Hartford, Connecticut 06106 (860) 424-3155
(Discharge Compliance)	Charles Nezinya, Sanitary Engineer II Bureau of Water Management Connecticut Department of Environmental Protection 79 Elm Street Hartford, Connecticut 06106 (860) 424-3846
	Brian Fowkes, Manager Water Pollution Control Facility City of Bristol 111 North Main Street Bristol, Connecticut 06010 (860) 584-3821

(TSCA Compliance)	Lori Saliby, Supervising Environmental Analyst Pesticide, PCB and Underground Storage Tank Program Connecticut Department of Environmental Protection 79 Elm Street Hartford, Connecticut 06106 (860) 424-3369
(HSWA/Facility Investigation Compliance)	Matthew Hoagland, Chief RCRA Corrective Action EPA Region I, New England J.F.K. Federal Building Mail Code HBT Boston, Massachusetts 02203-2211 (617) 918-1361

4.0 Process Description

Inorganic Aqueous Waste Treatment

The facility utilizes highly refined, multi-stage, chemical precipitation processes on a batch basis that remove heavy metals, suspended solids and residual organics from liquid wastes and render the effluents safe for discharge into municipal sewer systems. Resulting precipitated residues are dewatered with a filter press, and then disposed of in an approved landfill.

- Chemical Precipitation

All aqueous wastes are processed on a batch flow basis through a series of treatment units, where predetermined amounts of treatment chemicals are added and thoroughly mixed to effect precipitation of heavy metals and coagulation of suspended particles. Coagulated solids are removed in the form of sludge by gravity separation and filtration. Filtered effluent is stored in effluent storage tanks and is discharged to the Bristol Water Pollution Control Facility upon confirmation of discharge permit parameters from state certified laboratory analyses. Additionally, the Connecticut Department of Environmental Protection periodically monitors the discharge.

- Chemical Oxidation/Reduction

Waste needing pretreatment to remove specific contaminants is batch processed in controlled reactor vessels, the airborne emissions from which are treated within two in-series scrubbing units. Each batch of waste is treated by adding chemical reagents specific to the batch as determined by the laboratory bench-test simulation to achieve the desired reaction. Upon completion of the reaction, each batch is tested to confirm the end result of the treatment, prior to its transfer for final precipitation treatment or additional chemical treatment. Types of reactions carried out are: oxidation of cyanides and phenols, ammonia removal, chelating agent removal from wastes such as boiler cleaning solutions, reduction of hexavalent chromium to trivalent chromium, acid/base neutralization, etc.

- Sludge Dewatering/Fixation

Sludge produced upon treatment of the aqueous wastes and batch treatment of slurry wastes may be first thickened by precipitation or gravity. Settled sludge from the bottom of the pretreated tanks is pumped to a batch conditioning tank where chemical reagents are added to aid the dewatering and to stabilize the constituents of concern. The conditioned sludge is pumped into a plate-and-frame, membrane filter press to achieve a stable filter cake suitable for landfill. Filtrate produced is sent to effluent holding tanks for analysis and possible subsequent discharge, while the filter cake is collected into segregated accumulation containers, which are eventually bulked into a dump trailer for disposal into an approved landfill.

- Acid/Base Neutralization

Although this can be a final treatment method, neutralization is often used in conjunction with other treatment processes such as chemical precipitation, phase separation and oxidation/reduction treatment processes.

Neutralization involves the addition of an acid or a base to a solution to adjust the pH, usually to a level between 6 and 9. Alkaline neutralization usually involves the addition of sodium hydroxide or potassium hydroxide to an acidic wastewater to adjust the pH. Likewise, acidic neutralization involves the addition of a concentrated acid (such as sulfuric or hydrochloric) to an alkaline wastewater.

Storage and Transfer of Waste Oils

Waste industrial lubricating and fuel oils received in containers are stored on-site. Once a sufficient quantity is accumulated, the waste oil may be bulked or shipped off-site in drums for reclamation. Oil contained within bulk receipts may be separated off and accumulated within an onsite oil storage tank, from which loads are shipped offsite for reclamation.

Inorganic Lab Chemical Treatment/Consolidation

Drummed labs packed chemicals are segregated in groups based on their chemical compatibility. Contents from each group of chemical containers are consolidated into a reactor through a pour-off area where the batch is treated using laboratory directive tailored for the specific batch.

Container/Tank Storage and Transfer

A wide variety of wastes not acceptable for on-site treatment can be received for consolidation and transfer to other Clean Harbors' sites or select audited and approved non company-owned sites. The facility includes storage areas for tanks and containers meeting all RCRA requirements.

Stabilization/Solidification of Characteristic Waste

The facility is authorized to solidify non hazardous waste and stabilize D004 - D011 wastes. The resulting de-characterized waste is then subject to management in accordance with subtitle D of RCRA. The physical absorption method of solidification utilizes clay based absorbents and/or synthetic polymers to absorb liquids. Cement type stabilization is the process of blending high calcium-oxide limes with liquids/ solids to generate a gypsum-like solid. The process enables the hazardous waste to be contained in the gypsum-like matrix. These processes are performed for wastes received in drums and other bulk containers.

PCB Management

TSCA regulated waste may be managed in containers in three areas within the facility, and solids may be bulked for offsite shipment. Wastes are transported to TSCA approved incinerators or landfills and managed per regulations and customer requirements.

Dismantling Process

The Connecticut facility conducts a unique recycling activity onsite that allows customers to ship scrap or surplus equipment to the facility for the eventual offsite re-use of the various alloys and components. This process offers the shipper confidentiality for proprietary contents, liability protection from improper disposal, and financial benefits from the resultant recycling.

Our dismantling process can accept scrap/surplus equipment that has a value for recycle or reclaim, if the equipment is not itself a regulated "waste" and is not a "container" of regulated waste. Upon processing the employees will visually or analytically determine the various metal alloys and other components of dismantle receipts, which are reclaimable and segregate these materials accordingly. The dismantling employees are trained in finding and removing components which would be potentially regulated if they were improperly disposed, including small batteries, capacitors, refrigerant gases (using EPA-registered extraction equipment), cathode ray tubes, mercury switches, relays and thermometers, etc., among others. Such materials are containerized by Clean Harbors as the generator, labeled, stored within the facility's permitted areas, and tracked and disposed of at approved offsite recycle or disposal facilities.

Many States, including Connecticut, have adopted Universal Waste regulations that now classify computers and monitors as regulated materials that must be tracked and recycled. The dismantling process is able to receive these universal wastes, track, store, process, and recycle them, while offering generators the benefits. RCRA treatment, storage and disposal facility (TSDF) status and safeguards.

Waste Analysis

The Waste Analysis Plan for the facility outlines pre-qualification and on-site acceptance analysis requirements.

- Pre-Qualification

Prior to acceptance and treatment of a specific waste, a Waste Material Profile Sheet must be submitted to and approved by Clean Harbors prior to any waste shipment. A waste profile can be completed and submitted online on Clean Harbors' website at www.cleanharbors.com. Once the profiled waste material is approved for treatment/disposal, this information becomes part of the permanent record in the generator's file and the waste may be scheduled for shipment.

- On-Site Analysis/Acceptance

With each delivery of approved waste, a sample is taken from each container or the bulk load and tested to determine whether the waste is the same as the previously approved profile. If this analysis differs significantly from the wastestream profile, the waste will be deemed non-conforming. All non-conforming wastes are further analyzed to determine the best treatment alternatives, whether on-site handling at an adjusted price or transshipment to an alternative treatment facility. The customer is contacted regarding any non-conforming waste and given the option for alternate handling or return of their waste. On-specification shipments are processed with one or more of the storage or treatment operations previously identified.

5.0 Closure Plan

A comprehensive facility closure plan has been developed in accordance with RCRA requirements and is available at the site for inspection upon request. A Certificate of Insurance guarantees financial assurance for closure.

6.0 Insurance

Clean Harbors and its subsidiaries maintain General Liability and Automobile Liability insurance with aggregate limits of $30,000,000. The Company purchases Environmental Impairment Liability insurance for its' waste facilities with limits of $30,000,000 insuring the Company against liability for sudden and accidental occurrences from the time waste is picked up from a customer, while being handled at the Company's treatment and transfer facilities, through its delivery to a disposal site. See attached copy of Certificate of Liability Insurance.

In addition, Clean Harbors purchases an insurance program for Closure (Post-Closure and Corrective Action where so required) in amounts that meet regulatory requirements. See attached copy of the Closure Certificate of Insurance.

Clean Harbors Casualty Insurance Program Summary

Policy	Limits of Liability
Workers Compensation & Employer's Liability	Statutory $1,000,000 Each Accident
Business Automobile Liability (Includes MCS-90 Endorsement)	$1,000,000 Each Occurrence $5,000,000 MCS-90
Comprehensive General Liability	$1,000,000 Each Occurrence $3,000,000 Aggregate
Excess (Umbrella) Liability (Follow Form)	$10,000,000 Each Occurrence $10,000,000 Aggregate
Wharfingers Liability	$10,000,000 Any one Vessel/Any one Accident
Contractor's Pollution Liability (Off-Site)	$10,000,000 Each Occurrence $10,000,000 Aggregate
Protection and Indemnity	$1,000,000 Each Occurrence/Any one Vessel
Environmental Impairment Liability (Coverage for Clean Harbors Facilities)	$3,000,000 Each Occurrence $6,000,000 Aggregate
Excess Pollution Liability (Sudden and Accidental Occurrences)	$5,000,000 Each Occurrence $5,000,000 Aggregate
Total coverage for Pollution incidences that occur during transportation related activities	$30,000,000 Limit

For more detail concerning Clean Harbors coverage, please contact the Clean Harbors Risk Management Department at (781)792-5000.

Facility Closure Certificates

http://clark.cleanharbors.com/TagTeam/client/staticdownload.asp?dbid=1&siteid=823042&dataid=640

Certificate of Liability Insurance

http://clark.cleanharbors.com/TagTeam/client/staticdownload.asp?dbid=1&siteid=823042&dataid=98

7.0 Financial Information

Financial information on Clean Harbors and its subsidiaries are available from the Clean Harbors website in the Investor Relations section.

http://www.cleanharbors.com/Sites/Corp_Site/Investor_Relations/IR_Order_Center/ir_order_center.html

8.0 Appendix

If applicable, supporting facility documentation will follow.

CWM Chemical Services, L.L.C.

A Division of

Model City Facility
Customer Audit Package

1550 Balmer Road
P.O. Box 200
Model City, NY 14107

716-754-8231 or 800-843-3604

Model City Landfill
http://www.cwmlandfill.com/

WM Industrial Services
http://wmdisposal.com/

TABLE OF CONTENTS

GENERAL INFORMATION

- Name of Facility: **CWM Chemical Services, L.L.C.**
- Physical Address: **1550 Balmer Road**
  Model City, NY 14107
- Mailing Address: **P.O. Box 200**
  Model City, NY 14107
- Phone: **(716) 754-8231**
- Fax: **(716) 754-0211**
- Customer Service **(800) 843-3604**
- Parent Corporation: **Waste Management, Inc.**
  1001 Fannin, Suite 4000
  Houston, TX 77002
  (713) 512-6200
- RCRA Status: **Part B Approved**
- US EPA ID# **NYD049836679**
- Business Hours **Administrative 8:00 a.m. – 5:00 p.m.**
  Operations 6:00 a.m. – 4:00 p.m. (seasonal)

TOUR INFORMATION / RESTRICTIONS

Facility tours are available Monday thru Friday. Contact your Customer Service Representative for an appointment.

Safety Equipment Required

- Tour not leaving site vehicle
  - **No special equipment is needed**
- Tour with stops in operational areas (stabilization, drum warehouse) with viewing through protective barriers
  - **Long sleeve shirt, closed toe shoes, hard hat and safety glasses**
- Tour with stops entering operation areas (waste water treatment, lab, drum warehouse)
  - **Long sleeve shirt, safety shoes, hard hat and safety glasses**

Photography - Inquire if interested.

DIRECTIONS TO MODEL CITY FACILITY

1. **From the Buffalo-Niagara Airport**

    a. Take **Route 33** West
    b. **Route 33W** for 1.5 miles to **90 East**
    c. **90 East** for about 1 mile to **290 West (Niagara Falls)**
    d. **290 West** for ~10 miles to **190 North (Niagara Falls)**
    e. Cross 1st set of Grand Island Bridges ($0.75 toll)
    f. Approximately 5 miles across Grand Island and over 2nd set of bridges (no toll)
    g. Continue on **190 North** for about 7 miles to **Exit 25b** (last exit before Canada)
    h. Take exit and proceed to ramp marked – **Robert Moses Parkway**, **Fort Niagara**
    i. Take **Robert Moses Parkway** for approximately 4 miles to **Pletcher Rd**. exit
    j. Make right onto **Pletcher Rd**.
    k. Make a very quick left onto **Calkins Rd**.
    l. Take **Calkins Rd**. to end
    m. Make a left onto **Creek Rd**.
    n. **Creek Rd**. for about 0.5 mile to **Balmer** Rd.
    o. Make right onto **Balmer Rd**.
    p. **Balmer Rd**. for about 3 miles to entrance and guard house on right

2. **From I-90 East of Buffalo**

    a. Pay toll
    b. Take first exit to **290 West (Niagara Falls)**
    c. See 1d through 1p

3. **From I-90 West of Buffalo**

    a. Pay toll
    b. Stay on **I-90 Eastbound** for about 10 miles
    c. See 1d through 1p

4. **From Niagara Falls, NY (downtown hotel area)**

    a. Get directions from hotel front desk to the **Robert Moses Parkway North** to Fort Niagara
    b. Take **Robert Moses Parkway North** – Fort Niagara for about 5 miles
    c. See 1i through 1p

FACILITY DESCRIPTION

1. Describe the early history of the property.

From the early 1940s until 1966 the United States government owned the facility. The property was used for such activities as TNT manufacturing plant (1942-1943), Manhattan Project work (1949-1966) and a high-energy fuel production plant (1955-1960). The plants were reportedly cleaned up for future industrial use. In 1966, a real estate company purchased the property. During the period 1984-1986, the Department of Energy surveyed and remediated the majority of the areas affected by the previous Manhattan Project work. The Corps of Engineers is continuing to address issues associated with the former government use of the property (see Corrective Action Update).

2. When did the facility begin hazardous waste operations?

In 1972 Chem-Trol Pollution Services purchased and occupied the property and began operations as a hazardous waste treatment, storage, and disposal facility. SCA Services acquired the stock of Chem-Trol Pollution Services, Inc. in 1973. In 1979, SCA Services underwent a management change and the name of the facility became SCA Chemical Services, Inc.

3. When did Waste Management purchase the facility?

In 1984 SCA Chemical Services, Inc. became a wholly owned subsidiary of Waste Management, Inc. As a result of a corporate reorganization, SCA Chemical Services, Inc became a wholly owned subsidiary of Chemical Waste Management, Inc in 1986. The Model City facility changed its name to CWM Chemical Services, Inc. in 1988. The facility's current legal name is CWM Chemical Services L.L.C.

4. Where is the facility located?

The Model City facility is located within the Erie-Niagara Region in the western section of New York State. It is approximately 10 miles north of Niagara Falls, 30 miles north of Buffalo and three miles south of Lake Ontario. The facility is situated on the boundary between the towns of Lewiston and Porter in Niagara County.

5. What is the size of the facility?

The facility consists of 710 acres, 630 of which are subject to the site 373-2 permit.

6. What is the expected "life expectancy" of the facility?

At the current waste acceptance rates it is estimated that Model City will be able to accept wastes until the year 2041.

7. What are the uses of the surrounding area?

The surrounding area is primarily agricultural with some residential and commercial areas.

8. What properties are immediately adjacent to the facility?

A military installation to the north; a closed US government-owned facility to the northeast; a municipal waste landfill, Modern Disposal, Inc. and a Department of Energy-

owned property to the south; a private, forested property to the west zoned industrial; and unused, agricultural land to the east.

9. Is there a buffer zone between active operations and the perimeter of the property?
Yes, there is 150-foot buffer zone between the active operations and the perimeter of the facility (300 feet along public roads) consisting of undeveloped land with natural vegetation.

10. What is the proximity and direction of the nearest?

Type	Identity	Distance	Direction
School	Lewiston Porter School Complex	2.5 miles	West
Hospital	Mount St. Mary's	5 miles	South
Municipality	Niagara Falls	10 miles	South
Resident	Balmer Road	0.5 miles	East
Industrial/Commerc-ial Complex		Over 3 miles	
River or Stream	Niagara River	5 miles	West
Other Surface Waters	Four-Mile Creek Six Mile Swale Twelve Mile Creek	2 miles 2 miles 600 feet	
Potable Wells		10 miles	
Other Wells		2 miles	
Wetlands	On Site		
100-year flood plain		600 feet	
Earthquake Zone	Seismic Source Zone No. 111 Closendon-Linden	28 miles	Southeast
Game areas, forest preserves, or parks		2 miles	
Other recreational areas		5 miles	
Railroads		15 miles	
Airports	Niagara Falls	15 miles	

11. How large or extensive are the surface waters?
The facility is located in an area with extensive wetlands and surface waters.

12. What are current and potential uses of the surface waters?
Surface waters are used for recreation and as nature areas/wetlands.

13. What is the population within?
- One mile less than 400
- Three miles 4,000
- Five miles 18,000

14. Do any of the following apply?

- Deed restrictions (small strip of land with beechnut trees) Yes
- Liens on property No
- Zoning restrictions Yes
- Historic/Environmental preservation designations Yes

15. Are all operations or activities associated with the facility located on-site (i.e. are there any warehouses, staging areas, etc located off site)?

Yes. All operations are located on-site.

16. Is there any Superfund site, old landfill or abandoned plant in the vicinity of the facility?

Yes. There is a former Defense Department operation within the facility boundaries.

17. Are there any sources of contamination associated with neighbors adjacent to the facility?

No.

18. Have there been any remedial investigations or corrective actions taken at the facility?

Yes. See attached Corrective Actions Update

19. List the primary Environmental Consultants used at the site.

Company	Location	Type of Service/Support
Golder Associates	Niagara Falls, NY	Groundwater support
BB&L	Rochester, NY	Landfill Design, CQA, Permitting etc.
Earth Tech	Amherst, NY	Tank and Secondary Containment Inspections
ENSOL	Niagara Falls, NY	Design, Certifications, etc.

20. What is the current land use zoning designation?

- Active area – M3 heavy industrial
- Balance – M2 general industrial, M4 general industrial – service related

21. Does it appear that birds, rodents, insects or other potential disease-spreading vermin are or have been present in the landfill?

No.

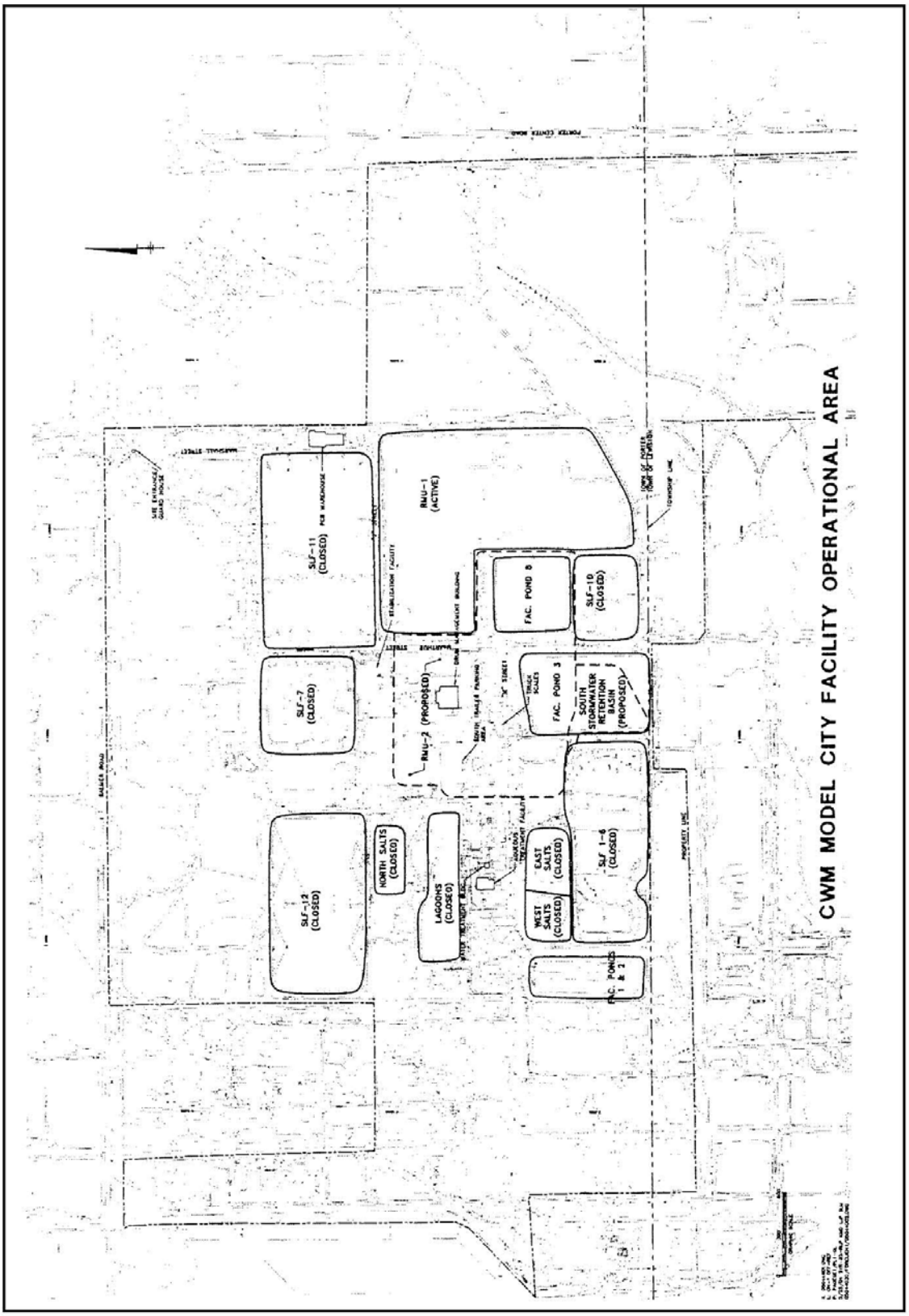
22. Average number of employees working at the facility for the last three years.

2007 75
2006 75
2005 80

23. What is the approximate annual employee turnover rate?

3%

Figure 1 - Operational Area Diagram



FACILITY CAPABILITIES

I.	**Storage**		
	A.	Bulk	Yes
	B.	Containers	Yes
	C.	Waste Piles	No
	D.	Surface Impoundments/Lagoons	Yes
	E.	Above ground tanks	Yes
	F.	Underground tanks	No
II.	**Transfer/Broker**		Yes
III.	**Treatment**		
	A.	Aqueous Treatment	Yes
	B.	Biological Treatment	Yes
	C.	Chemical Treatment	Yes
	D.	Detoxification/Chemical Destruction	Yes
	E.	Oil-Water Separation	Yes
	F.	Neutralization	Yes
	G.	Stabilization	Yes
	H.	Dewatering or Solidification	No
	I.	Medical/Pathological	No
	J.	Macroencapsulation debris management	Yes
	K.	Microencapsulation debris management	Yes
IV.	**Disposal**		
	A.	Landfill (secure chemical waste)	Yes
		1. RCRA	Yes
		2. PCB (TSCA)	Yes
	B.	Landfill (special waste or solid waste)	Yes
	C.	Landfill (co-disposal - “Bevill”)	Yes
	D.	Incineration	No
		1. RCRA	No
		2. PCB	No
		3. RCRA/PCB	No
	E.	Underground (deep well) injection	No
	F.	POTW with pretreatment, without pretreatment	No
	G.	Landfarm	No
	H.	Surface Impoundments	Yes
	I.	Low-level radioactive waste (above background)	No
	J.	Sanitary Landfill	No
	K.	Waste Piles	No
V.	**Recycling/Reuse**		
	A.	Oil recovery	Yes
	B.	Fluorescent lights	Yes
	C.	Batteries	
		1. Lead Acid	Yes

	2.	NiCad	Yes
	3.	Lithium	Yes
	4.	Mercury	Yes
D.	Electric, transformers, and equipment		
	1.	Salvage	Yes
	2.	Drain and flush	Yes
	3.	Remanufacture or repair	No
E.	Hazardous waste and/or material drums		Yes
F.	Solvent recovery		No
G.	Scrap metals		No
H.	Metal recovery		No
I.	Fuels Blending		Yes
J.	Fuels Burning		No
K.	Inorganic Recovery		No

VI. Transportation

A.	Company owned tractors/trailers	No
B.	Owner Operators	No
C.	Contracted services	Yes

VII. Laboratory Onsite Yes

AVERAGE ANNUAL THROUGHPUT

Waste Type	Average Annual Throughput	Unit of Measure	Handling Method	Amount Transferred Off-site (%)
Drums	30,000	Drums/year	Stab, LF, AT, Offsite	5%
Aqueous	15,000,000	Gallons/year	Treatment	0 – 2%
Bulk – Direct Landfill	125,000	Tons/year	Landfill	0 – 2%
Bulk – Stabilization	50,000	Tons/year	Treatment	0 – 2%

Note: Aqueous figures include facility generated leachate from landfills.

MATERIAL ACCEPTANCE

A. General

1. What types of wastes does the facility accept?

Model City is an industrial waste treatment, storage and disposal facility, which accepts nonhazardous, RCRA hazardous, and TSCA-regulated wastes. The facility accepts most hazardous and PCB-contaminated wastes, including inorganic solids and sludges (frequently containing or contaminated with heavy metals); solids and sludges with organic contamination; wastewaters generally containing metals and/or soluble organics; organic liquids; and PCB-containing transformers. For a summary list of acceptable waste codes see the attached "Acceptable Waste Code List."

2. What types of waste are not accepted by the facility?

Wastes containing explosives, shock-sensitive, or pyrophoric substances
Gaseous wastes
Radioactive wastes
Infectious wastes
Municipal wastes

3. What types of packaging does the facility accept?

Bulk Solids	Containerized Solids
Bulk Liquids	Containerized Liquids
Bulk Sludges	Containerized Sludges

4. What are the methods of waste delivery to the facility?

Dump trailers	Tankers
Rolloff trailers	Box Vans
Flatbeds	Pneumatic trailers
Cubic yard boxes	Drums
Rail located nearby	

(This list is not all inclusive - contact Customer Service for other container types)

5. What general scheduling guidelines does Model City employ?

All material must be scheduled prior to shipping into the facility. Customers may call our Customer Service Department to schedule pickup and/or delivery times. All loads are assigned a Service Request Number, which must be recorded on shipping papers and manifests.

B. Waste Analysis Plan

1. Does the facility maintain a written waste analysis plan?

Yes.

2. What is the last revision date of the plan?

June 2005

3. When is a revision due?

Modified as needed via permit modification.

4. What is included in the plan?
The WAP is over 130 pages long and includes parameters, sampling frequency, sampling methods, mandatory tests, supplemental tests and test methods.

C. Approval Process

1. Describe procedures to determine whether or not to accept a particular waste stream.
Per the facility Waste Analysis Plan, pre-qualification is based on profile information, generator supplied analysis and sample evaluations.

2. Is the generator required to complete a waste profile form?
Yes. All waste streams require a profile to be completed. A signed copy must be on file at the facility prior to the first shipment of waste.

3. Is a sample of the waste stream sent to the facility for analysis?
Only if requested.

4. What parameters and analytical methods are used?
Cyanide (Total/Amenable) - 9010
PCB's – 8082
Metals – 7000 series
TCLP – 1311
Radioactive screening
Table C-3 of the WAP includes "Usage of Mandatory Analyses" pages C-119 – C126

5. Can the generator send analytical results to the facility?
Yes. Analytical must include concentration units and test method.

6. Can a generator certify the waste properties without proof of analysis?
A generator can use process knowledge to make a hazardous waste determination. He can also use process knowledge to certify whether or not subpart CC or UHCs apply. However, analytical is required to certify that a waste meets the LDR standards.

7. Does the facility visit a new generator's site to confirm the waste source?
Sometimes.

8. What parties review and/or approve waste streams prior to shipment?
An Approval Chemist reviews and approves all waste streams. All landfill waste streams are also reviewed and approved by New York State DEC monitors located on site. The Technical Manager or Operations is consulted as needed.

D. Delivery Acceptance

1. How are incoming wastes screened to ensure compliance with the profile information and land disposal restrictions?
At a minimum, an LDR form is required with the first shipment. The information on this form and the manifest are reviewed against the profile and the Waste Management Decision (WMD).

2. What documents accompany incoming wastes as they move through the site?
NYS Hazardous Waste Manifest or Bill of Lading, Transporter Logs and Waste Tracking Forms.

3. What checks and/or analyses are used to verify the contents of the waste shipment?
Visual inspection and mandatory analysis as required by the WAP.

4. What percentage of incoming loads are checked and/or analyzed?
All loads are visually inspected. 100% of liquid containers are sampled and 10% of solid drums not classified as miscellaneous. 10% of drums for a single solid waste stream are sampled. All non-miscellaneous bulk loads are sampled unless otherwise authorized on a Waste Management Decision.

5. Where are wastes checked?
Bulk loads are checked at the receiving sampling racks. Drum loads are checked at the drum warehouse.

6. How are wastes managed while awaiting results of the inspection or analysis?
Bulk loads – Trucks are staged at the sampling racks in a stoned parking area until the waste material is inspected and approved for handling.
Drum loads – Trucks are staged and unloaded at the drum warehouse in secondary containment area with roof. The driver waits until the piece count is verified and paperwork is reviewed.

7. Are there any subsequent analyses of waste streams conducted after receipt that will confirm the presence of unacceptable wastes or constituents?
Yes, subsequent testing such as PCB analysis is performed if required by the Waste Analysis Plan or requested by technical personnel.

8. Does the facility have a certified weigh scale?
Yes.

9. Has the facility rejected wastes in the past?
Yes. When the material has been unacceptable for handling or storage on site it has been rejected.

10. Is the generator always notified of significant discrepancies and/or rejected wastes?
Yes.

11. When wastes are rejected, where are they sent?

Rejected waste is returned to the generator or sent to an alternate site if directed or approved by the generator.

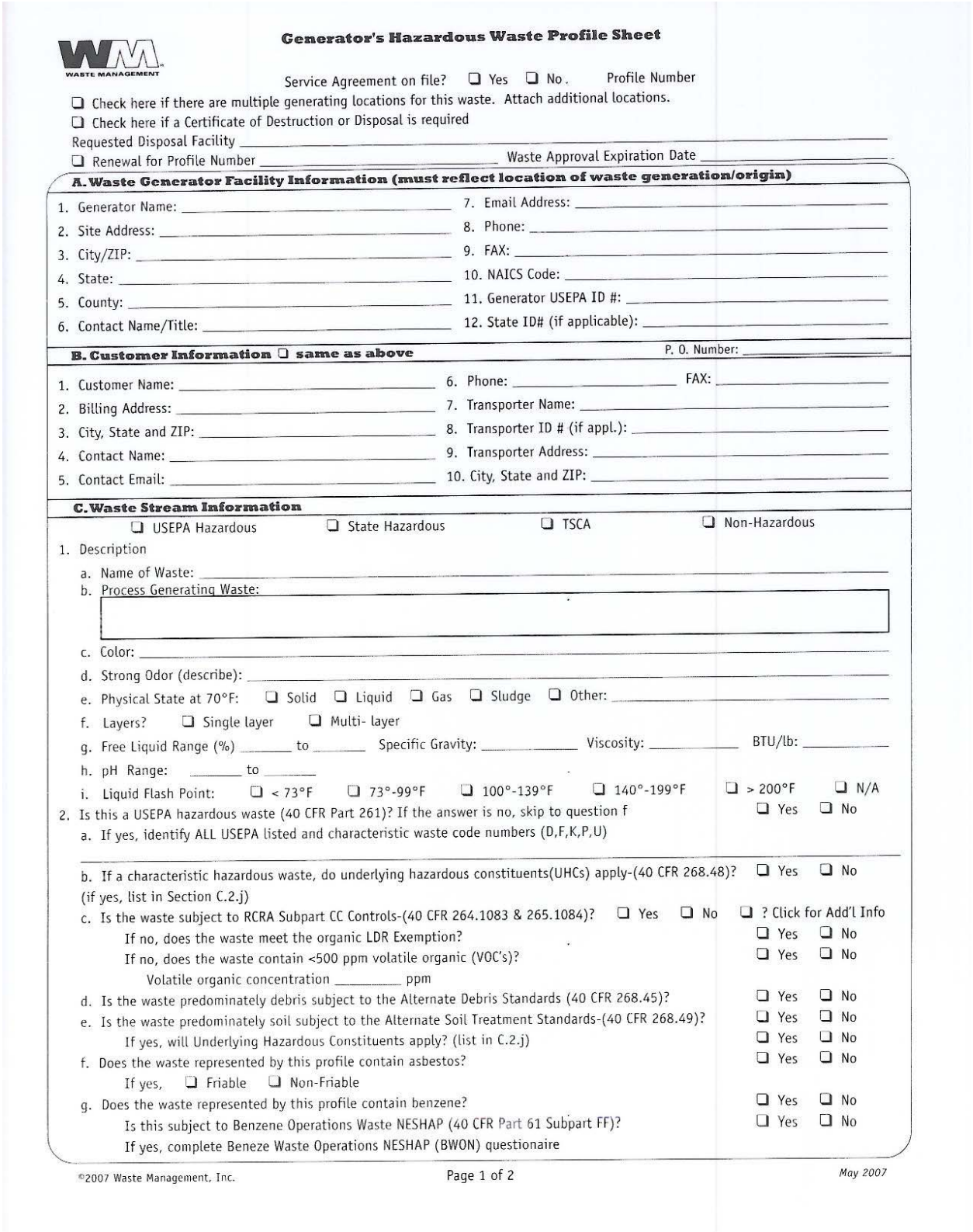
12. Are certificates of waste disposal issued to waste generators?

Certificates are issued automatically for PCB regulated wastes disposed of on-site. Certificates are issued upon request for other waste types.

13. What is the typical time lapse between receipt of waste and issuance of a certificate of disposal?

10 days for bulk waste placed directly in the landfill. Time frame varies for other waste streams.

Figure 2 - Generator's Waste Profile Sheet



Generator's Hazardous Waste Profile Sheet

WASTE MANAGEMENT

Service Agreement on file? ❑ Yes ❑ No. Profile Number

❑ Check here if there are multiple generating locations for this waste. Attach additional locations.

❑ Check here if a Certificate of Destruction or Disposal is required

Requested Disposal Facility _____

❑ Renewal for Profile Number _____ Waste Approval Expiration Date _____

A. Waste Generator Facility Information (must reflect location of waste generation/origin)

1. Generator Name: _____
2. Site Address: _____
3. City/ZIP: _____
4. State: _____
5. County: _____
6. Contact Name/Title: _____
7. Email Address: _____
8. Phone: _____
9. FAX: _____
10. NAICS Code: _____
11. Generator USEPA ID #: _____
12. State ID# (if applicable): _____

B. Customer Information ❑ same as above P. O. Number: _____

1. Customer Name: _____
2. Billing Address: _____
3. City, State and ZIP: _____
4. Contact Name: _____
5. Contact Email: _____
6. Phone: _____ FAX: _____
7. Transporter Name: _____
8. Transporter ID # (if appl.): _____
9. Transporter Address: _____
10. City, State and ZIP: _____

C. Waste Stream Information

❑ USEPA Hazardous ❑ State Hazardous ❑ TSCA ❑ Non-Hazardous

1. Description
   a. Name of Waste: _____
   b. Process Generating Waste: _____
   c. Color: _____
   d. Strong Odor (describe): _____
   e. Physical State at 70°F: ❑ Solid ❑ Liquid ❑ Gas ❑ Sludge ❑ Other: _____
   f. Layers? ❑ Single layer ❑ Multi- layer
   g. Free Liquid Range (%) _____ to _____ Specific Gravity: _____ Viscosity: _____ BTU/lb: _____
   h. pH Range: _____ to _____
   i. Liquid Flash Point: ❑ < 73°F ❑ 73°-99°F ❑ 100°-139°F ❑ 140°-199°F ❑ > 200°F ❑ N/A
2. Is this a USEPA hazardous waste (40 CFR Part 261)? If the answer is no, skip to question f ❑ Yes ❑ No
   a. If yes, identify ALL USEPA listed and characteristic waste code numbers (D,F,K,P,U)
   _____
   b. If a characteristic hazardous waste, do underlying hazardous constituents(UHCs) apply-(40 CFR 268.48)? ❑ Yes ❑ No (if yes, list in Section C.2.j)
   c. Is the waste subject to RCRA Subpart CC Controls-(40 CFR 264.1083 & 265.1084)? ❑ Yes ❑ No ❑ ? Click for Add'l Info
      If no, does the waste meet the organic LDR Exemption? ❑ Yes ❑ No
      If no, does the waste contain <500 ppm volatile organic (VOC's)? ❑ Yes ❑ No
      Volatile organic concentration _____ ppm
   d. Is the waste predominately debris subject to the Alternate Debris Standards (40 CFR 268.45)? ❑ Yes ❑ No
   e. Is the waste predominately soil subject to the Alternate Soil Treatment Standards-(40 CFR 268.49)? ❑ Yes ❑ No
      If yes, will Underlying Hazardous Constituents apply? (list in C.2.j) ❑ Yes ❑ No
   f. Does the waste represented by this profile contain asbestos? ❑ Yes ❑ No
      If yes, ❑ Friable ❑ Non-Friable
   g. Does the waste represented by this profile contain benzene? ❑ Yes ❑ No
      Is this subject to Benzene Operations Waste NESHAP (40 CFR Part 61 Subpart FF)? ❑ Yes ❑ No
      If yes, complete Beneze Waste Operations NESHAP (BWON) questionaire

©2007 Waste Management, Inc. Page 1 of 2 May 2007

Generator's Hazardous Waste Profile Sheet

WASTE MANAGEMENT

Profile Number

C. Waste Stream Information (continued)

h. Is this profile for remediation waste from a facility that is a major source of Hazardous Air Pollutants (Site Remediation NESHAP, 40 CFR 63 subpart GGGGG)? ❑ Yes ❑ No

If yes, does the waste contain <500 ppm VOHAPs at the point of determination? ❑ Yes ❑ No

i. Does the waste represented by this waste profile sheet contain concentrations of Polychlorinated Biphenyls (PCBs) regulated by 40 CFR 761? (if yes, list in Chemical Composition - C.2.j) ❑ Yes ❑ No

Were the PCBs imported into the U.S.? ❑ Yes ❑ No

Are PCBs regulated under the "Self-Implementing Remediation Section of (Mega) Rule?" 40CFR 761,61(a) ❑ Yes ❑ No

j. Chemical Composition (List all constituents [including halogenated organics, debris, and UHC's] present in any concentration and submit representative analysis): ❑ (See Attached - for entering additional constituents)

Constituents *(Total Composition Must be > 100%)*	Lower Range	Unit of Measure	Upper Range	Unit of Measure
1.				
2.				
3.				
4.				
5.				
6.				

k. Check any that apply: ❑ Pyrophoric ❑ Water Reactive ❑ OSHA Carcinogen ❑ Shock Sensitive ❑ Oxidizer ❑ Infectious

l. Is the waste subject to controls as a Group 1 wastewater or residual under the Hazardous Organic NESHAP? ❑ Yes ❑ No

If yes, is it a Table 8 _____ or Table 9 _____ compound?

m. Does the waste represented by this waste profile sheet contain radioactive material? ❑ Yes ❑ No

Is disposal regulated by the Nuclear Regulatory Commission? ❑ Yes ❑ No

If NORM, identify isotopes and concentration, _____ pCi/g

n. Is the waste from a CERCLA (40 CFR 300, Appendix B) or state mandated clean-up? ❑ Yes ❑ No

If yes, attach Record of Decision (ROD), 104/106 or 122 order or court order that governs site clean-up for activity.

For state mandated clean-up, provide relevant documentation.

o. Is this a State Hazardous Waste? ❑ Yes ❑ No If yes, please list applicable codes _____

If NY waste codes B001-B007 apply, please complete question C.2.c on page 1.

D. DOT Information and Shipping Volume

1. Quantity of Waste

a. ❑ Event ❑ Base/Ongoing (check one)

b. Estimated Annual Quantity: _____ ❑ Tons ❑ Yards ❑ Drums ❑ Other (specify) _____

c. Shipping Frequency: Units: _____ Per: ❑ Month ❑ Quarter ❑ Year ❑ One Time ❑ Other _____

2. Shipping Information

a. Packaging:

❑ Roll off/End dump: _____ ❑ Other: _____

❑ Drum Type/Size: _____ ❑ Vacuum Box

❑ Tanker ❑ Super Sack ❑ Tote Bin ❑ Cubic Yard Boxes

b. Is this a U.S. Department of Transportation (USDOT) Hazardous Material? (If no, skip c, d and e) ❑ Yes ❑ No

c. Reportable Quantity (lbs.; kgs.): _____ d. Primary/Subsidiary Hazard Class(es)/ID#: _____

e. USDOT Shipping Name: _____ PG: _____

E. Generator Certification (Please read and certify by signature below)

I hereby certify that all information submitted in this and all attached documents contain true and accurate descriptions of this wastestream. Any sample submitted is representative as defined in 40 CFR 261 - Appendix 1 or by using an equivalent method. I authorize WMI to obtain a sample from any waste shipment for purposes of recertification. If this certification is made by a broker, the undersigned signs as authorized agent of the generator and has confirmed the information contained in this Profile Sheet from information provided by the generator and additional information as it has determined to be reasonably necessary. If approved for management, Contractor has all the necessary permits and licenses for the waste that has been characterized and identified by this approved profile. All relevant information within the possession of the Generator regarding known or suspected hazards pertaining to the waste will be disclosed to the contractor. All changes which occur in the character of the waste will be identified by the Generator and be disclosed to the Contractor prior to providing the waste to the Contractor.

Certification Signature: _____ Title: _____

Name (Type or Print): _____ Company Name: _____ Date: _____

❑ Check if additional information is attached. Indicate the number of attached pages ____

Figure 3 - Hazardous Waste Codes

NYS HAZARDOUS WASTE CODES

B001	B002	B003	B004	B005	B006	B007

EPA HAZARDOUS WASTE CODES

"D" Codes

D001	D002	D003	D004	D005	D006	D007	D008	D009	D010	D011	D012	D013
D014	D015	D016	D017	D018	D019	D020	D021	D022	D023	D024	D025	D026
D027	D028	D029	D030	D031	D032	D033	D034	D035	D036	D037	D038	D039
D040	D041	D042	D043									

"F" Codes

F001	F002	F003	F004	F005	F006	F007	F008	F009	F010	F011	F012	F019
F020[1]	F021[1]	F022[1]	F023[1]	F024	F025	F026[1]	F027[1]	F028[1]	F032	F034	F035	F037
F038	F039											

"K" Codes

K001	K002	K003	K004	K005	K006	K007	K008	K009	K010	K011	K013	K014
K015	K016	K017	K018	K019	K020	K021	K022	K023	K024	K025	K026	K027
K028	K029	K030	K031	K032	K033	K034	K035	K036	K037	K038[2]	K039	K040
K041	K042	K043	K044	K045	K046	K047	K048	K049	K050	K051	K052	K060
K061	K062	K064	K065	K066	K069	K071	K073	K083	K084	K085	K086	K087
K088[2]	K090	K091	K093	K094	K095	K096	K097	K098	K099	K100	K101	K102
K103	K104	K105[2]	K106	K107[3]	K108[3]	K109[3]	K110[3]	K111	K112	K113	K114	K115
K116	K117	K118	K123[3]	K124[3]	K125[3]	K126[3]	K131[3]	K132[3]	K136	K141	K142	K143
K144	K145	K147	K148	K149	K150	K151	K156	K157	K158	K159	K161	K169
K170	K171	K172										

"P" Codes[2]

P001	P002	P003	P004	P005	P006	P007	P008	P009	P010	P011	P012	P013
P014	P015	P016	P017	P018	P020	P021	P022	P023	P024	P026	P027	P028
P029	P030	P031[3]	P033[3]	P034	P036	P037	P038	P039	P040	P041	P042	P043
P044	P045	P046	P047	P048	P049	P050	P051	P054	P056[3]	P057	P058	P059
P060	P062	P063[3]	P064	P065[3]	P066	P067	P068	P069	P070	P071	P072	P073
P074	P075	P076	P077	P078[3]	P081[3]	P082	P084	P085	P087	P088	P089	P092
P093	P094	P095[3]	P096[3]	P097	P098	P099	P101	P102	P103	P104	P105	P106
P108	P109	P110	P111	P112	P113	P114	P115	P116	P118	P119	P120	P121
P122	P123	P127	P128	P185	P188	P189	P190	P191	P192	P194	P196	P197
P198	P199	P201	P202	P203	P204	P205						

"U" Codes[2]

U001	U002	U003	U004	U005	U006	U007	U008	U009	U010	U011	U012	U014
U015	U016	U017	U018	U019	U020	U021	U022	U023	U024	U025	U026	U027
U028	U029	U030	U031	U032	U033[3]	U034	U035	U036	U037	U038	U039	U041
U042	U043[3]	U044	U045	U046	U047	U048	U049	U050	U051	U052	U053	U055
U056	U057	U058	U059	U060	U061	U062	U063	U064	U066	U067	U068	U069
U070	U071	U072	U073	U074	U075	U076	U077	U078	U079	U080	U081	U082
U083	U084	U085	U086	U087	U088	U089	U090	U091	U092	U093	U094	U095
U096	U097	U098	U099	U101	U102	U103	U105	U106	U107	U108	U109	U110
U111	U112	U113	U114	U115	U116	U117	U118	U119	U120	U121	U122	U123
U124	U125	U126	U127	U128	U129	U130	U131	U132	U133	U134	U135[3]	U136
U137	U138	U139	U140	U141	U142	U143	U144	U145	U146	U147	U148	U149
U150	U151	U152	U153[3]	U154	U155	U156	U157	U158	U159	U160	U161	U162
U163	U164	U165	U166	U167	U168	U169	U170	U171	U172	U173	U174	U176
U177	U178	U179	U180	U181	U182	U183	U184	U185	U186	U187	U188	U189[3]
U190	U191	U192	U193	U194	U196	U197	U200	U201	U202	U203	U204	U205
U206	U207	U208	U209	U210	U211	U213	U214	U215	U216	U217	U218	U219
U220	U221	U222	U223	U225	U226	U227	U228	U234	U235	U236	U237	U238
U239	U240	U243	U244	U246	U247	U248	U249	U328	U353	U359	U364	U367
U372	U373											

KEY

1 Waste codes refer to waste classified as derived from F020-F023 and F026-F028. No current production waste or out-dated products with these codes are accepted.

2 Site accepts specific substances in the code listing. Contact site for additional information.

3 These waste codes refer only to wastes from treatment such as incinerator ash.

LABORATORY

1. Does the facility have an on-site laboratory?
Yes.

2. What is the on-site laboratory used for?
Pre-qualification screening, in-coming load analysis, treatment recipe development, process control monitoring/analysis, residual analysis, LDR waste analysis, on-site laboratory QA/QC

3. What is the purpose of analysis performed?
- To screen out non-permitted wastes
- To verify that waste matches the profile
- To assess treatability

4. What major equipment and apparatus is the laboratory equipped with?

Major Equipment	Primary Function
ICAP	Metals – TCLP
GC/MS	Volatiles
GC	PCB
AA-Graphite Furnace	Metals
Mercury Analyzer	Mercury Analysis

5. Is the lab certified?
Yes. The State of New York certifies the lab. Certificates available upon request.

6. What are the qualifications of lab staff?

Title	Degree/Major	Years Exp.
Technical Manager	Masters Chemistry	31
Drum Bldg Supervisor	BS Chemistry	24
QA/QC Coordinator	BA Chemistry	20
AT Chemist	BS Chemistry	18
Lab Manager	BA Chemistry & BS Env Science	11
Organic Chemist	BS Biology	9
Metals Chemist	BA Env Science & Geology	4
Drum Handling Coordinator	Env Science	10
Drum Fingerprint Tech	AAS Chemistry	36
Lab Pack Coordinator	BS Marine Science/Biology	19

7. List in-house QA/QC protocols.
- "Blind" verification run regularly
- Blanks/replicates/spikes run as per NELAP
- Calibrations/standard solutions as per NELAP

8. Are outside laboratories used?

Yes. Outside laboratories are used for overflow volumes or for analyses not able to be performed by the on-site lab. We generally send samples to Test America Laboratories, Inc. or Adirondack Environmental Services (AES).

RESIDUAL WASTE MANAGEMENT

1. **Are all site-generated wastes shipped off-site?**
   No. Some site-generated wastes are treated and/or disposed of on site.

2. **Describe management methods and off-site disposal locations for the major site generated residual wastes.**

Waste Stream	Management Method	Offsite Facility	Location
WWT Sludge	Incineration	Veolia	Port Arthur, TX
WWT Carbon	Recycling	Siemens	Darlington, PA
Blended Fuels	Incineration	VonRoll	East Liverpool, OH
Lean Water Blend	Incineration	Veolia	Sauget, IL
PCB Liquids and Sludges	Incineration	Veolia	Port Arthur, TX
Fuels and Sludges	Incineration	Veolia	West Carrollton, OH

3. **List off-site facilities used for transfer of customer waste.**

Facility	Location	Waste Transferred
Veolia	Port Arthur, TX	PCB liquids and sludges
Systech	Paulding, OH	Blended Fuels
Veolia	Sauget, IL	Lean water blends, Incinerables
Veolia	West Carrollton, OH	Lean water blends, Incinerables
VonRoll	East Liverpool, OH	Incinerables
Ross	Grafton, OH	Incinerables
Stablex	Blainville, Quebec	Mercury & cyanide wastes
WM	Rochester, NY	Non-Haz wastes
Hotz	Hamilton, Ontario	Paint
Veolia	Port Washington, WI	Mercury wastes, batteries, capacitors
Ecycle	Gardner, MA	Electronic Recycling

4. **How are off-site facilities for the management of residual wastes selected?**
   CWM uses other Waste Management facilities or approved third party facilities through a non-WMI program before use.

5. **Does the facility maintain required documentation and permits related to the handling of these residual waste streams?**
   Yes.

6. **Are the wastes analyzed?**
   Yes, if necessary to supplement process knowledge.

7. **Are the wastes manifested?**
   Yes, if regulated.

8. **Are the shipments recorded and tracked?**
   Yes.

9. How are empty drums managed?

Empty drums are crushed and landfilled.

10. Does MDC recycle or reuse any site-generated wastes?

When possible, the carbon from the wastewater treatment process is sent for re-generation. Office paper, cardboard, lead-acid batteries, tires and toner cartridges are sent for recycling. CWM also recycles freon from tractor air-conditioning units.

OPERATING RECORDS

1. Does the facility maintain written operating records?
Yes.

2. What documents are included in the operating records?
- Sources of waste received
- Waste descriptions and quantities
- Analytical records
- Copies of the shipping papers, LDR forms and waste tracking forms for inbound and outbound wastes
- Methods/dates of disposal/storage/treatment/recycling/transfer
- Report/summary of any incident requiring implementation of Contingency Plan
- Facility Inspections

3. Are records available for review during an audit?
Yes.

4. Are operating records computerized?
Waste tracking records are computerized. Other operating records are not.

5. How does the facility track the incoming, residual and transferred waste through the facility to their final dispositions?
Receipt and subsequent movements are tracked using a computerized waste tracking system. Paper copies of the waste tracking forms with all information are filed in the daily operating record.

STORAGE / TRANSFER FACILITIES

A. General

1. Are the following types of storage facilities employed at the site?

- **Wastepiles** No
- **Containers** Yes (drums, bulk)
- **Aboveground Tanks** Yes
- **Underground Tanks** No

2. Describe design measures for spill/leak prevention in unloading/loading areas.

- **Drums/containers** – Drum dock with secondary containment
- **Bulk storage** – Concrete containment area
- **Tanks** – Overflow alarms and secondary containment

3. Are storage areas inspected for leaks and spills?

Yes. All storage areas are inspected daily by a site inspector using an inspection checklist.

4. Are all PCB wastes labeled and dated when placed into storage?

Yes.

5. Are all wastes disposed of within one year from the date when placed in storage?

Yes.

B. Container Storage

1. Describe container storage areas.

Location	Paving Material	Roof/Cover	Containment Material
South Parking Area	Concrete	No	Concrete
Stabilization	Concrete	No	Concrete
Drum Warehouse	Concrete	Yes	Concrete
PCB Warehouse	Concrete	Yes	Concrete
AT Dock	Concrete	No	Concrete
Transformer Building	Concrete	Yes	Concrete

2. What are the average number of containers in storage and the number allowed by permit?

Container type	Location	Average # in Storage	# Allowed by Permit
Bulk containers	South Parking Area	10	58
Bulk containers	Stabilization	20	82
Drums	Drum Warehouse	750	3412-55 gal equivalents (liq limit 1197)
Drums	PCB Warehouse	500	3706-55 gal equivalents (liq limit 2338)
Drums	AT Dock	50	128-55 gal equivalents
Transformers	Transformer Building	3	4246 gallons of material in transformers

3. Are all containers:

- In good condition? Yes
- Securely closed? Yes
- Segregated by waste type? Yes
- Marked to identify contents? Yes

4. Is there a containment system for spills leaks and precipitation?
Yes.

5. Is the containment system of sufficient capacity to contain 10% of the volume of all containers or the volume of the largest container?
Yes.

6. Is the containment system base, underlying the containers, free of cracks or gaps and impervious to the materials being stored?
Yes.

7. Is run-on to the container areas prevented?
Yes.

8. How are accumulated precipitation or spills removed from the sump or collection area, and where is it disposed of?
Generally, precipitation is removed with a vacuum truck and processed at the aqueous treatment facility. A small spill may be cleaned up with an absorbent.

C. <u>Tank Storage</u>

1. How many hazardous waste tanks are there? What is the storage capacity of existing tanks?
There are approximately 60 storage tanks with a capacity of approximately 2,500,000 gallons.

2. Do tanks have controls to prevent overflowing?
Yes. Type of control (auto shutoff, high level alarms, both audible and visual) varies depending on tank.

3. What other spill prevention/detection measures exist?
Tanks are inspected daily.

4. Do aboveground tanks have a containment system for spills, leaks and precipitation?
Yes. Concrete or HDPE secondary containment.

5. Is the system designed to efficiently drain and remove liquids?
Yes.

6. Is the containment system of sufficient capacity to contain 10% of the volume of all tanks or the volume of the largest tank, whichever is greater?
Yes.

7. Is the containment system base free of cracks or gaps and impervious to the materials being stored?
Yes.

8. Is run-on into the tank storage areas prevented?
Yes.

9. How are accumulated precipitation or spills removed from the sump or collection area, and where is it disposed of?
Material is removed by pump or vacuum truck into the aqueous treatment tanks.

10. Where are storage tanks vented?
Tanks are vented to the atmosphere, with controls as necessary.

11. Describe vapor control system.
Carbon canisters are used as required.

12. Are there any underground storage tanks at the site?
No.

13. Have there ever been underground storage tanks at the site?
Yes.

14. What were the tank capacities and materials stored in each tank?
There were a total of 7 tanks used for leachate and petroleum with a total capacity of 51,000 gallons. See below for list of individual tanks.

15. Have underground tanks been removed from the site? When?

Tank #	Service	Gallons Capacity	Closure Method	Closure Date
SLF 1-6 OWS	**Leachate**	**1,200**	**Filled with concrete**	**June 97**
SLF 7 OWS	**Leachate**	**2,000**	**Removed**	**June 97**
SLF 10 OWS	**Leachate**	**2,000**	**Removed**	**June 97**
SLF 11 OWS	**Leachate**	**12,800**	**Filled with concrete**	**June 97**
Leachate Hold Tank	**Leachate**	**20,000**	**Filled with concrete**	**June 97**
G05	**Petroleum**	**10,000**	**Removed**	**April 93**
G06	**Petroleum**	**3,000**	**Removed**	**April 93**

OWS= Oil/Water Separator

16. Was there State oversight and was a certification of closure submitted to NYS DEC?
Yes.

17. Were there any signs of leakage or spilling?
SLF 7 closure encountered some visibly contaminated material, which was removed, and testing conducted to confirm all contamination was removed.

18. Are there underground process tanks at the site?
Yes, stabilization pits.

19. Have there ever been any other underground process tanks at the site?
No.

20. Are tank piping connections for most tanks above ground or below ground?
Above ground.

21. Indicate frequency of inspection of above ground tanks and what they include.
All tanks are checked at least once a day on operating days for signs of leaks and are scheduled for a complete tank assessment per the schedule in the permit.

D. Storage Stockpiles
Not Applicable.

LANDFILL

A. General Information

Landfill operations consist of closed landfill units SLF 1 through 7 and 10 through 12 and the currently active RMU-1. RMU-1 is 47 acres and consists of 14 cells. As cells in RMU-1 reach final design waste capacity, a final cover is placed on these cells. This practice reduces the area exposed to precipitation and helps in reducing the amount of leachate produced. Since RMU-1 cells will be constructed, filled, and capped in stages over several years, a "cap as you go" final cover system is used. As final cover is applied, the leading edge adjacent to operating cells will be tied into as operating cells also reach final waste grades. The cover system will progress sequentially until the entire landfill is filled and capped. The facility expects to operate RMU-1 until 2012. It is anticipated that RMU-2 will be built by 2011.

B. Landfill Units

Unit	Years of Operation	Liner System	Wastes	Capacity
SLF 1-6	1971 – 1978	Single Hypolon and single clay	All types of wastes, including free liquids	201,124 cu yd 15 acres
SLF 7	1978 – 1983	Single HDPE and single clay	All types of wastes, depending on regulatory requirements	247,778 cu yd 7 acres
SLF 10	1982 – 1984	Single HDPE and single clay	All types of wastes, depending on regulatory requirements	160,550 cu yd 6 acres
SLF 11	1984 – 1990	Cell 11A: single composite Cell 11B & 11C: double composite	TSCA PCB wastes, RCRA and NY Hazardous wastes	920,000 cu yd 25 acres
SLF 12	1990 – 1994	Double HDPE and double clay	TSCA PCB wastes, RCRA and NY Hazardous wastes	940,800 cu yd 22 acres
RMU-1	1994 – present	Double HDPE and double clay	TSCA PCB wastes, RCRA and NY Hazardous wastes	3,500,000 cu yd 47 acres

C. Acreage and volume

1. What acreage is currently permitted for hazardous waste operations?
The facility is defined in the site 373-2 permit as 630 acres. Acreage permitted for hazardous waste operations is subject to DEC permitted operations and local zoning restrictions. The "active area" of the facility is approximately 350 acres.

2. What is the acreage and volume of the currently active landfill?
RMU-1 consists of 14 cells of approximately 47 acres and will hold 3,500,000 cubic yards.

3. What is the acreage of closed landfills?
There are 10 closed landfills totaling 75 acres.

4. What is the maximum and estimated disposal rate per year?
425,000 tons per year

5. What is the volume of waste previously disposed?
2,470,252 cubic yards in landfills 1 –12
2,851,307 yards in RMU-1 (through December 2007)

6. What is the estimated remaining life of the facility?
To the year 2041

D. Construction

1. Are sidewalls and bottom constructed with impervious materials?
Yes. RMU-1 has been designed with two, 80-mil, high-density polyethylene (HDPE) liners and two compacted clay liners.

2. List construction materials:

- Depth: Compacted clay 4.5 feet
- Depth of sideslopes: Compacted clay 3.0 feet
- Permeability: $K= 1x10^{-7}$ cm/sec

3. Is bottom material compacted?
Yes.

4. Does landfill contain synthetic liner(s) on bottom and sides?
Yes.

5. Type of liner and thickness.
See attachment "Base Liner" cross-section drawing for liner details.

6. What is the depth of the cell bottom below grade?
Varies. Top of operational layer is approximately original grade.

7. Are there any portions of the cell bottom below, or closer than, 10 feet to the upper most groundwater?
No.

8. What is the distance from the cell bottom to the uppermost groundwater?
Typically 10 to 20 feet.

9. What are the design details of closed cells if different from present design?
Pre-1985 cells were single composite liners only.

E. Leachate collection system

1. Does each cell/subcell contain a leachate collection system?
Yes.

2. Is the system controlled manually or automatically?
Automatically.

3. How is leachate handled/treated?
Leachate is treated on site through the aqueous treatment facility.

4. As a measure of liner integrity, what is the actual secondary liner leachate collection rate compared to the response action rate (RAP) in the permit?
The secondary leachate rate is routinely about 10% of the RAP. An exceedance of the RAP would be an indicator that the landfill may be leaking.

5. Is the leachate collection system capable of maintaining less than 30cm depth of leachate over the liner?
Yes.

F. Waste placement

1. Is the landfill segregated into cells?
Yes. Cells are separated by clay berms with HDPE.

2. What measures are taken to prevent commingling of incompatible wastes?
Special areas are designated by grid location for placement of acid generating and acid sensitive material.

3. Is a three-dimensional grid system used for recording waste placement in the landfill?
Yes.

4. Is the landfill managed to control wind dispersal of waste, litter and dust?
Yes.

5. Is waste pretreated at the site before placement in the landfill?
If required by regulation or permit, waste may be stabilized, solidified, macro-encapsulated or micro-encapsulated.

6. Are liquid wastes or wastes containing free liquids placed in the landfill?
No.

G. Cover

1. Are interim covers used on the landfill?

Yes. One foot of clean cover. An interim cover may be applied until final capping during the next construction season.

2. Describe daily cover procedures.

Daily cover is applied to the working face of the landfill using clean soil or other approved alternate cover.

H. Miscellaneous

1. Are local citizens allowed access to the landfill?

No.

2. Is facility permitted to accept wastes from SQGs?

Yes.

3. Are there explosive gas controls?

No. Gas is not generated.

4. Describe how methane gas is monitored and/or handled.

Not applicable.

Figure 4 - Landfill Diagram

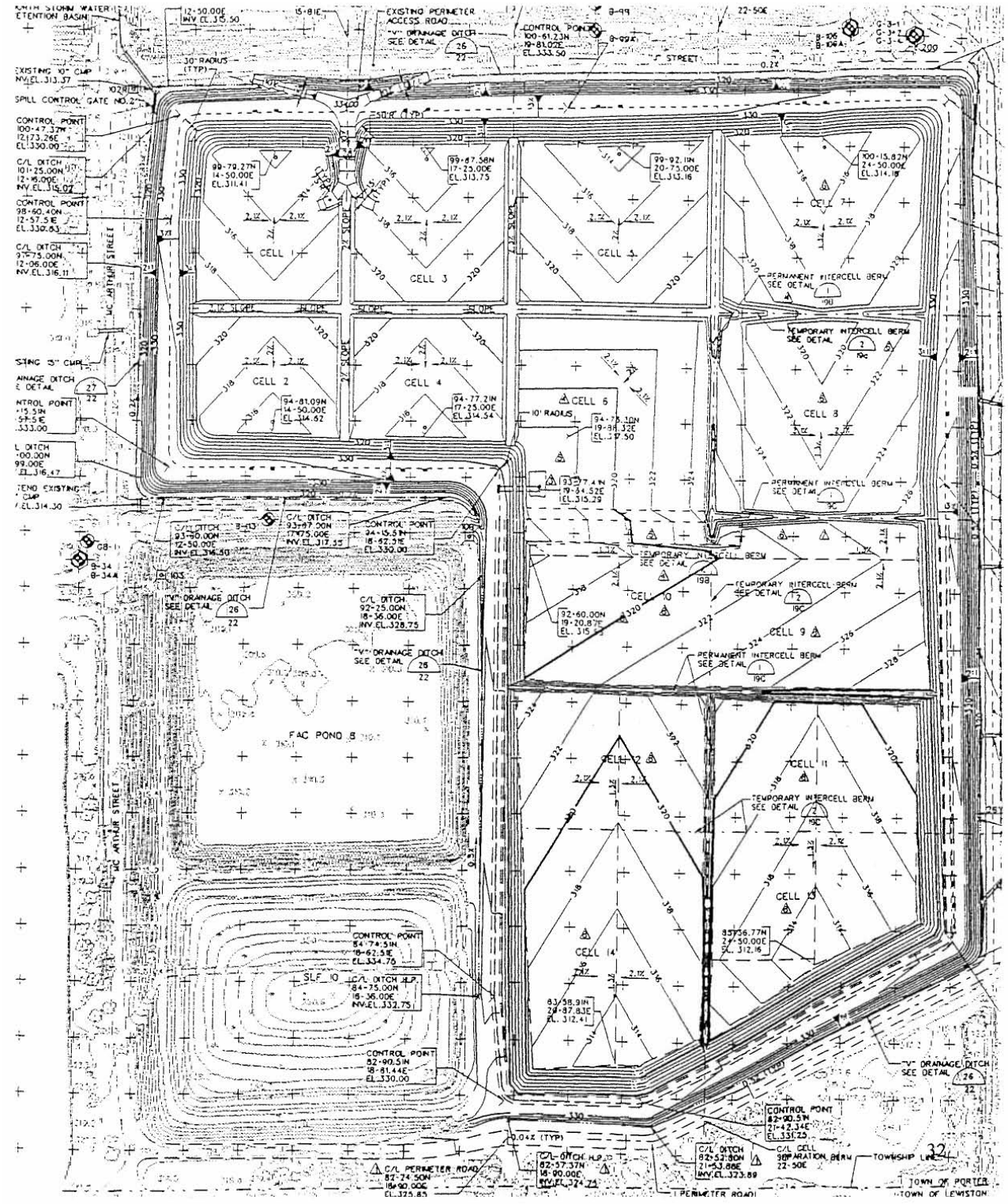


Figure 5 - Landfill Cross Section

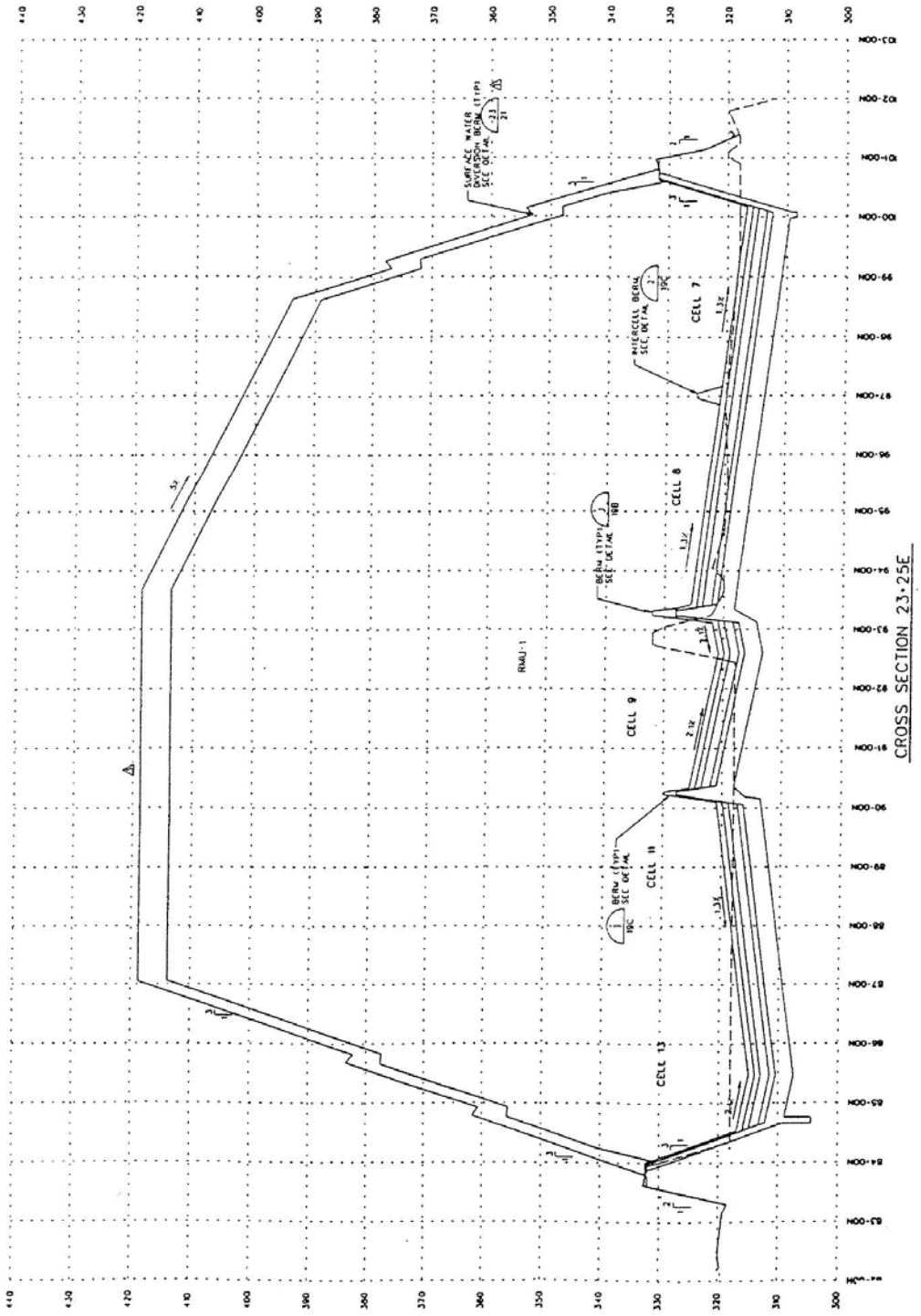
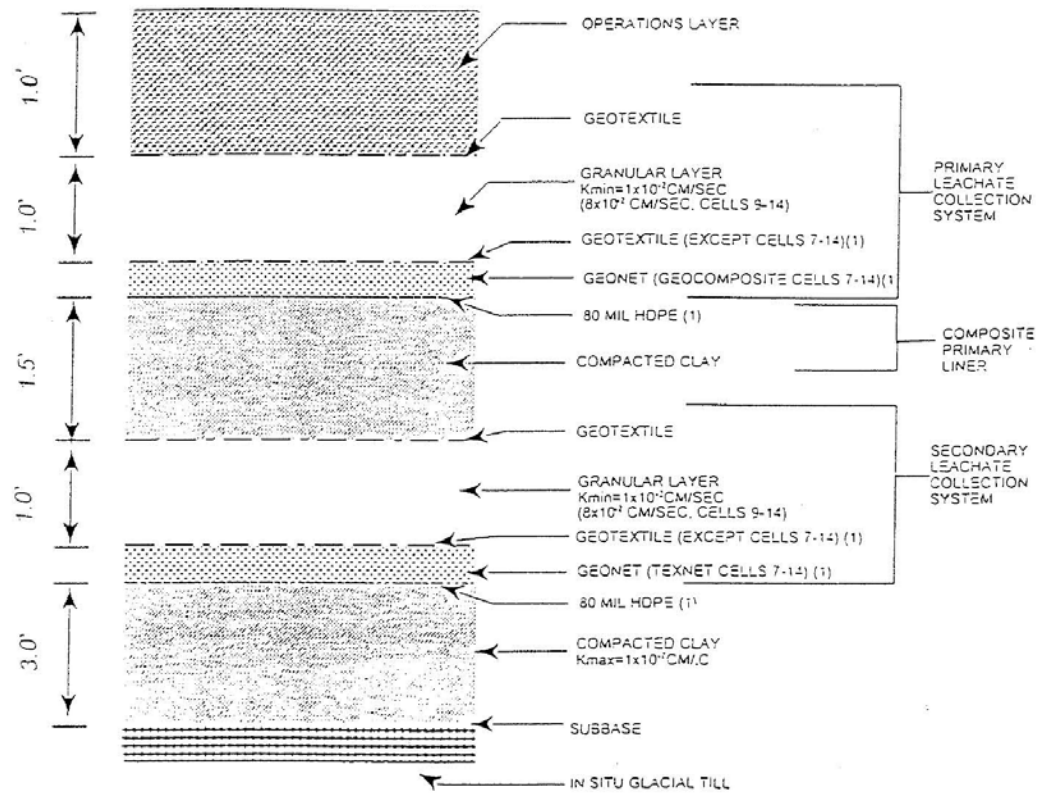


Figure 6 - Landfill Linear



BASE LINER
NTS

Notes:

(1) Liner systems for Cells 7 through 14 to consist of 80 mil HDPE textured sheet and geocomposite for both primary and secondary liner systems. The geotextile above the geonet is also eliminated.

FIGURE 1
BASE COMPOSITE LINER

CWM CHEMICAL SERVICES, INC.
RESIDUAL MANAGEMENT UNIT NO. 1
Model CITY, NIAGARA COUNTY, NEW YORK

STABILIZATION PROCESS

1. **Explain the stabilization process.**
   - Stabilization of wastes is accomplished by the addition of Portland cement, cement kiln dust (CKD), or other reagents as necessary and mixing. The stabilized waste is then landfilled.

   - Macro-encapsulation is a method used for debris. The waste is placed in a secure vault, made of HDPE, the void space filled with inerts, sealed and landfilled.

   - Micro-encapsulation is similar to stabilization. Reagents are mixed with debris to treat the chemical contamination on the surface.

2. **Briefly describe the unit design and operation.**
   The stabilization facility has two double walled steel tanks where mixing occurs with the use of backhoes. Trucks back up to the pits and waste is dumped into a pit. Reagents are added and mixed. Material is then placed in ten wheel dump trucks and taken to the landfill.

3. **Describe the typical run time for the operation.**
   The process takes approximately 30 – 60 minutes per batch depending on the quantity of material. The facility is permitted to operate 24 hours per day, 12 months per year.

4. **Are any products reclaimed, generated or regenerated from the wastes treated?**
   Yes, baghouse dust is generated.

SURFACE IMPOUNDMENTS

1. Are surface impoundments presently used to store waste?

Yes. Surface impoundments are utilized for final qualification and aeration of treated wastewater prior to discharge into the Niagara River in accordance with the facility's SPDES permit.

ID	Capacity	Typical Inventory	Double Liner (Y/N)	Contents	Liner	Leak Detection System	Underlying Materials	Groundwater Monitoring
FAC Pond 1 Pond 2	25.6 MM gal. 7.1 acres	30%	N	Treated Waste Water	Compacted Clay	N	Silt/clay till	Y
FAC Pond 3	48.21 MM gal. 13.2 acres	50%	N	Treated Waste Water	Compacted Clay	N	Silt/clay till	Y
FAC Pond 8	43.46 MM gal. 6.6 acres	70%	N	Treated Waste Water	Compacted Clay	N	Silt/clay till	Y

2. Are there surface impoundments which are not being used, or which the facility does not plan to use in the future?

Yes.

3. Is a minimum of 2 feet of freeboard maintained in the impoundments?

Yes.

4. What type of dike do the impoundments have?

Earthen.

5. Are dikes inspected and maintained?

Yes.

6. Are there any surface impoundments used to store or retain rainwater?

No, see next section "Water and Air".

7. Describe design and use.

Clay liner (stores treated waste)

WATER AND AIR

A. General

1. What is the potential for contamination of nearby waters?
Minimal.

B. Stormwater Management

1. How is run-on of stormwater to the facility prevented?
Facility grading and soil berms

2. Is stormwater diverted away from active areas?
Yes

3. Is stormwater falling on active areas collected?
Yes.

4. Describe collection and treatment system.
Stormwater is routed from facility active areas to stormwater retention ponds on the site, which are managed by control gates. Water collected in the ponds is analyzed for conductivity and is treated onsite through the aqueous treatment system if unsuitable for release. The facility has obtained New York Stormwater General Permit coverage as required (see General Permit Coverage Notice, SPDES General Permit for RMU-1 Construction). Details of the stormwater management program are included in the Surface Water Sampling and Analysis Plan, Attachment J of the permit. Runoff from process areas is always directed to the wastewater treatment system and then released to the surface impoundments on site.

5. Is stormwater discharged from the facility? Where?
Yes. Stormwater is discharged through outfalls 002 & 003 to Six Mile Swale into Four-Mile Creek and ultimately into Lake Ontario. Stormwater is discharged to Twelve-Mile Creek to Lake Ontario from outfall 004.

6. What are the discharge criteria?
General discharge criterion is 2500 micromhos/cm conductivity. SPDES permit lists other limits.

7. What is the design basis for the run-off control system?
25 year – 24 hour storm

8. Is the site located within the 100-year floodplain?
All waste management units are located outside the 100-year floodplan, except for the southeastern corner of RMU-1 which is in the floodway fringe of Twelve-Mile Creek and protected by its perimeter berm.

C. Wastewater Treatment

1. How does the facility dispose of its wastewater?
Leachate, groundwater from remediation activities, and other wastewater is treated in onsite aqueous treatment tanks as required, discharged to surface impoundments onsite and later released via SPDES outfall 001 located at Peggy's Eddy into the Niagara River.

2. Does the facility have a SPDES permit for this?
Yes.

3. Describe the steps in the treatment process.

- Lime is first added to form insoluble salts, which are removed by filtration.
- The pH is then adjusted to neutral and biological processes are employed to digest organics.
- Activated carbon is used as a final treatment step to remove traces of organics.
- Treated water is tested then transferred to facultative ponds (surface impoundments) and batch qualified prior to release to the Niagara River via a site-owned 5-mile pipeline.

4. What are the primary discharge treatment or pretreatment criteria?
There are over 200 parameters tested for prior to discharge according to the discharge permit.

5. Is the discharge monitored
Yes.

D. Air Pollution Controls

1. Describe air pollution controls for tankage.
Carbon canister as required for tanks containing organics.

2. Describe air pollution controls for process units.
Carbon canisters for organics or baghouses for particulates.

3. Describe air pollution controls for fugitive emissions.
The facility has a dust control plan, which includes use of water on roads and in the landfill.

4. Describe air pollution controls for wastewater treatment facilities.
Carbon canisters, caustic scrubber.

5. Describe air pollution controls for storage stockpiles.
Not applicable.

SITE GEOLOGY AND GROUNDWATER

A. General

1. Describe the geological profile beneath the facility.
See attached General Site Stratigraphy cross-section.

2. What is the permeability (general hydraulic conductivity) of the site's subsurface?
Less than 1×10^{-5} cm/sec

B. Drinking Water

1. What is the drinking water source for municipalities within 5 miles of the site?
Local surface water

2. If municipality supply source is a surface water body, provide name of the source, distance from the facility and direction from the facility.
The surface water body is the Niagara River, approximately 5 miles west of the facility.

3. What is the source of drinking water for the nearest residences to the site?
City water

4. What is the source of drinking water for the site?
City water and bottled water. Bottled water is used for convenience for chilled water.

5. Is groundwater within a 5-mile radius of the site used to irrigate crops or water livestock?
Yes.

6. How deep are the aquifers and where are they located?
See "General Site Stratigraphy" attached.

7. Where are the agricultural water supply wells situated in relation to the site?
The water supply wells are situated both upgradient and downgradient of the facility.

8. What is the distance and use of the nearest off-site wells?
The nearest wells are less than 2 miles from the facility and are used for irrigation.

C. Groundwater

1. What is the depth to the principal site aquifer?
50 – 65 feet

2. What is the quality of the groundwater?
Unpotable

3. What is the use of the groundwater?
None

4. What is the depth of the groundwater?
Less than 10 feet to upper saturated zone.

5. Is there evidence of a hydraulic connection between the water table and the confined aquifers and/or between the confined aquifers themselves?
No, with limited exception in central portion of the facility where glaciolacustrine clay "pinches out."

6. What is the local groundwater flow direction?
North to northwest

7. What is the discharge point for groundwater, if any?
Not applicable

8. What is the source of geological/hydrological data?
Local studies, over 500 borings completed at the facility.

9. Is the site located on or adjacent to wetlands?
Yes.

D. Groundwater Monitoring

1. Is groundwater monitoring currently being performed?
Yes.

2. Why is groundwater being monitored?
Permit requirement

3. How many wells are used in sampling groundwater?
Approximately 200 wells are used. (190 downgradient and 10 upgradient)

4. What are the water bearing formations and screened intervals?

Formation	Screened Interval (ft BGS)
Upper tills	5 – 20
Glacial silt / sand	50 – 65

5. What is their relationship to the site?
Facility perimeter and at individual treatment/disposal units

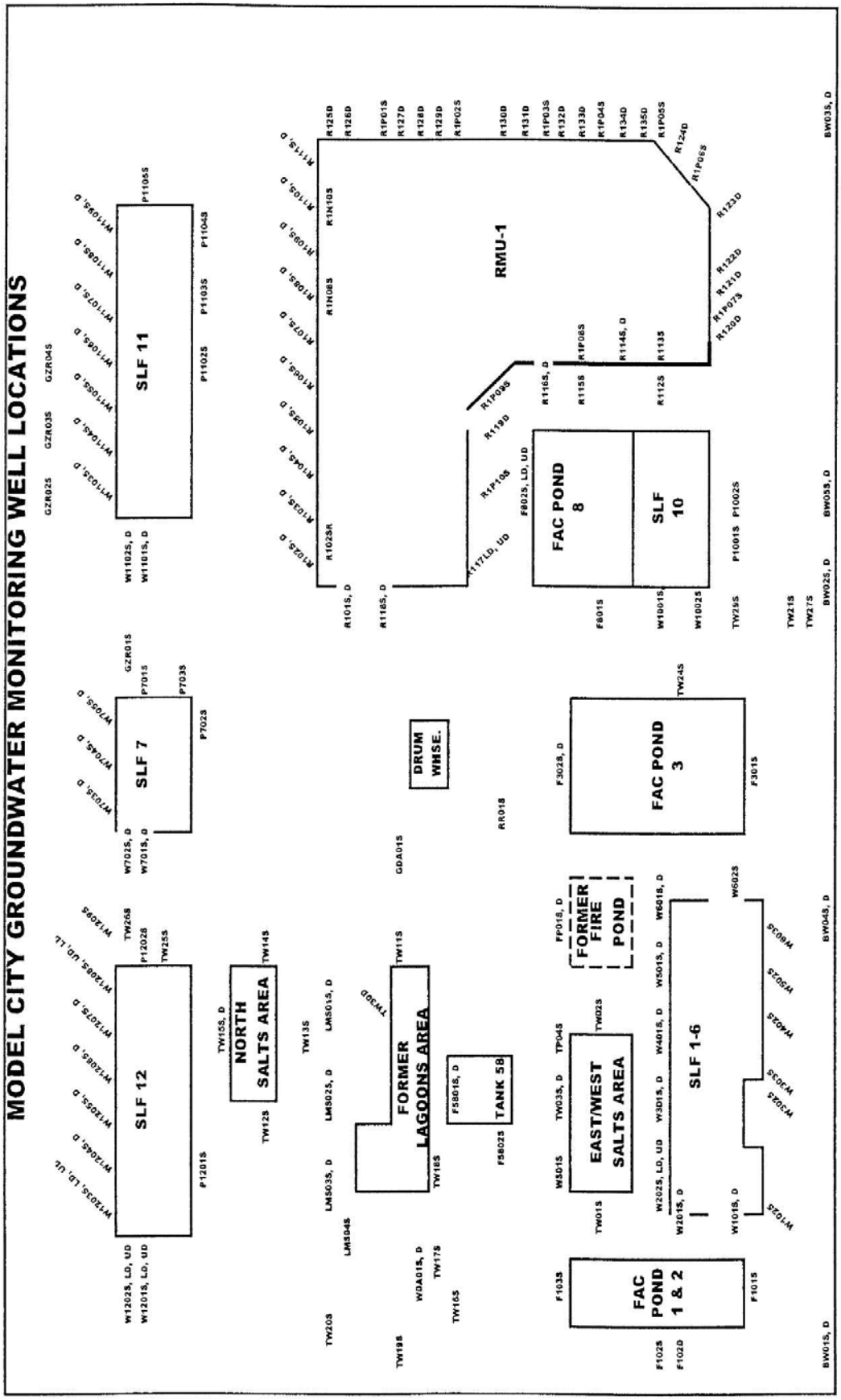
6. Has the monitoring system been approved by the state?
Yes.

7. What are the monitoring parameters and sampling/analysis frequencies?
The parameters and frequencies vary depending on the well and/or location.

8. Has the State or EPA reviewed in detail the groundwater monitoring results?
Yes.

9. Have contaminates been detected?
Yes. See the attached "RCRA Facility Investigations and Remedial Measures".

Figure 7 - Monitoring Well Locations



TOPOGRAPHY/GEOLOGY

A. Local Topography

The Towns of Porter and Lewiston are part of the Iroquois Lake Plain. The plain is located north of the Niagara escarpment, the northernmost major topographic feature in Niagara and Erie Counties. Both the elevation and relief of the land surface tend to increase from north to south. The facility is located on a flat plain forming a portion of the extended Lake Ontario shoreline natural grade. Ground elevations on the Model City Facility vary from 308 feet to 322 feet above sea level.

B. Local Geology

The bedrock formation underlying the Model City Facility is the Queenston Shale. The Queenston Shale is approximately 1,200 feet thick, with only the uppermost part exposed in the region. It underlies all of Niagara County north of the Niagara escarpment, including the Towns of Porter and Lewiston, and can be seen in the Lower Gorge of the Niagara River. It is characterized by brick-red shale which varies from argillaceous (high in clay-sized particles) to sandy (high in sand-sized particles). The Queenston Shale is not exploited for economic purposes. Approximately 50 feet of unconsolidated deposits overlie the bedrock formations. This material was deposited during several Pleistocene glacial periods and consists of alluvial glacial till and glaciolacustrine deposits.

The alluvial deposits are the uppermost units where they occur and consist of clay and silt. They are found sporadically across the Model City Facility. Where the alluvial deposits do not occur, the uppermost units are glacial tills and contain a variety of particle sizes including silts, clays, sands, and gravels. The glaciolacustrine deposits underlie the glacial tills and are made up of silts, clays, and sands. The stratigraphy of the Model City Facility is more fully described in Section D-5b(2) of this application.

Due to past regrading of the Model City site, several feet of fill overlie the original surface soils in some areas. This fill is quite similar to the deeper soils in composition and hydrogeologic properties. Also, a relatively thin veneer of alluvial deposits exists over some portions of the site. The alluvial deposits typically consist of laminated clayey silt, silt, and fine sand. The alluvium varies in thickness from 0 to 8 feet.

There are two original surface soil associations (types) found on the Model City site. The association covering the largest area is the Rhinebeck-Ovid-Madalin association. This consists of deep, somewhat poorly drained to very poorly drained soils having a fine-textured or moderately fine-textured subsoil that is dominantly brown or olive in color. The other soil association, covering a lesser area, is the Appleton-Hilton-Sun association. This consists of deep, moderately well-drained to very poorly drained soils having a medium-textured subsoil.

C. Hydrology

Groundwater conditions at the Model City Facility have been investigated and are discussed in detail in the 1993 Ground Water Level Interpretation Report, (RUST Environment and Infrastructure, February, 1994); Groundwater Monitoring Program Model City Facility (Golder Associates, May 1988); the RMU-1 Groundwater Monitoring Plan (Golder Associates, February 1991); and in many additional reports which have all been previously submitted to the New York State Department of Environmental Conservation (NYSDEC).

Within the several documented reports, potentiometric maps were used to estimate the primary ground water flow direction and rate under the facility for the Upper Tills unit and the Glaciolacustrine Silt/Sand unit.

Within the Upper Tills unit, ground water flow is generally directed to the north-northwest, following the topographic surface. A minor flow component to the south can be found in areas of ground water mounding, however the overall net flow direction is to the north-northwest.

The general flow direction of the Glaciolacustrine Silt/Sand unit is also north-northwest toward Lake Ontario, with a northwest component influenced by the higher transmissivity in the northwest portion of the site. In the southeastern portion of the facility, the Glaciolacustrine Silt/Sand unit is absent and has been replaced by the Glaciolacustrine Clay unit. In this area, the highly impermeable clay impedes ground water flow and has caused localized mounding.

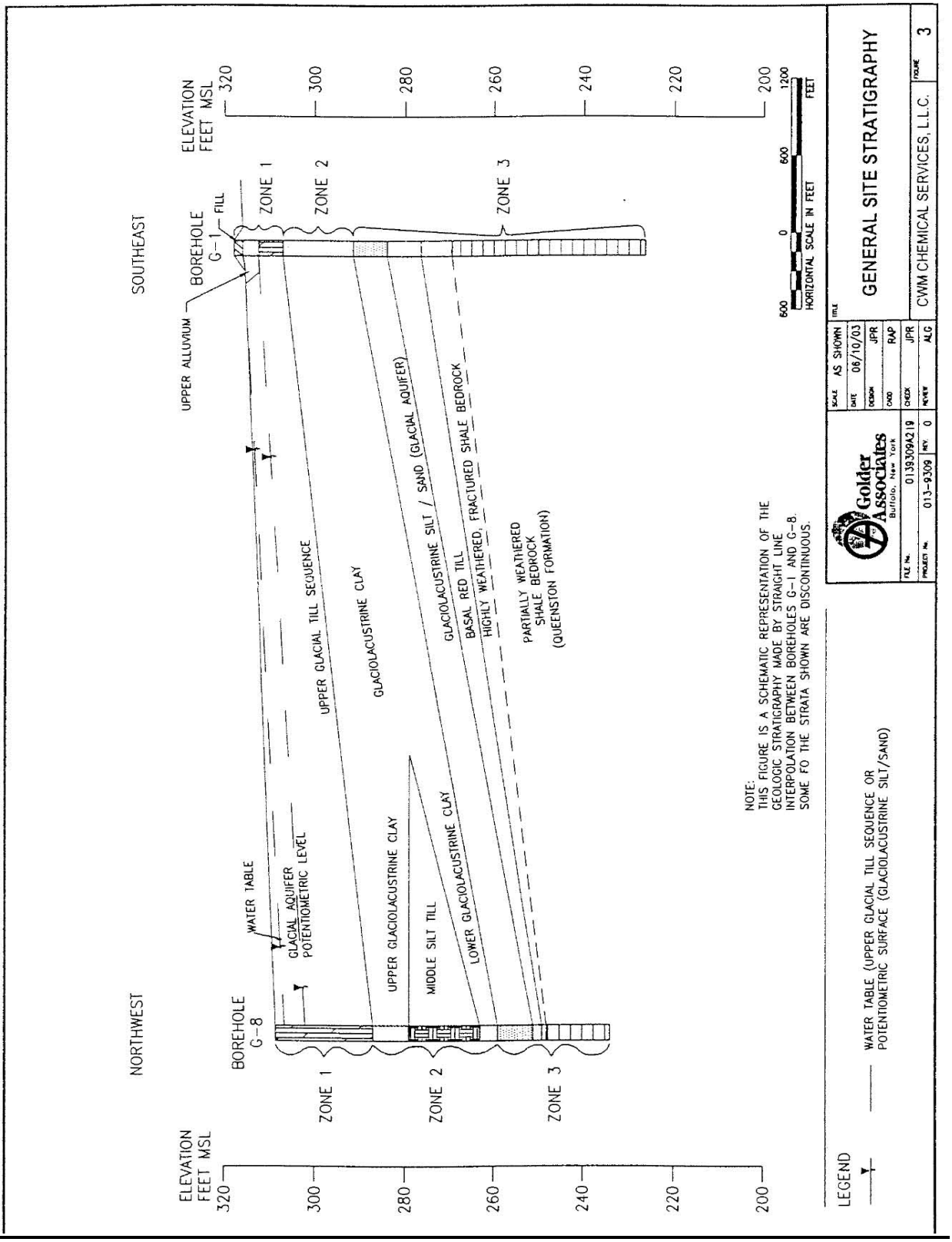
D. Surface Water

The Model City site is located in the Eighteen-Mile Creek Drainage Subbasin. This subbasin is a portion of the Lake Ontario Drainage Basin which includes the Eighteen-Mile Creek Subbasin and other tributaries of Lake Ontario entering the lake between the hamlet of Olcott and the mouth of the Niagara River. The basin drains an area of 233 square miles. Twelve Mile Creek drains 45 square miles including a small part of the Model City Facility property, but the major part of the property drains to Four Mile Creek through Six Mile Swale.

Surface drainage and runoff is collected on-site in a series of retention basins and drainage channels with control gates. Runoff collected from process areas is directed to the existing wastewater treatment system. Drainage from non-operational areas is collected in the drainage channels and, using a series of manually controlled gates, is held and tested prior to discharge to nearby surface waters. Discharges from surface water outfalls are also included in the Facility SPDES Permit.

In addition, the Model City Surface Water Monitoring Plan covers surface drainage, runoff, and stormwater monitoring in detail.

Figure 8- Site Stratigraphy



REGULATORY INFORMATION

1. Regulatory inspections by agency:

Agency	Frequency
USEPA (TSCA)	Varies – last in August 2004
NYSDEC (RCRA)	Semi-Annual
NYSDEC, On-Site Monitors	Daily

2. Regulatory agency contacts:

AGENCY	CONTACT	PHONE
USEPA (TSCA) 2890 Woodbridge Avenue Edison, NJ 08837	Daniel Kraft Chief, Toxics Section	(732)321-6669
USEPA (RCRA) 290 Broadway, 22nd Floor New York, NY 10007-1866	Jim Reidy Environmental Engineer	(212)637-4172
NYSDEC 270 Michigan Avenue Buffalo, NY 14203-2999	Bidjan Rostami Environmental Engineer II	(716) 851-7220
Niagara County Health Dept (NCHD) 5467 Upper Mountain Road Lockport, NY 14094	James Devald Deputy Director	(716) 439-7444

3. What is the regulatory status of the facility?
RCRA Part B permitted Facility

4. List all operating permits for the facility.
See attached list.

5. Has the facility's permit been modified to reflect current regulations or the land disposal restriction standards and the Hazardous Waste Toxicity Characteristics?
Yes

6. Describe the system for regulatory recordkeeping and manifest monitoring.
Waste is tracked electronically and in paper form from the generation of a waste tracking form through disposal. The facility tracks the waste on-site by manifest number, date, receipt number, and waste profile number (unique to each waste stream). Operating records consist of manifests, LDR forms, electronic waste tracking printouts, all inspection logs and documentation of repair status if inspection reports note deficiencies. The Technical Manager who reviews them for items requiring further approval, sign all inspection logs. Logs are kept indefinitely. Records are well organized, readily available and complete.

7. Is there a regulatory agency inspector stationed at the site?
There are two full-time NYS DEC monitors on site year round. A third monitor is on site during landfill construction activities.

8. What is the scope of the agency inspector's activities?
All operation, construction and recordkeeping activities are reviewed continually. In addition, the monitor reviews and approves all profiles for waste streams destined for the landfill.

9. A List of any compliance deficiencies from inspections, Notice of Violations, Consent Orders or fines.
Available upon request.

10. Has the facility received any warnings, violations, or fines other than as a result of inspections?
No.

11. Have violations and deficiencies been corrected in a timely manner?
Yes.

12. List any outstanding, unresolved, or incomplete corrections based on differences in legal interpretations leading to NOVs/ACOs.
None

13. List any outstanding, unresolved, or incomplete corrections based on schedule.
None

14. Are there any known regulations proposed or pending that may have a significant impact on the site?
No.

15. Has there been any significant, environmentally related litigation against the site in the last three years?
No.

16. Is the facility a potential responsible party (PRP) at a Federal or State Superfund site, or has the facility received a CERCLA Section 104(e) letter notifying them that they may be a PRP?
No.

Figure 9 – NYSDEC Inspection Report

New York State Department of Environmental Conservation
Division of Solid and Hazardous Materials, Region 9
270 Michigan Avenue, Buffalo, New York, 14203-2999
Phone: (716) 851-7220 • **FAX:** (716) 851-7226
Website: www.dec.state.ny.us

Denise M. Sheehan
Commissioner

April 3, 2006

Ms. Jill A. Banaszak
Technical Manager
Waste Management
CWM Chemical Services LLC
1550 Balmer Road
P.O. Box 200
Model City, New York 14107

Dear Ms. Banaszak:

Hazardous Waste Compliance Inspection Date: March 7, 2006
Location of Handler: Same as Above
EPA Identification Number: NYD049836679

In order to determine compliance with the New York State Hazardous Waste Regulations, the New York State Department of Environmental Conservation conducted an inspection of your facility on the above referenced date.

As a result of that inspection, we believe that your facility is operating as a generator and a treater, storer and/or disposer of hazardous waste.

No violations of the New York State Hazardous Waste Regulations were observed by the inspector on the inspection date referenced above. A copy of the Inspection Form can be obtained upon request.

Please note that this letter in no way addresses any liability you may have for any regulatory fees and hazardous waste special assessment fees.

If you have any questions about this notice or should you wish to discuss this matter further, please contact the Inspector or the Reviewer at the telephone number above.

Sincerely,

Nelson F. Schnabel
Environmental Engineer I

NFS/lj

Enclosure

cc: Ms. Efrat Forget, Inspector, Region 9
Mr. Bruce Knapp, Reviewer, Central Office

Figure 10 – USEPA Inspection Report

The public reporting burden for this collection of information is estimated to average 5 minutes per response. This estimate includes time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information to the Chief, Information Policy Branch (PM-223), US Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460, and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503, marked ATTENTION: Desk Officer for EPA.

1. Investigation Identification			2. Time	3. Firm Name
Date	Inspector No.	Duty Seq. No.		
8/ /2004	23562	1	8:25	CWM Chemical Services, LLC
4. Inspector Address				5. Firm Address
MS-105 2890 Woodbridge Ave., Edison, NJ 08837				1550 Balmer Road, Model City, NY 14207

REASON FOR INSPECTION

Under the authority of Section 11 of the Toxic Substances Control Act:

[x] For the purpose of inspecting (including taking samples, photographs, statements, and other inspection activities) an establishment, facility, or other premises in which chemical substances or mixtures or articles containing same are manufactured, processed or stored, or held before or after their distribution in commerce (including records, files, papers, processes, controls, and facilities) and any conveyance being used to transport chemical substances, mixtures, or articles containing same in connection with their distribution in commerce (including records, files, papers, processes, controls, and facilities) bearing on whether the requirements of the Act applicable to the chemical substances, mixtures, or articles within or associated with such premises or conveyance have been complied with.

[ ] In addition, this inspection extends to *(Check appropriate blocks)*:

- [ ] A. Financial data
- [ ] B. Sales data
- [ ] C. Pricing data
- [ ] D. Personnel data
- [ ] E. Research data

The nature and extent of inspection of such data specified in A through E above is as follows:

Certification

I certify that the statements I have made on this form and all attachments thereto are true, accurate, and complete. I acknowledge that any knowingly false or misleading statement may be punishable by fine or imprisonment or both under applicable law.

Inspector Signature		Recipient Signature	
Name: Chester Norman		Name: Jill Knickerbocker	
Title: Chemist	Date Signed: 8/11/04	Title: Technical Manager	Date Signed: 8/11/04

EPA 7740-3 Rev (8-91) Inspection File

CURRENT PERMIT LISTING

CWM Chemical Services, LLC ~ Model City, NY

Description	*Permit No.*	*Effective Date*	*Expiration Date*	*Comments*
Hazardous Waste				
Part 373 Sitewide	9-2934-00022/00097	8/5/05 (renewal)	8/5/10	All site operations
TSCA Authorization	N/A	12/4/02	None	USEPA; RMU-1 disposal and general site PCB issues; clarified 12/9/02
RMU-2	N/A	N/A	N/A	Application submitted 5/15/03
Water				
Sitewide SPDES	NY0072061	10/1/03 (renewal)	10/1/08	Includes treated wastewater discharge (001) and stormwater discharge (002, 003 and 004)
Miscellaneous				
Wetlands	92-986-72	2/24/93	N/A	Construction of RMU-1; Authorized under Nationwide Permit 33CFR330.5, Appendix A, Section B, No. 26, by U.S. Army Corps of Engineers (USACOE)
Wetlands	2000-01534(0)	8/30/00	N/A	Construction of compensatory flood water storage area (USACOE)
Wetlands	2000-01534(3)	2/21/03	N/A	Construction of RMU-1 East Stormwater Retention Basin (USACOE)
Wetlands	2000-01534(6)	N/A	N/A	Application submitted 11/18/03 – construction of RMU-2, new drum warehouse and scale bypass road (USACOE)
Sanitary Waste	N/A	4/26/95	None	Town of Lewiston approval letter; no monitoring required
Air				
Facility Registration	9-2934-00022/00226	6/29/06	None	Includes 23 previously permitted emission points

RELEASES AND REMEDIAL ACTIONS

A. Releases

1. Have there been any reported releases of pollutants to the environment in the last three years?
Yes. See attachment "Spills Reported to the EPA" for details.

2. What measures have been taken to prevent recurrences?
Training and preventative maintenance.

3. Were there any emergency responses due to accidental releases from spills, leaks, fires, etc., in the past three years?
No.

4. Describe past operations that have the potential to release contaminants to the environment.
During the course of conducting the RCRA Facility Investigation (RFI), numerous areas of contamination were discovered. In most cases, the contamination is thought to have resulted from historical (pre-1980) spills and leaks rather than from releases at regulated units. It should be noted that due to the slow rates of groundwater migration at the facility, there are no cases where the contamination has traveled more than a short distance from its presumed source. CWM has worked with the regulatory agencies to implement Interim Corrective Measures programs at several locations where groundwater contamination has been observed. For the most part, the contamination is limited to the shallow subsurface.

5. Are there closed surface impoundments at the site?
Yes.

6. If yes, have the wastes been removed from the impoundments?
Yes and no.

7. Have any closures been certified by the regulatory agency?
Yes. Closures have been certified by the NYS DEC.

B. Remediation Activities

1. Have there been any remedial assessments or investigations?
Yes. Old landfills, surface impoundments, and operating areas were investigated for contamination via an RFI (RCRA Facility Investigation) completed in 1993.

2. Have there been any remedial actions taken at the site in the past?
Yes. Landfill units 1-7 and 10-12 are closed (there were no landfills 8 or 9). Surface impoundments, fire pond and FAC Pond 9 have also been closed. Residual waste from closed units have been disposed of in an on site landfill as required. All unit closures and ongoing remediation projects are conducted under the direct supervision of the NYS DEC and USEPA Region II.

3. Are there any remedial actions currently underway or planned?
Yes.

C. Compliance

1. Is the facility in compliance with remediation requirements established by the regulatory agencies?
Yes.

2. Has remediation been conducted in a timely manner?
Yes.

D. Corrective Actions

1. Has a corrective action program for groundwater at the site been initiated or proposed?
Yes

2. Has a corrective action program for soil at the site been initiated or proposed?
Yes

3. Have clean-up cost been estimated?
Yes

RCRA FACILITY INVESTIGATIONS AND REMEDIAL MEASURES

1. Corrective Measures Study (CMS)

A RCRA Facility Investigation (RFI) was conducted to determine whether releases had occurred and to characterize the nature and extent of any release. Of the 146 Solid Waste Management Units (SWMUs) or areas identified in the RCRA Facility Assessment (RFA), over 80 were investigated as part of the RFI. As a result of this investigation, it was concluded that the sources of contamination at the site appear to be related to past activities and releases unrelated to current waste management activities. Of the 80 SWMUs investigated, 17 were identified as not having released chemicals to the environment. The remaining SWMUs have some level of contamination associated with them that is generally confined to the shallow upper tills soil unit. Seven of the SWMUs had sufficiently high levels of contamination for the NYSDEC to require Interim Corrective Measures. The interim corrective measures included the installation of ground water interceptor/collection systems at the former West Drum Area, the Lagoons Area, the Process Area (Phase I and II), the area South of SLF-3, Background Well BW02S, Piezometer P1202S, and the area south of the PCB warehouse. A number of SWMUs (approximately 18) appear to be related to past practices associated with the Department of Defense and the Department of Energy.

Corrective Measures is a two part process. In Phase I, a Corrective Measures Study (CMS) was conducted to evaluate the releases that have been identified at the facility, determine if remediation is warranted, review potential remedial solutions, and identify the most appropriate solution. Phase II is the Corrective Measures Implementation (CMI) phase, where the final design, construction, and implementation schedule of the selected remedies are addressed.

CWM Chemical Services, L.L.C. submitted the Site-wide CMS in January 1995, and SWMU Specific Corrective Measures Study in May 1995 to the NYSDEC.

2. Site-wide CMS Update

Agency comments to the Site-wide CMS were addressed by CWM in the draft Addendum to the Site-wide Corrective Measures Study and SWMU-Specific Corrective Measures Study (Golder Associates Inc., July 1996). Since the submittal of the Site-wide CMS, CWM performed the following activities:

- Design and construction of a groundwater extraction system for the area directly south of the PCB Warehouse. This system began operation in April, 1997.

- Design and construction of a DNAPL recovery system for existing wells EW-10 and EW-13, which are part of the Process Area II Interim Correctives Measures. This system began operation on April 15, 1997.
- Additional confirmatory PCB soil sampling at locations previously sampled during the RFI and remediation at three soil sample locations where PCBs were detected near or in excess of the "action limit" for PCBs in soil.

A comprehensive update to the Corrective Action program was submitted by CWM (Golder Associates, Inc., April 1999). Based upon its acceptance of the comprehensive update, NYSDEC issued a major permit modification to Module III, Corrective Action Requirements, of the Site-wide Part 373 Permit on February 13, 2001. In this modification, NYSDEC determined that all Interim Corrective Measures systems would serve to provide the Final Corrective Measures for these areas. CWM has agreed to operate these systems in perpetuity.

3. SWMU-Specific CMS

Based on comments received from the agencies on the SWMU-Specific CMS Report, CWM subsequently conducted an additional evaluation of alternative corrective measures through the use of a team of recognized experts from academia and consulting firms, which was referred to as the Peer Review Panel. The Peer Review Panel conducted an independent review and assessment of the corrective measures being considered for the facility and provided CWM with their recommendations for a comprehensive approach to closure and corrective measures at the facility. The Peer Review Panel Report was submitted to the Agencies by CWM in April 1996 and the Panel's recommendations were also included in the Draft Addendum to the Site-Wide and SWMU-Specific CMS (Golder, July 1996). These proposed actions included:

- Performing supplemental investigations including the evaluation of the engineering properties of the wastes and treatment residuals through field investigations, bench-scale treatability and demonstration /field scale studies;
- In-situ stabilization and closure of the Lagoon/Salts Areas surface impoundments in place;
- Construction of an additional Lagoons Area downgradient groundwater interceptor trench; and
- Provision of perpetual care for maintenance and monitoring for the Lagoons Area based on the need to manage groundwater in the Lagoons and Process area as a whole and to provide long term monitoring and maintenance activities.

The design report and addenda for the Lagoons Area Groundwater Interceptor Trench (LAGWIT) (Golder, July 1997) were submitted by CWM to the Agencies on July 3 and July 9, 1997 respectively. The design was approved by the Agencies on July 21, 1997 and construction of the LAGWIT was completed in December 1997. The system has been operational since spring of 1998.

The following supplemental investigations and treatability studies have been performed by CWM subsequent to the submittal of the Draft Addendum to the Site-Wide SWMU-Specific CMS in July of 1996:

- Geotechnical Assessment of the Engineering Properties of Salts Materials. The results of this activity are included in the "Final Report - Corrective Measure Implementation Salts Areas Geotechnical Design Investigation" (Golder, June 1997). These data were developed for use in the design of proposed in-situ stabilization and impoundment closure activities.

- Bench Scale Stabilization Treatability Studies. The report on the bench-scale treatability study (Kiber, October 1997) was submitted to the Agencies by CWM on October 3, 1997 which identified in-situ stabilization reagent formulations and the physical and chemical properties of the untreated and treated samples. The report also presented comparisons of TCA and TCLP concentrations for RCRA metals, VOCs, semi-volatile organic compounds (SVOCs) and PCBs. Approval from the Agencies of the bench-scale treatability study report was received by CWM on August 12, 1998.

- In May 1998, CWM contracted Sevenson Environmental Services, Inc. (Sevenson) and Waste Stream Technology, Inc. (WST) of Niagara Falls, New York to perform additional bench-scale treatability studies with samples of Lagoon 5 sludge based on their recommendations and approach for stabilization treatment. WST evaluated several stabilization reagent formulations and also performed TCLP and SPLP testing on samples of untreated and stabilized Lagoon 5 sludge. The results of this work were included in the work plan described below.

- In October 1998, CWM submitted the document "In-Situ Stabilization Work Plan - Lagoons and Salts Areas" to the Agencies for review. This work plan was developed utilizing the

combined resources of CWM, Golder, Blasland Bouck & Lee Inc. (BBL), Sevenson, Kiber, and WST. Based on comments received, an Addendum to the Work Plan was submitted to the Agencies on January 22, 1999 which was approved on February 9, 1999. As shown in this Work Plan, field demonstration stabilization activities by CWM were completed on the western half of Lagoon 5 in 1999. A demonstration report showing compliance with the treatment performance criteria was submitted by CWM on April 24, 2000 and approved by the Agencies on May 18, 2000.

Based upon that approval, NYSDEC included the requirements for full-scale treatment and final capping of the Lagoons and Salts Areas in its February 13, 2001, permit modification. As of 2003, treatment and final capping of all Lagoons and Salts (Lagoon 1, Lagoon 2, Lagoon 5, Lagoon 6, Lagoon 7, North Salts, East Salts and West Salts) have been completed.

4. Department of Defense (DOD)/Department of Energy (DOE)

- **DOD and DOE Involvement**

The DOD and the DOE continue to be involved in on-site remedial activity. The United States Army Corps of Engineers (USACOE) is conducting a comprehensive Remedial Investigation/Feasibility Study of the former Lake Ontario Ordinance Works. In addition, USACOE is working on site to remediate the TNT sewer that runs across the site and the chemical sewer on the “Syms Property." Work is also planned for the Olin Burn Area and buried drum trench north of SLF-7. However, because of funding issues, it is not known when work will begin on these areas.

The Department of Energy analyzed the soils beneath the tanks (T-64/65) area for the presence of PCBs and radiological contamination, and the results are currently being evaluated by way of risk assessment. Two other areas (soil beneath the PCB warehouse and the facility surface impoundments) will be reviewed by DOE at a future undetermined date corresponding to the closure of these units.

- **Remedial Measures: DOD Areas**

CWM Chemical Services, L.L.C. continues to operate the Groundwater Extraction Systems (GES) at Background Well BW02S and Piezometer P1202S. Even though CWM Chemical Services, L.L.C. has installed these remedial measures, CWM believes that the contamination in

these areas is a reflection of past practices of the DOD, and therefore, the responsibility of future monitoring of BW02S and P1202S lies with the DOD.

5. Department of Health (DOH)

➢ DOH Involvement

In 1972, the New York State DOH issued an Order dealing with residual radiological contamination found in soils on the former Fort Conti property which is now occupied by CWM. This property was previously used for storage of radioactive materials by the United States government during the 1940's and 1950's. The 1972 Order was modified by a DOH Supplementary Order in 1974. The Orders stipulate certain restrictions regarding the future use of this land, which would be terminated once further remedial actions were taken at the site. The Orders allow soil disturbance only after the submittal and approval of acceptable plans.

As a result of extensive corrective remedial actions taken at CWM since the 1972 DOH Order, on May 7, 1992, the DOE certified that all CWM property was in compliance with applicable radiological decontamination criteria, except for small portions of Vicinity Properties E, E' and G, which could not be accessed for evaluation. Based on the DOE certification, on December 23, 2003, CWM submitted a request to DOH to rescind and vacate the Orders, except for these three small areas. The DOH is currently evaluating this request.

➢ Projects Requiring DOH Approval

Until such time that the DOH vacates the 1972 and 1974 Orders, CWM will submit radiological survey plans for DOH approval prior to initiating any soil excavation or regrading projects. On July 2, 2004, CWM submitted a radiological survey plan for the Stormwater Upgrade Project, which is currently under DOH review.

Unless the Orders are vacated prior to initiation, additional radiological survey plans for other projects will be submitted for DOH approval. These projects are likely to include the installation of RMU-2 groundwater monitoring wells, the new Drum Management Building and the RMU-2 landfill. CWM submitted a generic radiological survey plan which is followed for minor soil disturbance projects, such as certain maintenance activities.

SPILLS REPORTED TO USEPA 2005 TO DATE

CWM Chemical Services, LLC – Model City, NY

DATE	MATERIAL DESCRIPTION	**QUANTITY**	**RELEASED TO**	**SPILL DESCRIPTION**	RESPONSE ACTION	DISPOSAL ACTION
11/11/2005	BIOTREATMENT TANK SOLIDS	10 LBS	GROUND	MATERIAL BACKED UP IN TANK SYSTEM DUE TO INTERNAL FUSE FAILURE WITHIN A VALVE	SHOVELED UP SOLIDS AND AFFECTED DIRT	SOLIDS AND DIRT DISPOSED ALONG WITH AWT FILTERCAKE
6/7/2006	EXTERNAL OIL/GAS FROM LAWNMOWER	SHEEN, 10' BY 10' (< 1 CUP)	ISOLATED ORNAMENTAL POND	OPERATOR "STUCK" MOWER IN POND	SHEEN ABSORBED WITH SPILL BOOMS AND PADS	BOOMS AND PADS DISPOSED IN LANDFILL
9/14/2006	OIL	SHEEN (5 DROPS)	STANDING WATER	“DISCOVERED” THE SHEEN	AFFECTED AREA WAS SAMPLED. RESULTS WERE < DETECTION LIMIT FOR VOCs	MATERIAL USED FOR THE SAMPLE, NO DISPOSAL REQUIRED
2/7/2007	PCB OIL	59 GAL	ASPHALT	TRANSFORMER TIPPED OVER DURING TRANSFER FROM FLATBED TO DECOMMISSIONING BUILDING	OIL ABSORBED ONTO SPEEDI DRY. AREA SCRAPED & SWEPT.	MATERIALS SHIPPED OFFSITE FOR INCINERATION
03/14/07	AQUEOUS LEACHATE	< 1 GAL	GROUND	FREEZE AND THAW TEMPS CAUSED LEAK AT FLANGE GASKET IN TRANSFER LINE FROM T-150 TO LEACHATE TANK FARM	DIRT IN AFFECTED AREA WAS REMOVED	MATERIALS SHIPPED OFFSITE FOR INCINERATION
11/22/07	OIL	SHEEN (EST 1/2 CUP)	ISOLATED PUDDLE OF WATER	“DISCOVERED” THE SHEEN	SHEEN ABSORBED WITH PADS	PADS DISPOSED IN LANDFILL

(Updated April 2008)

HEALTH & SAFETY

A. General

1. Who manages the facility's Health, Safety & Training program?
Tim Fogarty

2. Have there been any fires or explosions at the site in the last three years (2005-2007)?

Yes. There were a few fires. They did not cause any injuries or damage.

The first one occurred in RMU-1 in July 2005. The material that caught on fire was a waste stream consisting of elemental sulfur used in the production of sulfuric acid. The melting point of sulfur is about 240 F and the ignition temperature is 478 F. Tests performed by both the generator and CWM show that sulfur is not incompatible with acids or bases; only a slight temperature rise is obtained with a concentrated base. Literature does describe sulfur as incompatible with oxidizers. The sulfur solids were placed correctly in the acid sensitive area rather than the acid generating/oxidizer area. This was the first shipment of this wastestream, however, CWM has successfully landfilled elemental sulfur solids from several other generators. The generator does have additional material and as a precaution, intends to ship the sulfur solids in drums. The second one occurred in the stabilization pit in September 2006. A mixed drum load of material consisting of metals (mostly Cd, Cr and Pb) contaminated waste streams caught fire after CKD was added to the 66 drums. There were small pockets of isolated flames. By the time the profiles were reviewed, air monitoring was performed and ERT was mobilized, the flames died out on their own (within 40 minutes). The stabilization process was completed by the addition of ferrous sulfate and additional mixing. The stabilized waste was removed from the pit and sent to Interim Storage pending the results of the TCLP analysis for metals. The third one occurred in RMU-1 in September 2006. A shipment of non-hazardous solids caught on fire in the landfill @ 12:25 p.m. The ERT assembled and smothered the flames with dirt. The fire was out by 1:00 p.m. CWM requested a list of the exact materials included in the shipment from the generator. A review of the list did not identify any reactive materials. While the shipment did include latex solids, filtercake, resin and debris, it also included grease, rags and oil sludge, which were not listed on the profile. CWM worked with the generator to resolve the discrepancy concerning the types of materials that may be included under this profile. The shipment was placed on top of metal debris, which is the majority of the type of waste currently being received at CWM. As no chemical incompatibility was identified, the theory is that a spark was generated by the movement of the metal debris and it ignited the combustible materials in the shipment. Disposal decision modified to place material in portion of landfill not on top of metal debris.

3. Have there been any fatalities in the last three years (2005-2007)?
No.

4. What is the total number of cases with days away from work in the last three years?
2005-1 2006-1 2007-1

5. What is the total number of days away from work for the last three years?
2005-32 2006-13 2007-97

6. What is the OSHA Recordable Rate for the facility for the last three years?
2005-2.24 2006-5.74 2007-2.39

7. Is the facility in compliance with applicable fire codes and health and safety standards?
Yes.

B. Contingency Plan

1. Does the facility maintain written Contingency, Health & Safety, Training and Spill Prevention Control and Countermeasure (SPCC) Plans?
Yes, all of which may be reviewed on site.

Does the Contingency Plan include?

- **Emergency procedures?** Yes
- **Emergency coordinator's name and phone number?** Yes
- **List and description of all emergency equipment at the facility?** Yes
- **Evacuation plan for facility personnel?** Yes
- **Arrangements with local emergency response organizations, Including phone numbers, names or organizations** Yes

2. Is information in the Contingency Plan current?
Yes

3. What emergency capabilities are maintained on site?
In addition to the emergency equipment and systems, the site has an emergency response team (includes non-structural fire fighting).

4. Is the facility equipped with?

- **Telephone/2-way radio?** Yes
- **Internal communication/alarm system?** Yes
- **Adequate water for fire control?** Yes
- **Fire control equipment?** Yes
- **Spill decontamination equipment/materials?** Yes

5. Does the facility maintain?

- **Testing and maintenance of emergency equipment?** Yes
- **Adequate area for emergency movements?** Yes
- **No smoking signs?** Yes

6. What is the fire suppression system water source?
Stored water (tanks, fire truck), portable fire extinguishers.

7. What is the fire suppression system water pumping power source?
Diesel with electric jockey pumps.

8. Where is the nearest responding fire department?
Youngstown, approximately 6 miles from the site.

9. What is the potential for fire or open burning?
Slight

10. Where is the nearest hospital?
Lewiston, about 5 miles from the site.

11. Is the facility emergency response plan integrated/coordinated with community plans?
Yes

12. Are local fire and police departments aware of the facility activities?
Yes

13. Have local fire departments taken part in emergency preparedness drills with the facility?
Yes

C. Training

1. Is there a formal training program? Describe.
Training for all employees is conducted in the areas of safety, environmental, and operations. Initial training for new employees includes basic orientation, 24 hour OSHA training, RCRA, department and job specific training. Each department conducts monthly safety meetings during which specific training topics are covered. Annual training includes 8 hour OSHA refresher, RCRA refresher, confined space, first aid and CPR, lock out/tag out, Right-to-Know, emergency response, contingency plan, evacuation drill, noise exposure, and portable fire extinguisher. The emergency response team receives additional monthly training.

2. How is training conducted?
Training is conducted in both the classroom and on the job.

3. Are training requirements documented for each job or position at the site?
Yes.

4. Are all federal training requirements met?
Yes.

5. Describe contents of training records.
The training records include job title and written job description of each position, description of type and amount of training required and dates completed.

6. How long are training records retained?
Indefinitely.

7. Are drills conducted on emergency procedures?
Yes.

8. What is the frequency of the drills?

A major emergency evacuation drill is performed annually in the fall.
Emergency response drills are performed by the Emergency Response Team on an average of 8 – 10 per year.

9. Are the drills documented?

Yes.

D. Medical Programs

1. Describe the medical surveillance program?

Pre-employment and Scheduled in Service – Provide medical evaluations for employees, who are subject to Hazwoper, wear a respirator and audiograms (for employees exposed to average noise level of 85 dBA. Medical evaluations include :

- Medical history
- Blood chemistry screen
- Complete blood count (CBC)
- Pulmonary function test (PFT)
- Exposure specific tests
- Chest x-ray (if requested by physician)
- Resting electrocardiogram (EKG)
- Random- Drug testing for safety sensitive/Hazwoper workers
- Post employment – Offered to Hazwoper workers

E. Inspections

1. What site safety inspections are performed?

There are regular safety meetings in all departments as well as a full inspection of each area by the Department Supervisor and the Health and Safety Specialist on a monthly basis.

2. Does the facility maintain a written schedule for inspecting?

- **Monitoring equipment** Yes
- **Safety and emergency equipment** Yes
- **Security devices** Yes
- **Operating and structural equipment** Yes

3. Does the facility maintain a daily inspection log?

The facility performs daily inspections of the site. The inspection report includes date and time of inspection, name of inspector, inspection criteria, notation of observations, and corrective actions. The Technical and Environmental Monitoring Managers review the log. Corrections of deficiencies are confirmed through documentation on inspection records or via an Environmental Work Order. The inspection logs are maintained as part of the facility operating records.

4. When was OSHA's last inspection of the site?

Summer of 1995 and no citations were issued.

5. Has the facility been shut down by OSHA, or voluntarily, for any safety reasons during the last three years?
No.

6. Has there been any OSHA fines levied on the facility in the last three years?
No.

F. Internal Audits

1. Are site reviews/audits conducted in the following areas?

Type	Conducted (Y/N)	Frequency	Conducted by Whom?
Safety & Health	Y	Monthly	H & S
Industrial Hygiene	Y	Quarterly	H & S
Environmental	Y	Quarterly	Environ. Dept.

2. Do these reviews cover the following?

- **Compliance with regulations** Yes
- **Compliance with site/corporate policies** Yes
- **Compliance with applicable industry standards** Yes
- **Compliance with good practices** Yes

3. Are review results documented?
Yes

4. Describe the system for assuring follow-up and closure on deficiencies identified during these reviews.
A computer-generated database of deficiencies and required corrective action is prepared. Copies of this report are distributed to all relevant parties and the Division Manager. Status reports are required during monthly review meetings.

SECURITY

1. Is a security staff maintained?
There is a 24-hour, 7-day security service at the facility.

2. How is unlawful entry to the facility prevented?
An eight-foot chain-link fence with barbed wire and "warning" signs surrounds the property. There are several gated entrances to the property, which are kept locked unless attended by a security guard. Employees use a swipe-card entry system to control access. Contractors and visitors are signed in on a visitor's log.

3. Is there surveillance at the facility?
Yes. Cameras and TV monitoring and 24 hour security guard coverage at entry gate.

4. Are there substantial portions of the site that would not be readily visible to plant personnel during working hours?
Yes.

5. Is vehicular access to the facility controlled?
Yes. The facility is accessible only through the entrance gate, which is normally closed and staffed with a security guard.

6. Are there signs warning "Danger – Unauthorized Personnel Keep Out" posted at the entrance and at other locations in order to be seen from any approach?
Yes.

7. Is there a system to prevent theft?
All vehicles entering or leaving the facility are subject to random search.

INSURANCE

1. List all standard insurance coverage.

Type	Carrier	Policy #	Expiration	Amount of Limits
General Liability	Lockton Insurance Agency of Houston, Inc.	HDOG23736767	01/01/09	$5,000,000
Auto Liability	Lockton Insurance Agency of Houston, Inc.	ISA H08240395	01/01/09	$1,000,000
Excess Liability	Lockton Insurance Agency of Houston, Inc.	XOOG23889389	01/01/09	$15,000,000
Worker's Comp	Lockton Insurance Agency of Houston, Inc.	WLRC43997646 WLRC43997609 SCFC43997567	01/01/09	$3,000,000
Pollution Legal & Environmental Impairment Liability	Marsh USA, Inc.	PLS 5444079	01/01/11	$10,000,000 (each incident limit) $20,000,000 (aggregate limit) $5,000,000 (SIR)

2. How is the facility demonstrating financial responsibility for bodily injury and property damage to third parties caused by sudden or non-sudden accidental occurrences arising from operations of the facility per 40CFR 264.147?

	Sudden/Non-Sudden Combined
Financial Instrument	Insurance
Amount of coverage per occurrence	$5,500,000
Amount of coverage annual aggregate	$11,000,000

The carrier is AIG Environmental and the policy number is PLS8194904.

Figure 11 -Certificate of Insurance

ACORD™ CERTIFICATE OF LIABILITY INSURANCE 1/1/2009 — DATE (MM/DD/YYYY): 1/4/2008

PRODUCER
LOCKTON COMPANIES, LLC
5847 SAN FELIPE, SUITE 320
HOUSTON TX 77057
866-260-3538

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.

INSURED
1300299
WASTE MANAGEMENT HOLDINGS, INC. & ALL AFFILIATED, RELATED & SUBSIDIARY COMPANIES INCLUDING:
CWM CHEMICAL SERVICES, LLC
1550 BALMER ROAD
MODEL CITY NY 14107

INSURERS AFFORDING COVERAGE	NAIC #
INSURER A: ACE American Insurance Company	22667
INSURER B: Indemnity Insurance Co of North America	43575
INSURER C:	
INSURER D:	
INSURER E:	

COVERAGES AJ

THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE I INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER AND THE CERTIFICATE HOL

THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDI ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUC POLICIES. AGGREGATE LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	ADD'L INSRD	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIMITS	
A		GENERAL LIABILITY [X] COMMERCIAL GENERAL LIABILITY [ ] CLAIMS MADE [X] OCCUR [X] XCU INCLUDED [X] ISO CG 00011204 GEN'L AGGREGATE LIMIT APPLIES PER [ ] POLICY [X] PRO-JECT [X] LOC	HDO G23736767	1/1/2008	1/1/2009	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$ 5,000,000 $ 5,000,000 $ XXXXXX $ 5,000,000 $ 6,000,000 $ 6,000,000
A		AUTOMOBILE LIABILITY [X] ANY AUTO [X] ALL OWNED AUTOS [ ] SCHEDULED AUTOS [X] HIRED AUTOS [X] NON-OWNED AUTOS [X] MCS-90	ISA H08240395	1/1/2008	1/1/2009	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$ 1,000,000 $ XXXXXX $ XXXXXX $ XXXXXX
		GARAGE LIABILITY [ ] ANY AUTO	NOT APPLICABLE			AUTO ONLY - EA ACCIDENT OTHER THAN AUTO ONLY: EA ACC AGG	$ XXXXXX $ XXXXXX $ XXXXXX
A		EXCESS/UMBRELLA LIABILITY [X] OCCUR [ ] CLAIMS MADE [ ] DEDUCTIBLE [X] UMBRELLA FORM [ ] RETENTION $	XOOG23889389	1/1/2008	1/1/2009	EACH OCCURRENCE AGGREGATE	$ 15,000,000 $ 15,000,000 $ XXXXXX $ XXXXXX $ XXXXXX
B A A		WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? NO If yes, describe under SPECIAL PROVISIONS below	WLR C43997646 (AOS) WLR C43997609 (CA) SCF C43997567 (WI)	1/1/2008 1/1/2008 1/1/2008	1/1/2009 1/1/2009 1/1/2009	[X] WC STATU-TORY LIMITS [ ] OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	$ 3,000,000 $ 3,000,000 $ 3,000,000
A		OTHER EXCESS AUTO LIABILITY	XSA 1108240231	1/1/2008	1/1/2009	COMBINED SINGLE LIMIT $9,000,000 (EACH ACCIDENT)	

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES / EXCLUSIONS ADDED BY ENDORSEMENT / SPECIAL PROVISIONS
CANCELLATION: 30 DAYS *EXCEPT 10 DAYS NOTICE FOR NON-PAYMENT. BLANKET WAIVER OF SUBROGATION IS GRANTED IN FAVOR OF CERTIFICATE HOLDER ON ALL POLICIES WHERE AND TO THE EXTENT REQUIRED BY WRITTEN CONTRACT WHERE PERMISSIBLE BY LAW. CERTIFICATE HOLDER IS NAMED AS AN ADDITIONAL INSURED (EXCEPT FOR WORKERS' COMP/EL) WHERE AND TO THE EXTENT REQUIRED BY WRITTEN CONTRACT.

CERTIFICATE HOLDER
3524039
FOR BID PURPOSES ONLY
C/O CWM CHEMICAL SERVICES, LLC

CANCELLATION
SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRAT DATE THEREOF, THE ISSUING INSURER WILL ENDEAVOR TO MAIL 30 DAYS WRITT NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, BUT FAILURE TO DO SO SHA IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE INSURER, ITS AGENTS OR REPRESENTATIVES.
AUTHORIZED REPRESENTATIVE

ACORD 25 (2001/08) For questions regarding this certificate, contact the number listed in the "Producer" section above. © ACORD CORPORATION 1

MARSH

CERTIFICATE OF INSURANCE

CERTIFICATE NUMBER
HOU-000787186-10

PRODUCER
Marsh USA Inc.
1000 Main Street, Suite 3000
Houston, TX 77002

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER OTHER THAN THOSE PROVIDED IN THE POLICY. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES DESCRIBED HEREIN.

WMI -10/20-PLL-08-11 CWMC BID

INSURED
CWM Chemical Services, LLC
1550 Balmer Road
Model City, NY 14107

COMPANIES AFFORDING COVERAGE

COMPANY A: AMERICAN INTERNATIONAL SPECIALTY LINES INS CO
COMPANY B:
COMPANY C:
COMPANY D:

COVERAGES This certificate supersedes and replaces any previously issued certificate for the policy period noted below.

THIS IS TO CERTIFY THAT POLICIES OF INSURANCE DESCRIBED HEREIN HAVE BEEN ISSUED TO THE INSURED NAMED HEREIN FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THE CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, CONDITIONS AND EXCLUSIONS OF SUCH POLICIES. AGGREGATE LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

CO LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIMITS	
	GENERAL LIABILITY					
	COMMERCIAL GENERAL LIABILITY				GENERAL AGGREGATE	$
	CLAIMS MADE / OCCUR				PRODUCTS - COMP/OP AGG	$
	OWNER'S & CONTRACTOR'S PROT				PERSONAL & ADV INJURY	$
					EACH OCCURRENCE	$
					FIRE DAMAGE (Any one fire)	$
					MED EXP (Any one person)	$
	AUTOMOBILE LIABILITY					
	ANY AUTO				COMBINED SINGLE LIMIT	$
	ALL OWNED AUTOS				BODILY INJURY (Per person)	$
	SCHEDULED AUTOS					
	HIRED AUTOS				BODILY INJURY (Per accident)	$
	NON-OWNED AUTOS					
					PROPERTY DAMAGE	$
	GARAGE LIABILITY					
	ANY AUTO				AUTO ONLY - EA ACCIDENT	$
					OTHER THAN AUTO ONLY:	
					EACH ACCIDENT	$
					AGGREGATE	$
	EXCESS LIABILITY					
	UMBRELLA FORM				EACH OCCURRENCE	$
	OTHER THAN UMBRELLA FORM				AGGREGATE	$
						$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY				WC STATUTORY LIMITS / OTHER	
	THE PROPRIETOR/ PARTNERS/EXECUTIVE OFFICERS ARE: INCL / EXCL				EL EACH ACCIDENT	$
					EL DISEASE-POLICY LIMIT	$
					EL DISEASE-EACH EMPLOYEE	$
A	OTHER Pollution Legal Liability	PLS 5444079	01/01/08	01/01/11	Each Incident Limit	10,000,000
					Aggregate Limit is Excess the SIR	20,000,000
					Self Insured Retention Limit	5,000,000

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/SPECIAL ITEMS
For Proposal Purposes Only

CERTIFICATE HOLDER

CWM Chemical Services, LLC
1550 Balmer Road
Model City, NY 14107

CANCELLATION

SHOULD ANY OF THE POLICIES DESCRIBED HEREIN BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE INSURER AFFORDING COVERAGE WILL ENDEAVOR TO MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED HEREIN, BUT FAILURE TO MAIL SUCH NOTICE SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE INSURER AFFORDING COVERAGE, ITS AGENTS OR REPRESENTATIVES, OR THE ISSUER OF THIS CERTIFICATE.

MARSH USA INC.
BY: Stephanie S. Story

MM1(3/02)

VALID AS OF: 01/18/08

CLOSURE / POST CLOSURE

1. Describe the closure and post closure plans for the facility.
Closure plans involve capping the open landfill, covering with soil and re-vegetating. Surface impoundments will be emptied, filled with soil and re-vegetated. Tanks and container storage areas will be emptied, decontaminated and disposed. After closure, the site will resemble rolling hills.
Post closure perpetual care includes inspection, monitoring and maintenance of all closed landfills, closed surface impoundments and corrective measure activities forever.

2. What is the estimated closure / post closure cost?
$70,115,679

3. What financial instruments are used to meet this estimate?
A Surety Bond and a Letter of Credit.

4. What institutions hold the financial instrument?
RLI Insurance Company and Wachovia Bank.

5. Are estimates adjusted annually?
Yes, unless the cost of completed closure is greater than the inflationary adjustments.

6. Is it known, or likely, that some remediation or restoration may be required in the future?
Yes, costs for these corrective measures are included in the closure/post closure estimate**.**

7. Describe the cost estimate.
Costs are included in the closure/post closure estimate.

8. Are there any indemnification agreements to cover this?
No.

9. Are there any specially designated site or State funds set aside to cover this?
No.

Figure 12 - Financial Assurance

WASTE MANAGEMENT

CWM CHEMICAL SERVICES,
1550 Balmer Road
P.O. Box 200
Model City, NY 14107
(716) 754-8231
(716) 754-0211 Fax

November 30, 2007

Mr. Paul R. Counterman, P.E.
New York State Department of
Environmental Conservation
Division of Solid and Hazardous Materials
625 Broadway
Albany, New York 12233-7251

Re: Financial Assurance for CWM Model City

Dear Mr. Counterman:

In accordance with CWM's Part 373 Permit No. 9-2934-00022/00097, Module I, Conditions T(2)(a) and X(1), CWM is confirming continuing coverage of the financial assurance mechanisms for all closure, post-closure and corrective measures costs for the Model City Facility. This submittal provides the required annual evidence to the Department that these mechanisms have been maintained and not allowed to lapse.

The following summarizes the current coverage held by the CWM Model City Facility. These mechanisms were provided to you in correspondence dated September 19, 2003, and are automatically renewed annually.

	Closure	Post-Closure	Total
Wachovia Bank Letter of Credit #SM203351W	$ 27,697,888	$ 40,960,105	$ 68,657,993
RLI Surety Bond #RLB0003207	$ 1,205,381	$ 252,305	$ 1,457,686
	$ 28,903,269	$ 41,212,410	$ 70,115,679

The above amount represents the current requirement for financial assurance at the CWM Model City Facility and is based upon those closure, post-closure and corrective measures costs approved by the NYSDEC on February 12, 1999. A revised cost estimate, submitted by CWM on September 28, 2001, based upon a detailed review and updating of these costs associated with the April 2001 Part 373 Permit Renewal Application, is still under NYSDEC review. Since the revised estimate, and subsequently completed closures, results in a decrease from the previously approved estimate, CWM continues to maintain excess financial assurance coverage. An inflationary adjustment of the currently held financial assurance, as described by the 6NYCRR Part 373 regulations and CWM's Part 373 Permit, is not necessary at this time in accordance with the Department's March 3, 2004, letter.

CWM continues to seek NYSDEC comments for the September 28, 2001, cost estimate. Upon reaching agreement of the appropriate amount, CWM will revise its financial assurance mechanisms to reflect the new approved cost estimate and utilize this cost as the basis for inflationary adjustments in future years.

November 30, 2007
Mr. Paul R. Counterman, P.E.
NYSDEC
Re: Financial Assurance for CWM Model City

If you have any questions or comments, please feel free to call Mr. John B. Hino at (716) 754-0278 or myself at (716) 754-0246.

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

Sincerely,
CWM CHEMICAL SERVICES, LLC

Jill A. Banaszak
Technical Manager
Model City Facility

JBH/JAB/jbh

cc:
J. Strickland - NYSDEC/Region 9
B. Rostami - NYSDEC/Region 9
E. Dassatti - NYSDEC/Albany, NY
M. Mortefolio - NYSDEC/Albany, NY
P. Kutlina - NYSDEC/On-site Monitor
J. Reidy - USEPA/New York, NY
J. Devald - NCHD/Lockport, NY
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EMD Subject File
Q & A

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CERTIFIED WOMEN-OWNED BUSINESS ENTERPRISE

20 YEARS
1991 - 2011

QUALITY MANAGEMENT PLAN

Version 2.1

VERSION HISTORY

This version of Precision Environmental Services. Inc's (PES's) project Quality Management Plan (QMP) was developed from our general plan drafted in June 2008 for submission to the New York State – Department of Environmental Conservation (NYS DEC). The plan was developed by senior management/project personnel for review/modification and approval by the Corporation's QA/QC manager – Mr. William Hennessy – senior engineer.

Version #	Implemented By	Revision Date	Approved By	Approval Date	Reason
1.0	John Johnson	06/17/2008	William Hennessy	06/17/2008	
2.1	Stephen Phelps/John Johnson	05/09/2011	William Hennessy	05/10/2011	

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1.0 – Introduction:

1.1 - Purpose of the Project Quality Management Plan

The *purpose* of PES's QMP, is to document the necessary information required to effectively manage project quality from planning to delivery. It defines PESs quality policies, procedures, criteria for and areas of application, as well as roles, responsibilities and authorities.

Providing quality environmental management is a challenging task, which requires special attention and dedication. Implementing PESs experience, skills and expertise in the field demands an organized and systematic management approach. The goal of our QMP is to accurately account for all elements of a particular project necessary to provide effective and efficient services to the varied needs of the client. This not only includes consistent application of professional and technical procedures at the job site, but positive interaction between PES, its subcontractors and agents ('Team' members) and the client in all facets of the work. The QMP's intended audience is the project manager, project Team, project sponsor and any senior leaders whose support is needed to carry out the plan.

More than just procedures, reviews, and documents, this plan is dynamic, not static. Frequent interaction between Team members, the client and the regulatory community allows us to adjust our approach when the need arises. It is our firm belief that as a Contractor we must have a persistent attitude and the willingness to check, check, and recheck again. Hard work and attention to detail are the substance behind PES's Quality Management plan.

2.0 - Project Quality Management Overview:

2.1 –Approach, Policies, and Procedures:

Our Team has developed a management approach that focuses on the three key areas necessary to successfully complete work on a consistent basis with positive results.

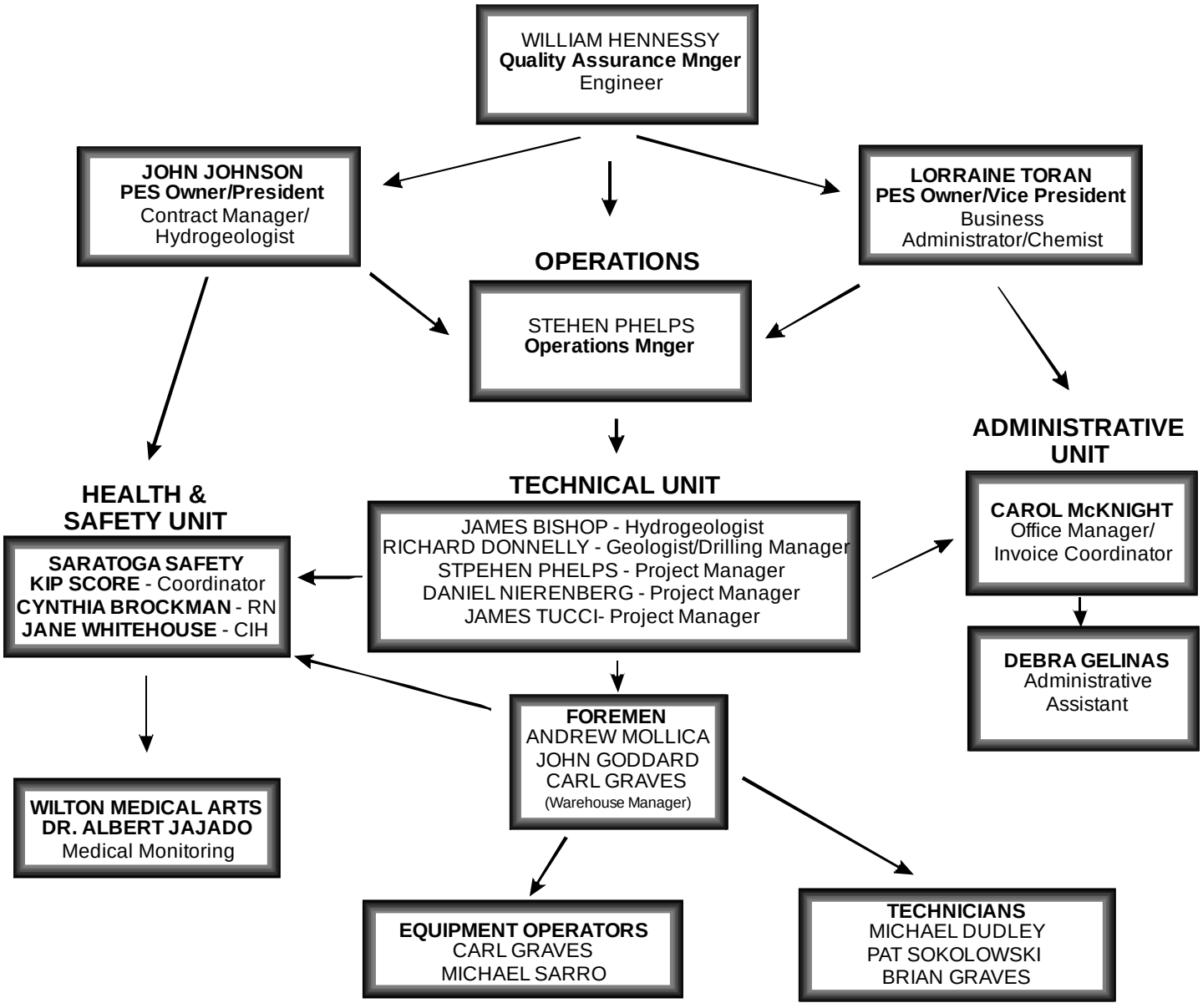
- **Effective communication:** *between Team members as well as between client representatives regarding goals and expectations, scope, resource allocation (labor/equip/materials), scheduling and project implementation,*
- **Systematic tracking:** *of administrative elements, budgetary expenditures and associated costing,*
- **Structured interaction:** *between the client and the Team regarding contractual administration items, including contractor performance, deliverables, information management, and issue resolution.*

Focus in these three management areas is based on our 20 years of successful experience satisfying the requirements of previous contracts with various private and public sector clientele. By design, our management program has a number of built in systematic checks and balances to ensure a high quality work product while maintaining efficient budgets and timelines. This plan incorporates a combination of management techniques with a "hands-on" approach. The Team at PES believes there is no substitute for hard work and attention to detail. Our experience has taught us that the ability to manage and identify key project requirements, coupled with quick field response is paramount to realizing successful completion of assignments. The project Team at PES has extensive experience and complementary strengths, that when combined ensure consistent quality services.

2.2 - Organization, Responsibilities, and Interfaces/Checks & Balances:

The following *organizational* chart pictorially represents lines of authority within our Team's management framework. In addition, the chart identifies proposed staff assignments, responsibilities and organizational interfaces.

PRECISION ENVIRONMENTAL SERVICES, INC.
QUALITY CONTROL ORGANIZATIONAL CHART



William Hennessy, P.E. will serve as the Quality Assurance Officer (QAO). The QAO will have ultimate responsibility to ensure that the Team operates within the framework established by the corporation as well as overall responsibility for ensuring each intramural organizational unit is satisfying its role within the Team's framework. The QAO has the authority to call a face-to-face meeting or conference call (including all/any corporate staff) to discuss any issue requiring immediate action. In addition to serving as QAO, Mr. Hennessy will fulfill the requirements of project engineer and/or project manager as needs arise. This dual role will allow for the QAO to oversee and enforce QA/QC policies at the ground level and will allow for an added level of continuity between the various organizational units.

All Team members are accountable to the QAO. Company Principles, Operations, Health and Safety, Technical and Administrative Units are all overseen by the QAO. Each organizational unit's Team lead will be responsible for ensuring their unit's needs are met and that individual goals of the unit are attained. Unit leads will act as additional quality assurance staff beneath the QAO. Staff that exist beneath the unit lead are encouraged to reach out to the lead regarding possible QA/QC issues; however PES maintains a strict confidentiality procedure with respect to all staff being able to approach the QAO directly without other knowledge or consent from either principles or unit leads.

Individual projects will be coordinated by project specific Project Managers (PMs). The PM is accountable for all financial, administrative and field/technical services related to client requested work. The PM is additionally responsible for preparation of the scope of work, preliminary budget, and schedule of manpower needs. These tasks, done in concert with frequent project coordination with the client's representative, regulatory community and internal organizational unit's lead, will ensure consistent and effective commencement of assigned work scopes. The PM will report regularly to Operations on matters of scope, progress, cost, and similar items relevant to successful completion of all projects. Operations in turn will communicate with the Principles and/or QAO on a routine basis.

For consistency and quality assurance it has been and will be the Team's policy to dedicate specific staff to individual clients. This allows our Team to become familiar with the needs of the client and often translates into increased project efficiency and lower project costs. Team management will administer a policy of frequent interaction between Team members, regulatory community and clientele, thus assuring focus on the "tasks at hand" and all project goals.

During the course of implementing a requested scope of work, Team PMs regularly review the success of a project with respect to established implementation schedules, technical goals and budgetary limitations. Problems in any of these key areas are addressed in *"real time"* as the project progresses. Modifications are made when necessary to correct deficiencies and achieve project goals. To further this process, PMs will serve as mentors as well as coaches for respective team members. Staff meetings regarding work progress (auditing/review) are held weekly and more frequently if the technical demands of an individual project require it.

Work progress meetings are conducted by the PM and/or Project Foreman (PF) in conjunction with daily Health and safety discussions. Subcontract personnel are included in these meetings when present on-site and are encouraged to identify any project elements that are or may become an issue. This process allows for identification and resolution of issues as projects progress. Project efficiency is recognized and new procedures that result in increased efficiency are noted and reinforced for future application. Non-effective or non-efficient practices are also identified and noted to prevent reoccurrences. In simple terms, our Team strives for continued improvement based on actual work experience.

In addition to ongoing "day-to-day" communication and interaction between the Team, routine weekly evaluation meetings are conducted with Operations and Principle staff. Team management staff are tasked with preparation of brief but detailed project summaries to be presented to the QAO. They are used to discuss project status, current/future requirements and modifications needed to increase communication and/or project advancement. These "face to face" meetings can also be used to address any policy modifications needed to increase the Team's effectiveness and performance. This practice has been implemented since PESs inception and has been found to be constructive for both the client and our own internal framework.

2.3 - Tools, Environment, and Interfaces:

A number of management and planning tools are routinely used to measure the project quality as well as level of conformance. PES management uses industry recognized protocols wherever possible. PES believes the tool that produces the most consistent and high quality results – is clear and detailed assignment instructions. To this end – clearly written instructions ("work tickets") are developed for each work assignment. In addition, PMs review "work tickets" with staff prior to implementation to ensure a clear understanding of scope. Written accountings of field work ("dailies") are turned into the oversight PM at the end of each assignment or work shift. Additional details related to this process are discussed subsequently. Other management and planning tools routinely used include the development of various diagram based information presentations. This type of tool simplifies the interrelationships of work assignment/management aspects and often clarifies the decision making process. Examples include the following:

- **Relations Diagram:** illustrating cause-and-effect relationships,
- **Tree Diagram:** breaks down broad categories into finer and finer levels of detail, helping Team members advance their thought processes step by step from generalities to specifics.
- **Matrix Diagram:** shows the relationship between two, three or four groups of information and can give information about the relationship, such as its strength, the roles played by various individuals, or measurements
- .**Arrow Diagram:** shows the required order of tasks in a project or process, the best schedule for the entire project, and potential scheduling and resource problems and their solutions.
- **Process Decision Program Chart (PDPC):** systematically identifies what might go wrong in a plan under development.

Routine analysis of actual staff performance within the above framework allows for refinement and efficiency adjustments to ensure quality compliance.

3.0 - Quality Assurance Plan Strategy:

PES believes effective implementation of quality work is founded on accurate and timely communication between both Team members and external individuals/firms (subcontractors, clientele, regulatory community, etc) . This includes identification of problems, formulation of the best course of action and coordination of resource allocation to ensure a swift resolve. All work assignments will be reviewed by Principles and Operations. A PM will then be assigned based on project specific requirements and the individual best suited for the needs of the project. Information exchange will occur via structured lines of communication between Team members. To assist in efficient distribution of information, PES has established infrastructure that allows all employees to access company computer files remotely and in a secure environment. This provision will allow project details to be shared and reviewed remotely by all Team members during normal and off-hours. A secure file is established for each project to serve as the receptacle for all electronically transmitted project information. This policy reduces the time required to distribute critical project information as well as improves the clarity of the messaging.

Upon receiving a request for services, Operations will establish written and verbal details regarding the scope of services requested. This information will be immediately reviewed with the assigned PM. The PM will be responsible for preliminary assessment of staff availability. The PM will consult with the warehouse manager (WM) to assess availability of equipment and materials needed for the work task(s). The Team's WM provides added control over the work and is responsible for inventory maintenance as well as assessment of current materials and equipment resources. Any immediate conflicts regarding resource availability will be identified at this time. The Team's Health & Safety Coordinator and Safety Officer will initiate the process to provide for the health and safety requirements for the assignment.

Our Team's extensive stock of equipment and materials allow for prompt responses to single and/or multiple work assignments. Frequent intercommunication regarding resource availability is practiced by all Project and Warehouse Managers.

3.1 - Details of Assignment Procedures & Resource Tracking:

The Team maintains a program of communication between management and labor force that consists of a number of task specific written documents. As a result, written instructions are clear and leave little to interpretation. Major components of this program are described below:

3.1.1 -Work Tickets: The PM produces *"work tickets"* which clearly identify the scope of work requested. Work tickets are based directly on information received during the work assignment/request process. These written documents, which are produced for each field assignment, provide details regarding the time allotment, appropriate materials and equipment required to complete the assignment effectively and efficiently. A Health & Safety short form is an element of this procedure. In addition, the project PM conducts a "face to face" overview of the work specifics with the assigned project foreman (PF) or field staff member. Any clarification of, or additions to, field instructions will occur at this time. In conjunction with generation of the *"work ticket",* a notification of impending work is transmitted to both the Team's internal WM and the client's representative. This simple process allows the client representative to refine or modify routine work assignments as well as perform coordinated site visits during the implementation of the scope of work. Notification of the WM assures availability of equipment and materials to complete the task.

3.1.2 - Site Directions: Specific site directions and location maps are prepared utilizing various on-line mapping resources. JIMAPCO county maps and GPS units are available to assist in efficient mobilization of resources to the work site.

3.1.3 - Field Activities Form (Dailies): The PF is responsible for implementing the fieldwork assignment and assuring timely resource mobilization on all large multi-staff assignments. The PF is tasked with the daily completion of the field activities form (*"Daily"*). These forms are produced in triplicate and are used for detailed tracking of all resources (labor/equipment/materials) allocated at individual job sites. Equipment and personnel start, stop and off-times are part of the required reporting detail. The first copy is left at the job site for Team/client reference, the second copy is submitted to the PM for data analysis and project file inclusion, and the third copy is also submitted to the PM for critical review prior to submittal to the billing department. The PM's review assures accuracy before entry into the invoicing system.

3.1.4 - "Real time" Communication: Consistent communication between team members is essential. We maintain constant communication in real time using wireless voice and data plans allowing immediate notification of project matters from the office to the field of operations. Our team members also utilize prepaid calling cards in the event one carrier's service is unavailable in remote geographic areas. This, coupled with the development of e-mail communications with clients, has greatly improved the information exchange

process. Issues can be addressed daily or even immediately in *"real-time"*, allowing swift resolution of technical and administrative issues. Communication between field and office prior to site demobilization is required. This allows the Team PM to request additional tasks that may have arisen as a result of the client's review of the impending work notification, thus eliminating the need for a return visit.

4.0 - - Staff Performance:

The Team is only as efficient as its individual members. Staff performance with respect to completion of the assigned scopes of work is and will continue to be monitored in a number of ways. The simplest mechanism is the PM's daily review of the completed *"work ticket"* and/or *"daily"* field activities form. Routine quality assurance (QA) site visitations are performed by PM staff and Operations to verify quality, efficiency and completeness of fieldwork tasks and conformance to goals of the project. The Team maintains a database regarding time required to complete routine tasks. Deviations from established norms are noted and explanations are required of the individual field staff. If upon review, it is the opinion of the PM that good value was not obtained for the client due to excessive time, the PM is authorized and instructed to reduce the time to within established norms. The collected information is used to fine tune field staff performance.

Performance data is logged in each employee's respective personnel file. This includes information regarding the ability of specific employees to excel at certain tasks or identification of special skills. This information is then used for future labor assignments to promote increased project efficiency. Each employee is given a performance based annual evaluation. Repetitive poor performance is appropriately addressed resulting in either retraining to improve job skills or disciplinary action. In an effort to obtain constructive input from clientele, we have developed an evaluation form to be filled out at the completion of each significant project. Feedback received from clients will be provided to management and field staff to promote continued improvement.

5.0 - Cost Tracking:

After the work assignment is accepted by Operations, the financial department will be notified and a project-specific control number will be established. If client specific job identification exists, PES will adapt the job specific identification into our program. Incorporation of the client's uniquely assigned number system allows for an additional level of consistency between the client and Team with respect to resource assignment, project management, budget tracking and invoicing for services rendered. This measure of consistency will begin the process to assure correct tracking of all billing, correspondence, costs, and other data associated with the project.

All project resource allocation is keyed to the universal project tracking number. This includes our "*work tickets"*, *"daily"* labor/equip/material forms, geotechnical time sheets, purchase orders and materials procurement receipts from vendors and subcontractors. QA/QC practices are built into all project management functions. Our policy is to maintain strict tracking and coordination on all facets of work and to perform internal verification of project expenditures prior to invoice production.

Project field expenditures of labor, equipment and materials are tracked each day *("dailies")* by the Foreman on an hourly basis consistent with contract rate schedules as applicable. This practice eliminates inconsistencies during cost review, authorization and invoice preparation. The *"dailies"* are submitted at the conclusion of each workday to the PM for review and authorization. Completed *"dailies"* will be reviewed at the

site with client staff, when represented, and/or submitted periodically. Discrepancies are resolved prior to approval and transfer to the invoicing department. Each employee is required to provide an accounting of all time via detailed time sheets. Detailed time sheets record all labor charges using the project tracking number as reference. Each employee produces these independently of tracking performed by the PF using the "dailies". An employee signature is required verifying the factual content of the labor record.

Billing staff cross-reference employee time sheets with PM approved *"dailies"*. Discrepancies are resolved prior to invoice generation. Draft invoices are produced only after expenditures have been filtered through this QA/QC process. Draft invoices are then reviewed by the PM prior to submission to Operations for final review and authorization. The business manager (Lorraine Toran) performs an additional level of invoice review to assure correctness of calculations and inclusion of vendor and subcontractor's invoices. Weekly internal meetings are conducted to stay apprised of all administrative elements affecting projects.

5.1 - Policy - Premium/Over/Double Times:

Our policy with respect to premium/over/double time is to minimize such expenditures. Our team firmly believes proper planning and scheduling can generally eliminate this project cost driver. Regardless of the circumstances, premium or over time requires prior approval by Team and client management. Overtime policy will be mutually defined for all large projects prior to the start of fieldwork. Given this, previous experience has revealed circumstances where the application of premium or overtime can provide fiscal relief as well as project progression advantages. Examples would include situations where limited extended time outweighs the cost of next day deployment. Determination of these situations will be the responsibility of the PM and Foreman. When these situations arise, client approval will be requested based on the merit of the cost savings.

5.2 - Problem Prevention & Resolution:

PES has found that ample project kick-off and daily site meetings greatly reduce unforeseen circumstances that require action. Nevertheless, changes in site characteristics and/or project scope that affect schedule, budget or work quality need to be addressed. Such circumstances will be immediately reported to client management. The task of communicating such information is assigned to the PM and/or PF. Prompt and clear communication is as much an essential part of issue prevention as is the accurate accounting of all aspects of the Team's work. The Team prefers a policy that avoids issue generation rather than one that addresses issue resolution.

Our Team project PM will be tasked with the initial troubleshooting of project problems including technical issues, performance issues and associated cost issues. Operations and Principles will be informed of all situations and be made available throughout the resolution process. Resolution of all issues will be initiated by first developing a clear definition of the problem, as defined from the client's perspective. Technical and/or performance problems having an on-going detrimental effect on project advancement will merit immediate Team action. The specifics of the issues will be addressed through Team and client interaction subsequent to the rectification process. Written responses and/or explanation will be prepared if the issue merits such a level of response and/or if requested by the client.

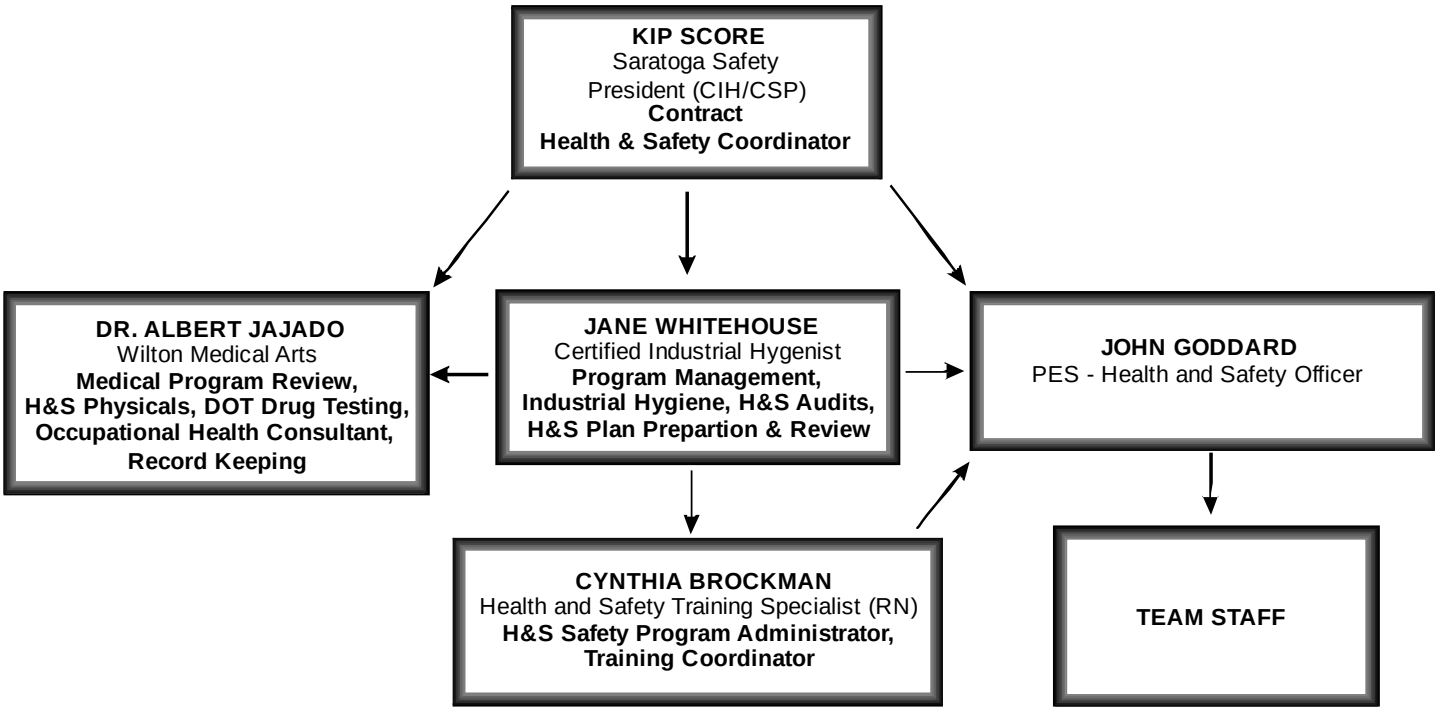
Simple accounting discrepancies will be resolved and backup justification prepared by our billing department for submission to the clients PM. In the case of discrepancies involving interpretation of the work assignment scope, the PM has authority to negotiate invoice adjustment to the satisfaction of the client's representative.

Performance meetings will be used (at the client's request) as the forum for contractual issues including but not limited to: contractor performance, billing procedures, contract interpretation, communication, information exchange policy and procedures and general constructive discussions of ways to increase Team effectiveness.

6.0 - Health and Safety Program:

Effective administration of the Team's Health and Safety program (H&SP) is always an important component of our projects. For several years Saratoga Safety Inc. (SSI) has provided comprehensive independent Health & Safety Services in support of the Team's environmental drilling, investigation and remediation work. Kip Score, of SSI, is designated the Team's Health & Safety Coordinator (H&SC). Kip is both a Certified Industrial Hygienist (CIH) and Certified Safety Professional (CSP). SSI administers the Team's on-going H&SP including but not limited to the following services: H&S program administration, HAZWOPER Training – 29 CFR 1910.120, annual 8- hour refresher, Confined Space Entry – 29 CFR 1910.146, Respirator Training and Fitting – 29 CFR 1910.134, Construction Safety – 29 CFR 1926, HASP Development, Certified Industrial Hygiene reviews (Jane Whitehouse (CIH) and/or Kip Score (CIH)), First Aid/CPR, Medical Monitoring Program support (Cindy Brockman, medical consultant/RN and Wilton Medical Arts Program, Dr. Albert Jajado), Safety Program Management and Site Safety Audits. The H&S organization chart is as follow:

PRECISION ENVIRONMENTAL SERVICES, INC.
HEALTH & SAFETY ORGANIZATIONAL CHART



The H&SP requires all site workers to become familiar with the program's written procedures and policies. Individuals are required to acknowledge their understanding by providing written endorsement. Details regarding the scope of services rendered by SSI and the commitment to continue administering services to the Team members on individual projects will be incorporated into site specific health and safety plans.

6.1 - General Health & Safety Program - Policy:

All site workers receive a minimum of 40 hour OSHA (as per 29 CFR 1910.120), annual 8-hour OSHA Refresher, and Personal Protective Equipment (PPE) training prior to field assignment. Each new Team member is assigned a field bag that contains all the routinely required PPE and safety equipment. The safety bag is carried at all times to allow for direct rapid deployment from remote locations. The Team Safety Officer (SO) is responsible for assessing the need for specialized PPE equipment and assigning it based upon site-specific needs, as identified in the Teams Health & Safety Plans. This responsibility applies to all new projects and/or existing sites whose initial Health & Safety (H&S) characteristics have changed.

John Goddard is PES's (in house) Safety Officer (SO). John has extensive experience with response, H&S procedures, and protocols. Much of this experience stems from "hands on" application while serving in past jobs and upper management of a local Fire Department Response Team. The SO works directly with the Team's Health & Safety Coordinator (H&SC) during the decision making process regarding all H&S as well as PPE requirements. Additional duties of the SO and/or PF include maintaining the Team's PPE stocks, maintaining the Team's "Right to Know" information, implementing and enforcing site HASP (including subcontractors), performance of daily tailgate safety meetings, site prevention of accidents, pre-construction indoctrination, notifying the client of initiation of work at hazardous sites and daily inspection of work areas.

Team HASPs are tailored to each individual site's characteristics. All HASPs address the policies, procedures and equipment required to assure personal protection against environmental and occupational health hazards. These documents are developed under the supervision of the designated H&SC. These documents are available to all site and regulatory personnel at all times.

Team field vehicles are equipped with bound MSDS folders that include technical data for all common products used when conducting fieldwork including fire extinguishers, first aid kits and contact numbers for emergency services. The Team is well versed in procedures involving lockout/tag out, UFPO (utility identification), excavation shoring/sloping, scaffolding/ladder safety, and identification and management of electrical hazards.

A significant component of our weekly management meeting addresses required H&S at each site. The PM maintains strict adherence to all required elements of review and reporting in order to assure proper adherence to H&S principals. Team members are evaluated regularly for compliance with H&S policies. Violations are recorded and habitual disregard of H&S policy requires mandatory disciplinary action.

7.0 - Subcontractors' Role:

Consideration will be made for subcontracting where specialized services are required, independent third party verification is needed or a significant budgetary advantage is realized by utilizing the specialized equipment or services.

PES has a strict policy pertaining to the usage of subcontractors. Real effort is expended to obtain the most qualified, cost competitive options. Bid solicitation protocols, are applied to the hiring of all

subcontractors unless otherwise directed by the client. It is our policy to obtain written responses to the bid solicitation process whenever possible. We require all written bid responses to include clearly stated (closed end) cost, scheduling availability and proof of required insurance. No subcontractors are hired without discussion and approval with the client's representative. Consideration and participation is always encouraged by WBE & MBE businesses.

Our team keeps up to date files on all vendors with respect to insurance coverage. An "additionally insured" status is always required of all subcontractors to minimize potential liability for the Team and client. Written indemnification documents are arranged where necessary. Subcontractors are mandated to meet the minimum insurance requirements of the project including but not limited to insurance coverage limitations, health and safety training, and costs.

Contractual documents are produced for all major subcontracted work. To ensure timely and cost effective implementation of the requested work, we include strict performance and budget clauses in our subcontractor agreements.

The Team maintains a strict policy of supervision for subcontractor activities. All subcontractors are directly responsible to the PM. Subcontracted services and vendor deliveries require a signature of receipt by a Team member. Authorization signatures are given only after verifying the delivery or service performed. Subcontractor's invoices are submitted to the PM for comparison to bid specifics and discrepancies are clarified prior to approval. Information generated in the field is additionally utilized to assure that the charges are accurate. Complete accounting of all costs associated with the performance of subcontracted site work is required including expenditure backup. These measures assure proper pricing structure and unit charges prior to inclusion in invoices submitted to the client. Once approved, subcontractor costs are promptly invoiced and include all backup and cost justification.

7.1 - Specific Subcontractor Requirements:

A number of subcontracted services have specific requirements inherent to the service provided. For example, all waste transporters are required to produce proper waste hauling permit documents and proof of any Department of Transportation (DOT) required license endorsements prior to commencing site work. Team management assumes responsibility for compliance with federal, state and local requirements of the temporary storage, reclamation, and/or waste disposal facility with regard to sampling, analysis, transportation and disposal. All waste manifests and documentation of disposal are required prior to subcontractor payment. Similarly, the services of any specialized analytical labs will require proof of certification via New York State's Department of Health ELAP program. Details regarding the labs QA/QC program will also be required for Team and client review. Projects with a Category B deliverables require the contract lab to be Laboratory Protocol (CLP) certified.

7.2 - General Subcontractor Considerations:

Where possible, we practice a policy of utilizing subcontractor resources within the community in which the work is being performed. Our experience is that this policy promotes cost savings and a good working relationship within the community, while reflecting positively on the Team and the client. It is our policy to clearly establish payment terms with each of our subcontractors prior to the award of work. We routinely work with smaller companies to formulate equitable payment terms. We practice prompt payment of all vendors and subcontractors upon receipt from the client.

8.0 - Summary Statement:

The preceding management plan functions to help the Team map progress toward providing a consistent quality product and to allow for continual improvements in key areas of program management including:

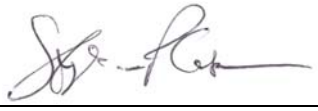
- Communication
- Policy
- Planning
- Implementation and Operation
- Corrective Action

The plan establishes clear responsibility, causing the entire organization to work harder. The structured single point authority, by Operations for the overall administration of work and PM for individual projects, promotes a sense of teamwork and responsibility to meet all project objectives. Company principles are utilized in positions of responsibility thus assuring the highest level of accountability for successful administration of the technical and administrative portions of the work. Our company leaders are well-seasoned technical experts whose experience stems from years of practical application and continued education. It is routine to observe Team principles involved with the technical field aspects of projects. This level of attention and "hands on" involvement in all work aspects enhances the understanding and effectiveness of upper level management.

There are many measures of project success. To some, success is a measure of whether the project was delivered on time and within budget. Others consider it successful if change orders are kept at a minimum. To others, it is whether the project worked as intended. Many clients will consider a project successful only if it's easy to operate and maintain. Quality means different things to different managers, but our management Team considers it our responsibility to each of our clients to satisfy them all to the extent possible. During the last 20 years of successfully servicing the needs of various clients the Team has learned to listen to the views of our client's managers and incorporate their perspective into the dynamics of each project. This partnering relationship involving the Team and clients assures project needs, goals and expectations are achieved.

Appendix A: Quality Management Plan Approval

The undersigned acknowledge they have reviewed the **Project Quality Management Plan** and agree with the approach it presents. Changes to this **Project Quality Management Plan** will be coordinated with and approved by the undersigned or their designated representatives.

Signature:		Date:	5/10/12
Print Name:	John Johnson		
Title:	Senior Hydrogeologist/President		
Role:			
Signature:		Date:	5/10/12
Print Name:	William Hennessy		
Title:	Senior Engineer/Quality Assurance Officer		
Role:			
Signature:		Date:	5/10/12
Print Name:	Stephen Phelps		
Title:	Operations Manager		
Role:			

TETRA TECH

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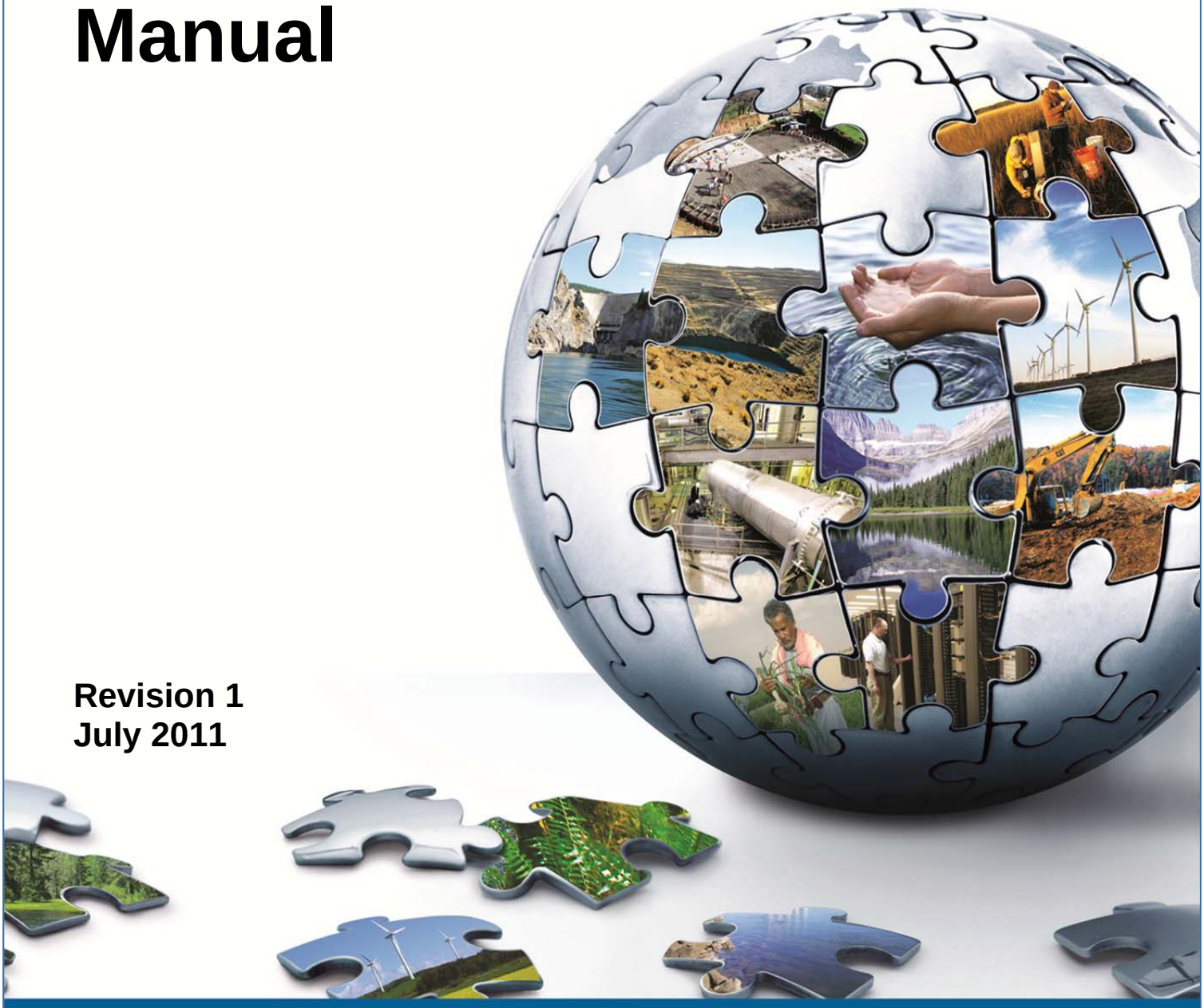
Quality Practices Manual



Revision 1
July 2011

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3475 East Foothill Blvd.
Pasadena, California 91107

REVISION RECORD

Revisions to this document will be reviewed and approved through the same level of authority as the original document. All changes to the Quality Practices Manual must be authorized by the Director of Quality Programs.

Revision	Date	Pages Affected	Reason	Authorized By
Basic	1 November 2010			W. Brownlie
Revision 1	20 July 2011	1-3 Multiple	Added Section 1.3 Editorial revisions	W. Brownlie W. Brownlie

PREFACE

Statement of Purpose

This Tetra Tech, Inc. (Tetra Tech) corporate Quality Practices Manual (QPM) describes Tetra Tech's quality program policy and requirements for our consulting, engineering, remediation, and construction services. The purpose of the QPM is to define basic quality assurance / quality control (QA/QC) requirements that will guide, as applicable, Tetra Tech programs and projects during planning, implementation, work product preparation, and field activities. Operating unit-specific and program- or project-specific quality plans that include specific quality requirements for the diverse range of services that Tetra Tech provides are prepared as needed to cover the specific needs of operating units and projects. This QPM was prepared by the Director of Quality Programs and the Quality Council, which is charged with developing quality policies rather implementation and enforcement of quality controls. Implementation of QA/QC programs is the responsibility of the senior management of the Tetra Tech operating units.

Quality Practices Manual Contents

The QPM describes:

1. **The Tetra Tech quality program organization**, including the roles and responsibilities of Tetra Tech and affiliated operating units in implementing this QPM;
2. **Basic Quality Management System (QMS) requirements** to be addressed by affiliated operating units and described in operating unit- or program-specific quality management plans (QMPs); and
3. **Basic QA and QC requirements** applicable to data collection, work product preparation, engineering design, construction services, and operation and maintenance (O&M) to be addressed within programs and projects supported by Tetra Tech.

The Tetra Tech QPM will also be used as the basis for developing more detailed program or project-specific QA and QC plans and to describe Tetra Tech's fundamental requirements for ensuring quality service and product performance for our customers.

Consensus standard American National Standards Institute/American Society for Quality (ANSI/ASQ) E4-2004, *Quality Management Systems for Environmental Data and Technology Programs*, provides the basis for the quality standards related to environmental programs addressed in this QPM. The Tetra Tech quality program is also modeled after the quality management principles outlined in the International Organization for Standardization (ISO) 9000 guidance document. The effective implementation of the QA/QC requirements of this QPM, coupled with operating-unit specific plans and project-specific quality assurance project plans (QAPPs), will ensure the quality of our environmental and engineering programs.

CONTENTS

FIGURES

ACRONYMS

ANSI	American National Standards Institute
ASI	Architect's Supplemental Information
ASTM	American Society for Testing and Materials
ASQ	American Society for Quality
CA	Construction Administration
CEO	Chief Executive Officer
CM	Construction Management
CQA	Construction Quality Assurance
CQC	Construction Quality Control
CQM	Construction Quality Management
CQMP	Construction Quality Management Plan
ECN	Engineering Change Notice
EDD	Electronic Data Deliverable
EPA	US Environmental Protection Agency
IT	Information Technology
ISO	International Organization for Standardization
O&M	Operations and Maintenance
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control

QAPP	Quality Assurance Project Plan
QC	Quality Control
QPM	Quality Practices Manual
QMS	Quality Management System
RFI	Requests for Information
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SOW	Scope of Work

DEFINITIONS

Quality
Conformance of the features and characteristics of the products or services provided by Tetra Tech to the stated or implied needs and expectations of our internal requirements and external customers and projects.

Quality Lead
Assigned Tetra Tech quality leader for a project, responsible for confirming that applicable quality assurance/quality control requirements have been applied. Sometimes referred to as Quality Manager, QA Manager, OA Officer, or other terms that may be specific to a program, project, or customer requirements.

Quality Policy
The overall intentions and direction of Tetra Tech related to quality as formally expressed by upper management and documented in this manual.

Quality Management System
Tetra Tech's set of interacting practices and associated organizational structure established for planning and executing services that meet the quality requirements of our customers.

Quality Assurance
The application of systematic activities within the Quality Management System that provides confidence that quality requirements will be fulfilled.

Quality Control
The implementation of operational techniques and activities at the project level to confirm Tetra Tech's and our customers' requirements for quality are fulfilled.

Note: The definitions provided above are adapted for use by Tetra Tech from ISO 9000, Second Edition 2000-12-15, *Quality Management Systems—Fundamentals and Vocabulary*.

TETRA TECH QUALITY MANAGEMENT PRINCIPLES

International Organization for Standardization (ISO) 9000 provides guidance on the fundamentals and vocabulary that can be used as the basis for developing Quality Management Systems (QMSs). The ISO guidance includes eight quality management principles that Tetra Tech subscribes to and that serve as the basic principles of our QMS. As indicated in the ISO 9000 guidance (p. v):

> *To lead and operate an organization successfully, it is necessary to direct and control it in a systematic and transparent manner. Success can result from implementing and maintaining a management system that is designed to continually improve performance while addressing the needs of all interested parties. Managing an organization encompasses quality management amongst other management disciplines.*

The following eight quality management principles adopted by Tetra Tech shall be used by upper management to lead our organization towards improved performance.

1. **Customer focus**: Tetra Tech depends on its customers and must understand current and future customer needs, meet our customer requirements, and strive to exceed customer expectations.
2. **Leadership**: It is the responsibility of the senior management of Tetra Tech to establish unity of purpose and direction of the organization. They must create and maintain the internal environment in which people can become fully involved in achieving the organization's objectives.
3. **Involvement of people**: Tetra Tech associates at all levels are the essence of our organization and their full involvement enables their abilities to be used for the benefit of Tetra Tech and our customers.
4. **Process approach**: A desired result is achieved more efficiently when Tetra Tech activities and resources are managed as a process.
5. **System approach to management**: Identifying, understanding, and managing interrelated processes as a system contributes to Tetra Tech's effectiveness and efficiency in achieving its objectives.
6. **Continuous improvement**: Continuous improvement of Tetra Tech's overall performance is a permanent objective of our organization.
7. **Factual approach to decision making**: Tetra Tech recognizes that effective decisions are based on the analysis of data and information.
8. **Mutually beneficial supplier relationships**: Tetra Tech and its suppliers are interdependent and a mutually beneficial relationship enhances the ability of both to create value.

These eight principles form the basis for the QMS standards implemented by Tetra Tech and are consistent with guidance within the ISO 9000 family.

TETRA TECH COMMITMENT TO QUALITY

The employees of Tetra Tech are dedicated to providing our customers with a quality advantage through a continuous process of quality advancement in all areas of our performance. Specifically, our Quality Policy is as follows:

> Tetra Tech is a world-class provider of professional services in the practice of consulting, engineering, remediation, and construction services. Our goal is to meet or exceed the expectations of our customers. We accomplish this in an environment that nurtures employee pride and satisfaction and leads to continuing growth and prosperity. We demonstrate our commitment to quality through continuous process improvement, through training, and by ensuring each of our team members recognizes the value of high quality products.

Commitment to quality begins at the highest management level of the team and is passed down to every level of the organization. In essence, a commitment is expected and required from all employees. This focus on quality by our entire organization has enabled Tetra Tech to deliver quality service in the past and will allow us to continue to do so in the future.

TETRA TECH QUALITY POLICY

Tetra Tech will continue to grow as a company by offering innovative and cost-effective solutions to complex world problems and consistently satisfying the needs of our customers. Tetra Tech works with its customers and suppliers in the early stages of each program and project to identify customer needs and expectations and to establish agreed-upon quality requirements. Tetra Tech also believes that we must continually verify customer needs, expectations, and quality requirements as work progresses. Accordingly, Tetra Tech's corporate policy is to implement a proactive quality program, backed by strong management commitment, to help identify and meet or exceed customer requirements. Tetra Tech's policy is to apply the following QA, QC, and quality improvement activities to our programs and projects:

- Develop project-specific plans that incorporate the QA and QC elements necessary to ensure that the deliverables and services produced will meet or exceed customer requirements.
- Implement the QA and QC procedures necessary to provide a documented, consistent level of quality for all work completed.
- Provide independent reviews of work products to ensure that these products are of acceptable quality and meet customer requirements.
- Document that data collected, stored, reported, and used are scientifically valid and defensible.
- Identify QA and QC deficiencies that may affect the quality of Tetra Tech's work and resolve these deficiencies expeditiously.
- Use QC check processes to identify process improvements that can be implemented as a proactive means of building quality into Tetra Tech's work products and enhancing the customer experience.
- Obtain employee and customer feedback on a regular basis as a means of evaluating QMS effectiveness and Tetra Tech's overall performance on a program or project.

TETRA TECH QUALITY COUNCIL

The management of Tetra Tech recognizes the necessity for a comprehensive quality program to address our complete line of consulting, engineering, remediation, and construction services. The Tetra Tech Quality Council is a permanent, standing committee comprised of senior management from various operating units representing all four business group service lines of the company. The Council's charter is to oversee the development of quality program policy, review program adequacy, and direct management assessments of quality programs. Director of Quality Programs, as delegated by the Chief Executive Officer (CEO) of Tetra Tech, heads the Council. The Director of Quality Programs is responsible for the development and administration of the quality policy, reporting directly to the Tetra Tech CEO and supported by the Quality Council.

By signature, the responsibility and authority for the policies described in this manual have been assigned to the Director of Quality Programs and to the Tetra Tech Quality Council to maintain, continually improve, and administer the Tetra Tech quality policies and practices. Tetra Tech has developed a comprehensive set of policies and practices to ensure quality objectives are attained and minimize the possibility of compromises that could adversely affect the quality of our internal operations and the services we provide to our customers. Our QMS, as described in this manual, is responsive to and follows the guidance and applicable requirements of the American National Standards Institute (ANSI) / ISO / American Society for Quality (ASQ) Q9001-2008, *Quality Management System Requirements Standard* and ANSI/ASQ E4-2004, *Quality Management Systems for Environmental Data and Technology Programs*.

This Quality Practices Manual will be revised and amended as necessary to reflect changes in quality requirements/policies and is issued in electronic format only. The goal and purpose of the manual are to ensure the quality and reliability of our services. Tetra Tech recognizes its responsibilities as a supplier of services to fully comply with all contractual provisions and governing regulatory specifications and requirements. Suggestions for improvement to this plan are solicited from its users.

William R. Brownlie, PhD, PE, Senior Vice President
Chief Engineer and Director of Quality Programs
Tetra Tech, Inc.

1.0 PURPOSE AND SCOPE

This Quality Practices Manual (QPM) identifies and describes the elements of Tetra Tech's QMS that are integral to the services provided by Tetra Tech. Operating unit-specific and program- or project-specific quality plans are prepared as needed to cover the specific needs of operating units and projects. These plans include specific Quality Assurance/Quality Control (QA/QC) requirements for the diverse range of services that Tetra Tech provides. This QPM discusses the quality policies for environmental and engineering practices in a general perspective that apply in the absence of more specific quality-related documents.

This QPM provides the framework and basic QA/QC requirements that may be used to develop detailed Quality Assurance Project Plans (QAPPs) and other QMS implementation procedures required to meet specific customer requirements. Other quality-affecting plans and implementing documents will contain applicable QA/QC requirements based on the policies outlined in this QPM.

1.1 Applicability

The quality management requirements outlined in this QPM apply to all work that Tetra Tech conducts for government, private, and non-government organizations domestically and internationally and also to subcontractors that work on Tetra Tech programs and projects. The following sections of this QPM apply as indicated:

- Section 2.0 – Management Systems—addresses the requirements of ANSI/ASQ E4-2004 and applies to all Tetra Tech operating units. This section describes the overall management of our QMS as applied at the operations level within each operating unit or major service program.

- Section 3.0 – Service Area Quality Management Policies and Practices—applies to activities involving the generation, evaluation, and reporting of environmental data; preparation and production of document and information technology (IT) deliverables; engineering design services; construction/fabrication of systems and components; operations and maintenance (O&M) of systems; and verification and acceptance of systems. This section addresses QA/QC activities applicable to these varied services areas.

1.2 Quality Management System Implementation Plans

To support Tetra Tech's QMS, individual Quality Management Plans (QMPs), QAPPs, or other quality program plans may be developed that contain distinctive information and requirements necessary for specific programs or projects. The development of these quality program plans typically occurs after individual contracts are received. However, individual QMPs describing the broad (non-contractual) implementation of the QMS in each of the operating units are often prepared to expand on specific details, implementation tools, and documentation schemes and systems selected by operating unit managers for the fulfillment of the requirements of this QPM. Thus, information or requirements not fully addressed in this QPM are covered in these plans providing full guidance for managing the quality of Tetra Tech activities.

1.3 Quality System Approach

Our quality system approach applies the fundamental principles of the Plan-Do-Check-Act model of continuous improvement. QA/QC activities are identified during project planning and applied throughout the project life. QA activities help guide the project work based on professional and regulatory standards. QC activities occur at key milestones to confirm project quality. Continuous improvement is achieved on the project by applying these QA/QC activities and on future projects by applying lessons learned.

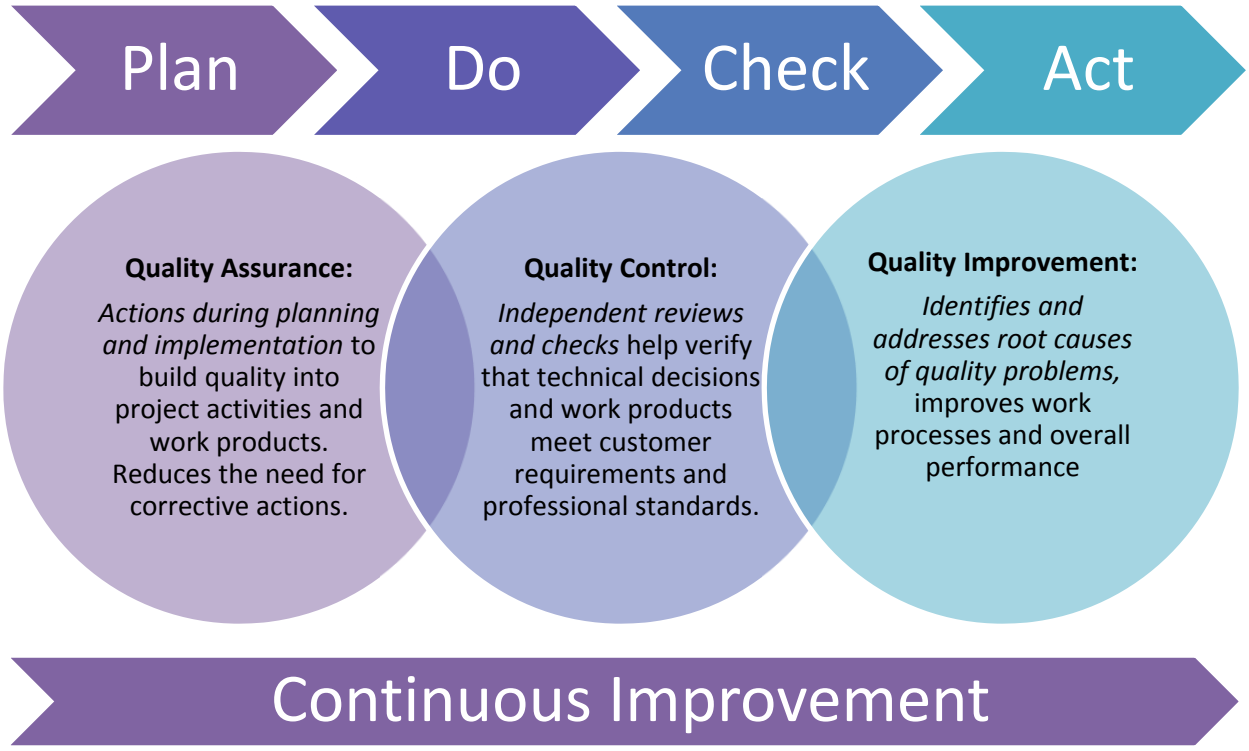

Figure 1: Tetra Tech Plan-Do-Check-Act Model

Our project teams are Tetra Tech's front line for ensuring quality performance. Regardless of a project's specific attributes, planning and executing high-quality work, obtaining client and stakeholder feedback, and adjusting to improve our services and work products are all critical to Tetra Tech's long-term success. All Tetra Tech personnel play a critical role in this pursuit.

1.3.1 Plan: Quality Management Planning

The success of a project or task is highly dependent on proper planning. Quality is built into the project at the planning stage. QAPPs should define:

- Tetra Tech roles and responsibilities
- Customer requirements
- Key program elements
- Processes and steps to be taken
- Identified risks and mitigations

1.3.2 Do: Implementation, Self-Inspection, and Completion.

Key elements to conducting the implementation, self-inspection, and completion process will include:

- Communicating the plan and its importance to the team
- Making the plan visual using procedures, regulatory requirements, statement of work, drawings, and specifications

- Identifying those action needed to be successful, and clearly defining quality objectives
- Executing the plan through procedural and regulatory compliance
- Providing status of actual progress versus plan
- Conducting self-inspection of work as it progresses
- Stating the completion requirements of the project when the project begins

1.3.3 Check: Checking Work

Before, during, and after a project begins, the check process is continually occurring. Checking is the process of collecting and evaluating information to the criteria established during the planning phase:

- Checks are conducted through discipline reviews and team reviews
- Document (plans, statements of work, specifications, drawings, forms) checks are conducted through peer reviews and assessments
- Work can be checked through independent (external and/or internal) inspections and testing, audits, and surveillances
- Suppliers are evaluated by capabilities, qualifications/certifications, and management systems
- Project reviews check the status of project objectives, including: schedule, scope, budget, and level of quality; quality objectives as defined in task implementation plans and work plans; and final customer reviews and acceptance.
- Deviations from the Plan Step as determined during the Check Step are fed to the Act Step.

1.3.4 Act: Corrective Actions

After checking is performed, either work continues as planned or deviations are identified. Once deviations are identified, the plan needs to be changed, the process needs to be changed, or a combination of the two. Acting on deviations identified in the checking step will result in a corrective action plan that will include lessons learned, event reports, corrective actions, and continuous iimprovement.

2.0 MANAGEMENT SYSTEMS

Management Systems include the common quality management functions such as leading, planning, organizing, and controlling QA/QC activities, plus specific activities that enable project-specific operations to be planned, implemented, and assessed. The elements contained in Section 2.0 are used in conjunction with the other sections of this QPM to formulate a complete QMP. Program elements discussed in Section 2.0 include the following:

2.1 Management and Organization

2.2 Quality Management System Description

2.3 Personnel Qualification and Training

2.4 Procurement of Items and Services

2.5 Documents and Records

2.6 Computer Hardware and Software

2.7 Planning

2.8 Implementation of Work Processes

2.9 Assessment and Response

2.10 Continuous Quality Improvement

Tetra Tech management determines the requirements to meet customer needs based on Tetra Tech's understanding of the scope of work (SOW), and is responsible for meeting those needs as a measure of quality and success. Individuals performing work will comply with the requirements of this QPM and the applicable Tetra Tech procedures and documents to ensure the desired level of quality.

2.1 Management and Organization

2.1.1 Purpose and Scope

This section describes the matrix organization and authority for the development, implementation, and assessment of the QPM. This section also documents the organizational structure, functional responsibilities, levels of authority, and lines of communication established within Tetra Tech to achieve quality work and data. Specific individuals with responsibilities and authorities related to individual operating units and contracts are defined in operating unit-, contract-, program-, and project-specific quality plans developed by various operating units.

2.1.2 Responsibilities and Authorities

The Director of Quality Programs is responsible for overseeing the administration of the quality program. The business group presidents, and the individual operating unit managers that report to them, are responsible for ensuring the QMS is implemented for their respective groups and units. Each operating unit manager assigns personnel with specific responsibilities for implementing the QMS for their operations, programs, and contracts. This includes designation of Quality Council representatives for each Tetra tech business group. Tetra Tech's top-level quality program organization, as illustrated in Figure 2, provides an independent framework for implementing quality practices for the enterprise.

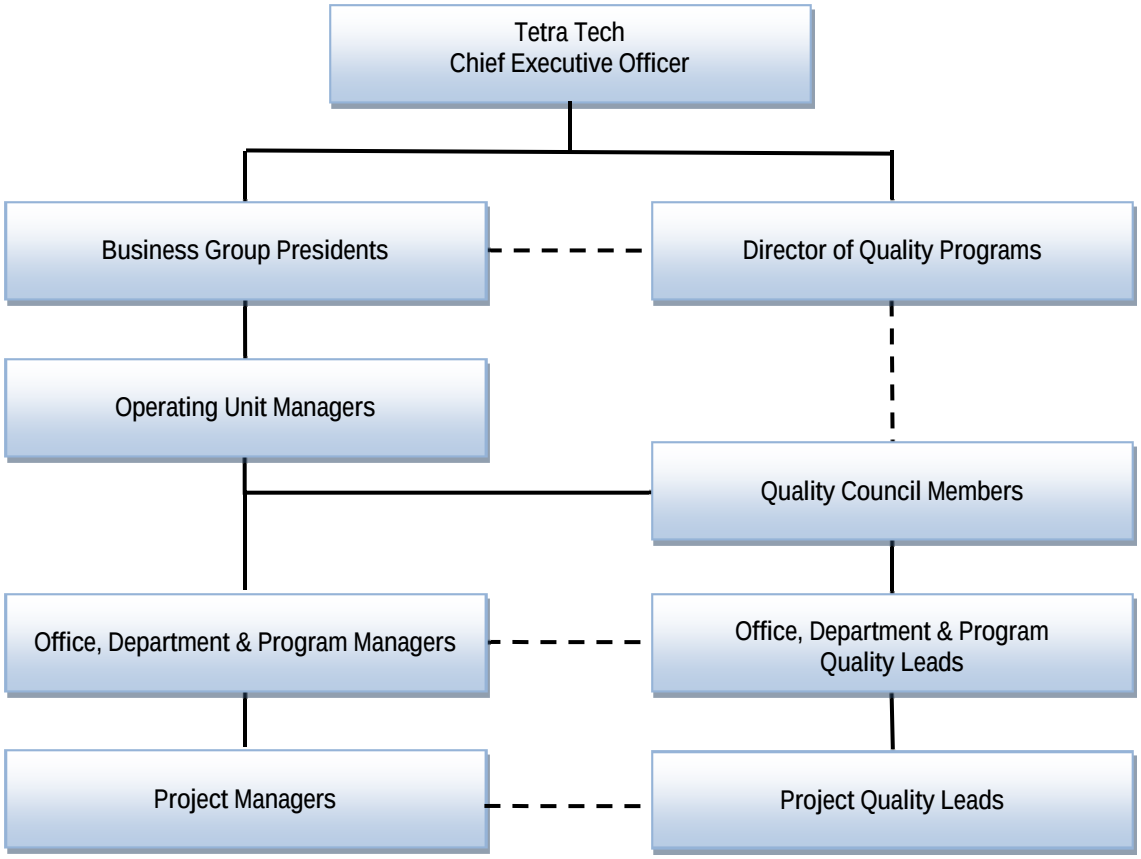

Figure 2: Tetra Tech Quality Practices Organization Chart

Because of the diversity of services offered by Tetra Tech, the responsibility for implementing the QMS at the program and project level lies with the business group presidents and operating unit managers. These individuals oversee the quality programs with support from the quality council members and assign quality leads at the operating unit, office, department, and program levels. At the project level, quality leads report up through the organization as illustrated in Figure 2. Quality council members have the responsibility and the authority to report any breaches of the QMS policies and practices to Director of Quality Programs.

2.1.3 Inherent Responsibilities

Ensuring achievement of the expected quality level is the inherent responsibility of every project manager and every individual or group engaged in performing work. These responsibilities include initiating action to prevent the occurrence of product/service nonconformance, identifying and recording any product/service nonconformance, identifying root causes and corrective actions, verifying corrective actions have been implemented, and initiating control procedures to prevent the use of nonconforming products/services or procedures.

2.1.4 Records

Quality management records shall be developed and maintained in project files in accordance with service area and project and customer requirements as discussed further in Section 3.0 of the QPM. Storage, maintenance, retention, and final transmittal requirements are implemented in accordance with Section 2.5 — Documents and Records.

2.2 Quality Management System Description

2.2.1 Purpose and Scope

This QPM describes the quality practices and policies that will be implemented to ensure the production of quality results to achieve the goals for each activity undertaken. The QPM establishes the structure, defines the authority, identifies the responsibilities and documentation requirements, and provides the instructions used to manage, implement, and assess quality-affecting activities and to create operating unit or project-specific quality documents.

2.2.2 Responsibilities and Authorities

Responsibilities and authorities for the work to be performed pursuant to this QPM are delineated in Section 2.1.2 — Responsibilities and Authorities.

2.2.3 Requirements and Instructions

This QPM applies to quality-affecting work performed by Tetra Tech personnel and subcontractors to Tetra Tech. The extent to which this QPM is applied will depend upon the nature and scope of the individual project activities to be performed. The level of application of the QPM and specific customer quality requirements may be delineated and documented in other program or project-specific quality plans such as QAPPs, QMPs, or work plans. This implementation approach provides a mechanism to address basic quality program requirements, while providing the flexibility to implement additional quality requirements to meet specific internal and external customer expectations.

This QPM is part of a systematic management approach for planning, implementing, and assessing work to ensure that the results satisfy stated technical, administrative, and quality objectives. This QPM encompasses the policies, authorities, and requirements necessary for implementation. Procedures that implement activities are established, reviewed, and approved to satisfy the criteria of this QPM. This QPM also includes provisions to ensure that engineered systems are designed, constructed, and operated to fulfill their intended purposes and that environmental data of the quality needed are produced and documented.

This QPM includes two levels of management controls: the organizational level (Section 2.0 of this QPM) and the technical project level (Section 3.0 of this QPM). The organizational level consists of activities supporting common or standardized functions (e.g., management assessment, personnel qualifications and training, procurement policies, and document control) and establishes the basic structure for performing work. The technical project level consists of contract-specific quality activities necessary to produce the desired quality of products, data, and results.

2.2.4 Records

QAPPs, QMPs, Work Plans, and other quality-controlling plans are documentation developed as part of the QMS.

2.3 Personnel Qualification and Training

2.3.1 Purpose and Scope

Tetra Tech management is responsible to ensure Tetra Tech and subcontractor personnel are sufficiently trained, qualified, or certified, where appropriate, to perform work within their specific work scope. Tetra Tech and subcontractor personnel performing work in accordance with this QPM are selected based on their qualifications to perform their assigned work according to the requirements of this QPM and to contract-specific requirements. Tetra Tech emphasizes

education and training for our employees. Employee education and training helps achieve and maintain proficiency, while creating an environment that promotes individual responsibility and accountability for quality. This requirement applies to personnel performing or managing activities directly affecting quality.

2.3.2 Responsibilities and Authorities

Tetra Tech management is responsible for the following:

- Determining the level of education, experience, and training required to ensure that Tetra Tech personnel are qualified to perform work within their respective organizations and specific contracts. Specialized training requirements needed to accomplish highly technical work activities are identified in work plans, QAPPs, and standard operating procedures (SOPs).

- Establishing specific requirements for indoctrination, subject matter training, qualification, certification, personnel training records (and their maintenance), and implementation in accordance with project procedures.

- Providing training resources for required education, training, and retraining, including activities such as continuing education, on-the-job training, and training seminars to ensure that personnel demonstrate and maintain proficiency in performing assigned work.

- Ensuring that when job requirements change, the need for retraining is evaluated by Tetra Tech management and provided when necessary.

- Ensuring that records of training, qualification, and certifications are maintained.

2.3.3 Requirements and Instructions

Tetra Tech management must perform the required actions to accomplish the specific responsibilities identified in Section 2.3.2.

Tetra Tech personnel selected to perform work shall possess the education, experience, and training commensurate with the specified activity.

Where required by statute or other applicable requirement, personnel may be required to be qualified and/or certified to conduct specific work. Management and workers must achieve specific requirements for qualification and/or certification to meet specific needs.

2.3.4 Records

Records generated through implementation of the requirements of this section of the QPM include documentation needed to support successful accomplishment of training, qualification, and certification. Records may include one or more of the following documents applicable to the type of experience, education, and/or training provided:

- Course or training outline or similar documentation of the subject matter of the course or training offered, when course training is used

- Records of training duration

- Test or examination results or other documentation indicating proficiency as applicable

- Records directly related to historical work experience or training

- Copies of qualification or certification documents issued
- Job Classification training requirements for Tetra Tech employees

Education and training records of Tetra Tech employees are documented and managed to provide evidence of successful completion; records are maintained in employee files with their local Human Resource representatives.

2.4 Procurement of Items and Services

2.4.1 Purpose and Scope

This section of the QMP defines a QMS to ensure that procurement processes are properly documented and controlled and that procured items and services conform to established requirements.

2.4.2 Responsibilities and Authorities

Tetra Tech's contracting and procurement personnel are typically responsible for the following:

- Controlling procurement documents (e.g., master ordering agreements, purchase requisitions, purchase orders, basic ordering agreements, service contracts)
- Adhering to the Tetra Tech procurement requirements
- Securing replacement, or remedy, for suppliers of deficient items and services

Project managers are responsible for the following:

- Providing contracting and procurement personnel with appropriate specifications, drawings, SOWs, and other documentation necessary to obtain suitable and acceptable items and services and to flow down quality and technical requirements to suppliers
- Ensuring that the appropriate technical reviews of procurement documents are conducted prior to the distribution for bid
- Identifying quality-affecting items and services to the contracting and procurement personnel and the project quality leads (QA officers or managers assigned to implement quality programs at the project level)
- Ensuring that documents used for procurement of items and services include appropriate quality requirements (e.g., applicable specifications, standards, regulations, drawings, and a SOW including quality requirements)
- Ensuring QMSs, workmanship standards, acceptance test procedures, test correlation, and other appropriate quality and technical requirements are included in subcontract SOWs for products and services procured from subcontractors and suppliers
- Documenting and tracking the disposition of supplier responsible product non-conformances

The project quality lead is responsible for the following:

- Performing subcontractor procurement evaluations when requested by management or the project manager

- Providing methods for determining the level of supplier quality through assessments, inspections, surveillance, tests, and certifications to verify compliance of items and services to procurement document requirements, upon Tetra Tech management request

2.4.3 Requirements and Instructions

The Tetra Tech project personnel define the specifications of each requirement to be subcontracted and verify that quality requirements are clearly stated and appropriate for the program or project. The specifications and other project-specific criteria make up a comprehensive statement of work that addresses subcontractor performance objectives and deliverable requirements.

Suppliers providing items and services according to the requirements of this section are required to have a system capable of ensuring items and services meet requirements of the procurement document. Assessment of the supplier's QA approach relative to the SOW may be completed as part of the review of the bid package or proposal. Suppliers must incorporate appropriate quality requirements in their sub-tier procurement documents as appropriate.

2.4.4 Records

The QA records generated through implementation of the requirements of this QPM include the following:

- Copies of pertinent portions of procurement documents
- Reports on supplier evaluations from the procurement group and technical personnel
- Reports on monitoring supplier quality

2.5 Documents and Records

2.5.1 Purpose and Scope

Documents developed for use in project activities, including those affecting quality, will be prepared, reviewed, approved, distributed, revised, indexed, filed, stored, maintained, retrieved, and transmitted to the customer according to requirements specified in Tetra Tech procedures. Documents may include, but are not limited to, the following:

- Design packages (30, 60, 90, and 100 percent designs)
- Tetra Tech Health and Safety Plan (HASP)
- Procedures and SOPs
- Specifications
- QAPPs
- Sampling and Analysis Plans (SAPs)
- SOWs

Records are generated and used to document the quality of items, services, environmental processes, and engineered systems and require the same controls as documents discussed above. Specific records generated by performance of activities associated with this QPM are identified within each specific section, within each contract-specific QAPP, and/or within plans or

specifications used to perform specific tasks. The QA records may be in the form of handwritten, printed, or electronic media. Quality records to be controlled by this QPM include only those that furnish documentary evidence of the quality of items, services, environmental processes, and engineered systems. The term record(s) used throughout this QPM denotes quality records.

2.5.2 Responsibilities and Authorities

Tetra Tech project managers are responsible for implementing a document control and records management system to ensure clarity, completeness, retrievability, and conformance to contract and procedural requirements.

Originators and, to a lesser extent, custodians of documents and records are responsible for the following:

- Legibility, accuracy, and completeness of documents and records
- Preparation, review, issuance, and revision(s) of documents and/or records that specify quality requirements
- Proper filing of documents and records by following project and/or operating unit filing procedures

The project manager is responsible for ensuring that reports, technical plans, design documents, and other technical deliverables are subjected to an internal review and approval process. The project quality lead is responsible for assessing the effectiveness of the implementation of document and record requirements. Project managers are responsible for maintenance, issuance, retrieval, filing, and final transmittal to the customer of project records.

2.5.3 Requirements and Instructions

Document control and records management include: (a) identification of documents and records to be managed and their specified distribution; (b) identification of assignment of responsibility for preparing, reviewing, approving, and issuing documents; and (c) review of documents for adequacy, completeness, and correctness prior to approval and issuance. Prior to issuance, deliverable document revisions shall follow the review and approval processes outlined in Section 3.2 of this QPM.

Special requirements for records include validation, indexing, record accuracy, maintenance, and final transmittal. Maintenance of records shall include provision for retention, protection, preservation, traceability, retrievability, and final transmittal.

2.6 Computer Hardware and Software

2.6.1 Purpose and Scope

This section of the QPM addresses computer hardware and software used in Tetra Tech activities. Hardware includes network servers and disk drives, electrical components, personal computers, and printers. Computer programs are synonymous with software. Computer programs addressed by this QPM include, but are not limited to, design, design analysis, models of environmental processes and conditions, operations or process control, and databases. Computer programs not addressed by this QPM include, but are not limited to, nontechnical software such as word processing applications.

2.6.2 Responsibilities and Authorities

The IT Department is responsible for software installation and support, maintenance and support of computer-related equipment, maintenance of the computer network, computer-related equipment troubleshooting, ensuring network security, maintaining electronic mail, and maintaining an inventory of computer-related hardware and equipment.

All Tetra Tech personnel are responsible for meeting Tetra Tech corporate computer use policy.

2.6.3 Requirements and Instructions

Computer program development for technical project applications is accomplished using an approved software development methodology. Internally developed technical programs are validated, verified, and documented according to the intended use of the software. Test requirements for internally developed software include verification tests, in-use tests, testing procedures, documentation of results, and control and maintenance of test records. Documentation of software test results is maintained.

Revisions to verified computer programs are controlled and assessed to determine the potential impact of the change on the performance of the software. Revised computer programs are verified and documented according to the same procedures required for the original program.

Computer programs that are commercially available, have been widely used, and can be reasonably assumed to be correct may not require independent verification.

2.6.4 Records

QA records generated through implementation of the requirements of this section of the QPM include records documenting acceptance of computer hardware and software, inventories of computer-related hardware and equipment, and verifications of internally developed technical computer programs.

2.7 Planning

2.7.1 Purpose and Scope

This section describes the planning process that Tetra Tech implements for projects. Planning is conducted in accordance with established procedures to accomplish several objectives.

Planning provides a basis through which the following project objectives can be defined:

- Implementation and completion of the defined SOW
- Completion of an assigned task within the approved and agreed-upon schedule
- Performance of the task work within established project budgets
- Meeting the technical and quality goals of the customer and the identified acceptance criteria

Planning establishes and confirms agreement on the details of these project objectives and provides guidance on the conduct of tasks to project personnel. In addition, planning provides a base for forecasting and monitoring progress on project tasks.

2.7.2 Responsibilities and Authorities

The project manager is responsible for ensuring Tetra Tech projects are planned in accordance with corporate procedures and policies and for planning and executing the SOW to the customer's satisfaction.

2.7.3 Requirements and Instructions

Projects and supporting activities are planned, and planning documentation is reviewed, approved, and documented. The amount of detail in the planning documents depends on the scope, complexity, and significance of the project being planned. Organizational responsibilities, interfaces, and implementing instructions are identified during planning and maintained throughout the work. Organizations assigned responsibilities are included in the review process, and their comments are resolved prior to the start of that specific work. Typical elements associated with most project planning activities include:

- Tasks needed to complete the work using work breakdown structure techniques and critical dependency relationships between tasks
- Schedules for completing individual tasks to achieve the overall project schedule
- Resources needed to perform each task (labor, equipment, supplies, and services)
- QA/QC requirements and quality leads
- Specific actions planned to ensure the customer's performance expectations are met or exceeded
- Control mechanisms to monitor budget, schedule, quality, and customer satisfaction during project implementation

2.7.4 Records

The QA records generated through implementation of the requirements of this section include completed copies of approved project planning documents.

2.8 Implementation of Work Processes

2.8.1 Purpose and Scope

Work conducted by Tetra Tech is planned, implemented, and assessed according to applicable sections of this QPM. The work processes and operations discussed in this section of the QPM relate to quality-affecting processes and operations. Contract-specific requirements for work processes and operations are discussed in the individual QAPPs, QMPs, or other quality planning documents. Basic QA/QC elements applied to most common areas of service are further described in Section 3.0 of this QPM.

2.8.2 Responsibilities and Authorities

Project managers are responsible to plan, implement, and assess work processes.

Managers must identify applicable basic contract quality requirements, program and task expectations, and the project SOW during the work planning process. This planning process occurs before and during the initiation of individual contracts.

Responsible managers must establish policies and procedures to address identification of routine operations requiring plans; preparation of plans including form, content, and applicability; and documented approval of plans.

Tetra Tech managers are responsible for performing assessments of compliance and effectiveness of work processes under their control. The quality leads and support staff are responsible for performing independent assessments of work processes impacting quality. Tetra Tech and subcontractor personnel are required to perform work according to approved documents.

2.8.3 Requirements and Instructions

The basic requirements for controlling work processes and operations are discussed below:

- Planning for quality is conducted according to a graded approach by addressing the nature, complexity, and SOW to be performed. The graded approach defines the extent and degree of the level of quality applied to work activities.

- Planning and implementation for characterization of environmental processes and conditions are guided by determination of the level, type, quantity, and quality of data required (see Section 3.1).

- Planning and implementation for engineered systems include determination of the appropriate design criteria and design bases and any specially controlled conditions required to ensure that objectives are satisfactorily achieved (see Section 3.3).

- QMS requirements for construction and O&M services are guided by construction quality management plans, SOPs, and other project specific plans and procedures (see Sections 3.5 and 3.6).

- Work is performed according to approved work plans, drawings and specifications, SAPs, QPM, QAPPs, and other applicable documents or procedures.

- Work is implemented in a sequence consistent with the need for completion of prerequisite as well as final operations.

- Plans are developed and implemented for appropriate routine and standard work operations. Specialized and/or critical operations may use project-specific documents to perform work operations.

- Management assessments of work processes and operations are accomplished through self-assessments and independent assessments. Assessments are conducted according to the requirements of Section 2.9 – Assessment and Response

2.8.4 Records

Records generated through implementation of the requirements of this section include program and project records such as SOWs, work plans, and procedures identified in Section 3.0 and assessment records as identified in Section 2.9 – Assessment and Response.

2.9 Assessment and Response

2.9.1 Purpose and Scope

Tetra Tech management will regularly assess the adequacy of the QMS and ensure its effective implementation. Quality assessment activities are typically delegated to qualified professionals by

Tetra Tech management to ensure that an effective QMS has been established, implemented, and followed. Assessments are planned and documented based on program or project requirements. Approaches used for assessments will vary with the objectives of the assessment and the status of the project. Assessment activities will be performed in accordance with the requirements of this QPM. Additional project-specific requirements for assessments are discussed in the individual QAPPs, QMPs and other quality planning documents.

2.9.2 Responsibilities and Authorities

Management assessments require direct participation of affected levels of management. Both organizational level and technical level managers are responsible for ensuring that assessments are completed to determine the quality of products and technical work and adequate implementation of the corporate procedures. Tetra Tech management implements effective corrective actions to remedy problems discovered by management assessments. Independent management assessments may be performed as determined by the project manager or the responsible QA officer. Independent management assessments are used to evaluate the performance of the work process and the application of and compliance with programmatic requirements.

Quality leads, with support from staff assigned to support the quality process, have prime responsibility for conducting independent assessments and for implementing corporate and project QMS requirements. Independent assessments evaluate the performance of work processes with regard to QMS requirements, compliance and expectations for safely performing the work, and achieving the goals of the project and organization.

2.9.3 Requirements and Instructions

Assessments provide a means for determining the following:

- Effectiveness of the management control system used to achieve and ensure quality
- Adequacy of resources and personnel provided to implement and ensure the quality of Tetra Tech activities
- Adequacy, implementation, and compliance with the corporate and project plans and procedures

Management and technical independent assessments will be conducted by management and QA and QC personnel to provide an objective and unbiased evaluation of the QMS and project-specific requirements. Independent assessments are conducted by those who are not performing or responsible for work or specific projects and who possess the necessary technical or management skills to perform the assessment. Management and technical self-assessments are conducted by those responsible for specific work. Independent assessments associated with deliverable reviews are further detailed in Section 3.2 of this QPM.

Tetra Tech management determines the response actions necessary as a result of independent assessments and self-assessments and implements appropriate corrective actions. Tetra Tech management shall perform follow-up assessments to determine the effectiveness of implemented corrective measures and to confirm that corrective actions prevent a recurrence of the problem.

Assessment tools consist of audits, surveillances, peer reviews, readiness reviews, and technical reviews.

2.9.4 Records

Records generated by implementation of this section of the QPM include the following:

- Assessment (Audit, Surveillance, and Inspection) Plans and Reports
- Nonconformance Reports

2.10 Continuous Quality Improvement

2.10.1 Purpose and Scope

The Tetra Tech Quality Program shall foster continuous process improvements. This includes: identifying opportunities for improvement, implementing improvements, and monitoring the impact of the improvements. The intent is to improve operations and work processes, thus providing better value. The principles of continuous quality improvement include understanding the customer's requirements and expectations, implementing quality improvement "tools," involving all personnel in the improvement process, and measuring the impact of improvements on applicable operations, services, and products.

2.10.2 Responsibilities and Authorities

Tetra Tech managers conduct quality improvement activities to enhance work processes and detect/correct problems that adversely affect quality during planning, implementation, and assessment of technical and management activities. The improvement system employed by Tetra Tech management involves various components including, but not limited to, quality committee evaluations, management assessments, lessons learned evaluations, and corrective and preventive action implementation. The improvement system focuses primarily on exceeding internal and external customer requirements and expectations, thus indirectly and/or directly providing more value to customers.

Tetra Tech management is required to develop and implement solutions to correct quality-affecting problems, thus supporting and augmenting the overall improvement process. Project managers and department heads identify applicable performance data to analyze and detect trends that adversely impact quality.

2.10.3 Requirements and Instructions

Tetra Tech uses the assessments discussed in Section 2.9 of this QPM as a means to identify components of the QMS that are not functioning effectively and need corrective action. Technical system audits are identified and overseen by program or contract-specific quality leads. Operating units may also conduct periodic audits of selected operations. Corrective actions resulting from Tetra Tech's assessment activities can be immediate or long-term. Immediate corrective actions will include revising a test procedure that is not working effectively or correcting errors or deficiencies in documentation. Long-term corrective actions represent an opportunity to build quality into project planning and implementation activities rather than relying on deliverable reviews and audits to identify and correct errors and deficiencies.

Tetra Tech also will conduct periodic customer feedback surveys to obtain performance feedback on a particular program or project and as a means to better understand customer goals and priorities. In addition, Tetra Tech relies on information from the government's Architect-Engineer Contract Administration Support System and other related systems that provide feedback on our performance. Customer surveys allow Tetra Tech to learn how our customers perceive our services and help us improve our service by resolving performance issues before they become significant problems.

2.10.4 Records

The QA records generated through implementing this section of the QPM include the records of the assessments described in Section 2.10.3 above.

3.0 SERVICE AREA QUALITY MANAGEMENT POLICIES AND PRACTICES

Section 3.0 of the QPM contains service area-specific QA/QC elements needed to plan, implement, and assess projects performed by Tetra Tech. These elements are used in conjunction with the management systems described in Section 2.0 to address the entire scope of Tetra Tech's QMS. The following program elements are contained in Section 3.0:

3.1 Environmental Data Collection and Use

3.2 Document Deliverables

3.3 Engineering Design

3.4 Construction Management

3.5 Construction

3.6 Operation and Maintenance

3.7 Commissioning and/or Verification and Acceptance of Systems

These project activities encompass virtually all work performed and completed by Tetra Tech. Individuals performing work that affects quality will comply with the policies and practices identified in this QPM and subordinate procedures and documents.

3.1 Environmental Data Collection and Use

3.1.1 Purpose and Scope

This section of the QPM defines the QMS requirements to ensure that projects involving the generation, acquisition, and use of environmental data are planned and documented. Project-specific requirements for planning and scoping are discussed in individual QAPPs or other planning documents.

3.1.2 Responsibilities and Authorities

Tetra Tech project managers responsible for activities involving the collection and evaluation of environmental data are responsible for the following planning and scoping activities:

- Determining data assessment tools (i.e., program technical reviews, peer reviews, inspections, surveillances, and audits) as needed and/or specified in the QPM
- Providing training activities as necessary to meet specific data requirements contained within individual contracts per the requirements of Section 2.3 – Personnel Qualification and Training, and related project-specific requirements
- Providing training considerations specific to work on individual contracts discussed in individual work plans, SAPs, and QAPPs
- Managing the collection and processing of data
- Ensuring the data are properly identified, recorded, authenticated, and filed

The project quality lead is responsible for ensuring that the policies and practices outlined in this section of the QPM are implemented and for ensuring the applicable quality planning documents for data collection are developed and followed.

3.1.3 Requirements and Instructions

Data collection and use involve four critical components that must be accomplished in concert to ensure the data are useable, complete, and defensible for their intended use. The four critical components are: (1) planning, (2) implementation, (3) assessment, and (4) storage. Our QA/QC policy for data collection and use encompasses management and technical activities used in support of our customer services. This policy focuses primarily on the collection and use of primary data; however, similar requirements are applied to secondary data based on customer requirements and needs. Primary data are defined as *information collected directly for measurements under a subject project (e.g., sample data results, field measurements)*. Secondary data are defined as *existing data collected for other purposes or obtained from other sources outside the project (e.g., literature sources, industry surveys)*.

The level of sophistication and detail applied to each of these critical components is scalable based on the professional judgment of the program or project leadership. However, all four components must be addressed and documented as part of program or project effort.

Tetra Tech's project level QA/QC requirements presented in this section are applicable to projects that require data collection and use. Many of these requirements are most effectively applied as part of program level plans and procedures when providing support to a customer under a mission support contract or when providing routine services to various customers. However, the basic quality requirements described in this section apply whether addressed at the project level or as part of program level plans and procedures.

3.1.3.1 Planning

The following procedures apply to data collection activities to ensure that data collected meets the intended problem solving or decision making needs of the activity:

- Systematic planning is used to define the data needs and performance criteria (i.e., the type, quantity, and quality of data needed for a specific purpose) for the data collection activity. The U.S. Environmental Protection Agency (EPA) *Guidance on the use of the Data Quality Objective Process* (EPA GA/G-4). This guidance outlines primary methods to be followed for environmental data collection planning and is applied a various levels of detail depending on the project. Other applicable government guidance or less rigorous processes may be applied as appropriate, but must involve definition of data needs and collection methods, performance criteria for use of data, and data collection boundaries (spatial and temporal).

- Sampling plans are prepared and followed that document data collection needs, approaches, quality requirements, and QC activities needed to ensure the performance criteria are satisfied. Sampling plans may range from detailed QAPPs prepared in accordance with EPA or other applicable government requirements (e.g. EPA QA/R-5, *EPA Requirements for Quality Assurance Project Plans*) to summary tables that document number and types of samples and reference field data collection SOPs. *The Uniform Federal Policy for Implementing Environmental Quality Systems* (EPA-505-F-03-001) is an example of a specific planningfinal QC protocol followed for federal government data collection plans.

3.1.3.2 Implementation

Data shall be collected using approved methods and procedures documented in SAPs. The following components apply to Tetra Tech data collection activities:

- Data collection is conducted in accordance with written procedures either referenced or included in the sampling plans. Procedures may be developed at the

organizational/program or the project level depending on the requirements. Nevertheless, each field measurement and sample activity shall be guided by a written procedure to ensure the field activities are conducted appropriately and the resultant data is usable. Procedures will address, as applicable, calibration and use of field testing or measurement equipment, sample collection and handling, and field documentation.

- Field documentation shall be completed for data collection activities and maintained in project files as per the customer contract requirements or corporate document retention policy requirements. Field documentation should include field log books and field measurement forms.

- Standard test methods shall be applied to field measurements and samples submitted for offsite testing or analysis. Examples of standard test methods *include Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA SW-846), American Society for Testing and Materials (ASTM) standard test methods, and other equivalent recognized and accepted methods. If non-standard methods are used, the method shall be described and approved by our customer prior to conducting the work.

3.1.3.3 Assessment

Data assessments shall be completed on data collected prior to their use. These assessments will be used to confirm that the data are acceptable for their intended use and meet the performance criteria established during the project planning.

Data validation or verification shall be performed for laboratory data received and used in support of project goals. The level of data validation shall be consistent with applicable regulatory requirements, customer procedures, and professional due diligence. Data review may range from (1) an independent third party validation as specified by regulatory agencies or customer requirements, such as EPA requirements under *Guidance on Environmental Data Verification and Data Validation* (EPA QA/G-8) EPA/240/R-02/004, November 2002, or (2) be limited to cursory review from a qualified professional to ensure there are no key analytical issues/deficiencies that prevent the data results from being used.

Other data assessment activities shall be completed to the level specified by regulatory or customer requirements and include:

- Evaluating field records for completeness and consistency

- Ensuring a sufficient amount of data was collected to achieve the established degree of precision

- Determining if the data are of appropriate quality to achieve their intended use and make a decision with an acceptable established level of confidence or make an estimate within a desired level of uncertainty

These data assessment activities shall be documented in project reports that use the subject data.

3.1.3.4 Storage

Data storage requirements shall be defined at the beginning of data collection efforts and may involve electronic or hard copy storage based on customer requirements and usage. Data shall be managed to ensure its integrity and reproducibility.

Data integrity shall be maintained through use of electronic data deliverable (EDDs) procedures and database management systems. When manual data transfer is conducted, QC procedures

shall be established and followed to ensure the accuracy of the data transfer. Both electronic and manual procedures shall be defined at the program or project level depending on customer requirements and needs.

Data reproducibility shall be maintained through data storage security and controls. Electronic data shall be stored in secured servers or data storage devices that include standard back up protection protocols. Hard copy data shall be maintained in project files or other secured areas. Records shall be legible and stored and retained in such a way that they are readily retrievable. Data storage facilities shall provide a suitable environment to prevent damage, deterioration, or loss. Both hard copy and electronic files shall be maintained as required by the contract or for at least 10 years as per Tetra Tech requirements.

3.1.4 Records

The QA/QC records generated through the implementation of the requirements of this section of the QPM include the following:

- Approved project-specific SAPs and revisions
- Laboratory data reports and/or EDDs
- Data Validation Records

3.2 Document Deliverables

3.2.1 Purpose and Scope

This section of the QPM identifies QA policies and practices to ensure that the processes for development of document deliverables are defined, verified, and controlled. The policy for document deliverables shall identify relevant activities pertaining to the preparation of high quality documents. In addition, the basic QA policy for IT Deliverables is also specified.

3.2.2 Responsibilities and Authorities

The Tetra Tech managers directing or supporting project-specific tasks are responsible for the following requirements as appropriate:

- Approving deliverable preparation procedures, instructions, specific personnel, applicable requirement documents, authorities, and subsequent revisions or cancellations
- Ensuring that persons knowledgeable in the technical disciplines and appropriate administrative details perform reviews
- Providing reports regarding the status and quality of document deliverables and results of assessment activities to program/project management, as well as supporting organizational management

The project quality lead is responsible for the following:

- Ensuring independent review processes are established and followed for deliverable preparation and production
- Ensuring incorporation of appropriate quality requirements in document preparation procedures
- Developing an assessment schedule of and overseeing document reviews

- Providing the project manager with assistance to evaluate and control activities related to deliverable completion and production

3.2.3 Requirements and Instructions

Tetra Tech is committed to producing quality written documents and IT work products that respond to the customer's needs, fulfill contract requirements, and are in accordance with sound engineering and scientific practice. This policy requires that review procedures be established and implemented for project deliverables. Tetra Tech subscribes to ANSI's definition of peer (technical) review and the expectations that written work products will undergo independent peer reviews as defined by ANSI:

> "A peer review is conducted by qualified individuals or organizations independent of those who performed the work, but are collectively equivalent in technical expertise to those who performed the original work. A peer review is conducted to verify that activities are technically adequate, competently performed, properly documented, and satisfy established technical and quality requirements. A peer review is an in-depth assessment of the assumptions, calculations, extrapolations, alternate interpretations, methodology, acceptance criteria, and conclusions pertaining to specific work and to the documentation that supports them. Peer reviews provide an evaluation of a subject where quantitative methods of analysis or measures of success are unavailable or undefined."

Our procedure was established to ensure consistent application of the review process cited above.

3.2.3.1 Deliverable Reviews

It is Tetra Tech's policy that document deliverables undergo a peer review by a qualified professional independent of the project. Tetra Tech's deliverable review process typically requires technical, editorial, and QC reviews. Our review process is applicable to most technical reports, plans, and other written deliverables that we prepare. We have also tailored our review process to address the unique customer and IT requirements. The following sections describe our deliverable review procedures for each deliverable type.

Standard reports and plans will typically undergo a two- or three-level review consisting of technical and QC reviews, as well as editorial reviews where warranted. Each review step is described below.

Technical reviews shall be completed by experienced employees with direct knowledge of the technical areas addressed by a deliverable and independent from the project activities. The purpose of the technical review is to evaluate the overall technical quality of the deliverable. This is done by evaluating whether the project background is presented appropriately; the data collection and discussion are sufficient to support the deliverable's conclusions; the overall technical approach presented in the deliverable is valid; the conclusions and recommendations are justified; and the deliverable fulfills the requirements of the SOW. Multiple technical reviewers may be used for deliverables that have significant content in more than one technical area (for example, geology and engineering).

Editorial reviews are recommended for all reports and necessary for sensitive documents or documents prepared for public review. Editorial reviews should include spelling and grammar checks and should evaluate the editorial quality of written deliverables, including: whether the purpose is clearly stated; the discussion is coherent and consistent; the deliverable is clear, readable, and well-organized; data are clearly presented in tables and figures; and an appropriate summary is included. In addition, editorial reviewers may help authors plan and organize documents before the writing process begins.

The QC review is a final check on each deliverable before it is submitted to the customer. The QC review focuses on ensuring that (1) technical and editorial review comments on the deliverable have been addressed, (2) the deliverable is consistent with overall program and project goals, and (3) the deliverable does not contain assertions or statements that could expose either the customer or Tetra Tech to excessive risk. The QC reviewer can require additional technical or editorial reviews of a deliverable if questions remain about technical or editorial issues.

The deliverable is released when the technical, editorial, and QC reviews have been satisfactorily completed and documented. On larger programs, the Tetra Tech contract quality lead, or representative, will monitor the deliverable review process to ensure that any significant quality issues have been resolved.

In some cases, more or less stringent review levels may be appropriate. Tetra Tech project managers will discuss the required level of review for the project with the quality lead, and agree on an appropriate review level during the planning stages for each deliverable. For projects that are part of a missions support program for the customer, the program's assigned quality lead, or representative, should be involved in defining the review level to be applied to a project or work product. Use of a less stringent review level requires concurrence from the contract quality lead or assigned final QC reviewer in advance of starting the review process. Either the project work plan or other planning materials developed for the project (e.g., proposal technical approach, project execution plans) are used to document the deliverable review requirements established for the project.

3.2.3.2 Information Technology Work Products

Tetra Tech's internal review process is applied to IT work products to ensure that customer needs are met. We develop, calibrate, evaluate, and test multiple IT work products, such as mathematical models, decision support software, geographical information system databases, and web sites. The review process applied to IT work products is similar to plans, reports, and other written documents, but includes the additional IT components. Typical components of our IT work products include a database, programming, a user interface such as a web site, technical content, and other content (text and graphics). Each component undergoes an appropriate level of review to ensure the quality of the entire product.

3.2.4 Records

The QA records generated by implementing this section of the QPM include the following:

- Document Review Records
- Any additional quality records generated by specific procedures, work instructions, or SOPs referenced in contract-specific documents, which may be listed within the policies and practices listed above

3.3 Engineering Design

3.3.1 Purpose and Scope

This section of the QPM establishes the quality policies and practices to ensure that designs are completed using sound engineering, architectural, and scientific principles and appropriate standards. Design activities include the technical and management processes for all stages of design including concept design and planning, formulation of design basis, contract document production, construction administration (CA), and operations documentation and training. Operating unit specific and project-specific requirements for design services are discussed in the individual operating unit and contract-specific plans.

3.3.2 Responsibilities and Authorities

Tetra Tech project and technical managers are responsible for ensuring that facilities and technologies and their components are designed in accordance with contract scopes and applicable industry and customer codes and standards. Tetra Tech personnel performing design activities are responsible for following the policies of this QPM and supplementary procedures specified by Tetra Tech operating unit or project-specific requirements.

Project managers have primary responsibility for ensuring the implementation of QC measures specified in this QPM and in operating unit and/or project specific standards. Project managers or operating unit management may appoint others, such as a project quality lead and/or independent technical reviewers, to oversee, direct, and perform QC functions. Project managers and/or quality designers are responsible for delineating necessary QC procedures relating to design documents, including reports, drawings, specifications, and other documents instructive to the project design. These procedures include, but are not limited to:

- Frequency and scheduling parameters for quality reviews
- Method of documentation of review comments
- Method of documentation for back-checking and tracking the dispensation of review comments in project documents
- Method for sign-off and approval of project design documents

In addition to any other quality measures specified for a project, design drawings and specifications shall be reviewed and approved by a registered professional in responsible charge for each applicable discipline as designated by the project manager. Regulations under which professional licenses are issued prohibit registered professionals from placing their seal and signature on any design documents that are not prepared under their responsible charge. Although the exact wording used to describe responsible charge varies with licensing authorities, in every case the professional is required to be actively involved throughout the design process and to have authority over the technical work that ultimately produces the documents. Reviewing documents after they have been developed by others without being involved throughout the design and development process does not constitute being in responsible charge.

Project managers are responsible for ensuring that technical reviews and other assessments, such as constructability reviews, are performed at appropriate stages throughout the design process. Project managers shall ensure that design documents have been reviewed by the designated responsible parties before approving those documents.

Project managers are responsible for ensuring that quality procedures are accounted for and incorporated into project schedules, particularly the necessary time for evaluating and addressing review comments.

3.3.3 Requirements and Instructions

All design personnel shall use applicable engineering procedures for preparation, review, and approval of drawings, specifications, and other design-related documents. Engineering and design procedures cover preparation, review, and approval of calculations; reports, drawings and specifications; CA related documents, such as requests for information (RFI) and engineering change notices (ECN); O&M manuals and training materials; and record drawings. The requirements apply to documents produced by Tetra Tech and those produced by Tetra Tech's subcontractors and vendors.

3.3.3.1 Data Utilized for Design

Data utilized for the purpose of design shall be reviewed by the appropriate technical leads for accuracy and completeness and to ensure that it is of an adequate level of detail to complete the design. Data utilized for design include, but are not limited to, the following types of information:

- Maps and plans of existing conditions such as utility maps or existing building plans
- Land surveys
- Geographic Information System (GIS) data
- Geotechnical reports
- Equipment data sheets

For data received from customers, agencies, subcontractors, technical vendors, or other external sources:

- The customer shall be notified as to what data received from outside sources is being relied upon for design purposes since Tetra Tech's ability to confirm such data is limited. If field verification of such data, beyond what is contractually required, is desired by the customer, the manner in which this verification will occur shall be determined.
- When data, such as geotechnical reports or surveys, are received from subcontractors or technical vendors under contract with Tetra Tech, the data shall be reviewed with the subcontractor or vendor. The review shall be conducted to ensure that the data meet contract requirements and include adequate project-specific evaluations and recommendations when required.

Data utilized for design shall be referenced in the design basis as described in the following section.

3.3.3.2 Design Basis

Tetra Tech creates a design basis for each project to delineate the applicable codes and standards, as well as project- and site-specific design factors, which form the basis for design calculations and methods. The design basis may be as simple as a single sheet or may comprise a manual depending on the size and complexity of the project. The design basis normally will be a "living document" that should be updated as needed during the course of a project. We maintain revision histories and prepare project communication plans that document the method for communicating updates and changes to the design basis. At a minimum, the design basis shall include the following information:

- Applicable codes and standards
- Project site information including location and environmental factors such as climate when applicable to the project
- Approved calculation methods
- Approved design software, including software versioning

- References to data utilized for design, including issuance and/or revision date, applied to maps and plans of existing conditions, geotechnical reports, surveys, and other items as appropriate

3.3.3.3 Design Calculations

Design calculations should be completed following the policies and practices listed below:

- Calculation methods shall be reviewed by registered professionals, scientists, or other qualified senior personnel to ensure that the calculation method is in line with project design criteria, industry, and code standards.

- All calculations shall be completed in an organized and legible fashion with adequate narratives, attachments, etc. to clearly document the purpose of the calculation.

- Calculations may be performed manually; through "computer-assisted" methods such as Excel spreadsheets, MathCAD, etc.; or via design software purchased/licensed for use by Tetra Tech.

- Manual calculations shall be completed on Tetra Tech and/or project approved calculation sheets.

- Computer-assisted output shall be "page formatted" for printing so that the output fits properly on printed sheets and includes headers/footers as needed to include requirement calculation documentation.

Manual and computer-assisted calculations shall include initials of the person performing the calculation ("performed by") and the review/approver ("approved by") on each calculation sheet. Project and design specific information including the name of the project; applicable area of the project; purpose of the calculation; date the calculation was performed; and design assumptions, parameters, and variables shall be clearly indicated. Sheets shall be numbered to indicate "Page _ of _" on each sheet. Hand and computer-assisted calculations shall include references to specific sections in codes and standards, where appropriate.

For design software, methods for validating both the computer input data and output results shall be delineated in the project quality plan. Design software often includes many options for creating output files of both input data and design results. The method of creating output files and how such files are named and stored shall be established for the project. This is particularly important when the output data is presented to and/or reviewed by the customer or approving agencies. The method for documenting the review and approval of design software output shall be determined for the project – this may include a "performed by/reviewed by" cover sheet, signing hard copied output, or other means of clearly documenting that necessary reviews have occurred.

Calculation packages, which may include hand calculations, computer-assisted calculations, design software output, and other attachments, such as equipment cut sheets, shall be well organized and include a table of contents, clearly labeled exhibits/attachments, and shall include sufficient narratives to clearly describe the purpose of the calculations.

Because design software is often replaced with new versions incompatible with past versions, or software falls completely out of circulation, it is important that "soft" copies of design software results are not relied upon as the sole means of documenting design results. In addition, not all reviewers of design data (or other parties needing to view design data) will have access to or familiarity with the design software used. Output files of final design results in file formats, such as PDF, should be generated and clearly named and stored in the project file in an organized manner. It is also important to supplement design software output with additional information that clarifies the design software results. For example, finite element software used for structural

design relies upon member numbers to key output to the structural model. As such, it is important to include diagrams of the model which clearly identify the member numbering from the structural model, and which orient the model to the actual structure being designed (building grid, north arrow, etc.) so that the output can be readily keyed to the members. The use of reliable design software can save time and improve accuracy and design efficiency, but it is important to utilize some of that time saved to document and organize design software output.

Calculations for major design components must be checked by an independent reviewer. The project manager or project quality lead will make a determination of which major components require independent review. The calculation "approver" may not be the calculation "preparer." Review and approval is performed by licensed design professionals or other senior science/technical professionals. In case of a disagreement between the designer and the checker, the project manager is consulted. The project manager, if not technically qualified to resolve disagreement, will seek guidance from an appropriate technical expert to do so.
As a recommended best practice, checking of calculation sheets shall be performed on copies of the originals. They must be dated and signed on the cover page and signed or initialed on subsequent pages, then returned to the designer. At the point of agreement between the designer and the checker, original sheets shall be signed or initialed and dated. Electronic signature is acceptable if an acceptable method is established for the project. Calculation sheets shall be organized, indexed and kept in the permanent project file.

3.3.3.4 Reports

Reports include the following types of documents, which can comprise part of the project design deliverables:

- Design Basis Manual
- Geotechnical Report
- Supporting Calculations
- Feasibility Study

Reports should be completed following the policies and practices listed below:

- Report quality is primarily the responsibility of the project manager and lead engineer.
- Reports should be initiated from approved contract, or Tetra Tech business group/operating unit report templates, whenever applicable, and should comply with applicable Tetra Tech style guides.
- Report editing/word processing should be done only by personnel competent in the word processing software so as to maintain the integrity of the document formatting.
- Reports shall be reviewed and approved by senior level professionals.
- Reports shall be signed and sealed by licensed professionals as required in the project state or province.

In addition to technical accuracy and compliance with scope, reports are reviewed for clarity of wording, graphics standards, grammar/spelling, consistency, and overall document layout and presentation.

3.3.3.5 Contract Drawings

Contract documents consist primarily of contract drawings and specifications. Contract drawings include any engineering, architectural, or planning drawings prepared for a specific project. Specifications are discussed in the subsequent section. Contract drawings should be completed following the policies and practices listed below:

- Contract drawing quality standards should be consistent with operating unit and/or business group specific guidelines or standards manuals.
- Drawing sets shall be well organized and arranged in a consistent format and order.
- Drawings shall be checked by the original designer after the calculations are checked. The checker should have a copy or access to final checked calculations.
- After drawing markups/comments are generated and the comments are addressed on the drawings, the markups/comments must be “back-checked” against the drawings to confirm that review comments have been addressed.
- Checking shall be performed on prints, which should be dated and signed; or through operating unit or business group approved software specifically designed for drawing review. Drawing review software includes applications such as AutoDesk Design Review. When drawing review software is utilized, the process for naming and storing files and for the workflow associated with checking and back-checking should be included in the project QA/QC plan.
- Original sheets and electronic files shall be kept in the project files. Where practical and contractually permitted, prints should be scanned and stored electronically to minimize paper storage. The project manager establishes, in the project QC plan and/or document control plan, the procedures for storing and naming files.
- Final design review prints/files shall be kept on file, at minimum, until construction of the project is completed and the project is commissioned, and/or placed in service under the owner’s or operators control.
- Drawings shall be signed and sealed by licensed professionals as required in the project state or province.

Drawings must show the names (initials are acceptable) of the designer (“designed by”) and the drafter (“drawn by”) unless a client-specific title block excludes this information. If the drawing title block does not allow for recording of “designed by” and “drawn by” information then that information should be included in a non-printing area or layer of the drawing, or included as metadata to the drawing file. Drawings must be dated, sealed, and signed in accordance with the client's requirements.

Checking of drawings includes coordination with project specifications to avoid conflicts and/or unnecessary redundancy between drawings and specifications. All parties engaged in checking contract drawings should have a clear understanding as to the information that is intended to be included on the drawings and that which is intended to be included in specifications. Drawing reviewers must also be familiar with project cost and quantity estimates so that drawings can be verified against probable costs and estimated quantities.

Drawing reviews include considerations for constructability, operations, and maintenance, which should be performed by senior professionals with adequate field and/or construction experience. Drawing reviews include CAD standards and general graphic and presentation standards, which should be performed by senior designers familiar with the applicable standards for the project.

Electronic CAD files should also be reviewed for adherence to CAD standards. When electronic deliverables are part of the contract scope, printed copies are not sufficient to review for adherence to CAD standards. Electronic review need not be performed on all drawings (unless a CAD standards checking software is utilized), but should be performed on a sufficient sampling of drawings to ensure that standards are being properly applied across all project disciplines. This review should include adherence to file naming and file organization standards. Keeping CAD files well organized and deleting or archiving obsolete files is a critical aspect of contract drawing quality. Project managers are responsible to ensure that sufficient review of electronic CAD files is occurring.

At a minimum, contract drawings shall be reviewed for completeness relative to project scope, adherence to applicable codes and standards, consistency and accuracy with design calculations and existing conditions, CAD standards, graphic presentation clarity, consistency across drawing set, constructability, operability, and maintainability at 30 percent, 60 percent, and 90 percent approximate levels of completeness.

3.3.3.6 Specifications

Specifications should be completed following the policies and practices listed below:

- The project specifications and/or drawings should clearly indicate how the specifications work in conjunction with the contract drawings.
- Specifications should be started from approved specification master templates – either those provided by the client or an approved Tetra Tech specification master. Care should be taken to ensure that each project is started using the most current master specification.
- Tetra Tech master specifications shall be periodically reviewed and updated to published industry specification standards, such as MasterSpec to ensure current references to codes, standards, etc.
- Specification editing shall be performed by, or edited under the direction of, senior level technical professionals or designated specification writers.
- Care should be taken to ensure that embedded information, such as notes to editors and specification selection options, is visible to those reviewing specifications so that the choices, instructions, explanations, etc. are visible to the specifications editor.
- Copies of the original specifications with markups (on printed copies or electronically) should be maintained in project files so that those reviewing edited project specifications can refer back to the original to review choices made, including additions and deletions.
- Specifications shall be signed and sealed by licensed professionals as required in the project state or province.

Because specification documents generally include sophisticated formatting, it is important that personnel experienced in specification editing, and in the word processing software (MS Word, etc.) prepare original specifications for preliminary project editing and perform the actual editing. Tetra Tech utilizes, on some projects, specification editing tools that facilitate the specification production process. These tools rely on the formatting styles, embedded field codes, hidden text, etc. to properly function; therefore, it is important to maintain the integrity and format of the electronic specification documents.

Reviews of specifications should be coordinated with other major reviews of contract drawings. Specifications should be reviewed to ensure that materials and work delineated on contract

drawings are covered by the project specifications unless they are sufficiently specified on contract drawing notes. The reviews should ensure that drawings and specifications are well coordinated.

Specification reviews should include consideration of submittal requirements to ensure that contractors provide shop drawing and other required materials. These items will allow Tetra Tech to have the product material needed for compilation of O&M manuals and for commissioning work.

3.3.3.7 Checking Reports, Drawings, and Specifications

Procedures for making review comments on reports, drawings, and specifications, and for back-checking those comments after they are addressed, shall be clearly delineated for each project; and whenever possible shall follow established practices. This is particularly critical on large multi-disciplinary projects where numerous reviewers may comment on the same document. Examples of markup and back-check procedures include:

- Establishing color codes for each reviewer.
- Requiring yellow or pink highlighting of review comments after the comment has been addressed.

Establishing review checklists for use on the project is encouraged to ensure consistency of review comments and to clearly establish expectations for those performing design or writing reports and specifications. Project review checklists should be based on well-established checklists for specific disciplines or designs, modified for project ad client specific standards.

3.3.3.8 Using Appropriate Wording in Reports, Drawings, and Specifications

While the technical accuracy of reports, drawings, and specifications is very important, the language used to convey the technical information is also critical. Language that conveys the technical meaning, but may be interpreted in unintended ways, and have adverse legal consequences, should be avoided. Examples of good and bad practice include the following:

- Be instructive, not passive, in drawings and specifications. For example, a note on a site demolition plan pointing to an existing retaining wall indicating, “RETAINING WALL TO BE REMOVED” could be interpreted by the contractor as meaning it will be removed by someone else, when the intent is that the contractor include removal of the retaining wall in their bid. A more appropriate drawing note for this instruction is simply, “DEMOLISH AND REMOVE RETAINING WALL”.
- Avoid wording that conveys a level of effort or diligence that is beyond industry standard of care or contract requirements. This includes inappropriate use of words such as “all,” “every,” and “always.”
- Do not use terms like “inspect” or “approve” when Tetra Tech is only involved in design and CA. These terms should only be used when Tetra Tech’s contract scope includes construction and/or construction management (CM) responsibilities. Instead, terms such as “observe” and “review” are more appropriate.
- Avoid terms such as “Draft” and “Final” when issuing documents and instead use terminology such as “Issued for Use” and “Issued for Review”.
- When Tetra Tech’s scope is limited to design and CA services, avoid words (and actions) that imply responsibility for jobsite safety, which are the responsibility of the contractor, not the design consultant.

3.3.3.9 Quantities and Cost Estimates (Opinions of Probable Cost)

Specifications, quantities, and cost estimates should be completed following the policies and practices listed below:

- The client's expectation of plus/minus accuracy for quantity and cost estimates should be understood so that those reviewing estimates ensure appropriate level of detail and that the level of contract document completeness is able to support the expected/desired level of accuracy in the estimate.

- All calculations of contract quantities shall be based on the contract documents and are treated in the same manner as design calculations.

- Estimates shall include adequate narratives, assumptions, and other documentation.

- Cost estimates performed during design must always be referred to as approximate – the term "Engineer's (or Architect's) Opinion of Cost" is a preferred terminology.

- Cost estimates shall be reviewed and approved by senior level design professionals.

3.3.3.10 Construction Administration

CA is essentially the continued involvement by the design consultant during project construction. CA is distinct from construction management (CM), which is discussed in this QPM in Section 3.4. When Tetra Tech performs CA, it generally means that Tetra Tech is not performing CM. When Tetra Tech is contracted to provide CM services, it may mean that Tetra Tech is directly responsible for CA (if design is also part of Tetra Tech's scope) or that CA is performed by a design subcontractor to Tetra Tech.

CA includes issuance of addenda, review of shop drawings and other forms of submittals by the construction contractor, answering RFIs, providing updated design information through ECNs, or Architect's Supplemental Information (ASIs), performing periodic site visits and issuing field observation reports, and performing punch lists at substantial completion and closeout. CA services should be completed following the policies and practices listed below:

- For addenda issued during the bidding process, the same review procedures that apply to contract drawings and specifications (addenda can apply to either) apply since an addendum represents an amendment to or correction of the contract documents.

- Copies of submittal reviews should be maintained in the project file.

- RFIs should be responded to by the original designer or designated CA representative. Responses must be reviewed and approved by the engineer or architect of record for the affected contract documents before issuing to the client or construction contractor.
- Care should be taken when responding to RFIs that the responses are consistent with contract documents. If the RFI is requesting information already present in the contract documents, the RFI should be responded to by simply pointing the contractor to the relevant information in the contract drawings and/or specifications.

- The same procedures that apply to contract drawings and specifications apply to ECNs and ASIs.

- The same procedures that apply to reports (Section 3.3.3.4) apply to field reports and punch lists.

- All reports shall be prepared using contract or business unit specific standard report format.

Shop drawings and other submittals shall be reviewed for conformance to contract documents and stamped by Tetra Tech, but the construction contractor is still responsible for conformance with the contract documents unless specifically instructed by Tetra Tech to modify the design. Tetra Tech is responsible for providing a thorough and competent review of contractor submittals, but "approval" of these submittals does not de-obligate the contractor from constructing to contract document specifications unless specifically authorized to deviate.

Shop drawings often consist of assemblies involving multiple technical disciplines, such as HVAC equipment requiring electrical power. Shop drawing reviews are performed first by the responsible designer/engineer/architect for the primary discipline. They should also be reviewed and signed by the responsible parties in other affected disciplines. Shop drawings for multi-discipline assemblies can also affect individual shop drawings for other elements of the project. For example, an electrical engineer should see, and sign off on, the voltage/electrical characteristics for any equipment that is submitted to a mechanical engineer. Multiple reviews are important for coordination and review of other submittals that an electrical engineer will receive, such as wiring and control panels. Another example would be a concrete/rebar shop drawing for a mechanical equipment pad, which includes a bolt pattern for mechanical or electrical equipment mounted on the pad. Depending on which item is submitted for review first (the pad or the equipment), it is important that a structural engineer engage the mechanical/electrical engineer or the mechanical/electrical engineer engage the structural engineer in the shop drawing review process.

Detailed review of shop drawings and other submittals should be performed by the original designer or by a shop drawing review specialist familiar with the contract documents. After detailed review, submittals, particularly those representing critical or complex aspects of the design, should be spot-checked by a senior level design professional, preferably the engineer or architect of record, before release to the construction contractor.

3.3.3.11 Record Drawings

Some contracts require record drawings, also known as "as-built" drawings where contract drawings are updated to reflect any changes from the "approved for construction" contract drawings. The same procedures that apply to contract drawings (Section 3.3.3.5) apply to Record Drawings, plus the following:

- Even though it is common terminology, the term "as-built" should be avoided as this can imply confirmation of constructed conditions that is not practical or contractually required for the consultant.

The project files shall be reviewed to confirm that the contractor has provided a complete and orderly set of as-built data, per their contract obligations before proceeding with record drawings. It is generally the construction contractor's responsibility to maintain accurate records of changes from the approved-for-construction set of contract drawings.
Whenever possible and when feasible under contract terms, record drawings shall be verified through observations of field conditions.

3.3.3.12 O&M Manuals and Training

Designs involving industrial facilities and plant work, such as water or wastewater treatment facilities, often include an O&M manual and/or training component, where documentation and/or training is provided to the client's plant/facility operators. The scope and nature of this type of work varies widely depending on the industry and client, but the following considerations and procedures should apply in all cases.

The purpose of an O&M manual is to provide the owner/operator with the information needed to understand the design criteria for the facility, operate the facility within the design parameters, maintain the equipment, troubleshoot effectively when issues arise, understand safety issues related to equipment and chemicals, and monitor the plant performance for compliance with functional and regulatory requirements. As such, the clarity and organization of the O&M material is extremely important.

Assurance should be made that as-built information is in hand before finalizing O&M material. Product data, whether links to vendor sites or hard copies of data sheets, should be based on the actual final products installed in the field. Vendors should be consulted to ensure that referenced product data reflect proper O&M instructions for their products.

Whenever possible, O&M and training material should be prepared and/or reviewed by staff with plant operation experience.

3.3.4 Records

The QA records generated by implementing this section of the QPM shall include the following:

- Checked calculations with applicable review and approval signatures
- Approved reports, drawings, specifications, and related design documents with applicable review signatures, including sealing of 100 percent design documents generated in support of design-engineered systems

3.4 Construction Management

3.4.1 Purpose and Scope

This section of the QPM establishes the quality policies and practices to ensure CM projects are performed under suitably controlled conditions according to the drawings, specifications, and requirements of the approved design. Note that CA, which is distinct from CM, is covered under Section 3.3 Design.

3.4.2 Responsibilities and Authorities

The Tetra Tech managers of CM projects are responsible for ensuring applicable QC activities are followed as per the requirements of this QPM and of the approved designs. The project manager is responsible to ensure that CM projects are performed under suitably controlled conditions according to the requirements of the approved design.

The project construction quality manager is responsible to ensure the requirements of this section of the QPM or project specific construction QC plans are properly applied. The project construction quality manager has the authority to stop construction if he or she observes that quality or health and safety practices are not being followed correctly.
Personnel assigned to QC of construction projects are responsible for the following inspection activities:

- Developing written procedures for the inspection of items when standard specifications and drawings do not provide an adequate basis for inspection
- Preparing reports for inspections performed
- Controlling inspection procedures and revisions

- Scheduling and coordinating training for assigned QC personnel in advance of implementation of the applicable inspection documents

Personnel assigned to QC activities are responsible for performing inspection activities in accordance with the appropriate project design documents.

3.4.3 Requirements and Instructions

CM is the process of professional management applied to a planning, design, and construction project from inception to completion for the purpose of controlling time, scope, cost, and quality. This process applies integrated systems and procedures by a team of professionals to achieve the owner's project goals. These systems and procedures are intended to bring each team member's expertise to the project in an effective and meaningful manner. The essence of good CM is professionalism and teamwork, both within the CM firm and among the project team. The two primary components of the CM process are inspections and testing.

3.4.3.1 Inspections

Inspections are planned and executed at the project level to verify conformance of a project and its components to the specified requirements. In general, Tetra Tech considers construction inspection to be a part of the QC system in a project and inspections are described in project-specific procedures that specify the characteristics subject to inspection and the inspection methods. Qualifications of inspection personnel are evaluated, approved, and documented at the project level. Inspector qualification records are maintained in project files in accordance with accepted procedures for document control.

Inspection documents are prepared based upon the quality requirements contained in purchasing documents, specifications, QC documents and procedures, work plans, QAPPs, compliance plans, risk mitigation documents, and other applicable codes and standards. Characteristics to be inspected, methods of inspection, and acceptance criteria must be identified during the inspection planning process. If mandatory inspection hold points are required, the specific hold points are indicated in the work control documents. Where mandatory inspection hold points are indicated on work control documents or procedures, work may continue beyond a hold point only with the written approval of the QC supervisor or designee. Work control documents shall specify or reference, at a minimum, the activities to be performed, the acceptance criteria, by whom the activities are performed, and the sequence in which the activities shall be performed. When inspections utilize a sampling program, the sampling plan is identified in the inspection documents. Sampling justification is based upon recognized standard construction practices and valid statistical methods; successful past experience; and the complexity and function of the activity, item, or service inspected.

Inspectors must have education, experience, and training to ensure their competence performing their assignment. Competence is developed by providing one or more of the following:

- Working knowledge of appropriate regulatory documents, practices, codes, and standards
- Training/orientation in planning and performing inspections
- On-the-job training under direct supervision of an experienced, qualified inspector
- The requirements for initial qualification of inspection personnel are based upon consideration of records of education and experience, test results, where applicable, and results of capability determination.

Personnel performing inspections shall maintain their proficiency through regular, active participation in the inspection process and/or review and study of codes, standards, and procedures related to QA programs and program inspection.

Inspection of items and facilities under construction or otherwise in-process are planned and executed at the project level in accordance with procurement document, project work plan, and QAPP requirements. Indirect control by monitoring or surveillance of process controls, equipment, and/or personnel may be utilized if direct inspection is not possible, but the indirect controls must be specified in instructions or procedures.

Final inspections are executed at the project level and include records review, direct inspection (where possible), and review of resolution of nonconformances identified in prior inspections. Completed items are inspected in accordance with project-specified procedures for completeness, marking, calibrations, and any other characteristics required to verify the quality of the item and its conformance to the specifications. If an item is modified or repaired subsequent to its final inspection, re-inspection is required to verify continued conformance and acceptability for use.

3.4.3.2 Testing

Tests are required to demonstrate that items will perform satisfactorily in service and are identified and documented. Test requirements apply to all phases of a testing program, including but not limited to functional testing, proof testing, acceptance testing, and operational testing. In general, Tetra Tech considers testing to be a part of the QC system in a project. Tests are described in project-specific procedures that specify the characteristics subject to test, the test methods, and include or reference the acceptance limits contained in applicable technical documents.

Test procedures must include the following:

- Test configuration and objectives
- Use of trained personnel to witness and/or perform tests
- Identification of test equipment and the item to be tested
- Use of devices calibrated for the performance of tests
- Performance of tests under proper environmental conditions
- Documentation of test results
- Acceptance criteria for test requirements

Alternative procedures, such as ASTM methods or other consensus methods, may be used.

The project quality manager or designee reviews project-specific test procedures for inclusion of the information noted in the above section. Test procedures may not be used until approved. Test results must be documented and evaluated by a designated, responsible individual to ensure that requirements and acceptance criteria have been satisfied. When tests are performed for design purposes, the results must be evaluated by the responsible design organization.

3.4.4 Records

Inspection records and documents shall be maintained in project files in accordance with accepted procedures for document control. Records of training, education, experience, and

certification of inspectors shall be maintained for personnel who are performing inspections or who have previously performed inspections. These records shall be retained for the same period of time as that required for the inspection reports with which the inspection personnel are associated. Inspection records must indicate the item inspected the date of inspection, the type of observation, and whether or not the items or services inspected meet the applicable quality requirements. They must reference actions taken regarding nonconformances and must be signed by the inspector.

Records pertaining to testing shall be maintained in project files in accordance with accepted procedures for document control. Test reports shall be reviewed and signed in accordance with procedure requirements to ensure that test requirements have been satisfied.

3.5 Construction

3.5.1 Purpose and Scope

This section of the QPM establishes the quality policies and practices to ensure that construction, fabrication, manufacture, and erection of engineered systems are performed under suitably controlled conditions according to the drawings, specifications, and requirements of the approved design.

3.5.2 Responsibilities and Authorities

The project manager is responsible to ensure that construction, fabrication, manufacture, and erection of engineered systems are performed under suitably controlled conditions according to the requirements of the approved design. The project manager is also responsible for ensuring QA/QC activities are implemented as per the requirements of this QPM, the approved design, and Construction Quality Management Plans (CQMPs).

The project construction quality manager is responsible to ensure the requirements of this section of the QPM or project-specific CQMPs are properly implemented. The project construction quality manager has the authority to stop construction if he or she observes that quality or health and safety practices are not being followed correctly.

3.5.3 Requirements and Instructions

The construction of engineered technologies shall be coordinated among applicable organizations, and includes the following requirements as applicable to the specific contract(s) performed:

- Projects are developed, assembled, and inspected in a controlled and managed order
- The plan for building/fabricating the project is being followed and that trained resources are assigned with clearly defined roles and responsibilities
- Measuring and monitoring devices used during fabrication are properly calibrated and certified
- Inspection plans are followed to verify compliance to design requirements

This policy applies to Tetra Tech projects and operations with a construction component. It is applicable to mobilization, demolition, construction, testing, submittal, and commissioning activities during construction operations.

Construction Quality Management (CQM) is a system for producing construction complying with the terms of a contract. It encompasses all phases of work, such as submittals, procurement, storage of materials and equipment, coordination of subcontractor activities, and the inspections

and tests required to ensure that the specified materials are used and the installation is acceptable to produce the required end product. CQM consists of Construction Quality Control (CQC) and Construction Quality Assurance (CQA).

- CQC includes management and control of Tetra Tech resources and subcontractor and supplier activities so that the completed project will comply with the contract and specifications. CQC shall be conducted in-process.

- CQA consists of those inspections and tests carried out in completed portions of work to ensure the end product complies with the quality established by the contract. CQA shall be conducted after the fact.

CQM QC and QA efforts may be generically described in the “Deming Cycle” and “Shewhart Cycle” as “Plan-Do-Check-Act.”

3.5.3.1 Plan: Construction Quality Management Planning

The success of a project is highly dependent on proper planning. Quality is built into the project at the planning stage. CQMPs should define:

- Tetra Tech roles and responsibilities

- Customer requirements

- Key program elements

- CQM processes and steps to be taken

- Identified risks and mitigations

3.5.3.2 Do: Implementation, Self-Inspection, and Closeout.

Key elements to conducting the CQM implementation, self-inspection, and closeout process will include:

- Communicating the plan and its importance to the project team

- Making the plan visual using SOW, drawings, and specifications

- Explaining what the team needs to do to be successful and clearly defining quality objectives

- Executing the plan through procedural and regulatory compliance

- Providing status of where the progress is versus where it should be

- Detailed self-inspection of the work as it progresses

- Starting the close-out of the project when the project starts

3.5.3.3 Check: Checking Work

Before-during-after a project the check process is continually occurring. Checking is the process of collecting and evaluating information to the criteria established during the planning phase:

- Proposal checks are conducted through discipline reviews and red team reviews.

- Document (plans, subcontractor statements of work, specifications, drawings, forms) checks are conducted through peer reviews.

- Work is checked through inspections and testing, audits, and surveillances.

- Suppliers shall be evaluated by capabilities, qualifications/certifications, and management systems.

- Project reviews check the status of project objectives, including: schedule, scope, budget, and level of quality; quality objectives as defined in task implementation plans and work plans; and final customer reviews and acceptance.

- Deviations from the Plan Step as determined during the Check Step are fed to the Act Step.

3.5.3.4 Act: Corrective Actions

After checking is performed, either work continues as planned or deviations are identified. Once deviations are identified, the plan needs to be changed, the process needs to be changed, or a combination of the two. Acting on deviations identified in the checking step will result in a corrective action plan that will include lessons learned, event reports, corrective actions, and continuous Improvement.

3.5.4 Records

The QA records generated by implementing this section of the QPM include the following:

- Records of acceptance of items and equipment used for the construction of engineered systems

- Traceability documents, when records of acceptance are maintained on documents traceable to an accepted item

- Startup, maintenance, and calibration records

- Documentation of final senior management and customer approvals

3.6 Operation and Maintenance

3.6.1 Purpose and Scope

This section of the QPM establishes the quality policies and practices that shall be applied to systems that are operated and maintained by Tetra Tech. The policy is designed to ensure that such systems are operated and maintained according to management-approved designs, operating instructions, and guides. Any project-specific requirements shall be discussed in individual QAPPs, standard operating procedures, or other quality related plans or procedures.

3.6.2 Responsibilities and Authorities

Project managers are responsible for ensuring that engineered environmental systems are operated according to management-approved design, operating instructions, and guides.

Tetra Tech personnel operating engineered technologies or performing support activities are responsible for controlling the quality of their activities and supervising system operators. All

operators of engineered systems perform work processes and operations per the applicable requirements of the project-specific plans and procedures.

The project quality lead is responsible for ensuring that the requirements of this section of the QPM are implemented.

3.6.3 Requirements and Instructions

The goal of QA during the O&M phase is to ensure the ability of a product to perform its intended function by invoking quantitative and qualitative analyses using system and equipment parameters to develop predictive performance models. The operation of engineered systems requires the development of procedures, work instructions, and/or SOPs for individuals to perform required operations. These procedures, work instructions, and SOPs are developed and controlled per the applicable requirements of Section 2.5 – Documents and Records.

QAPPs for O&M projects should address at least the following during the O&M life cycle:

- Development and integration of standardized, measurable/repeatable system monitoring to ensure performance requirements are fulfilled
- Design and implementation of quality- and reliability-centered maintenance plans to ensure product requirements are fulfilled and maintained
- Participation in system optimization activities and design reviews of operating system performance to achieve increased system effectiveness, operational availability, and lower maintenance costs
- Review and resolution of system performance anomalies including collaboration with suppliers and customers as necessary to establish effective, timely preventive/corrective-actions

The operation of engineered environmental systems is coordinated among participating organizations and shall include the following requirements as applicable to the specific task(s) performed:

- Only qualified and accepted services or items and consumables are used during the operation of systems.
- Status indicators with tolerance limitations must be provided to indicate the operating status of systems and components as indicated in the approved design and operating instructions.
- Identification of components and complete engineered systems are maintained or recorded in a manner ensuring that identification is accurately established and maintained.
- Inspections or tests are performed and documented at various points during operation to verify conformity to operating specification or parameters. Such inspections or tests clearly indicate the acceptance criteria applied and reflect the importance of the item or service to quality.
- The handling, storing, cleaning, and preservation of equipment, components, and complete engineered systems are controlled during setup and operation to prevent damage, loss, and deterioration.

- Periodic preventive and corrective maintenance of engineered systems is performed and documented according to operating guidance and/or design specifications to ensure satisfactory performance of the system within established operating parameters.

- Critical spare parts are provided and maintained according to operating guidance and/or design specifications.

- All measurement and testing equipment affecting quality are of the proper type, range, and accuracy and are calibrated, maintained, and used according to approved design specifications.

- Equipment found unsatisfactory for acceptance testing must be recalibrated and certified within tolerances or replaced. The validity of any measurements and tests performed with out-of-calibration equipment is evaluated and such measurements and tests are repeated as required.

3.6.4 Records

The QA records generated by implementing this section of the QPM shall include the following:

- Acceptance records for startup and operation of components, equipment, and complete engineered systems

- Logs and other documentation of the O&M of systems and their components including review and sign-off by project management and/or quality team personnel

- Calibration records

3.7 Commissioning and/or Verification and Acceptance of Systems

3.7.1 Purpose and Scope

This section of the QPM establishes the quality policies and practices that shall be applied to construction inspection and operational acceptance testing of engineered systems and their components. Construction inspection and operational acceptance tasks are performed according to specified approved design specifications and operating documents. Project-specific requirements are discussed in individual contract QAPPs. For ease of discussion the term “commissioning” is used in this section to refer to “verification and acceptance of systems.”

3.7.2 Responsibilities and Authorities

Project managers are responsible for ensuring that engineered systems are properly inspected and tested and that appropriate submittals and information are specified in the contract documents obtained during construction to facilitate commissioning work. Inspection and testing of temporary facilities are performed as determined by the design engineer.

Project managers, personnel inspecting or testing engineered systems, or personnel performing support activities are responsible for documenting the outcome of inspection and testing related activities.

All operators of engineered systems perform work processes and operations per the applicable requirements of the project-specific plans and procedures.

The project quality lead is responsible for ensuring that the requirements of this section of the QPM are properly implemented.

3.7.3 Requirements and Instructions

The inspection and testing of construction and operation of engineered systems requires the development of procedures, inspection plans, test plans, and/or SOPs for individuals to perform required tasks. Commissioning of systems does not begin after construction, but is an integral part of the design and construction phases when key submittal and pre-commissioning requirements, which are critical to inspection and testing, are specified and verified.

Development of procedures is coordinated among participating organizations and shall include the following requirements, as necessary, for the specific task(s) to be performed:

- Specifications are reviewed to ensure that submittal and pre-commissioning requirements are appropriately specified in the contract documents for commissioning work.

- A specification section, such as "Starting of Systems," shall be included that clearly identifies the contractor's pre-commissioning and commissioning responsibilities. This should include requirements for master O&M training schedule, substantial completion submittal -- including items such as O&M manuals, equipment installation and pre-demonstration start-up certifications, as well as proof of receipt of specified items from manufacturers or suppliers -- and provisions for the cost of startup activities.

- Startup specifications and test plans should, at minimum, identify requirements for a pre-demonstration period; a demonstration period; personnel training; testing, adjusting, and balancing; and requirements for related systems. Schedule requirements for startup, verification, and acceptance should be clearly defined.

- Contract specifications should clearly identify the actions required by the construction contractor when systems or components do not meet performance specifications.

- Pre-commissioning requirements by the construction contractor or vendors as described shall be verified before performing final commissioning activities.

- Testing plans are developed to ensure key system performance requirements have been met. Testing plans are reviewed by experienced engineers and/or operators to ensure that the plans include proper procedures, safeguards, checklists, etc. to avoid damage to systems during testing and verification. Plans should include validation of measurement equipment to ensure that testing is grounded on accurate measurement of system performance.

- Testing of systems should not begin until the performance and operability of individual system components have been verified and documented.

- Testing is conducted by qualified and trained personnel with clearly defined roles and responsibilities.

- Test results are analyzed for conformance to expected system performance and any non-conformances are documented. Non-conformance documentation is reviewed to ensure that corrective requirements are clearly identified and in line with contract documents and performance requirements.

3.7.4 Records

The QA records generated by implementing the requirements of this section of the QPM include the following:

- Copy of approved procedures and test plans

- Documents indicating acceptance or rejection of either inspection and testing or re-inspection and retesting

- Equipment startup certificates and calibration records