ENVIRONMENTAL CONSULTING & MANAGEMENT

**ROUX ASSOCIATES INC**

402 HERON DRIVE
LOGAN TOWNSHIP, NEW JERSEY 08085 OFFICE: (856) 423-8800 FAX: (856) 241-4670

September 22, 21015

Erica Bergman
Bureau of Case Management
New Jersey Department of Environmental Protection
401 E. State Street - Mail Code 401-05
P.O. Box 420
Trenton, NJ 08625-0420

Re: Perfluoroaklyl Compounds Work Plan
West Deptford, New Jersey, Plant
Solvay Specialty Polymers USA, LLC
10 Leonard Lane
West Deptford, NJ 08086-2150

Dear Ms. Bergman:

As the Licensed Site Remediation Professional (LSRP) retained by Solvay Specialty Polymers USA, LLC (Solvay), I have reviewed the attached Perfluoroalkyl Compounds Work Plan for the West Deptford, New Jersey, Plant. The Work Plan includes as attachments a Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP).

Three paper copies are provided and each includes a CD with additional documents in electronic format, including the commercial laboratory Standard Operation Procedures (SOPs).

These materials are submitted on behalf of Solvay. Please feel free to contact Mitch Gertz with any questions.

Concurrent with this Work Plan, a letter from Chuck Jones is being submitted to respond to comments received from the Department on July 31, 2015 regarding data submitted to the Department in conjunction with the perfluoroalkyl compounds Work Plan from November 2013.

Sincerely,
ROUX ASSOCIATES, INC.

Thomas R. Buggey, LSRP #580659
Principal Hydrogeologist

cc: Mitch Gertz, Solvay Specialty Polymers USA LLC
Charles M. Jones, Solvay Specialty Polymers USA LLC
Nidal Azzam, USEPA Region II

Enclosures

integral consulting inc.

# Work Plan Perfluoroalkyl Compounds

## West Deptford, New Jersey, Plant

*Prepared for*
**Solvay Specialty Polymers USA, LLC**
10 Leonard Lane
West Deptford, NJ 08086

*Prepared by*
**Integral Consulting Inc.**
923 Haddonfield Road
Suite 300
Cherry Hill, NJ 08002

September 22, 2015

# WORK PLAN

# PERFLUOROALKYL COMPOUNDS

# West Deptford, New Jersey, Plant

*Prepared for*
**Solvay Specialty Polymers USA, LLC**
10 Leonard Lane
West Deptford, NJ 08086

*Prepared by*

integral consulting inc.
923 Haddonfield Road
Suite 300
Cherry Hill, NJ 08002

September 22, 2015

# CONTENTS

**LIST OF FIGURES** ..... **iii**

**LIST OF TABLES** ..... **iv**

**ACRONYMS AND ABBREVIATIONS** ..... **v**

**1 PROJECT BACKGROUND** ..... **1-1**

1.1 SITE LOCATION ..... 1-2

1.2 HISTORICAL OPERATIONS AND ACTIVITIES AT THE SITE ..... 1-2

1.3 SUMMARY OF AVAILABLE DATA ..... 1-3

1.3.1 Delaware River Basin Commission Sampling ..... 1-3

1.3.2 Public Drinking Water Supply Occurrence Studies ..... 1-4

1.3.3 PFC Investigations Conducted by Solvay ..... 1-4

**2 PROPOSED WORK PLAN** ..... **2-1**

2.1 OBJECTIVES ..... 2-1

2.2 DATA QUALITY OBJECTIVES ..... 2-2

2.3 SAMPLE COLLECTION DESIGN AND RATIONALE ..... 2-4

2.3.1 Groundwater Sampling ..... 2-4

2.3.2 Soil Sampling ..... 2-6

2.3.3 Surface Water and Sediment Sampling ..... 2-7

2.4 PARAMETERS TO BE TESTED AND FREQUENCY ..... 2-9

2.5 EVALUATE SITE-SPECIFIC PARTITIONING ..... 2-9

2.6 OUTFALL MIXING EVALUATION ..... 2-10

**3 REPORTING** ..... **3-1**

**4 REFERENCES** ..... **4-1**

Appendix A. Quality Assurance Project Plan

Appendix B. Field Sampling Plan



ED_004850_00001502-00004

# LIST OF FIGURES

Figure 1. Location Map

Figure 2. Proposed Monitoring Well Sampling Locations

Figure 3. Proposed Monitoring Well Locations and Areas to be Canvassed for Existing Wells

Figure 4. Proposed Soil Boring Locations

Figure 5. Proposed Co-Located Surface Water and Sediment Sampling Locations



ED_004850_00001502-00005

# LIST OF TABLES

Table 1. DQO Process for the Work Plan

Table 2. Long Carbon-Chain PFCs for Laboratory Sample Analysis



ED_004850_00001502-00006

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AFFF | aqueous film-forming foam |
| bgs | below ground surface |
| DQO | data quality objective |
| DRBC | Delaware River Basin Commission |
| EPA | U.S. Environmental Protection Agency |
| Eurofins | Eurofins Lancaster Laboratories Environmental |
| FSP | field sampling plan |
| ISRA | Industrial Site Recovery Act |
| LSRP | Licensed Site Remediation Professional |
| NaPFO | sodium perfluorooctanoate |
| NJDEP | New Jersey Department of Environmental Protection |
| NJPDES | New Jersey Pollutant Discharge Elimination System |
| NOAA | National Oceanic and Atmospheric Administration |
| Pennwalt | Pennwalt Ltd |
| PFC | perfluoroalkyl compound |
| PFNA | perfluorononanoic acid |
| PFOA | perfluorooctanoate acid |
| PFOS | perfluorooctanesulfonic acid |
| PFUnDA | perfluoroundecanoic acid |
| Plant | Main Plant Area |
| POET | point of entry treatment |
| POTW | publicly owned treatment works |
| PRM | Potomac-Raritan-Magothy |
| PVDF | polyvinylidene fluoride |
| PWS | public water system |
| QAPP | quality assurance project plan |
| QA/QC | quality assurance/quality control |
| RIR | remedial investigation report |



ED_004850_00001502-00007

| | |
|---|---|
| RM | river mile |
| SSC | site-specific compound |
| Site | West Deptford, New Jersey, Plant |
| Solvay | Solvay Specialty Polymers USA, LLC |
| SOP | standard operating procedure |
| TOC | total organic carbon |
| TWP | temporary well point |
| VOC | volatile organic compound |



ED_004850_00001502-00008

# 1 PROJECT BACKGROUND

This work plan outlines the next step in an iterative and voluntary program that Solvay Specialty Polymers USA, LLC (Solvay) continues to undertake to investigate perfluoroalkyl compounds (PFCs) in the environment at and near the Solvay West Deptford, New Jersey, Plant (Site). Notwithstanding the voluntary nature of Solvay's ongoing PFC related investigation, the work described in this work plan (and the work performed in conjunction with Solvay's prior 2013 work plan as noted below) is intended to be performed in a manner that is consistent with New Jersey technical regulations regarding environmental sampling.

Certain PFCs were used historically in manufacturing operations at the facility and have been detected in the groundwater and in the immediate area surrounding the Site. Based on data collected to date, it is evident that additional potential PFC sources likely exist within the study area, including aqueous film-forming foam (AFFF) training areas and use sites, landfills, and other industrial facilities. While the primary objective of this work plan is to investigate PFCs that may have been emitted from the Solvay plant, additional empirical evidence of additional source contributions of PFCs to the surface waters, groundwater, and soils in the immediate vicinity of the Site may be identified as a result of this work plan.

This is the second work plan submission for this project. The first work plan was submitted to the New Jersey Department of Environmental Protection (NJDEP) and the U.S. Environmental Protection Agency (EPA) on November 15, 2013. Solvay worked collaboratively with the agencies to investigate and report the concentrations of PFCs in groundwater, surface water, and sediment at and near the facility. Solvay also voluntarily retained a Licensed Site Remediation Professional (LSRP), to help facilitate completion of Solvay's PFC related environmental work. Solvay submitted data both from investigations outlined in the 2013 work plan as well as additional investigations of drinking water and groundwater at locations near the plant. NJDEP provided comments on the data submitted to date, and Solvay is submitting responses to the comments concurrent with the submission of this work plan.

The objectives of this work plan are two-fold: 1) to expand on prior efforts to assess the extent of PFCs in groundwater, surface water, soils, and sediment in the areas surrounding the plant through additional sampling, and 2) to evaluate Site-related potential transport pathways to groundwater, including air, soil, groundwater, and surface water.

This work plan and associated documents detail the scope and methods of the data collection efforts for the investigation of PFC presence at and around the Solvay Site. The current work plan has been prepared on behalf of Solvay to conduct the following activities designed to achieve the work plan objectives:

- Re-sampling select onsite and offsite Solvay monitoring wells



ED_004850_00001502-00009

- Canvasing existing third party monitoring wells to determine existence and suitability for sampling of PFCs
- Installation of additional offsite groundwater monitoring wells
- Onsite soil sampling
- Offsite surface water and sediment sampling in Little Mantua Creek and Main Ditch
- Evaluation of tidal mixing of historic Site discharges to the Delaware River.

## 1.1 SITE LOCATION

The facility is located at 10 Leonard Lane in West Deptford Township, Gloucester County, New Jersey in a mixed-use agricultural and industrial area. The Site is situated between a railroad line located north of Crown Point Road and the Delaware River across from the Philadelphia Airport near river mile (RM) 90. A site map showing the property boundary and neighboring municipalities is provided in Figure 1.

The Site encompasses 243 acres. Approximately 34 acres of the property are used for active manufacturing operations. This active portion of the Site is referred to as the Main Plant Area (Plant). The remaining acreage is either unused or leased for agriculture.

## 1.2 HISTORICAL OPERATIONS AND ACTIVITIES AT THE SITE

PFCs were first used at the Site in 1985 by Pennwalt Ltd. (Pennwalt) to produce polyvinylidene fluoride (PVDF) resin. The Site was purchased by Elf Atochem North America Inc. in 1989 and by Ausimont USA in 1990. Solvay acquired the Site with the acquisition of Ausimont USA, Inc. in May 2002. The company changed its name to Solvay Solexis, Inc. in 2003, and continued the production of fluoropolymers, fluorocarbons, and fluoroelastomers. In October 2012, Solvay Solexis merged with another Solvay business unit with a resulting change in name to Solvay Specialty Polymers USA, LLC.

The telomer-based fluorosurfactant, Surflon®, was used to produce PVDF at the Site from 1985 to 2010. Sodium perfluorooctanoate (NaPFO) was also used on the Site from 1995 to 2003. Solvay voluntarily joined the EPA 2010/2015 PFOA Stewardship Program (USEPA 2013) in 2006 and by 2010 proactively phased out use of perfluorooctanoate acid (PFOA) and all long carbon-chain PFCs at the Site.

As part of an ongoing remedial investigation unrelated to Solvay's voluntary PFC investigation, NJDEP provides project oversight of this Site under the Industrial Site Recovery Act (ISRA) for corrective action/site remediation. Highlights of the separate ISRA-related activities that have occurred onsite over approximately the past 10 years include:



ED_004850_00001502-00010

- In 2010, a groundwater treatment system was installed to remove volatile organic compounds (VOCs) and other compounds using air stripping. Treated groundwater is beneficially reused at the Site to reduce loading on the aquifer.
- In April 2012, NJDEP established interim groundwater quality standards for the site-specific compounds (SSC) 1-chloro-1,1-difluoroethane (142B), 1,1,1-trifluoroethane (143A) and 1,1-dichloro-1-fluoroethane (141B). In November 2012, a Remedial Action Permit was issued for the dredged spoils area.
- In May 2014, Solvay submitted the remedial investigation report (RIR) for the ISRA project.

Also In February 2014 as part of a pilot test for PFC treatment, the Plant installed a carbon unit to pretreat the recovered groundwater prior to its reuse in the process. The system operation was technically challenging. In May of 2015, a pressure sand filter was installed prior to the carbon system to enhance system reliability.

## 1.3 SUMMARY OF AVAILABLE DATA

Environmental monitoring for PFCs has been conducted in the Delaware River, existing groundwater monitoring wells owned by Solvay and in drinking water supplied by local public water distribution authorities, by the Delaware River Basin Commission (DRBC), NJDEP, and Solvay. The studies and findings are summarized below.

### 1.3.1 Delaware River Basin Commission Sampling

The DRBC conducted two pilot multi-year surveys of contaminants of emerging concern in the main stem of the Delaware River within the tidal wedge (MacGillivray 2012). The first study looked at finfish at sampling locations ranging from RM 58 to 289 from 2004 to 2006 and measured 10 PFCs in fish fillets from several species and different year classes. A subsequent DRBC study measured PFC concentrations in surface water from RM 50 to 131. Specifically, from 2007 to 2009, surface water from 6 locations in the Delaware River was sampled annually by the DRBC for unregulated constituents of interest including 13 PFCs.

The concentration of perfluorononanoic acid (PFNA) in surface water exhibited a spatial gradient that increased in concentration from RM 131 (at Biles Channel) to a peak at RM 80 (at Marcus Hook Creek). PFNA concentrations decreased from RM 80 downstream to RM 50 (Liston Point). Similarly, the concentration of PFOA in surface water increased with distance downstream, peaking at RM 68 (Delaware Memorial Bridge), then decreased further downstream at RM 50. Overall, PFOA and PFNA maximum concentrations in surface water decreased substantially between 2007 and 2009 downstream of the Site.



ED_004850_00001502-00011

### 1.3.2 Public Drinking Water Supply Occurrence Studies

Within the past 10 years, several studies have provided measurements of PFCs in public drinking water supplies in New Jersey, including locations in the vicinity of the Site. These studies are briefly summarized below.

NJDEP conducted two statewide occurrence studies for detection of PFOA and other PFCs in New Jersey public drinking water (NJDEP 2007; Post et al. 2009, 2013). In the first study in 2006, 23 public water systems (PWSs) were sampled to measure concentrations of PFOA and perfluorooctanesulfonic acid (PFOS), both of which have eight carbons (or are "C8 PFCs"). PFOA was detected in 65 percent of the 23 tested systems at concentrations greater than the analytical reporting limit of 0.004 μg/L. Approximately 12 percent of PWSs had at least one sample with a PFOA concentration greater than NJDEP's preliminary health-based guidance value for drinking water (i.e., 0.04 μg/L).

In 2009, a second study was performed that involved sampling of 29 PWSs and measuring concentrations for PFOA, PFOS, PFNA, and 7 other PFCs in surface water and raw (unfinished) groundwater from mostly unconfined aquifers. PFOA was detected with concentrations greater than the reporting limit (0.005 μg/L) in 57 percent of all samples. PFNA was detected at wells in three counties, including Camden (0.013 μg/L), Gloucester (0.096 μg/L), and Morris (14 to 80 μg/L).

Additional samples of raw and treated water were collected by the Paulsboro Water Company in September 2013. Concentrations of PFNA were detected in raw and finished water from all three wells, with the maximum concentrations occurring in Well #7 (NJDEP 2013; Post et al. 2013).

### 1.3.3 PFC Investigations Conducted by Solvay

In November 2013, Solvay issued a work plan for investigating PFCs in various media at and in a broad area near the Plant (Integral 2013). Activities described in the work plan included the following:

- Environmental sampling for PFCs from:
    - Onsite and offsite groundwater from Solvay's monitoring wells;
    - Offsite groundwater from private drinking water supply wells;
    - Municipal water at seven townships surrounding the Plant;
    - Groundwater collected at offsite temporary well points (TWPs) installed east of the Site between the Plant and Woodbury Creek; and



ED_004850_00001502-00012

  - Surface water and sediments from the same locations as DRBC's prior sampling plus nearby other potential sources along 80 miles of the Delaware River.

- Air modeling of potential and estimated historical PFC emissions from the Plant.

Results of the environmental sampling program identified PFCs in groundwater sampled from Solvay's onsite and offsite monitoring well network. The concentrations of PFCs in groundwater are generally higher at the Plant site and they tend to decrease with distance from the Plant. Sampling and analysis for PFCs were completed at 93 properties within a broad area south and east of the Plant (Integral 2015). PFCs were detected in some private wells. Point of entry treatment (POET) systems were installed at approximately 10 to 15 properties (Integral 2015). PFCs were detected in samples collected from at least one PWS municipal supply well at each of the seven townships. Sampling results from TWP locations east of the Site indicated that PFCs detected at private well locations near Woodbury Creek are cross-gradient from the Plant.

PFNA was not present in any of the surface water samples collected along approximately 80 miles of the Delaware River. Other PFCs were detected in surface water samples. PFNA was detected at low concentrations at some sediment stations.

Air modeling was used to predict dispersion and deposition of PFNA in the area surrounding the Plant. Modeling results indicate a preference for deposition in an easterly direction, which is consistent with prevailing wind patterns. Model-predicted maximum particle deposition occurs within the Site boundaries and deposition rates decreased substantially with distance downwind.

Additional details on prior environmental sampling and air modeling efforts are provided in a summary report issued by Integral (2015). Shortly after the summary report was issued, Solvay met with NJDEP on June 10, 2015 to discuss the summary report and discuss next steps in a path forward for evaluating the extent of PFCs and their transport pathways to groundwater. Subsequently, via letter dated July 31, 2015, NJDEP provided additional comments on the work performed to date and next steps. This work plan is designed to address those issues and a response letter to NJDEP is being submitted by Solvay concurrently with this work plan.



ED_004850_00001502-00013

# 2 PROPOSED WORK PLAN

The following section provides a summary of the proposed work plan objectives and major elements of the plans for sampling, chemical analysis, and implementation of quality assurance/quality control (QA/QC) procedures. Additional details for implementation of the site investigation of the work plan are provided in the appendices to this document:

- Appendix A. Quality Assurance Project Plan (QAPP)
- Appendix B. Field Sampling Plan (FSP).

This work plan includes some of the same standard operating procedures (SOPs) submitted with the 2013 work plan (updates as appropriate), as well as additional SOPs for vertically integrated sampling and sediment pore water sampling that were requested by NJDEP.

## 2.1 OBJECTIVES

This technical work plan describes the scope for evaluating the presence of long carbon-chain PFCs (i.e., C8 to C12) in the following environmental media at or near the Site in an effort to better understand the distribution of PFCs and their potential transport pathways to groundwater:

- Groundwater from monitoring wells located onsite and offsite
- Soil samples from locations onsite
- Surface water and sediments from creek systems adjacent to the Plant.

In addition to sample collection activities described herein, this work plan includes two tasks aimed at quantifying PFC mobility in soils and surface water concentrations at the New Jersey pollutant discharge elimination system (NJPDES) discharge outfall from the Plant to the Delaware River. These tasks involve:

- An evaluation of Site-specific partitioning between soils and groundwater, and
- Outfall mixing evaluation of Plant discharges.

The results of the investigations described in this work plan will be assessed in conjunction with results of previous investigations to provide additional understanding of the distribution of PFCs and their fate in the environment in the vicinity of the Plant.



ED_004850_00001502-00014

## 2.2 DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) have been established to ensure that the data collected are sufficient and of adequate quality for their intended uses to achieve project objectives. The primary objectives of the investigation are as follows:

- Quantitatively assess the presence or absence of PFCs in groundwater obtained from onsite and offsite monitoring wells
- Quantitatively assess the water elevation in groundwater monitoring wells and temporary well points (after equilibration within the bore hole) in order to determine offsite groundwater flow direction
- Quantitatively assess the presence or absence of PFCs in Site soils
- Quantitatively assess the presence or absence of PFCs in the surface water and sediment in Little Mantua Creek and Main Ditch adjacent to the Plant
- Determine Site-specific partitioning behavior of long-chain PFCs between soil and groundwater
- Evaluate PFC concentrations in surface water near areas of potential mixing of Plant outfall discharges into the Delaware River.
- Evaluate a surface water to groundwater pathway proximate to the plant

The DQOs are consistent with EPA's *Guidance on Systematic Planning Using the Data Quality Objectives Process* (USEPA 2006). Table 1 summarizes each of the steps of the DQO process that are related to planning for this project.



ED_004850_00001502-00015

Table 1. DQO Process for the Work Plan

| Step | | Description |
|---|---|---|
| 1 | State the Problem | Determine if the designated investigation areas for sampling of groundwater, soils, surface water, and sediment contain PFCs listed in the QAPP and FSP (Appendices A and B). Evaluate site-specific soil-groundwater partitioning and to assess the mobility of PFCs. Assess PFC concentrations in surface water related to Plant outfall mixing into the Delaware River. |
| 2 | Identify the Decision | The results of the sampling described in this work plan and QAPP (Appendix A) will be assessed for precision, accuracy, completeness, sensitivity, representativeness, and comparability (PACSRC). The overall goal of the sampling is to determine the presence and range of concentrations of PFCs in each of the media sampled in order to develop a conceptual site model of potential transport pathways |
| 3 | Identify Inputs to the Decision | Analytical methods are listed in Table A-3 of the QAPP. Quality assurance protocols and procedures for addressing data quality issues are described in the QAPP. |
| 4 | Define the Boundaries | The boundaries of the investigation areas are defined as follows for each field investigation: a) monitoring wells are defined by the Site property and areas offsite and up to 2.25 miles south of the property boundary; b) soils samples are defined by the Site property boundary; c) the surface water and sediment collection area is limited to Little Mantua Creek and the Main Ditch, located adjacent to and east and west of the Site, respectively. |
| 5 | Develop a Decision Rule | If the PACSRC results are satisfactory and the sampling results provide sufficient characterization to meet the project objectives in Section 2.1, no additional work will be proposed in this investigation. |
| 6 | Specify Limits on Decision Errors | The data generated will be evaluated to determine if the quality control objectives in the QAPP are met. |
| 7 | Optimize the Design for Obtaining Data | Samples will be obtained as follows for each field investigation: a) monitoring wells – locations were selected to maximize the chance of detecting PFCs based on prior data collection results, historical site knowledge of production processes and uses associated with PFCs and knowledge of hydrogeological properties of the area. Potential 3rd party or new monitoring wells will be selected to characterize groundwater in aquifer units downgradient from the Site; b) soil borings – locations were selected to maximize the likelihood for detecting PFCs based on prior data collection results, historical site knowledge of production processes, and reviews of historical aerial photographs to focus on undisturbed areas; c) surface water and sediment – proposed sampling locations were selected based for uniform sample distribution and knowledge regarding sample collection accessibility. |

Notes:

DQO = data quality objective
FSP = field sampling plan
PACSRC = precision, accuracy, completeness, sensitivity, representativeness, and comparability
PFC = perfluoroalkyl compound
QAPP = quality assurance project plan



ED_004850_00001502-00016

## 2.3 SAMPLE COLLECTION DESIGN AND RATIONALE

This section provides a summary of the sample collection design and rationale for collecting water quality samples from monitoring wells, surface water, and sediment pore water, and soils and sediments for the purpose of detecting the presence/absence of PFCs and their concentrations.

Additional sampling details are provided in the QAPP (Appendix A) and FSP (Appendix B). SOPs included with this work plan are consistent with NJDEP's *Field Sampling Procedures Manual* (NJDEP 2005), N.J.A.C. 7:18-1 et seq., and 40 CFR 141.

### 2.3.1 Groundwater Sampling

Groundwater sampling will occur in three phases:

I. Sample existing monitoring wells

II. Canvass areas offsite for potential 3rd party offsite monitoring wells for possible inclusion in the sampling program as appropriate

III. Installation of additional monitoring wells (up to 7 shallow-deep pairs in the Upper Potomac-Raritan-Magothy [PRM])

Each phase of the groundwater sampling program will be completed in successive fashion. At minimum the first two phases will be conducted. All or portions of phase III of the groundwater sampling program will be conducted if monitoring wells suitable for sampling cannot be identified during the canvassing step described in phase II.

**Phase I: Sample Existing Monitoring Wells**

The first phase of the groundwater sampling program involves collecting groundwater samples from 45 existing monitoring wells (Figure 2). In spring 2014, groundwater samples from 58 of Solvay's monitoring wells were analyzed for PFC concentrations (Integral 2015). Since that time, 13 additional wells have been installed offsite. To begin to develop a temporal dataset, and sample newly installed wells, a total of 45 existing monitoring wells will be sampled as part of this work plan (Figure 2). Data from the monitoring well sampling will be used to improve the understanding of the spatial and temporal trends in PFC concentrations in groundwater and assess the effect of the existing onsite VOC recovery well system on hydraulic containment of PFCs.

**Phase II: Canvass Areas Offsite for Potential Third-Party Offsite Monitoring Wells**

The second phase of the groundwater investigation consists of canvassing existing 3rd party offsite monitoring wells (i.e., NJDEP data miner and well search). PFC concentrations in



ED_004850_00001502-00017

groundwater decrease with distance downgradient from the Plant (Integral 2015); however, prior sampling identified PFCs at the distal margins of the existing monitoring well network. To provide additional data on the presence and distribution of PFCs in groundwater in areas beyond its existing monitoring well network, Solvay will canvass areas distal to the Plant to identify potential 3rd party monitoring wells suitable for groundwater sampling (Figure 3). In order for potential 3rd party monitoring wells to be considered suitable for groundwater sampling, they must meet all of the following criteria:

1. Within the general area targeted for additional monitoring well installation shown in Figure 3.

2. Screened within the upper PRM aquifer.

3. In good working condition as deemed by a qualified hydrogeologist.

Owners of third-party wells identified as suitable for sampling will then contacted to obtain access to sample for PFCs in accordance with the same procedures used for the onsite/offsite monitoring well sampling program. Data generated from 3rd party wells will be used to inform and refine the number and location of additional Solvay monitoring wells to be installed in Phase III, as necessary.

**Phase III: Installation of Additional Monitoring Well Pairs**

If 3rd party monitoring wells suitable for sampling cannot be located, Solvay will install shallow and deep monitoring well pairs screened in the Upper PRM at the approximate locations indicated in Figure 3. These locations were selected to provide a wider monitoring well network for determining the presence and distribution of PFCs. The installation of additional monitoring wells is contingent upon landowners voluntarily granting access to Solvay to install monitoring wells. If Solvay is unable to obtain access to a specific location, an alternate location will be selected. Well drilling and construction will be performed by a well driller licensed by the state of New Jersey. Soil logs will be recorded at each new well installation consistent with NJAC 7:26E-4.4(g)4. Well development and sample collection will be performed consistent with relevant state laws and regulations. QA/QC protocols for groundwater sample collection are provided in the QAPP attached to this work plan (Appendix A).

Well drillers reports, boring and development logs for any new monitoring wells installed by Solvay during execution of this work plan will be provided in the summary report documenting the results of this work plan (Section 3). The report will include the well location, relevant groundwater level measurements, and a potentiometric groundwater surface map based on contouring of the measurements.



ED_004850_00001502-00018

### 2.3.2 Soil Sampling

Soil sampling will be conducted to validate air modeling results and to evaluate air deposition to soils as a potential pathway to groundwater. Prior air modeling indicated minor PFNA deposition offsite, and greater deposition onsite. In order to determine if air deposition to onsite soils represents an ongoing source to groundwater, soil samples will be collected from 18 locations as shown on Figure 4. Boring locations were selected in areas that are either close to historic emissions or appear to be undisturbed throughout the history of PFC use at the Site based on a review of historic aerial photographs.

Soil borings will be advanced using direct push (Geoprobe) technology to the water table. In the area where soil bores are located, the variably saturated zone is approximately 12 ft thick. Soil samples will be collected from discrete 6-in. intervals, at depths described in the paragraph below. No samples will be collected from the saturated zone. Sampling and equipment decontamination procedures will conform to NJDEP's August 2015 *Field Sampling Procedures Manual* (NJDEP 2005). After collection of soil samples, borings will be backfilled consistent with NJAC 7:9D-3.4. A well driller licensed in the state of New Jersey will conduct the drilling. Soil cores will be logged during sample collection consistent with NJAC 7:26E-4.4(g)4.

Soil samples at six s soil borings will be analyzed for PFC compounds at a higher resolution, with one 6-in. sample analyzed per linear foot from ground surface to 3 ft, then one sample every 2 ft to the water table. Seven samples are anticipated for each of the higher resolution borings; however, the number of samples may vary depending on the depth to groundwater encountered in the field. For the remaining 12 borings, laboratory analyses of PFC compounds will be conducted at a lower resolution, with 4 samples analyzed from each boring. Anticipated depths for sampling are 0 to 6 in., 2 to 2.5 ft below ground surface (bgs), 5 to 5.5 ft bgs, and 8 to 8.5 ft bgs. Approximately two samples per borehole will be analyzed for grain size and total organic carbon (TOC) and selection of these samples will be made based on field observations.

Additional samples will be collected for batch sorption tests at the Integral Laboratory in Louisville, CO. Three locations will be chosen for additional sample collection for batch partitioning testing. The goal for determining site-specific partitioning is to obtain material from undisturbed locations with well-defined soil horizons because PFNA has been noted to have different adsorption characteristics in different soil horizons (FLUOROS 2015). Partitioning samples will be collocated with selected soil bore locations as determined in the field. Potential locations are near soil bores SB15-16, SB15-17, and SB15-18, with alternate locations of soil bores SB15-07 and SB15-01. Sufficient material will be collected from 1) the surficial organic zone, 2) the surface soil zone immediately beneath, and 3) subsurface soil zone for both partition testing and grain size TOC analyses.

Samples for analysis of PFC compounds will be sent to AXYS Analytical Services Ltd. (AXYS), of Sydney BC, Canada. Samples for the analysis of grain size and TOC will be sent to Eurofins



ED_004850_00001502-00019

Lancaster Laboratories Environmental of Lancaster, Pennsylvania (Eurofins). Samples for laboratory analysis will be collected in containers provided by the laboratories. Information on the container types, preservation method, method-recommended holding times, and minimum sample sizes are presented in Table B-2, Appendix B. Additional information regarding health and safety, sample collection methods, analytical methods, quality assurance sampling, and chain-of-custody protocol can be found in the QAPP and FSP (Appendices A and B, respectively).

### 2.3.3 Surface Water and Sediment Sampling

Sample of surface water and co-located sediments will be collected in Little Mantua Creek and Main Ditch adjacent to the Site to determine if PFCs are present and to measure their concentration. Sampling results will aid in the evaluation of any potential surface water-to-groundwater transport pathway.

Sampling locations were selected to maximize the likelihood of detecting PFCs based on tidal connection to the Delaware River and modeled deposition of historic air emissions. Sampling is focused in depositional environments adjacent to the Plant. Surface water and sediment samples will be collected offsite from three stations at the Main Ditch (east of the facility) and from four stations at the Little Mantua Creek (west of the facility). Surface water and sediment stations will be co-located as shown in Figure 5.

At each station, sediment will be collected from up to three discrete sampling depths to provide a measure of variability within the sediment column. At least one core will be collected at each station. If sample volume requirements dictate the need for additional sediment, then additional co-located core(s) will be collected and the sediment will be composited prior to analysis by the lab. In the event that sufficient volumes of sediment are available within a single core interval, then additional sediment from each interval will be kept in long term storage by the analytical laboratory for possible future analysis, if necessary.

Recent estimates of sedimentation rates for tidal marsh sites located close to the Site indicate sedimentation rates between 0.3 to 1.5 cm/yr (Sommerfield and Madsen 2003). Based maximum sedimentation rates and historical PFC use timeframes, assuming no sediment scouring, dredging, or other disturbances has occurred, sediments below approximately 18 in. should not contain PFCs related to Site operations. Therefore, sediments will be sampled in the following core intervals: 0–6 in. (0–15 cm), 6–12 in. (15–30 cm), 12–24 in. (30-60 cm) or to refusal, if refusal occurs less than 24 in. below the sediment surface. Any separate sediment horizons that are observed in the core will be logged on a field form, and collection intervals may be revised based on professional judgment. Sediment will be collected from the entire sediment interval and a discrete sample from the composited, homogenized sediment core will be collected. Shorter core lengths are considered acceptable if soils other than sediment are encountered, or if



ED_004850_00001502-00020

multiple attempts (i.e., two attempts) at coring at a given sampling location do not provide the target core length.

Sediments for pore water sample extraction will be collected in the field from sediment cores as described above. The sediment samples for pore water extraction will be prepared at Eurofins Lancaster using centrifugation following their SOP. The pore water volume will be aliquoted into appropriate sample containers and analyzed for cations (calcium, iron, magnesium, manganese, potassium, and sodium), anions (bromide, chloride, fluoride, and sulfate), and pH. An aliquot of the pore water will be shipped to AXYS for the analysis of PFCs. In addition, a fraction of the volume may be archived for future analyses.

In prior sampling events by Solvay, Delaware River surface water samples were homogenized from multiple locations vertically within the water column and PFNA was non-detect in all samples (Integral 2015). Considering the depth of the water column and that PFNA is unlikely to be detected in surface waters of Little Mantua Creek and Main Ditch, surface water samples will be collected at a single mid-depth interval at each sampling station. Prior to sampling, the water column length will be measured with a lead line from the boat deck or by hand. Surface water samples will be collected by using either water collection bottles without Teflon® lining (e.g., Niskin or Go-Flo bottles, or similar) or by using a peristaltic pump and tubing. Both methods are proven to provide acceptable and representative samples. Thus, either method may be used interchangeably by the field crew depending on field conditions.

In addition to surface water collection, general water quality parameters (i.e., water temperature, pH, dissolved oxygen, salinity, oxidation-reduction potential, turbidity, and conductivity) and tide stage will be measured and recorded prior to sample collection at every sample location using a multi-probe (e.g., YSI EXO-1).

At Main Ditch and portions of Little Mantua Creek, stations located in shallow waters can be accessed by wading. At those sites, sediment cores will be collected by hand with a 48 in. (122 cm) long Wildco™ stainless steel hand corer. A 2 in. (5 cm) diameter CAB (cellulose acetate butyrate) plastic liner will be used for all sediment cores. An extension may be used to collect cores submerged in deeper waters where a boat cannot be used. In areas where a boat can have access at high tide, a vibracorer mounted on an A-frame of the boat will be used to collect sediment cores. A minimum 3 in. (7.6 cm) diameter core tube will be used when samples are collected using a vibracorer.

Additional details on sampling collection, processing and shipping are described in the FSP attached to this document (Appendix B).



ED_004850_00001502-00021

## 2.4 PARAMETERS TO BE TESTED AND FREQUENCY

Consistent with NJDEP's request for investigating concentrations of longer carbon-chain PFCs (i.e., C8 to C12), the PFCs listed below in Table 2 will be measured in each sample using the analytical protocols given in the QAPP (Appendix A).

Table 2. Long Carbon-Chain PFCs for Laboratory Sample Analysis

| Chemical Name | Acronym | Number of Carbons |
|---|---|---|
| Perfluorooctanoic acid | PFOA | 8 |
| Perfluorononanoic acid | PFNA | 9 |
| Perfluorodecanoic acid | PFDA | 10 |
| Perfluoroundecanoic acid | PFUnDA | 11 |
| Perfluorododecanoic acid | PFDoDA | 12 |
| Perfluorooctanesulfonic acid | PFOS | 8 |

Notes: PFC = perfluoroalkyl compound

In addition, because variability in PFC concentrations may be correlated with variability in the physical and chemical properties of the sampled medium, conventional parameters will be measured in the laboratory and field. Conventional laboratory parameters will include total anions (Br, Cl, F, $SO_4$), cations (Ca, Fe, Mg, Mn, K, Na), TOC, total suspended solids, total dissolved solids (surface water only), pH, and alkalinity for surface and groundwater samples and grain size and TOC for soil and sediment samples. Pore water samples will be analyzed for anions, cations, and pH. Field water quality parameters will include water temperature, pH, dissolved oxygen, salinity, oxidation-reduction potential, turbidity, and conductivity.

## 2.5 EVALUATE SITE-SPECIFIC PARTITIONING

A partitioning coefficient describes the ratio between a chemical's concentrations in the solid phase to its concentrations in solution at equilibrium. For organic compounds, the partitioning coefficient is often a function of the organic carbon content; however, for some PFCs, there does not appear to be a predictable relationship without site-specific data. Understanding the relationship between aqueous and adsorbed PFCs across a range of site-specific conditions provides a basis for evaluating the potential for leaching of historic PFC deposition from soils to groundwater.

Sorption batch testing will be performed using site groundwater and soils cores obtained as part of this work plan. Site groundwater containing high concentrations of PFNA will be diluted with background groundwater to test adsorption across a range of PFC concentrations.



ED_004850_00001502-00022

Groundwater will be collected from two wells selected following the onsite/offsite sampling described in this work plan. Groundwater will be mixed to create four water types spanning the range of concentrations observed onsite. Sorption (adsorption and desorption) batch tests will be conducted at the Integral Laboratory using the EPA *Fate, Transport and Transformation Test Guidelines, OPPTS 835.1230 Adsorption/Desorption* (USEPA 2008). Following the tests, groundwater and soil samples will be submitted to AXYS for PFC analysis. The relationships between solid and aqueous equilibrium concentrations will be used to develop Site-specific partitioning coefficients for each PFC compound detected.

## 2.6 OUTFALL MIXING EVALUATION

An evaluation of the Solvay effluent discharge into the Delaware River will be performed to support an understanding of the near-field mixing and dilution of the discharge and an understanding of potential surface water-groundwater interactions. The mixing evaluation will be performed using CORMIX, an EPA-supported application that is widely used for environmental impact assessment of regulatory mixing zones resulting from continuous point source discharges.

The mixing evaluation will be performed using monitoring data collected by Solvay in 2015 to characterize the effluent flow and concentration in the Solvay facility surface water outfall (Pipe 001). Typical ambient river depth and currents will be characterized from National Oceanic and Atmospheric Administration (NOAA) data (e.g., PORTS Station db0301) and other available information. The mixing evaluation will be performed for PFNA and PFNUA and for 6 to 10 river flow and effluent discharge combinations (e.g., peak flood and ebb, high and low river flow, high and low effluent discharge). A detailed work plan will be developed in collaboration with NJDEP prior to performing the mixing evaluation. The work plan will specify the inputs that will be used to characterize the effluent discharge and the ambient waters and will include a description of the set of scenarios that will be performed.

The mixing evaluation will provide an estimate of water column concentrations and the extent of the effluent mixing zone under a range of flow and discharge conditions. The estimated water column concentrations will be compared with the water column data collected during the summer 2014 and reported in Integral (2015). A memo will be submitted to NJDEP summarizing the input values and the results of the mixing evaluation.



ED_004850_00001502-00023

# 3 REPORTING

A data summary report will be prepared that describes the methods and presents the results of the chemical analysis as well as the data evaluation in support of the work plan objectives. The report and corresponding electronic data deliverables will be delivered in electronic and hard copy format to NJDEP.

The validated results of the water quality sampling and solid-phase chemistry at individual sample locations will be communicated to NJDEP in a memorandum that provides a summary of the validated data. Pre-validated data will not be submitted to the agency.



ED_004850_00001502-00024

# 4 REFERENCES

FLUOROS. 2015. International Symposium on Fluorinated Organics in the Environment. July 12-14, 2015. Golden, CO. http://igwmc.mines.edu/Fluoros.html

Integral. 2013. Perfluorinated compounds work plan, West Deptford, NJ, Plant. Prepared for Solvay Specialty Polymers USA LLC. Integral Consulting Inc., Annapolis, MD. November.

Integral. 2015. Summary report: Findings of PFC investigations conducted by Solvay Specialty Polymers USA, LLC. West Deptford, NJ. Integral Consulting Inc., NJ. March.

MacGillivray, A.R. 2012. Contaminants of emerging concern in the tidal Delaware River, pilot monitoring study 2007–2009. Delaware River Basin Commission, West Trenton, NJ. 87 pp. July.

NJDEP. 2005. Field sampling procedures manual. Available at: www.nj.gov/dep/srp/guidance/fspm/. New Jersey Department of Environmental Protection, Trenton, NJ. August.

NJDEP. 2007. Determination of perfluorooctanoic acid (PFOA) in aqueous samples. Final Report. New Jersey Department of Environmental Protection, Division of Water Supply, Bureau of Safe Drinking Water, Trenton, NJ. 17 pp. January.

NJDEP. 2013. Personal communication (email from E. Bergman to M. Gertz, Solvay Specialty Polymers USA, LLC, dated October 17, 2013 including Laboratory Report for QC Laboratories prepared by Eurofins Eaton Analytical, dated October 8, 2013). New Jersey Department of Environmental Protection, Trenton, NJ.

Post, G.B., J.B. Louis, K.R. Cooper, B.J. Boros-Russo, and R.L. Lippincott. 2009. Occurrence and potential significance of perfluorooctanoic acid (PFOA) detected in New Jersey public drinking water systems. *Environ. Sci. Technol.* 43:4547-4554.

Post, G.B., J.B. Louis, R.L. Lippincott, and N.A. Procopio. 2013. Occurrence of perfluorinated compounds in raw water from New Jersey public drinking water systems. *Environ. Sci. Technol.* Accepted for publication November 4, 2013.

Sommerfield, C.K. and J.A. Madsen. 2003. Sedimentological and geophysical survey of the Upper Delaware Estuary. Final report to the Delaware River Basin Commission. October.

USEPA. 2006. Guidance on systematic planning using the data quality objectives process. EPA QA/G-4. EPA/240/B-06/001. U.S. Environmental Protection Agency, Office of Environmental Information, Washington, DC. 121 pp. February.



ED_004850_00001502-00025

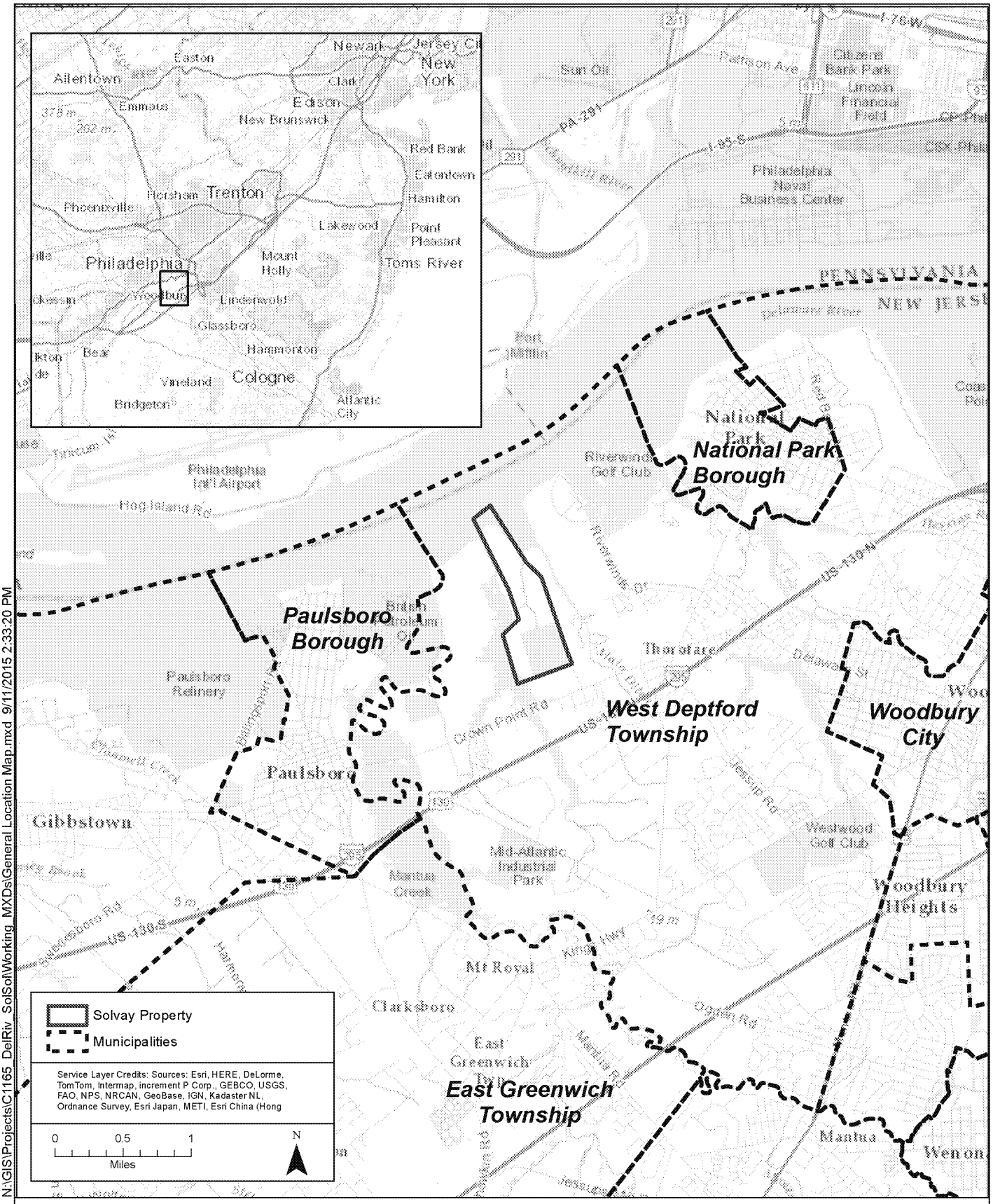
USEPA. 2008. Fate, transport and transformation test guidelines. OPPTS 835.1230: Adsorption/desorption (batch equilibrium). EPA 712-C-08-009. U.S. Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances. October. 55 pp.

USEPA. 2013. 2010/2015 PFOA Stewardship Program. www.epa.gov/oppt/pfoa/pubs/stewardship/. Accessed on November 5, 2013. U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics, Washington, DC.



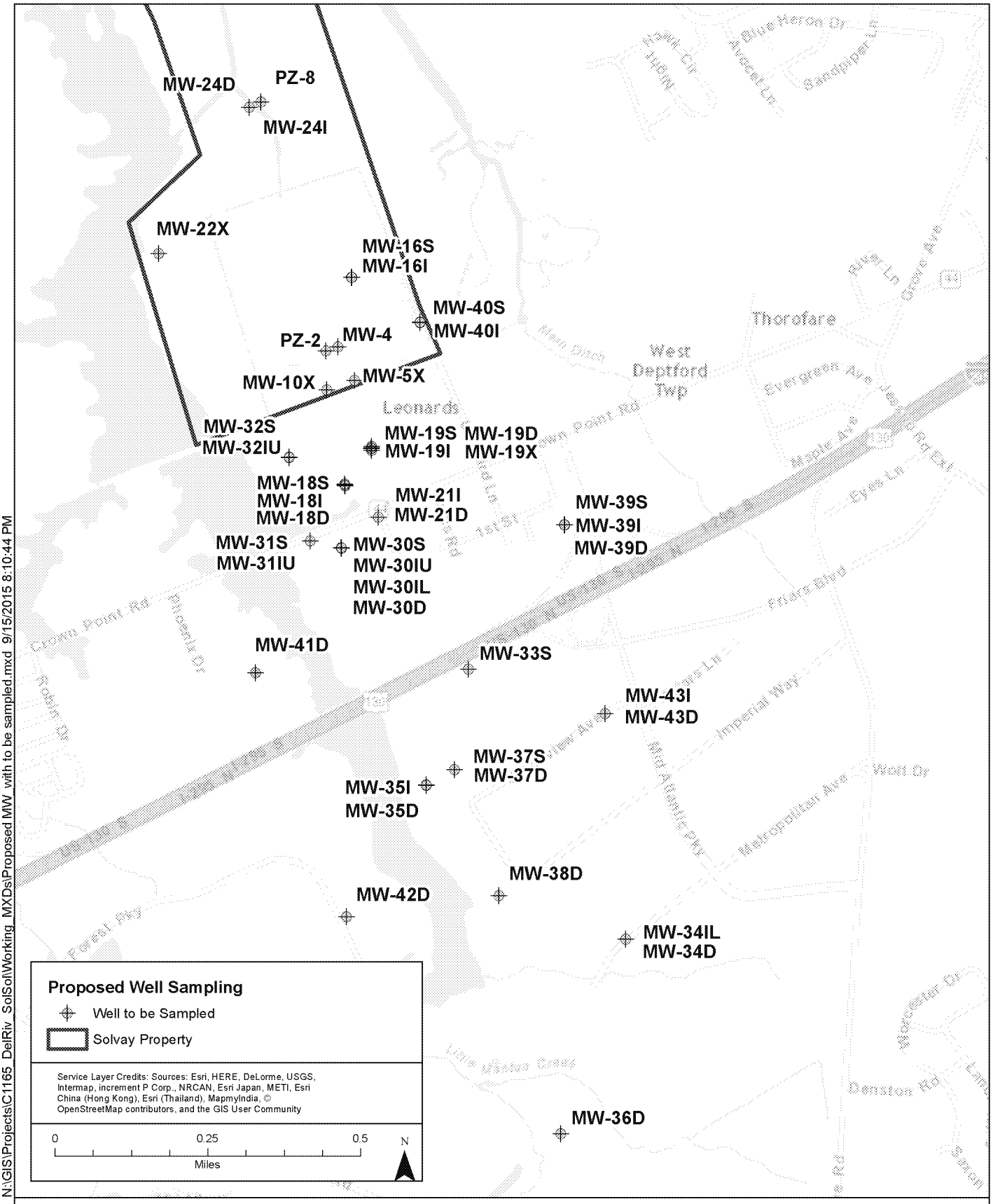
ED_004850_00001502-00026

# FIGURES




integral consulting inc.

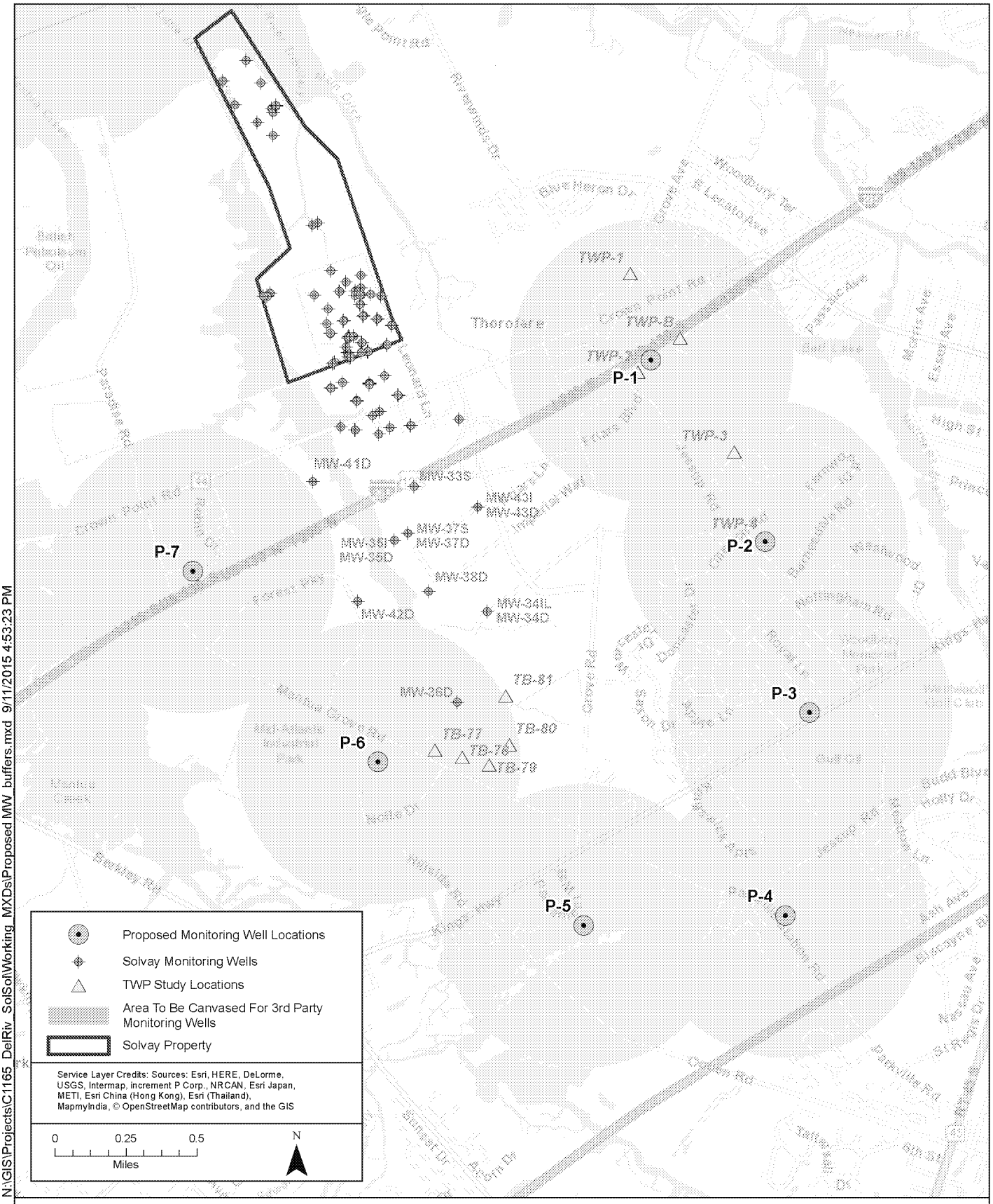
**Figure 1.**
Location Map




N:\GIS\Projects\C1165_DelRiv_SolSol\Working_MXDs\Proposed MW_with to be sampled.mxd 9/15/2015 8:10:44 PM

integral consulting inc.

**Figure 2.**
Proposed Monitoring Well Sampling Locations




N:\GIS\Projects\C1165_DelRiv_SolSol\Working_MXDs\Proposed MW_buffers.mxd 9/11/2015 4:53:23 PM

integral consulting inc.

Notes:
All monitoring well locations are approximate pending access considerations and negotiations with property owners.

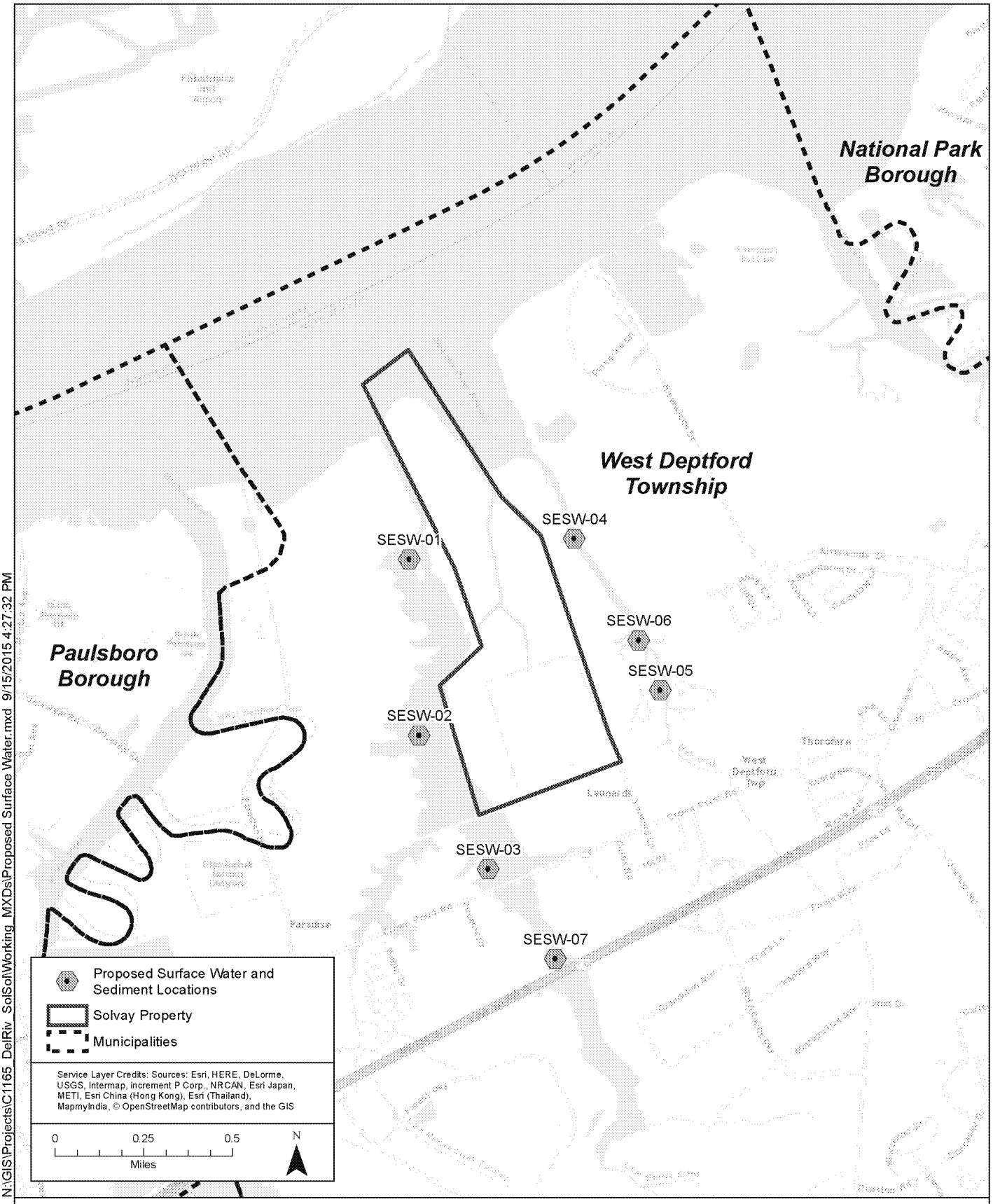
Each location will include a well couplet with anticipated screen zones corresponding to the top and base of the UPRM.

**Figure 3.**
Proposed Monitoring Well Locations and Areas to be Canvassed for Existing Monitoring Wells

N:\GIS\Projects\C1165_DelRiv_SolSol\Working_MXDs\Proposed Soil Borings_2.mxd 9/15/2015 4:17:45 PM

integral consulting inc.

**Figure 4.**
Proposed Soil Boring Locations




N:\GIS\Projects\C1165_DelRiv_SolSol\Working_MXDs\Proposed Surface Water.mxd 9/15/2015 4:27:32 PM

integral consulting inc.

**Figure 5.**
Surface Water and Sediment Sample Locations

# APPENDIX A

## QUALITY ASSURANCE PROJECT PLAN

# APPENDIX A
# QUALITY ASSURANCE PROJECT PLAN

## Perfluoroalkyl Compounds Work Plan

*Prepared for*
**Solvay Specialty Polymers USA, LLC**
10 Leonard Lane
West Deptford, NJ 08086

*Prepared by*

integral consulting inc.
923 Haddonfield Road
Suite 300
Cherry Hill, NJ 08002

September 22, 2015

# CONTENTS

**LIST OF FIGURES** ..... **v**

**LIST OF TABLES** ..... **vi**

**ACRONYMS AND ABBREVIATIONS** ..... **vii**

**1 PROJECT MANAGEMENT** ..... **1-1**

1.1 DISTRIBUTION LIST ..... 1-1
1.2 INTRODUCTION AND TASK ORGANIZATION ..... 1-1
1.3 PROJECT ORGANIZATION ..... 1-2
1.3.1 General Project Management ..... 1-2
1.3.2 Laboratories ..... 1-4
1.4 PROJECT SCHEDULE ..... 1-5

**2 CRITERIA FOR MEASUREMENT DATA** ..... **2-1**

2.1 DEFINITIONS ..... 2-1
2.2 LEVEL OF QUALITY CONTROL EFFORTS ..... 2-2
2.3 ACCURACY, PRECISION, AND SENSITIVITY OF ANALYSES ..... 2-3
2.3.1 Accuracy ..... 2-3
2.3.2 Precision ..... 2-3
2.3.3 Sensitivity ..... 2-4
2.4 DATA COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY ..... 2-4
2.4.1 Completeness ..... 2-5
2.4.2 Representativeness ..... 2-5
2.4.3 Comparability ..... 2-5

**3 DOCUMENTATION AND RECORDS** ..... **3-1**

3.1 FIELD RECORDS ..... 3-1
3.2 LABORATORY DATA REPORTS ..... 3-1
3.3 DATA QUALITY DOCUMENTATION ..... 3-2
3.4 REPORTS AND DELIVERABLES ..... 3-3

**4 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION** ..... **4-1**

**5 ANALYTICAL METHOD REQUIREMENTS** ..... **5-1**

5.1 METHODS FOR MUA, GROUNDWATER, AND SURFACE WATER SAMPLES ..... 5-1



ED_004850_00001502-00035

5.2 METHODS FOR SEDIMENT SAMPLES ..... 5-2

**6 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS ..... 6-1**

6.1 FIELD SAMPLING ..... 6-1
6.2 LABORATORY ANALYSIS ..... 6-1
6.2.1 Laboratory Control Samples ..... 6-1
6.2.2 Laboratory Duplicates ..... 6-1
6.2.3 Matrix Spikes ..... 6-2
6.2.4 Surrogate Standards ..... 6-2
6.2.5 Internal Standards ..... 6-2
6.2.6 Method Blanks ..... 6-2
6.2.7 Instrument Blanks ..... 6-2

**7 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS ..... 7-1**

7.1 FIELD INSTRUMENTS/EQUIPMENT ..... 7-1
7.2 LABORATORY INSTRUMENTS ..... 7-1

**8 INSTRUMENT CALIBRATION AND FREQUENCY ..... 8-1**

8.1 FIELD INSTRUMENTS/EQUIPMENT ..... 8-1
8.2 LABORATORY INSTRUMENTS ..... 8-1

**9 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES ..... 9-1**

**10 DATA MANAGEMENT ..... 10-1**

10.1 DATA MANAGEMENT PLAN ..... 10-1
10.1.1 Implement the Project Database ..... 10-1
10.1.2 Acquire Existing Site Data ..... 10-1
10.1.3 Summarize Data for Project Planning ..... 10-2
10.1.4 Establish Electronic Data Deliverable Reporting Specifications ..... 10-2
10.1.5 Integrate Field Sampling Results ..... 10-2
10.1.6 Integrate Laboratory Analysis Results ..... 10-3
10.1.7 Summarize Data for Validation and Integrate Validation Results ..... 10-3
10.1.8 Maintain the Project Library ..... 10-3
10.1.9 Summarize Data for Work Plan Analyses and Reporting ..... 10-4
10.1.10 Provide Access to Data ..... 10-4
10.1.11 Back Up and Maintain Database and Data Files ..... 10-4
10.2 DATA SUMMARIZATION ..... 10-5
10.3 DOCUMENTS ..... 10-6



ED_004850_00001502-00036

10.3.1 Record Preservation ..... 10-6

**11 ASSESSMENT/OVERSIGHT ..... 11-1**

11.1 ASSESSMENTS AND RESPONSE ACTIONS ..... 11-1

11.2 REPORTS TO MANAGEMENT ..... 11-2

**12 DATA REVIEW, VERIFICATION, AND VALIDATION ..... 12-1**

12.1 DATA REVIEW AND VERIFICATION ..... 12-1

12.1.1 Laboratory Analyses and Tests ..... 12-1

12.1.2 Overall Sampling Results ..... 12-1

12.2 DATA VALIDATION ..... 12-1

**13 RECONCILIATION WITH DATA QUALITY OBJECTIVES ..... 13-1**

**14 DATA USABILITY AND REPORTING ..... 14-1**

**15 REFERENCES ..... 15-1**

Attachment A1. AXYS Quality Assurance Manual and SOPs

Attachment A2. Eurofins Lancaster Quality Assurance Manual and SOPs



ED_004850_00001502-00037

# LIST OF FIGURES

Figure A-1. Integral Project Organizational Chart

Figure A-2. Gantt Chart of Proposed Project Schedule for Sampling and Lab Validation



ED_004850_00001502-00038

# LIST OF TABLES

Table A-1. Chemicals of Interest

Table A-2. Sample Containers, Preservation, and Holding Time Requirements

Table A-3. Laboratory Methods for Groundwater, Surface Water, and Sediment Samples.

Table A-4. Analytes, Method Reporting Limits, and Method Detection Limits

Table A-5 Laboratory Control Limits for Matrix Spike and Laboratory Control Samples

Table A-6 Laboratory Control Limits for Surrogates



ED_004850_00001502-00039

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AXYS | AXYS Analytical Services Ltd |
| CLP | Contract Laboratory Program |
| COC | chain of custody |
| EDD | electronic data deliverable |
| EPA | U.S. Environmental Protection Agency |
| Eurofins | Eurofins Lancaster Laboratories Environmental, LLC |
| FSP | field sampling plan |
| HAZWOPER | Hazardous Waste Operations and Emergency Response |
| HSP | health and safety plan |
| Integral | Integral Consulting Inc. |
| LC-MS/MS | liquid chromatography tandem mass spectrometry |
| LCS | laboratory control sample |
| LCSD | laboratory control sample duplicate |
| LDC | Laboratory Data Consultants, Inc. |
| LFB | laboratory fortified blank |
| MDL | method detection limit |
| MRL | method reporting limit |
| MS | matrix spike |
| MSD | matrix spike duplicate |
| NJDEP | New Jersey Department of Environmental Protection |
| PFC | perfluoroalkyl compound |
| QA | quality assurance |
| QAPP | quality assurance project plan |
| QA/QC | quality assurance and quality control |
| QC | quality control |
| RPD | relative percent difference |
| RSD | relative standard deviation |
| Site | West Deptford, New Jersey, Plant site |



ED_004850_00001502-00040

| | |
|---|---|
| Solvay | Solvay Specialty Polymers USA, LLC |
| SOP | standard operating procedure |
| TOC | total organic carbon |



ED_004850_00001502-00041

# 1 PROJECT MANAGEMENT

## 1.1 DISTRIBUTION LIST

| Title | Name |
|---|---|
| NJDEP Project Manager | Erica Bergman |
| Roux Licensed Site Remediation Professional | Tom Buggey |
| Solvay Specialty Polymers USA, LLC Project Manager | Mitch Gertz |
| Integral Principal in Charge | Judi Durda |
| Integral Project Manager | Phil Goodrum |
| Integral Field Lead | Erin Palko |
| Integral Laboratory Coordinator | Craig Hutchings |
| Database Administrator | Sanjay Advani |
| AXYS Project Manager | Georgina Brooks |
| Eurofins Lancaster Project Manager | Angela Miller |
| Laboratory Data Consultants Project Manager | Linda Rauto |

## 1.2 INTRODUCTION AND TASK ORGANIZATION

This quality assurance project plan (QAPP) and associated attachments have been prepared on behalf of Solvay Specialty Polymers USA, LLC (Solvay). This QAPP is an update to the QAPP that was previously submitted with the November 2013 work plan, pursuant to the agreement with New Jersey Department of Environmental Protection (NJDEP) outlined in a meeting between the two parties on September 6, 2013, where it was agreed that Solvay would develop a plan designed to investigate potential pathway(s) of long-chain perfluoroalkyl compounds (PFCs) from the West Deptford, New Jersey, Plant site (the Site) to the environment. The following elements are included in the current project scope:

- Sampling appropriate existing groundwater monitoring wells.
- Installation of monitoring wells.
- Sampling surface water and sediments at select locations adjacent to the Site.
- Sampling surface soil at select location on the Site.

This document is the QAPP, Appendix A to the overall work plan for the *Perfluoroalkyl Compounds Work Plan of the West Deptford, New Jersey, Plant*. The companion document, Appendix B, consists of the field sampling plans (FSPs).



ED_004850_00001502-00042

This section reviews the organizational structure for activities associated with the work plan, including project management and oversight, field work, sample analysis, and data management. The organizational structure for this project is illustrated in Figure A-1. Contact information for key personnel is provided in Section 1.3.

## 1.3 PROJECT ORGANIZATION

Solvay has retained Integral Consulting Inc. (Integral) to study PFCs at the Site). Tom Buggey of Roux Associates serves as the Licensed Site Remediation Professional. Figure A-1 illustrates the organization of personnel on the project. The primary contacts for NJDEP, Solvay, and Integral are provided in the following table. A description of the project organization and contacts pertaining to this QAPP are provided after the table.

### 1.3.1 General Project Management

**NJDEP and Respondent Project Managers**

| Title | Name | Contact Information |
|---|---|---|
| NJDEP Project Manager | Erica Bergman | NJDEP - Bureau of Case Management<br>401 E. State Street - Mail Code 401-05<br>P.O. Box 420<br>Trenton, NJ 08625-0420<br>(609) 292-7406<br>erica.bergman@dep.state.nj.us |
| Solvay Project Manager | Mitch Gertz | Solvay Specialty Polymers USA, LLC<br>10 Leonard Lane<br>West Deptford, NJ 08086<br>(856) 251-6630<br>mitchell.gertz@solvay.com |
| Licensed Site Remediation Professional | Thomas Buggey | Roux Associates<br>(215) 962-3493<br>402 Heron Drive<br>Logan Township, NJ 08085<br>tbuggey@rouxinc.com |

The names and quality assurance QA responsibilities of key project personnel for Integral who will be involved in sampling and analysis activities are provided below.



ED_004850_00001502-00043

**Project Personnel Quality Assurance Responsibilities**

| Title | Responsibility | Name | Contact Information |
|---|---|---|---|
| Principal in Charge | Coordination of project information and related communications on behalf of Solvay | Judi Durda | Integral Consulting Inc.<br>200 Harry S. Truman Pkwy, Suite 330<br>Annapolis, MD 21401<br>(410) 573-1982 ext. 514<br>jdurda@integral-corp.com |
| Project Manager | Responsible for the successful completion of tasks described in this document, and coordination with NJDEP project manager and Solvay project manager to execute the study described in this document | Phil Goodrum | Integral Consulting Inc.<br>7030 E Genesee Street, Suite 110<br>Fayetteville, NY 13066<br>(310) 445-5090 ext. 751<br>pgoodrum@integral-corp.com |
| Corporate Health and Safety Manager | Oversight of health and safety program for field tasks | Matt Behum | Integral Consulting Inc.<br>200 Harry S. Truman Pkwy, Suite 330<br>Annapolis, MD 21401<br>(410) 573-1982 ext. 512<br>mbehum@integral-corp.com |
| Field Lead | Field data collection and implementation of the health and safety plan | Erin Palko | Integral Consulting Inc.<br>923 Haddonfield Road<br>Suite 300<br>Cherry Hill, NJ 08002<br>(856) 324-8248<br>epalko@integral-corp.com |
| Database Administrator | Database development and data management | Sanjay Advani | Integral Consulting Inc.<br>605 S. College Avenue<br>Suite 101<br>Fort Collins, CO 80524<br>(970) 682.2184, ext. 133<br>sadvani@integral-corp.com |
| Laboratory Coordinator | Completeness of quality assurance documentation and procedures; liaison between project personnel, chemical testing laboratories and data validators and for related quality assurance communications with NJDEP | Craig Hutchings | Integral Consulting Inc.<br>1205 West Bay Dr. NW<br>Olympia, WA 98502<br>(360) 705-3534 ext. 417<br>chutchings@integral-corp.com |



ED_004850_00001502-00044

### 1.3.2 Laboratories

The laboratories that will perform the chemical analysis on samples collected during this investigation are AXYS Analytical Services Ltd (AXYS), located in British Columbia, Canada, and Eurofins Lancaster Laboratories Environmental, LLC (Eurofins), located in Lancaster, PA. AXYS and Eurofins are certified by NJDEP for the analyses they will be performing. Contact information and certification numbers for both laboratories are provided below.

**Laboratory Contract Information**

| | | |
|---|---|---|
| AXYS Analytical Services Ltd | Georgina Brooks<br>Senior Project Manager<br>2045 Mills Road<br>Sidney, BC Canada<br>V8L 5X2<br>(888) 373-0881<br>gbrooks@axys.com | NJDEP Certification Number: CANA005<br>Canadian Association for Laboratory Accreditation: A2637 |
| Eurofins Lancaster Laboratories Environmental, LLC | Angela Miller<br>Specialist<br>2425 New Holland Pike<br>Lancaster, PA 17601<br>717-556-7260<br>AngelaMiller@eurofinsUS.com | NJDEP Certification Number<br>PA011 |

The following responsibilities apply to the project managers and quality assurance managers at the analytical laboratories used for this task.

The laboratory project managers are responsible for the successful and timely completion of sample analyses, and for performing the following tasks:

- Ensure that samples are received and logged in correctly, that the correct methods and modifications are used, and that data are reported within specified turnaround times.
- Review analytical data to ensure that procedures were followed as required in this QAPP, the cited methods, and laboratory standard operating procedures (SOPs).
- Keep the task laboratory coordinator apprised of the schedule and status of sample analyses and data package preparation.
- Notify the task laboratory coordinator if problems occur in sample receiving, analysis, or scheduling, or if control limits cannot be met.
- Take appropriate corrective action as necessary.
- Report data and supporting quality assurance information as specified in this QAPP.



ED_004850_00001502-00045

The laboratory quality assurance manager is responsible for overseeing the quality assurance activities in the laboratory and ensuring the quality of the data for this project. Specific responsibilities include the following:

- Oversee and implement the laboratory's quality assurance program.
- Maintain quality assurance records for each laboratory production unit.
- Ensure that quality assurance and quality control (QA/QC) procedures are implemented as required for each method and provide oversight of QA/QC practices and procedures.
- Review and address or approve nonconformity and corrective action reports.
- Coordinate response to any quality control issues that affect this project with the laboratory project manager.

## 1.4 PROJECT SCHEDULE

Figure A-2 shows the key elements of the proposed schedule for sampling, well installation, analysis, data validation, and reporting. Implementation of the work plan will not begin until formal approval of the work plan is received from the NJDEP.



ED_004850_00001502-00046

# 2 CRITERIA FOR MEASUREMENT DATA

The overall quality assurance objectives are to develop and implement procedures for field sampling, chain-of-custody (COC), laboratory analysis, field measurement, and reporting that will provide data that are scientifically valid, meet the data quality objectives, are to a degree of quality consistent with their intended use, and are defensible in a court of law. This section defines the goals for the QA/QC effort and the accuracy, precision, sensitivity, completeness, representativeness, and comparability of laboratory analyses. The chemicals of interest for each matrix are presented in Table A-1; Table A-2 presents sample preservation and holding time requirements; and Table A-3 presents the laboratory methods that will be used. The SOPs applied in this project will comply with the quality assurance requirements of NJDEP's *Field Sampling Procedures Manual* (NJDEP 2005, Chapter 2) and *Data of Known Quality Protocols Technical Guidance* (NJDEP 2014).

## 2.1 DEFINITIONS

The data quality indicators and their use for assessment of data quality are as follows:

- **Precision** measures the reproducibility of measurements under a given set of conditions without consideration of the "true" or accurate value, i.e., variability between measurements of the same material for the same analyte. Precision is measured in terms of relative percent difference (RPD) between a sample and its duplicate or between a matrix spike (MS) and a matrix spike duplicate sample (MSD). The laboratory uses laboratory control samples/laboratory control sample duplicate (LCS/LCSD) pairs when MS/MSDs are not practical due to the nature of a sample or analytical method used, and they are prepared and analyzed with each batch of samples instead of MS/MSDs. An LCS/LCSD may also be prepared in place of an MS/MSD in the case that a sufficient sample volume was not obtained in the field to perform the MS/MSD analysis. For inorganic analyses, analytical precision is usually calculated based on the sample and spike duplicate results. Field sampling precision will be evaluated based on the RPD for field duplicate samples.
- **Accuracy** measures the bias of an analytical system by comparing the difference of a measurement with a reference value. The difference between the observed value and the reference value includes components of both systematic error (bias) and random error. Accuracy will vary from analysis to analysis because of individual sample and matrix effects. Control limits are defined as the mean recovery, plus or minus 3 standard deviations, of the 20 data points, with the warning limits set as the mean, plus or minus 2 standard deviations. Percent recoveries for MS, MSD, and LCS that are analyzed for every batch of up to 20 samples serve as a measure of analytical accuracy. Surrogate standards are added to all samples, blanks, MS, MSD, and LCS analyzed for



ED_004850_00001502-00047

organic contaminants to evaluate accuracy of the method and help to determine matrix interferences. The spiking solutions used for accuracy determinations are not used for instrument calibrations.

- **Completeness** is defined as the percentage of measurements made that are judged to be valid measurements. For the data to be considered complete, they must meet all acceptance criteria including accuracy and precision and other criteria specified for an analytical method.
- **Representativeness** expresses the degree to which the data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, process condition, or an environmental condition. Representativeness is a qualitative parameter, which is dependent upon the proper design of the sampling program and the laboratory quality control protocol.
- **Comparability** is a qualitative parameter expressing the confidence with which one data set can be compared with another. This goal is achieved through using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units.
- **Sensitivity** is evaluated by whether the laboratory met the practical quantitation limits established in the QAPP. The laboratory will determine the method detection limits (MDLs) for each method, instrument, analyte, and matrix by using the procedure described in Title 40 CFR Part 136B. The MDL is defined as the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. The laboratory will select the practical quantitation limits for all analytes at concentration levels that exceed the calculated MDLs by a factor of 2 to 10. Reporting limits for the project are presented in Table A-4.

## 2.2 LEVEL OF QUALITY CONTROL EFFORTS

The level of quality control effort for the field sampling efforts will include the following types of quality control samples. The frequency of quality control samples per sample or sampling event is specified in Section 6.2.

- Field "blind" duplicate samples will be obtained to provide an estimate of the reproducibility of measurements, sampling procedures, and analytical procedures.
- MS/MSD samples will be obtained to provide information about the effect of the sample matrix on digestion and measurement methodology.
- Equipment rinsate blanks will be collected to determine the effectiveness of the decontamination procedure if non-dedicated equipment is used during sampling.



ED_004850_00001502-00048

The analytical laboratory will follow the quality control requirements of the analytical methods in accordance with the requirements in the method.

## 2.3 ACCURACY, PRECISION, AND SENSITIVITY OF ANALYSES

Data generated in the field and the laboratory will be evaluated for accuracy, precision, and sensitivity as described below.

### 2.3.1 Accuracy

The following equation illustrates how accuracy is evaluated:

$$\text{Accuracy as percent recovery} = \frac{\text{Spiked Sample Result - Sample Result}}{\text{Spike True Value}} \times 100\% \qquad (2\text{-}1)$$

Percent recoveries for MS, MSD, and LCS that are analyzed for every batch of up to 20 samples serve as a measure of analytical accuracy. Surrogate standards are added to all samples, blanks, MS, MSD, and LCS analyzed for organic contaminants to evaluate accuracy of the method and help to determine matrix interferences.

Laboratories will evaluate percent recovery data based on in-house statistically based control limits for each method of analysis and specific sample matrix. The laboratory will review the quality control samples and surrogate standard recoveries for each analysis to ensure that internal quality control data lie within the limits of acceptability. The laboratory will investigate any suspect trends and take appropriate corrective actions.

### 2.3.2 Precision

The following equation illustrates the method for calculating RPD to assess a method's precision:

$$\text{Precision as RPD} = \frac{2x\left|\text{Result} - \text{Duplicate Result}\right|}{\text{Result} + \text{Duplicate Result}} x100\% \qquad (2\text{-}2)$$

Precision is expressed in terms of the relative standard deviation (RSD) for three or more measurements and the RPD for two measurements. The RSD is the ratio of the standard deviation of three or more measurements to the average of the measurements, expressed as a percentage. The analytical laboratory will have statistically based acceptability limits for RPDs established for each method of analysis and sample matrix. Laboratory-evaluated duplicates may include spike duplicates (for inorganics), and MSDs or LCSDs (for organics). The



ED_004850_00001502-00049

laboratory will review the quality control samples to ensure that internal quality control data lie within the limits of acceptability. Any suspect trends will be investigated and corrective actions taken.

Field precision will be monitored based on the field blind duplicate results for evaluation of the sampling techniques and sample handling procedures. Analytical data will not be qualified during the data validation process based on the field precision values. The analytical results of field blind duplicates will be evaluated as part of the data validation process described in Section 12.

Results for field and method blanks can reflect systematic bias that results from contamination of samples during collection or analysis. Any analytes detected in field or method blanks will also be evaluated as potential indicators of bias.

### 2.3.3 Sensitivity

The sensitivity of the analyses is reflected in the MDLs and method reporting limits (MRLs). Target MDLs and MRLs for this study are summarized in Table A-4. Nondetected results will be reported to the MDL unless no MDL is listed in Table A-4, in which case nondetected results will be reported to the MRL. Analytes detected at concentrations between the MRL and the MDL will be reported with a J qualifier to indicate that the value is an estimate (i.e., the analyte concentration is below the calibration range).

The achievement of reporting limits depends on the instrument's sensitivity and sample matrix effects. Therefore, it is important to monitor the instrument's sensitivity to ensure the data quality through appropriate instrument performance. The instrument's sensitivity will be monitored through the analysis of method blanks, calibration check samples, and laboratory control samples.

Additional laboratory quality control results will be evaluated to provide supplementary information regarding overall quality of the data, performance of instruments and measurement systems, and sample-specific matrix effects.

## 2.4 DATA COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

Data generated in the field and the laboratory will be evaluated for completeness, representativeness, and comparability as described below



ED_004850_00001502-00050

### 2.4.1 Completeness

The data will be reviewed and/or validated to keep invalid data from being processed through data collection. Completeness is evaluated using the following equation:

$$\text{Completeness} = \frac{\text{Acceptable Results}}{\text{Total Results}} x100\% \qquad (2\text{-}3)$$

Acceptable results (usable data) are unqualified data and U- or J-qualified data. Completeness will be calculated for each suite of analytes for each sample type. The completeness goal for this project is 90 percent.

### 2.4.2 Representativeness

Representativeness is a qualitative QA/QC parameter. Representativeness is the degree to which data represent a characteristic of an environmental condition. Field personnel will be responsible for ensuring that samples are representative of field conditions by collecting and handling samples according to approved FSP and field SOPs. Errors in sample collection, packaging, preservation, or COC procedures may result in samples being judged as non-representative and may form a basis for rejecting the data.

Data generated by the laboratory must be representative of the laboratory database of accuracy and precision measurements for analytes in different matrices. Laboratory procedures for sample preparation will ensure that aliquots used for analysis are representative of the whole sample. Representativeness will be ensured by the proper handling and storage of samples and initiation of analysis within holding times.

### 2.4.3 Comparability

Comparability is the qualitative similarity of one data set to another (i.e., the extent to which different data sets can be combined for use). Comparability will be assessed by evaluating whether 1) sample collection and handling procedures adhered to the procedures specified in the QAPP and the work plan; and 2) laboratory procedures followed standard analytical protocols, used standard units and standardized report formats, followed the calculations as referenced in approved analytical methods, and used a standard statistical approach for quality control measurements.



ED_004850_00001502-00051

# 3 DOCUMENTATION AND RECORDS

Records will be maintained documenting all activities and data related to sample collection and to laboratory analyses. Results of data verification and validation activities will also be documented. Procedures for documentation of these activities are described in this section.

This document, the FSP (Appendix B) and the health and safety plan (HSP) will be provided to every task participant listed in Section 1.3, with the exception that the FSP and HSP will not be provided to the laboratories. Any revisions or amendments to any of these documents will also be provided to these individuals.

## 3.1 FIELD RECORDS

Components of field documentation are discussed in Section 3 of the FSP. Integral's field lead will ensure that the field team receives the final, approved version of this document, the FSP, and HSP prior to the initiation of field activities. Field records that will be maintained include the following:

- Field logbooks
- Photo documentation
- Field data and sample collection information forms
- Field change request forms (as needed)
- Sample tracking/ COC forms.

Observations recorded in the field logbook will be used to provide context and aid in presentation and interpretation of analytical results. Additional details regarding the content and use of these documents are described in Section 3.0 of the FSP.

## 3.2 LABORATORY DATA REPORTS

All activities and results related to sample analysis will be documented at each laboratory. Internal laboratory documentation procedures are described in the laboratory quality assurance manuals (Attachments A1 and A2).

Each laboratory will provide a data package for each sample delivery group or analysis batch that is comparable in content to a full contract laboratory program (CLP) package. The format of the data may differ from CLP requirements. Each data package will contain all information required for a complete quality assurance review, including the following:



ED_004850_00001502-00052

- A cover letter discussing analytical procedures and any difficulties that were encountered.
- A case narrative referencing or describing the procedures used and discussing any analytical problems and deviations from SOPs and this document.
- COCs and cooler receipt forms.
- A summary of analyte concentrations (to two significant figures, unless otherwise justified), MRLs, and MDLs.
- Laboratory data qualifier codes appended to analyte concentrations, as appropriate, and a summary of code definitions.
- Sample preparation, digestion, extraction, dilution, and cleanup logs.
- Instrument tuning data.
- Initial and continuing calibration data, including instrument printouts and quantification summaries, for all analytes.
- Results for method and instrument blanks.
- Results for all QA/QC checks, including but not limited to surrogate spikes, internal standards, LCSs, MS samples, MSD samples, and laboratory duplicate samples provided on summary forms.
- Instrument data quantification reports for all analyses and samples.
- Copies of all laboratory worksheets and standards preparation logs.

Data will be delivered by the laboratories in both hard copy and electronic format to the task laboratory coordinator, who will be responsible for oversight of data verification and validation and for archiving the final data and data quality reports in the project file. Electronic data deliverables (EDDs) will be compatible with the project database.

## 3.3 DATA QUALITY DOCUMENTATION

Data verification (i.e., confirming the accuracy and completeness of field and laboratory data) will be completed by Integral's technical team for data generated in the field, and by each laboratory for the data that it generates. Data validation reports for chemical analyses will be prepared as described in Section 12 and provided to Integral's Laboratory Coordinator. All changes to data stored in the database will be recorded in the database change log. Any data tables prepared from the database for data users will include all qualifiers that were applied by the laboratory and during data validation.



ED_004850_00001502-00053

## 3.4 REPORTS AND DELIVERABLES

Groundwater, surface water, soil, and sediment sample data will be provided to NJDEP following receipt of all validated data. Laboratory and data validation reports will accompany all transmittals of data.



ED_004850_00001502-00054

# 4 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

A technical team will be assembled with the requisite experience and technical skills to successfully complete the proposed study. All technical team personnel involved in sample collection will have extensive environmental sampling experience.

Sampling personnel will be required to have completed the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) standard training course and 8-hour refresher courses. Sampling personnel participating in the onsite groundwater sampling will be required to have completed additional Solvay Site-specific safety training courses. The training provides employees with knowledge and skills that enable them to perform their jobs safely and with minimum risk to their personal health. Documentation of course completion will be maintained in personnel files.

The selected laboratories will hold certification through the NJDEP and National Environmental Laboratory Accreditation Program for the methods which that laboratory will perform, where applicable. Training and certification requirements for laboratory personnel are provided in the laboratory quality assurance plans (Attachments A1 and A2).



ED_004850_00001502-00055

# 5 ANALYTICAL METHOD REQUIREMENTS

Samples collected for this study will be analyzed for the chemicals of interest as indicated in Table A-1. The analytical methods that will be used are presented in the following sections and summarized in Table A-3. MRLs and MDLs are presented in Table A-4.

## 5.1 METHODS FOR GROUNDWATER, PORE WATER, AND SURFACE WATER SAMPLES

All groundwater, pore water, and surface samples will be analyzed for PFCs by AXYS of Sidney BC, Canada.

AXYS employs an in-house method MLA-060. This method uses solid phase extraction with high performance liquid chromatography, tandem mass spectrometry (LC-MS/MS). The laboratory' SOP for this methods is considered confidential and was not released; however, method performance information is provided with the laboratory quality assurance manual in Attachment A1.

Analyses for conventional parameters in groundwater, pore water, and surface water samples will be performed by Eurofins of Lancaster, as indicated in Table A-3. The following parameters will be analyzed:

Groundwater:

- Bromide, chloride, fluoride, sulfate.
- Calcium, iron, magnesium, manganese, potassium, sodium.
- Total suspended solids.
- pH.
- Total hardness.
- Alkalinity.

Pore water:

- Bromide, chloride, fluoride, sulfate.
- Calcium, iron, magnesium, manganese, potassium, sodium.
- pH.



ED_004850_00001502-00056

Surface water:

- Bromide, chloride, fluoride, sulfate.
- Calcium, iron, magnesium, manganese, potassium, sodium.
- Total suspended solids.
- Total dissolved solids.
- Total organic chlorine.
- pH.

The laboratories SOPs for these methods are provided with the laboratory quality assurance manual in Attachment A2.

## 5.2 METHODS FOR SEDIMENT AND SOIL SAMPLES

Sediment and soil samples will be analyzed for PFCs by AXYS located in Sidney, British Columbia, Canada, and for conventional parameters by Eurofins located in Lancaster, Pennsylvania, as indicated in Table A-3.

The analysis for PFCs will be performed by AXYS's in-house method MLA-041. Samples are extracted by shaking and analysis is performed using LC-MS/MS.

Sediment and soil samples will also be analyzed for the following conventional parameters:

- Grain size.
- Total organic carbon (TOC).

The laboratories' SOPs for these methods are provided with the laboratory quality assurance manuals in Attachment A2.



ED_004850_00001502-00057

# 6 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

Quality control samples will be prepared in the field and at the laboratory to monitor the precision and bias of the sample collection and analysis procedures.

## 6.1 FIELD SAMPLING

Field quality control is discussed in Section 2.12 of the FSP.

## 6.2 LABORATORY ANALYSIS

The analytical method protocols include descriptions of quality control procedures, control limits, and requirements for corrective actions. Laboratory control limits are provided in Tables A-5 and A-6. Control limits are updated periodically by the laboratories and control limits that are in effect at the laboratory at the time of analysis will be used for sample analysis and data validation. These may differ slightly from the control limits shown Tables A-5 and A-6. Quality conttol procedures will be completed by the laboratory, as required in the protocols and their SOPs. Laboratory quality control procedures are summarized below.

### 6.2.1 Laboratory Control Samples

Laboratory control samples or laboratory fortified blanks (LFBs) will be performed for all parameters indicated in Table A-5 at a frequency of 1 every 20 samples, or 1 per extraction batch, whichever is more frequent. Laboratory control limits for recoveries of LCS are provided in Table A-5. If the LCS or LFB recoveries do not meet the laboratory control limits the samples should be reanalyzed.

### 6.2.2 Laboratory Duplicates

Laboratory duplicates will be performed for all parameters indicated in Table A-5 at a frequency of 1 every 20 samples, or 1 per extraction batch, whichever is more frequent. Laboratory control limits for laboratory duplicate RPDs are provided in Table A-5. If laboratory duplicate RPDs do not meet the laboratory control limits the data should be flagged by the laboratory to indicate this outlier.



ED_004850_00001502-00058

### 6.2.3 Matrix Spikes

MSs and MSDs will be performed for all parameters indicated in Table A-5, at a frequency of 1 set every 20 samples, or 1 set per extraction batch, whichever is more frequent. An LCSD may be performed if insufficient sample volume is available for an MS/MSD. Laboratory control limits for recoveries of MSs and for RPD between MS/MSDs are provided in Table A-5. If the laboratory control limits for percent recovery or RPD are not met, the data should be flagged by the laboratory to indicate this outlier.

### 6.2.4 Surrogate Standards

Surrogates will be added to all samples for PFC analyses prior to extraction. Laboratory control limits for surrogate recoveries are provided in Table A-6. If the laboratory control limits for percent recovery are not met the samples should be reanalyzed.

### 6.2.5 Internal Standards

Internal standards are added to all sample extracts for PFCs. The area of the internal standards should be within the limits specified in the laboratory's SOP. If the internal standard area does not meet this criterion the sample should be reanalyzed.

### 6.2.6 Method Blanks

Method blanks will be analyzed at a frequency of 1 every 20 samples, or 1 per extraction batch, whichever is more frequent. Method blanks are not performed for grain size analyses. If target analytes are detected in the method blanks greater than the MRL the associated samples should reanalyzed.

### 6.2.7 Instrument Blanks

Instrument blanks will be performed with all analyses for TOC. Instrument banks will be analyzed following every calibration verification standard. If TOC is detected in the instrument blanks greater than the MRL the associated samples should reanalyzed.



ED_004850_00001502-00059

# 7 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

This section describes testing, inspection, and maintenance requirements for field and laboratory instruments.

## 7.1 FIELD INSTRUMENTS/EQUIPMENT

Maintenance of field instruments and equipment are discussed in Section 2.9.2 of the FSP.

## 7.2 LABORATORY INSTRUMENTS

Analytical instrument testing, inspection, maintenance, setup, and calibration will be conducted by the laboratories in accordance with the requirements identified in the laboratories' SOPs and manufacturer instructions. In addition, each of the specified analytical methods provides protocols for proper instrument setup and tuning and critical operating parameters. Instrument maintenance and repair will be documented in the maintenance log or record book.



ED_004850_00001502-00060

# 8 INSTRUMENT CALIBRATION AND FREQUENCY

This section describes the frequency and requirements for the calibration of field and laboratory instruments.

## 8.1 FIELD INSTRUMENTS/EQUIPMENT

Calibration of field instruments and equipment are discussed in Section 2.9.2 of the FSP.

## 8.2 LABORATORY INSTRUMENTS

Laboratory instruments will be properly calibrated, and the calibration will be verified with appropriate check standards and instrument blanks for each parameter before beginning each analysis. Instrument calibration procedures and schedules will conform to analytical protocol requirements and descriptions provided in the laboratories' quality assurance plans and SOPs.

All calibration standards will be obtained from a commercial vendor, and the laboratories will maintain traceability back to the National Institute of Standards and Technology. Stock standards will be used to make intermediate standards and calibration standards. Special attention will be given to expiration dating, proper labeling, proper refrigeration, and prevention of contamination. Documentation relating to the receipt, mixing, and use of standards will be recorded in a laboratory logbook. All calibration and spiking standards will be checked against standards from another source, as specified in the methods and the laboratory quality assurance manual.



ED_004850_00001502-00061

# 9 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

The quality of supplies and consumables used during sample collection and laboratory analysis can affect the quality of the project data. All equipment that comes into contact with the samples and extracts must be sufficiently clean to prevent detectable contamination, and the analyte concentrations must be accurate in all standards used for calibration and quality control purposes.

During sample collection, the quality of laboratory water used for decontamination will be documented at the laboratory that provides that water. Precleaned sample jars (with documentation) will be provided by the laboratories. All containers will be visually inspected prior to use, and any suspect containers will be discarded.

Reagents of appropriate purity and suitably cleaned laboratory equipment will also be used for all stages of laboratory analyses. Details for acceptance requirements for supplies and consumables at the laboratories are provided in the laboratory SOPs and quality assurance manuals (Attachments A1 and A2). All supplies will be obtained from reputable suppliers with appropriate documentation or certification. Supplies will be inspected to confirm that they meet use requirements, and certification records will be retained by Integral (i.e., for supplies used in the field) or the laboratories.



ED_004850_00001502-00062

# 10 DATA MANAGEMENT

This section describes the data management procedures that will be used for incorporating data into the project database.

## 10.1 DATA MANAGEMENT PLAN

Data management processes will occur throughout all phases of this project, as part of, or underlying, all other activities. The data management processes that accompany each of these other activities differ, however. The principal data management processes are described in the following sections.

### 10.1.1 Implement the Project Database

A project database will be set up that is capable of accommodating all of the data that are planned to be collected. This step will be completed early in the process because analysis of existing data sets is necessary to help develop the work plan.

Activities carried out during implementation of the project database will include:

- Initiation of a project-specific instance of a general-purpose environmental database (database development is not required; Integral will use a model database that it has developed specifically for similar projects).
- Establishment of backup procedures for the database.
- Initialization of the database with lists and definitions of valid values for the types of samples, analytes, and results that will be measured.
- Establishment of access controls on the database so that only appropriately qualified staff can access or update the database.

### 10.1.2 Acquire Existing Site Data

Data that have been previously collected from the Site, and that are relevant to the analyses to be carried out under the work plan, will be obtained and loaded into the project database. Data management activities carried out during this process will include:

- Acquisition of data tables and documents.
- Discussions with original investigators, as necessary, to compile detailed information on sampling locations, dates, and depths; methods; detection limits; measurement bases; and concentrations.



ED_004850_00001502-00063

- Acquisition of relevant spatial data to provide context for analytical measurements made at the Site and in the surrounding region.
- Reformatting the data such that they conform to rules and constraints within the project database.
- Loading those data into the project database.
- Review of the data and execution of quality assurance check to ensure that the entered data are correct and complete.

After existing data have been acquired, the quality of these data will be assessed for use in the investigation process.

### 10.1.3 Summarize Data for Project Planning

Data management activities carried out to support project planning will include:

- Recording planned sampling information in a way that allows later quality assurnace checks.
- Ensuring that the types of data collected, the data structures used, and the data retrieval and summarization tools will all be able to support the planned data uses.
- Organizing historical data as necessary so that it is in a consistent and well-documented format consistent with planned data uses.
- Acquiring, organizing, transforming, and documenting the regional and site-specific spatial data needed to support data analysis and interpretation.

The overall project plan is documented in the work plan and this QAPP, which will be reviewed and approved by NJDEP.

### 10.1.4 Establish Electronic Data Deliverable Reporting Specifications

Analytical results will be provided by the laboratories in EDD formats that are specifically designed to facilitate loading of data into the project database. These specifications will be provided to the laboratories, and support will be provided to the laboratories in the production of appropriate deliverables. For this project, an EDD format will be used that facilitates upload of laboratory results into the project database, as well as the NJDEP EDD format described in the Technical Requirements for Site Remediation (N.J.A.C. 7:26E).

### 10.1.5 Integrate Field Sampling Results

Data management activities carried out to support field sampling will include (but not be limited to):



ED_004850_00001502-00064

- Preparation of guidance and support materials, including maps and specifications for assignment of sample identifiers.
- Receipt, entry, and quality assurance checks of sampling information from field logbooks, sampling forms, and global positioning system devices.
- Receipt, entry, and quality assurance checks of methodological information and sample analysis results from analytical and testing laboratories.
- Filing of hard copy materials.

### 10.1.6 Integrate Laboratory Analysis Results

Integration of laboratory results into the project database will include the following procedures:

- Review of EDDs provided by the laboratory to identify erroneous formats or missing or discrepant data; discrepancies will be resolved in cooperation with the laboratory.
- Loading of data from EDDs into the project database.
- Merging and linking of field-collected data and sample metadata not available to the laboratories with the appropriate lab-reported samples.
- Production of summaries of field and laboratory quality control measures to support data validation.
- Following an independent validation according to specifications in the project QAPP, incorporation into the database of qualifiers and other results of data validation.

### 10.1.7 Summarize Data for Validation and Integrate Validation Results

Data management activities carried out to support data validation include:

- Preparation of summaries of sampling information, analytical results for field samples, and analytical results for laboratory quality control samples, for use by data validators.
- Updating of the database with data validation results, and quality assurance checks of the updates.
- Filing of hard copy materials.
- Preparation of data tables for data reporting.

### 10.1.8 Maintain the Project Library

Data management activities carried out in support of document management will include:

- Document acquisition and transformation (e.g., scanning, text extraction) as necessary.



ED_004850_00001502-00065

- Entry of document citations, abstracts, keywords, reviewers' comments, and other information as necessary.
- Linking of documents to relevant sampling or other Site data.

### 10.1.9 Summarize Data for Work Plan Analyses and Reporting

Data management activities carried out in support of analytical and reporting activities conducted under the work plan will include:

- Preparation of a wide variety of data summaries and maps.
- Development of data summarization and reporting tools as necessary.
- Acquisition and organization of ancillary data (e.g., guideline values, model parameters, model results) so that they can be efficiently used in conjunction with other data.
- Preparation of report tables and figures.

### 10.1.10 Provide Access to Data

Data management activities carried out to allow respondents and regulators access to the project data include:

- Provision of tools, training, and support to respondent team members to allow querying of the database.
- Setup of a website portal linked to the document and analytical chemistry (project) databases for the sharing of documents and data with regulators and reviewers.
- Establishment of access controls on the website portal so that only appropriately qualified staff can access or update the website portal..
- Assistance to users to facilitate their understanding and use of the data.

### 10.1.11 Back Up and Maintain Database and Data Files

The project database, document library, and all geographic information system files will be stored on a networked server.

All data on the networked server will be stored on redundant, mirrored hard drives to protect against data loss due to hard drive failure. These drives will be mounted in a file server protected by an uninterruptible power supply. The data from these drives, as well as any other data stored elsewhere on the network, will be backed up daily after work hours to a separate, corporate backup server to protect against data loss due to user error. This backup enables access to the most recently changed versions of all files. Overall, components that make up the



ED_004850_00001502-00066

data infrastructure (systems that store, backup, archive, etc.) and network systems will be monitored and maintained weekly to ensure that ongoing data storage and access needs are efficiently managed. Backup procedures will protect the data from system failure, accidental damage, catastrophic failures, and intrusion.

## 10.2 DATA SUMMARIZATION

Chemistry data will frequently be summarized for use in analyses or for presentation using tables or maps. Multiple concentration values for a given sample are often stored within a database as a result of field or laboratory replications, from field splits created for quality control evaluations, or from sample reanalyses. Although field splits and laboratory replicates are created to support data quality assessments, all of the valid results that are produced are informative, and will be used to produce the most accurate possible estimate of the true concentration in a sample. When there are replicate results for a sample, the data will be averaged in a stepwise, or hierarchical, fashion. Because each level of the hierarchy represents a different source of variation, all the results at a single level are averaged together before results are averaged across other levels. The different levels of replication, and the source of variation that each represents, are as follows:

- Laboratory replicates—Variability of laboratory measurement methods.
- Laboratory reanalyses—Variability of overall laboratory procedures.
- Sample splits—Variability of field sample handling or homogenization procedures.
- Field replicates—Spatial variability and variability of sample collection procedures.

Data will be summarized by successive averaging across these levels of replication, in the order given above. During the averaging process, data validation qualifiers and significant digits will be propagated. The rules for propagating the data validation qualifiers U (undetected), J (estimated), and R (rejected) are as follows:

- If both detected and undetected data are to be averaged, then if the detection limit of the undetected data is lower than the highest detected value, the value of the nondetect(s) will be taken at one-half the detection limit and averaged with the detected data, and the result will be identified as detected.
- If all data to be averaged are undetected, the result will be taken to be the lowest detection limit, and will be identified as undetected.
- If any of the data to be averaged are J-qualified data are averaged with non-J-qualified data, the final result will be J-qualified.
- If R-qualified data are averaged with non-R-qualified data, the result will be R-qualified.



ED_004850_00001502-00067

## 10.3 DOCUMENTS

The project database will be used to store citations for all authoritative or finalized documents. The database will be used to record the name, authors, date, and other descriptive information for documents. Every project document will be assigned a unique identifier, and that identifier will be used as a key to the citation in the database. Electronic copies of project documents will be stored as PDF files and the document's file name will be included as part of the document description in the database. Paper copies of project documents will be filed by the document identifier.

### 10.3.1 Record Preservation

The storage of all source and reference documents within the project database allow for the preservation of all original values for each data set. This allows for both automated and interactive comparisons between original and summarized data.



ED_004850_00001502-00068

# 11 ASSESSMENT/OVERSIGHT

This task will rely on the knowledge and expertise of the technical team, as described in Section 1. The field team and laboratories will stay in close verbal contact with the task manager and task laboratory coordinator during all phases of this task. This level of communication will serve to keep the management team informed about activities and events, and will allow for informal but continuous task oversight.

## 11.1 ASSESSMENTS AND RESPONSE ACTIONS

Assessment activities will include readiness reviews by the field coordinator prior to sampling, by the database administrator prior to release of the final data to the data users, and internal review while work is in progress. An informal technical systems audit may be conducted if problems are encountered during any phase of this project.

The first readiness review will be conducted by the field lead prior to field sampling to verify that all field equipment is ready for transfer to the Site. The field lead will also verify that the field team and any subcontractors have been scheduled and briefed and that the contracts for the subcontractors have been signed by both parties. Any deficiencies noted during this readiness review will be corrected prior to initiation of sampling activities.

The second readiness review will be completed by the database administrator before final data are released for use to verify that all results have been received from each laboratory, data validation has been completed for all of the data, and data qualifiers have been entered into the database and verified. Any deficiencies noted during this review will be corrected by the database administrator, or their designee. Data will not be released for final use until all data have been verified and validated. No report will be prepared in conjunction with the readiness reviews. However, the technical team coordinator and data users will be notified when the data are ready for use.

Technical review of intermediate and final work products generated for this task will be completed throughout the course of all sampling, laboratory, data validation, data management, and data interpretation activities to ensure that every phase of work is accurate and complete and follows the quality assurance procedures outlined in this document. Any problems that are encountered will be resolved between the reviewer and the person completing the work. Any problems that cannot be easily resolved or that affect the final quality of the work product will be brought to the attention of the technical team coordinator and project coordinator.



ED_004850_00001502-00069

Each laboratory will be required to have implemented a review system that serves as a formal surveillance mechanism for all laboratory activities. Details are provided in the laboratory quality assurance plans (Attachments A1 and A2).

Technical system audits may be conducted if serious problems are encountered during sampling or analysis operations. If completed, these audits will be conducted by the task laboratory coordinator or designee, or by the laboratory, as appropriate. These audits may consist of onsite reviews of any phase of field or laboratory activities or data management. Results of any audits will be provided along with the associated laboratory data.

Any task team member who discovers or suspects a nonconformance is responsible for reporting the nonconformance to the project manager, the laboratory coordinator, or the laboratory project or quality assurance manager, as applicable. The laboratory coordinator will ensure that no additional work dependent on the nonconforming activity is performed until a confirmed nonconformance is corrected. Any confirmed nonconformance issues will be relayed to the technical team coordinator.

## 11.2 REPORTS TO MANAGEMENT

Each laboratory has implemented routine systems of reporting nonconformance issues and their resolution. These procedures are described in the laboratory quality assurance manuals (Attachments A1 and A2). The laboratories will keep the laboratory coordinator informed of any laboratory quality control data outside of control limits and any corrective actions implemented and will provide descriptions and justification for any significant changes in methodology or QA/QC procedures. Laboratory nonconformance issues will also be described in the data report if they affect the quality of the data.

Data packages and EDDs will be prepared by each laboratory upon completion of analyses for each sample delivery group. The case narrative will include a description of any problems encountered, control limit exceedances (if applicable), and a description and rationale for any deviations from protocol. Copies of corrective action reports generated at the laboratory will also be included with the data package.

Data validation reports will be prepared following receipt of the complete laboratory data packages for each sample delivery group. These reports will be provided to the laboratory coordinator when validation is completed for each parameter. A summary of any significant data quality issues will be provided with the data report.



ED_004850_00001502-00070

# 12 DATA REVIEW, VERIFICATION, AND VALIDATION

Data generated in the field and at the laboratory will be reviewed, verified, and validated according to the criteria and procedures described in this section.

## 12.1 DATA REVIEW AND VERIFICATION

Data review and verification will be performed by Integral in accordance with *Guidance on Environmental Data Verification and Validation* (USEPA 2002), which defines verification as "…the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual requirements."

Field data will be verified during preparation of samples and COC forms. Field data and COC forms will be reviewed daily by the field supervisor. After field data are entered into the project database, 100 percent verification of the entries will be completed to ensure the accuracy and completeness of the database. All entries into the database will be verified. All errors found during the verification of field data, laboratory data, and the database will be corrected prior to release of the final data.

### 12.1.1 Laboratory Analyses and Tests

Review and verification of laboratory analyses and tests will be performed in conjunction with the data validation procedures described in Section 12.2.

### 12.1.2 Overall Sampling Results

Verification of the overall sampling results will be performed once all field sampling events are completed and all analytical data has been received. The FSP will be reviewed to verify that all planned samples were collected, including field quality control samples. The project database will be reviewed to verify that all planned analytical data has been received and validated in accordance with the procedures described in Section 12.2.

## 12.2 DATA VALIDATION

All laboratory data will be validated by Laboratory Data Consultants, Inc. (LDC) of Carlsbad, California. The first data package generated for each matrix (groundwater, surface water, soil, and sediment) will be fully validated, equivalent to a Stage 4 validation described in *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (USEPA 2009). If no major problems are encountered during validation of these packages, subsequent data packages will be selected so that 10 percent of the packages are fully validated. Validation for the



ED_004850_00001502-00071

remaining data will be based on review of the summary forms for sample and quality control data, equivalent to a Stage 2B validation. If problems or questions are encountered during validation, the laboratory will be contacted for resolution. Additional full validation will be completed if required to fully assess the quality of the data or to verify that laboratory errors have been addressed. The accuracy and completeness of each data set will be verified at the laboratory when the EDDs are prepared and again as part of data validation. Ten percent of entries to the database from the laboratory EDDs will be checked against the hard-copy data packages.

No guidelines are available for validation of data for PFCs; the data will be validated using procedures described in the following U.S. Environmental Protection Agency (EPA) guidance documents for data validation:

- *Guidance on Environmental Data Verification and Validation* (USEPA 2002)
- *USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Data Review* (USEPA 2008).

Data will be qualified as estimated as necessary if results for surrogates, LCS, MS samples, MSD, or internal standards do not meet laboratory control limits. Results for other quality control procedures will be qualified if they do not meet control limits outlined in the laboratory's SOP. Data will be qualified as undetected based on concentrations of target analytes detected in laboratory or field blanks, according to EPA's functional guidelines and SOPs for data validation.

Results for field split samples will be evaluated using control limits of 35 percent for aqueous samples and 50 percent for nonaqueous samples. Data will not be qualified as estimated if the measurement quality objectives are exceeded, but RPD results will be tabulated and any exceedances will be discussed in the data validation report. Equipment rinse blanks will be evaluated and data qualifiers will be applied in the same manner as method blanks, as described in the functional guidelines for data review (USEPA 2008).

Data will be rejected if control limits for acceptance of data are not met, as described in USEPA (2008).



ED_004850_00001502-00072

# 13 RECONCILIATION WITH DATA QUALITY OBJECTIVES

The goal of data validation is to determine the quality of each data point and to identify data points that do not meet the project criteria. Nonconforming data may be qualified as estimated or rejected as unusable during data validation if criteria for data quality are not met. Data qualified as estimated will be used for all intended purposes and will be appropriately qualified in the final project database. These data may be less precise or less accurate than unqualified data. Rejected data will not be used for any purpose. An explanation of any rejected data will be included in the data validation report.



ED_004850_00001502-00073

# 14 DATA USABILITY AND REPORTING

Following the completion of all sample analyses and data validation the data will be reported in a tabular format to the NJDEP. A transmittal letter detailing any data limitations and their effect on data interpretation activities will accompany the data as will the data validation reports.



ED_004850_00001502-00074

# 15 REFERENCES

NJDEP. 2005. Field sampling procedures manual. New Jersey Department of Environmental Protection, Trenton, NJ.

NJDEP. 2014. Data of known quality protocols – Technical guidance. Version 1.0. New Jersey Department of Environmental Protection, Trention, NJ. April.

USEPA. 2002. Guidance on environmental data verification and validation. EPA QA/G-8. U.S. Environmental Protection Agency, Office of Environmental Information, Washington, DC.

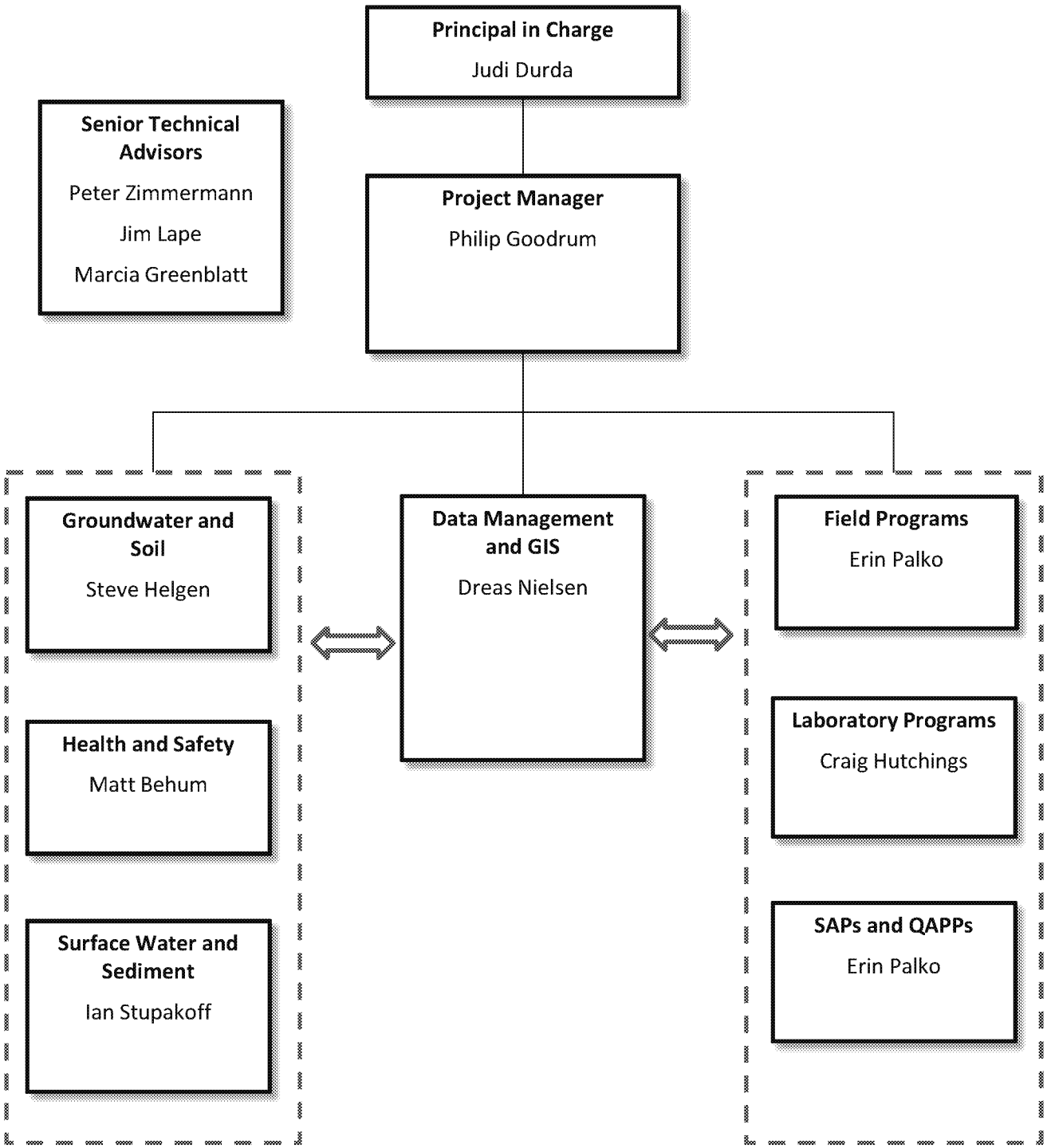
USEPA. 2008. USEPA contract laboratory program functional guidelines for superfund organic methods data review. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC.

USEPA. 2009. Guidance for labeling externally validated laboratory analytical data for superfund use. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC.



ED_004850_00001502-00075

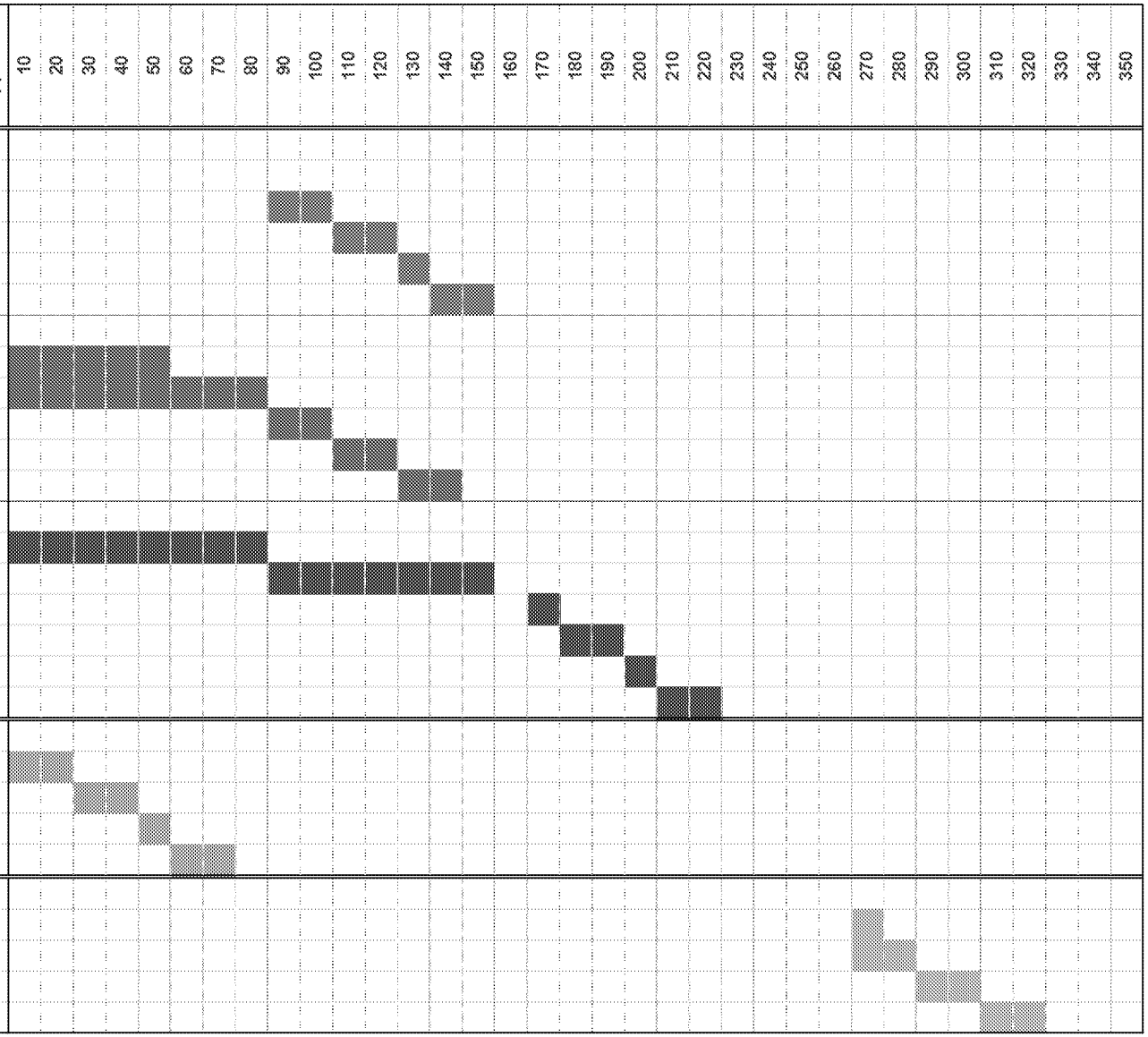
# FIGURES




integral consulting inc.

**Figure A-1.**
Integral Project Organizational Chart

| Task Description | Begin | End | Approval |
|---|---|---|---|
| **Task 1** | | | |
| **Phase 1 - Sample Groundater Wells** | | | |
| Sampling | 90 | 110 | |
| Laboratory Analysis | 110 | 130 | |
| Data Validation | 130 | 140 | |
| Data Evaluation | 140 | 160 | |
| **Phase 2 - Sample Groundwater Wells** | | | |
| Start (Canvas for potential third party wells) | 0 | 60 | |
| Sample Third Party Wells | 0 | 90 | |
| Laboratory Analysis | 90 | 110 | |
| Data Validation | 110 | 130 | |
| Data Evaluation | 130 | 150 | |
| **Phase 3 - Installation of Additional Monitoring Well Pairs** | | | |
| Access Negotiations | 0 | 90 | |
| Well Installation | 90 | 160 | |
| New Well Sampling | 170 | 180 | |
| Laboratory Analysis | 180 | 200 | |
| Data Validation | 200 | 210 | |
| Data Evaluation | 210 | 230 | |
| **Task 2 - Soil Sampling** | | | |
| Sampling | 0 | 30 | |
| Laboratory Analysis/Testing | 30 | 50 | |
| Data Validation | 50 | 60 | |
| Data Evaluation | 60 | 80 | |
| **Task 3 - Surface Water and Sediment Sampling** | | | |
| Sampling | 270 | 280 | |
| Laboratory Ananlysis/Testing | 270 | 290 | |
| Data Validation | 290 | 310 | |
| Data Evaluation | 310 | 330 | |




integral

**Figure A-2.**
Gantt Chart of Proposed Project Schedule for Sampling and Lab Validation

# TABLES

Table A-1. Chemicals of Interest

| Analyte | CAS Number | Matrix | | | | |
|---|---|---|---|---|---|---|
| | | Groundwater | Pore Water | Surface Water | Sediment | Soil |
| **PFCs** | | | | | | |
| Perfluorooctanoic acid (PFOA;C8) | 335-67-1 | X | X | X | X | X |
| Perfluorononanoic acid (PFNA;C9) | 375-95-1 | X | X | X | X | X |
| Perfluorodecanoic acid (PFDA; C10) | 335-76-2 | X | X | X | X | X |
| Perfluoroundecanoic acid (PFUnDA; C11) | 2058-94-8 | X | X | X | X | X |
| Perfluorododecanoic acid (PFDoDA; C12) | 307-55-1 | X | X | X | X | X |
| Perfluorooctanesulfonic acid (PFOS; C8) | 1763-23-1 | X | X | X | X | X |
| **Conventional Parameters** | | | | | | |
| Anions | | | | | | |
| Bromide | 24959-67-9 | X | X | X | -- | -- |
| Chloride | 16887-00-6 | X | X | X | -- | -- |
| Fluoride | 16984-48-8 | X | X | X | -- | -- |
| Sulfate | 14808-79-8 | X | X | X | -- | -- |
| Cations | | | | | | |
| Calcium | 7440-70-2 | X | X | X | -- | -- |
| Iron | 7439-89-6 | X | X | X | -- | -- |
| Magnesium | 7439-95-4 | X | X | X | -- | -- |
| Manganese | 7439-96-5 | X | X | X | -- | -- |
| Sodium | 7440-23-5 | X | X | X | -- | -- |
| Potassium | 7440-09-7 | X | X | X | -- | -- |
| Total organic carbon | 7440-44-0 | -- | -- | X | X | X |
| Total suspended solids | -- | X | -- | X | -- | -- |
| Total dissolved solids | -- | -- | -- | X | -- | -- |
| pH | 12408-02-5 | X | X | X | -- | -- |
| Alkalinity | -- | X | -- | -- | -- | -- |
| Grainsize | -- | -- | -- | -- | X | X |

Notes:

CAS = Chemical Abstracts Service registry number

PFC = perfluoroalkyl compound

X = samples will be collected and analyzed for these parameters

-- = not available



ED_004850_00001502-00080

Table A-2. Sample Containers, Preservation, and Holding Time Requirements

| Analyses | Container [a] Type | Container [a] Size | Preservation | Holding Time | Minimum Sample Size |
|---|---|---|---|---|---|
| **Water Samples (Groundwater, Pore Water, Surface Water)** | | | | | |
| PFCs | HDPE | 2 x 500 mL<br>1 x 50 mL | < 10°C | 60 days to extraction<br>30 days from extraction to analysis | 500 mL |
| Cations (calcium, iron, magnesium, manganese, sodium, potassium) | HDPE | 250 mL | 4 ± 2°C, $HNO_3$ to pH<2 | 6 months | 100 mL |
| Anions (bromide, chloride, sulfate) | Glass | 2 x 40 mL | 4 ± 2°C | 28 days | 40 mL |
| Fluoride | HDPE | 2 X 500 mL | 4 ± 2°C | 28 days | 100 mL |
| Total dissolved solids | | | | 7 days | 100 mL |
| Total organic carbon | AG | 2 x 40 mL | 4 ± 2°C, $H_3PO_4$ to pH<2 | 28 days | 40 mL |
| Total suspended solids | HDPE | 1,000 mL | 4 ± 2°C | 7 days | 100 mL |
| pH | HDPE | 250 mL | 4 ± 2°C | Analyze immediately | 100 mL |
| Alkalinity | | | | 14 days | 50 mL |
| **Sediment and Soil Samples** | | | | | |
| PFCs | Wide Mouth HDPE | 250 mL | < 10°C | 1 year to extraction<br>30 days from extraction to analysis | 10 g |
| Grainsize | WMG | 16 oz. | 4 ± 2°C | 6 months | 500 g |
| Total organic carbon | WMG | 4 oz. | 4 ± 2°C | 28 days | 3 g |

Notes:
AG = amber glass
HDPE = high density polyethylene
$HNO_3$ = nitric acid
$H_3PO_4$ = phosphoric acid
PFC = perfluoroalkyl compound
WMG = wide mouth glass

[a] The size and number of containers may be modified by the analytical laboratory.

Table A-3. Laboratory Methods for Groundwater, Surface Water, and Sediment Samples

| | | Sample Preparation | | Quantitative Analysis | |
|---|---|---|---|---|---|
| Analyses | Laboratory | Protocol | Procedure | Protocol | Procedure |
| **Water Samples (Groundwater, Pore Water, Surface Water)** | | | | | |
| PFCs | AXYS | Laboratory SOP: MLA-060 | Solid phase extraction | Laboratory SOP: MLA-060 | LC-MS/MS |
| Anions (bromide, chloride, fluoride, sulfate) | Eurofins Lancaster | -- | -- | EPA 300.0 | Ion chromatography |
| Cations (calcium, iron, magnesium, manganese, sodium, potassium) | | EPA 3050B | Strong acid digestion | EPA 6010B | Inductively coupled plasma - atomic emission spectrometry |
| Total organic carbon | | SM 5310C | Heated-persulfate oxidation | SM 5310C | Infrared detector |
| Total suspended solids | | SM 2540D | Filtration and drying | SM 2540D | Gravimetric |
| Total dissolved solids | | SM 2540 C | Filtration and drying | SM 2540 C | Gravimetric |
| pH | | -- | -- | SM 4500H$^{+}$ B | Electrometric |
| Alkalinity | | -- | -- | SM 2320 B | Titrimetric |
| **Sediment and Soil Samples** | | | | | |
| PFCs | AXYS | Laboratory SOP: MLA-041 | Shaking | Laboratory SOP: MLA-041 | LC-MS/MS |
| Grain size | Eurofins Lancaster | -- | -- | ASTM D422 | Sieve and hydrometer |
| Total organic carbon | | SM 5310 B Modified | Acid pretreatment | SM 5310 B Modified | Infrared detector |

Notes:
ASTM = American Society for Testing and Materials
EPA = U.S. Environmental Protection Agency
LC-MS/MS = liquid chromatography- tandem mass spectrometry
PFC = perfluoroalkyl compound
SM = Standard Methods for the Examination of Water and Wastewater
SOP = standard operating procedure
-- = not available



ED_004850_00001502-00082

Table A-4. Analytes, Method Reporting Limits, and Method Detection Limits [a]

| Analyte | Units | MRL | MDL [a] |
|---|---|---|---|
| **Groundwater, Pore Water, and Surface Water Samples** | | | |
| ***PFCs*** | | | |
| Perfluorooctanoic acid (PFOA) | ng/L | 1 | NA [b] |
| Perfluorononanoic acid (PFNA) | ng/L | 1 | NA [b] |
| Perfluorodecanoic acid (PFDA) | ng/L | 1 | NA [b] |
| Perfluoroundecanoic acid (PFUnDA) | ng/L | 1 | NA [b] |
| Perfluorododecanoic acid (PFDoDA) | ng/L | 1 | NA [b] |
| Perfluorooctanesulfonic acid (PFOS) | ng/L | 2 | NA [b] |
| ***Conventional Parameters*** | | | |
| Anions | | | |
| Bromide | mg/L | 2.5 | 1.25 |
| Chloride | mg/L | 2 | 1 |
| Fluoride | mg/L | 0.5 | 0.25 |
| Sulfate | mg/L | 5 | 1.5 |
| Cations | | | |
| Calcium | mg/L | 2 | 0.0333 |
| Iron | mg/L | 0.200 | 0.0333 |
| Magnesium | mg/L | 0.100 | 0.0167 |
| Manganese | mg/L | 0.0050 | 0.0008 |
| Sodium | mg/L | 1.00 | 0.167 |
| Potassium | mg/L | 0.500 | 0.192 |
| Total organic carbon | mg/L | 1.0 | 0.50 |
| Total suspended solids | mg/L | 3.00 | 1.00 |
| Total dissolved solids | mg/L | 30.0 | 9.7 |
| pH | pH units | 0.010 | 0.010 |
| Alkalinity | mg/L as $CaCO_3$ | 2.0 | 0.70 |
| **Sediment and Soil Samples** | | | |
| ***PFCs*** | | | |
| Perfluorooctanoic acid (PFOA) | µg/kg | 0.10 | NA [b] |
| Perfluorononanoic acid (PFNA) | µg/kg | 0.10 | NA [b] |
| Perfluorodecanoic acid (PFDA) | µg/kg | 0.10 | NA [b] |
| Perfluoroundecanoic acid (PFUnDA) | µg/kg | 0.10 | NA [b] |
| Perfluorododecanoic acid (PFDoDA) | µg/kg | 0.10 | NA [b] |
| Perfluorooctanesulfonic acid (PFOS) | µg/kg | 0.20 | NA [b] |
| ***Conventional Parameters*** | | | |
| Grainsize | percent | NA | NA |
| Total organic carbon | mg/kg | 300 | 100 |

Notes:

MDL = method detection limit

MRL = method reporting limit

NA = not applicable

PFC = perfluoroalkyl compound

[a] Method detection limits are updated periodically by the laboratories. MDLs that are in effect at the laboratory at the time of analysis will be used for sample analysis and data validation. These may differ slightly from the MDLs shown in this table.

[b] AXYS reports PFCs down to the MRL only.

Table A-5. Laboratory Control Limits for Matrix Spike and Laboratory Control Samples [a]

| Analytes | MS/LFSM Recovery (%) | LCS/LFB Recovery (%) | Type of Duplicate | Control Limit RPD |
|---|---|---|---|---|
| **Groundwater, Pore Water, and Surface Water Samples** | | | | |
| ***PFCs*** | | | | |
| Perfluorooctanoic acid (PFOA) | 80–120 | 80–120 | MSD | 40 |
| Perfluorononanoic acid (PFNA) | 80–120 | 80–120 | MSD | 40 |
| Perfluorodecanoic acid (PFDA) | 80–120 | 80–120 | MSD | 40 |
| Perfluoroundecanoic acid (PFUnDA) | 80–120 | 80–120 | MSD | 40 |
| Perfluorododecanoic acid (PFDoDA) | 80–120 | 80–120 | MSD | 40 |
| Perfluorooctanesulfonic acid (PFOS) | 70–130 | 70–130 | MSD | 40 |
| ***Conventional Parameters*** | | | | |
| Anions | | | | |
| Bromide | 90–110 | 90–110 | LD | 20 |
| Chloride | 90–110 | 90–110 | LD | 20 |
| Fluoride | 90–110 | 90–110 | LD | 20 |
| Sulfate | 90–110 | 90–110 | LD | 20 |
| Cations | | | | |
| Calcium | 75–125 | 80–120 | LD | 20 |
| Iron | 75–125 | 80–120 | LD | 20 |
| Magnesium | 75–125 | 80–120 | LD | 20 |
| Manganese | 75–125 | 80–120 | LD | 20 |
| Sodium | 75–125 | 80–120 | LD | 20 |
| Potassium | 75–125 | 80–120 | LD | 20 |
| Total organic carbon | 91–113 | 80–120 | LD | 20 |
| Total suspended solids | NA | 91–105 | LD | 20 |
| Total dissolved solids | NA | 80–120 | LD | 9 |
| pH | NA | 95–105 | LD | 3 |
| Alkalinity | NA | 90–110 | LD | 5 |
| **Sediment and Soil Samples** | | | | |
| ***PFCs*** | | | | |
| Perfluorooctanoic acid (PFOA) | 70–130 | 70–130 | MSD | 40 |
| Perfluorononanoic acid (PFNA) | 70–130 | 70–130 | MSD | 40 |
| Perfluorodecanoic acid (PFDA) | 70–130 | 70–130 | MSD | 40 |
| Perfluoroundecanoic acid (PFUnDA) | 40–130 | 40–130 | MSD | 40 |
| Perfluorododecanoic acid (PFDoDA) | 70–130 | 70–130 | MSD | 40 |
| Perfluorooctanesulfonic acid (PFOS) | 70–130 | 70–130 | MSD | 40 |
| ***Conventional Parameters*** | | | | |
| Grainsize | NA | NA | NA | NA |
| Total organic carbon | 47–143 | 47–143 | LD | 20 |

Notes:

LCS = laboratory control sample
LD = lab duplicate
LFB = laboratory fortified blank
LFSM = laboratory fortified sample matrix
MS = matrix spike
MSD = matrix spike duplicate
NA = not applicable
PFC = perfluoroalkyl compound
RPD = relative percent difference

[a] Control limits are updated periodically by the laboratories. Control limits that are in effect at the laboratory at the time of analysis will be used for sample analysis and data validation. These may differ slightly from the control limits shown in this table.



ED_004850_00001502-00084

Table A-6. Laboratory Control Limits for Surrogates [a]

| Analytes | Surrogate Recovery (%) |
|---|---|
| **Groundwater, Pore Water, and Surface Water Samples** | |
| $^{13}C_2$- Perfluorooctanoic acid ($^{13}C_2$-PFOA) | 40–150 |
| $^{13}C_5$-Heptadeafluoronoanoic acid ($^{13}C_5$-PFNA) | 40–150 |
| $^{13}C_2$- Perfluorodecanoic acid ($^{13}C_2$-PFDA) | 40–150 |
| $^{13}C_2$- Perfluoro-n-(1,2)dodecanoic acid ($^{13}C_2$-PFDoDA) | 40–150 |
| $^{13}C_4$-Perfluorooctanesulfonate ($^{13}C_4$-PFOS) | 40–150 |
| **Sediment and Soil Samples** | |
| $^{13}C_2$- Perfluorooctanoic acid ($^{13}C_2$-PFOA) | 40–150 |
| $^{13}C_5$-Heptadeafluoronoanoic acid ($^{13}C_5$-PFNA) | 40–150 |
| $^{13}C_2$- Perfluorodecanoic acid ($^{13}C_2$-PFDA) | 40–150 |
| $^{13}C_2$- Perfluoro-n-(1,2)dodecanoic acid ($^{13}C_2$-PFDoDA) | 40–150 |
| $^{13}C_4$-Perfluorooctanesulfonate ($^{13}C_4$-PFOS) | 40–150 |

Notes:

[a] Control limits are updated periodically by the laboratories. Control limits that are in effect at the laboratory at the time of analysis will be used for sample analysis and data validation. These may differ slightly from the control limits shown in this table.



ED_004850_00001502-00085

# ATTACHMENT A1

## AXYS QUALITY ASSURANCE MANUAL AND SOPS

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# Quality Assurance/Quality Control (QA/QC) Policies and Procedures Manual

QDO-001 Revision No. 25
22-Jan-2015

Uncontrolled if printed

## AXYS Analytical Services Ltd

**2045 Mills Road**
**Sidney, British Columbia**
**Canada V8L 5X2**

**Telephone: (250) 655-5800**

**Fax: (250) 655-5811**

Management Approval:

**Approved 13-Jan-2015** **John Cosgrove, President and Senior Technical Director**
**Shea Hewage, Director of Operations**
**Dale Hoover, QA Manager**

Hardcopy distribution:

Copy #: _____

Issued to: _____

Date Issued: _____

Copyright 2015 by AXYS Analytical Services Ltd.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# THIS PAGE LEFT INTENTIONALLY BLANK

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# RESPONSIBILITY, DISTRIBUTION AND CONTROL

The QA/QC Policies and Procedures Manual (Quality Manual) has been prepared under the direction of the Quality Assurance (QA) Manager. The QA Manager is responsible for maintaining and distributing the manual and has final authority for approving all content.

The Quality Manual is catalogued under the laboratory document control system. The manual is identified with a unique document identifier, a revision number and a date. The QA Manager and the Technical Directors of AXYS sign the manual electronically to indicate their endorsement.

Only approved, official copies of the manual are distributed to staff. The Quality Manual is available to all staff in electronic 'read only' format and bound hardcopies are controlled with a unique copy number.

The policies, procedures and responsibilities documented in this manual, and the documents referenced therein, have the full support of the management of AXYS Analytical services and are binding on all employees of the company.

The QA/QC Policies and Procedures Manual is the property of AXYS Analytical Services Ltd and is a proprietary and confidential business document. It may not be reproduced or distributed without the permission of the QA Manager.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# AMENDMENTS

Amendments are made to the Quality Manual as required. The Director or Manager of each work area submits recommendations and requests for amendments to the QA Manager. The QA Manager approves all amendments. The Quality Manual is reviewed annually and revised and reissued as warranted.

A revision history of the Quality Manual is presented in Appendix E.

Uncontrolled if printed



ED_004850_00001502-00090

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# TABLE OF CONTENTS

Page

COVER PAGE
RESPONSIBILITY, DISTRIBUTION AND CONTROL....1
AMENDMENTS....2
TABLE OF CONTENTS....3
I. INTRODUCTION....9
1. CORPORATE HISTORY....9
2. COMPANY DESCRIPTION....9
3. ACCREDITATION SUMMARY....16
II. QUALITY SYSTEM OVERVIEW....18
1. QUALITY POLICIES....18
2. QUALITY DOCUMENTATION....19
2.1 QA/QC Policies and Procedures Manual....19
2.2 Analytical Methods....20
2.3 Standard Operating Procedures....20
2.4 Quality System Records....20
2.5 Document Reviews....20
3. DOCUMENT CONTROL PROCEDURES....22
3.1 Document Preparation....23
4. DEPARTURE FROM DOCUMENTED PROCEDURES....24
III. ORGANIZATIONAL STRUCTURE....26
1. DIRECTOR OF SALES, MARKETING, AND SERVICE....26
2. PRESIDENT....26
3. DIRECTOR OF OPERATIONS....27
3.1 Client Services Manager....27
3.2 Sample and Extract Preparation Lab Manager....27
3.2.1 Lab Schedule Coordinator....27
3.2.2 Technical Service Coordinator....27
3.3 Instrumental Analysis Manager....27
3.3.1 Operations Coordinator....28
3.4 Advanced Product Development Scientist....28
4. QUALITY ASSURANCE (QA) MANAGER....28
5. LABORATORY INFORMATION MANAGEMENT SYSTEM (LIMS) MANAGER....28
IV. HUMAN RESOURCES....30
1. STAFF TRAINING....30
1.1. Orientation and Basic Training....30
1.2. Job Training....31
1.3. QA/QC Training....32
2. DATA INTEGRITY AND ETHICAL AND LEGAL RESPONSIBILITIES....32
V. FACILITIES....34
1. QA SPECIFICATIONS OF FACILITIES....35
1.1 Sample Storage....35
1.2 Facilities Maintenance....36

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

1.3 Laboratory Conditions ....36
1.4 Additional Conditions for Instrument Laboratories ....37
2. SAFETY FEATURES ....37
3. SAFETY PROCEDURES ....37
4. SECURITY FEATURES ....38
5. SECURITY POLICY ....38
5.1 Security of Facilities ....38
5.2 Security of Samples ....39
5.3 Security of Data ....39
6. COMPUTING CAPABILITIES ....40
VI. CONTRACT MANAGEMENT ....42
1. CONTRACT MANAGEMENT ....42
1.1 Bidding Process ....42
1.2 Project Management ....43
1.3 Workload Management ....43
1.4 Work Scheduling ....44
VII. SAMPLE HANDLING PROCEDURES ....46
1. SUBMISSION OF SAMPLES ....46
2. SAMPLE CONTROL PROCEDURES ....47
2.1 Sample Acceptance Criteria ....47
2.2 Receipt of Samples ....48
2.3 Sample Log-In ....49
2.4 Sample Storage and Retrieval ....49
2.5 Sample Preparation ....49
2.6 Consumption of Samples ....50
2.7 Disposal of Samples ....50
3. CHAIN-OF-CUSTODY PROCEDURES ....50
VIII. ANALYTICAL TESTING PROCEDURES ....52
1. METHOD MANAGEMENT ....52
1.1 Method Validation ....52
1.1.1 Detection Limits ....52
1.2 Measurement Uncertainty ....52
1.3 Method Control ....53
1.4 Method Numbers ....53
1.5 Method Specifications ....53
1.6 Custom Methods ....53
1.7 Methods Inventory ....54
2. TEST PROCEDURES ....54
2.1 Sample Preparation Procedures ....54
2.2 Extraction Procedures ....54
2.3 Instrumental Analysis Procedures ....55
2.3.1 Operational Checks ....57
2.3.2 Preventive Maintenance Procedures ....58
2.4 Primary Data Validation Procedures ....58
2.5 Calculation of Results ....59
2.6 Data Validation ....60
2.6.1 Quality Control Samples ....61
2.6.2 Detection Limits ....61
2.6.3 Percent Recovery of Surrogate Standards ....61

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

2.7 Data Reporting ..... 61
2.8 Record Keeping ..... 63
IX. QUALITY CONTROL MEASURES ..... 64
1. QUALITY CONTROL SAMPLES ..... 64
1.1 Procedural Blank (BLK) ..... 64
1.2 Laboratory Sample Duplicate ..... 64
1.3 Reference Samples ..... 65
1.3.1 Certified Reference Materials (CRMs) ..... 65
1.3.2 Reference Materials (RMs) ..... 65
1.3.3 Internal Reference Materials (IRMs) ..... 65
1.3.4 Laboratory Control Sample (LCS) ..... 65
1.4 Spiked Blank (SPB) ..... 66
1.5 Unspiked Matrix (USM) ..... 66
1.6 Matrix Spike (MS) / Matrix Spike Duplicate (MSD) ..... 66
2. INSTRUMENT QUALITY CONTROL CHECKS ..... 67
2.1 Instrument Linearity ..... 67
2.2 Window Standards ..... 67
2.3 Resolution Standards ..... 67
2.4 Sensitivity ..... 68
2.5 Instrumental Response Calibration ..... 68
2.6 Injection Blank (to Monitor Instrumental Injection Carryover) ..... 68
X. QUALITY ASSURANCE MEASURES ..... 70
1. PURCHASING OF GOODS AND SERVICES ..... 70
2. LABORATORY QA MEASURES ..... 71
2.1 Reagent Checks ..... 71
2.2 Glassware Checks ..... 71
2.3 Volumetric Measurements ..... 72
2.4 Balance Checks ..... 72
2.5 Thermometer Checks ..... 73
2.6 Controlled Environment Checks ..... 73
2.7 Equipment Inventory Control ..... 73
2.8 Equipment Maintenance ..... 73
3. PROFICIENCY TESTING (PT) ..... 74
4. AUDIT PROCEDURES ..... 74
4.1 Internal Audits ..... 74
4.1.1 Quality System Management Review ..... 74
4.2 External Audits ..... 75
4.3 Performance Audits ..... 75
5. PERFORMANCE MONITORING ..... 75
6. SUBCONTRACTING ..... 76
7. CORRECTIVE ACTIONS ..... 76
7.1 Client Complaints ..... 77
8. CONFIDENTIALITY ..... 78
9. PROPER RECORD KEEPING ..... 78
10. MONITORING PRACTICES ..... 79
11. PROCESS IMPROVEMENT ..... 79
XI. STANDARDS ..... 81
1. CATEGORIES OF STANDARDS ..... 81
1.1 Certified Reference Materials (CRMs) ..... 81

Uncontrolled if printed



ED_004850_00001502-00093

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

1.2 Primary Standards ....81
1.3 Stock Standards ....81
1.4 Working Standards ....82
1.4.1 Surrogate Standard ....82
1.4.2 Recovery Standard ....82
1.4.3 Cleanup Standard ....82
1.4.4 Authentic Standard ....82
1.4.5 Calibration Standards ....83
1.4.6 Window Standards ....83
1.4.7 Sensitivity Standard ....83
1.4.8 GC Column Resolution Standard ....83
2. NAMING OF STANDARDS ....83
3. PREPARATION OF STANDARD SOLUTIONS ....83
4. DOCUMENTATION OF STANDARD PREPARATION ....84
5. VALIDATION OF PREPARED STANDARD SOLUTIONS ....84
6. STORAGE AND CONTROL OF STANDARDS ....84
6.1 Certified Reference Materials ....85
6.2 Primary Standards ....85
6.3 Stock Standard Solutions ....85
6.4 Working Standards ....86
7 STABILITY OF STANDARDS ....86
7.1 Certified Reference Materials ....86
7.2 Primary Standards ....86
7.3 Stock Standards ....87
7.4 Working Standards ....87
APPENDIX A INTERNAL STANDARD METHOD OF QUANTIFICATION: SAMPLE CALCULATIONS ....89
APPENDIX B NAMING CONVENTIONS ....93
1. STANDARD SOLUTIONS ....95
2. TEST SAMPLES ....96
3. QUALITY CONTROL SAMPLES ....99
4. ANALYSIS BATCHES ....99
5. INSTRUMENTATION ....100
6. CHROMATOGRAMS ....100
6.1 Low Resolution GC/MS and GC/ECD Instruments ....100
6.2 High Resolution GC/MS and Waters LC/MSMS Instruments ....101
6.3 AB Sciex LC/MSMS Instruments ....102
7. ANALYTICAL METHODS ....103
8. INSTRUMENTAL ANALYSIS METHODS ....103
9. MICROVIAL LABEL CODES ....103
APPENDIX C DOCUMENT CONTROL SYSTEM ....105
1. ORGANIZATION AND NAMING ....107
2. DOCUMENTATION FORMAT ....111
2.1 Analytical Methods ....111
2.2 Instrument Methods ....113
3. STANDARD OPERATING PROCEDURES ....113
4. ANALYSIS REPORT FORMAT ....115
4.1 AXYS Method Report Format ....115
4.2 Signature ....116

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

4.3 Footnotes ..... 116
4.4 Rounding ..... 116
4.5 Significant Figures ..... 116
APPENDIX D AXYS GLOSSARY ..... 119
1. DEFINITIONS ..... 121
2. DETECTION LIMIT AND REPORTING LIMIT DEFINITIONS ..... 125
3. ACRONYMS ..... 127
APPENDIX E REVISION HISTORY OF QUALITY MANUAL ..... 129
APPENDIX F AXYS ANALYTICAL SERVICES FLOOR PLANS ..... 152
APPENDIX G CHEMICAL ABSTRACT (CAS) NUMBER USAGE POLICY ..... 162
APPENDIX H DATA FLAGGING CONVENTIONS ..... 166

## List of Tables

TABLE 1 SCOPE OF PRODUCTS ..... 10
TABLE 2 INSTRUMENTATION ..... 15
TABLE 3 PRICING APPROVAL LIMITS ..... 43
TABLE 4 NAMING CODES ..... 98
TABLE 5 CATEGORIES OF DOCUMENTS ..... 110
TABLE 6 REQUIREMENTS FOR ANALYSIS REPORTS ..... 117
TABLE 7 GUIDELINES FOR REPORTING SIGNIFICANT FIGURES ..... 118

## List of Figures

FIGURE 1 QUALITY SYSTEM DOCUMENTATION ..... 21
FIGURE 2 AXYS ANALYTICAL SERVICES LTD – ORGANIZATIONAL CHART ..... 29
FIGURE 3 FLOW DIAGRAM OF TESTING PROCEDURES ..... 56
FIGURE F-1 AXYS ANALYTICAL SERVICES, FACILITY FOOTPRINT ..... 154
FIGURE F-2 NORTH BUILDING, LOWER FLOOR ..... 155
FIGURE F-3 NORTH BUILDING, UPPER FLOOR ..... 156
FIGURE F-4 SOUTH BUILDING, BOTH FLOORS ..... 157
FIGURE F-5 WEST BUILDING, LOWER FLOOR ..... 158
FIGURE F-6 WEST BUILDING, UPPER FLOOR ..... 159
FIGURE F-7 SOUTH BUILDING COMPOUNDS ..... 160
FIGURE F-8 TRAILERS ..... 161

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# THIS PAGE LEFT INTENTIONALLY BLANK

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# I. INTRODUCTION

## 1. CORPORATE HISTORY

AXYS Analytical Services Ltd, located in Sidney, British Columbia, Canada, was founded in 1974 under the name of Seakem Oceanography Ltd to carry out trace metal and hydrocarbon analysis in the marine environment. Seakem Oceanography Ltd expanded and improved its capabilities in trace organic analysis in response to the demands and environmental issues of the 1970s and 1980s. The analysis service was incorporated in 1988 as a separate company, Seakem Analytical Services Ltd, and its mandate was broadened in order to offer full service contracts to an expanded client base. In 1991 the parent company reorganized, resulting in a name change to AXYS Analytical Services Ltd. There has been no change of ownership of the company.

AXYS Analytical Services Ltd (AXYS) is a 100% privately owned Canadian company.

## 2. COMPANY DESCRIPTION

AXYS is a complete service analytical laboratory specializing in routine and custom trace organic analyses on environmental and industrial samples. Permanent analytical facilities are located in Sidney, British Columbia and include modern laboratory facilities and state-of-the-art instrumentation. AXYS employs approximately 100 highly trained chemists, chemical technologists and support staff. AXYS has clients worldwide and is recognized for its expertise in trace organic analyses.

The scopes of the routine analyses and speciality analyses offered by AXYS are presented in Table 1. The instrumentation owned and operated by AXYS is presented in Table 2.

Normal business hours are 8:00 a.m. to 4:30 p.m. PST/PDT, Monday through Friday. Individual work areas are staffed outside these hours as required. The switchboard is operated 8:30 am – 4:30 pm.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

## TABLE 1 SCOPE OF PRODUCTS

The following table lists AXYS "A", "B", and "C" class products and supported matrices that are available to clients subject to default commercial guidance contained in the AXYS "Product and Service Guidelines". Note that other analyses not listed here may exist but are archived (D products). D products may be reinstated conditionally by management approval. A + B products represent fully developed analyses performed on a regular basis. C class products represent analyses which have more stringent commercial guidance. This may be the result of the analysis being in development, being applied to new matrices, having limited inter-batch QC statistics available, limitations in capacity due to equipment or proficient personnel, or being governed by commercial terms specific to a submission, project, or client.

| Test Description and Instrumentation | Matrix |
|---|---|
| Octylphenol & Nonylphenols by GC-LRMS | Water / Effluent |
| | Soil / Sediment |
| | Biosolids / Influent |
| Polychlorinated Biphenyls (PCBs) (209 congeners) by GC-LRMS | Water / Effluent |
| | Soil / Sediment |
| | Tissue |
| + Aroclors | All matrices |
| Organochlorine Pesticides by GC-LRMS (Includes E2 fraction by GC-ECD and Technical Toxaphene) | Water / Effluent |
| | Soil / Sediment |
| | Tissue |
| Toxaphene Parlars by GC-ECNI MS | Water |
| | Soil / Sediment |
| Polychlorinated Biphenyls (PCBs) by GC-HRMS (1668A/1668C, CBC01.2) | Water / Effluent |
| | Soil / Sediment |
| | Biosolids / Influent |
| | Tissue |
| | Serum / Plasma |
| | Whole Blood |
| | Filter / Swab |
| | Active High Vol Samples (XAD-2, PUFF) |
| | Passive High Vol Samples (SPMD, PED) |
| + Aroclors | All matrices |
| Polychlorinated Biphenyls (PCB) Toxics Based on 1668 (WHO List + 2) | Water / Effluent |
| | Soil / Sediment |
| | Biosolids / Influent |
| | Tissue |

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| Test Description and Instrumentation | Matrix |
|---|---|
| | Serum / Plasma |
| | Whole Blood |
| | Filter / Swab |
| Carbon Column Clean-up as Addition to GC-HRMS Polychlorinated Biphenyls (PCB) Run | Water / Effluent |
| | Soil / Sediment / Biosolids |
| | Tissue |
| | Serum / Plasma |
| | Whole Blood |
| | Filter |
| Polychlorinated dibenzodioxins and -furans by GC-HRMS (1613B, DLM02.2, 8290, 0023A) | Water / Effluent |
| | Soil / Sediment |
| | Biosolids / Influent |
| | Tissue |
| | Serum / Plasma |
| | Whole Blood |
| | Air Sampling Train |
| | Filter / Swab |
| | Active High Vol Samples (XAD-2, PUFF) |
| | Passive High Vol Samples (SPMD, PED) |
| | Ash |
| Chloroparaffins by GC-LRMS | Water / Effluent |
| | Soil / Sediment |
| | Tissue |
| Polycyclic aromatic hydrocarbons (PAHs) Parents and Alkylated PAHs by GC-LRMS | Water / Effluent |
| | Soil/ Sediment |
| | Biosolids / Influent |
| | Tissue |
| | Serum / Plasma |
| | Whole Blood |
| | Filter |
| | Air Sampling Train |
| | Active High Vol Samples (XAD-2, PUFF) |
| | Passive High Vol Samples (SPMD, PED) |
| Alkanes by GC-LRMS | Water / Effluent |
| | Soil / Sediment |
| | Tissue |
| Dioxin and Furan Pre-Cursors | All Matrices |
| | |
| | |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| Test Description and Instrumentation | Matrix |
|---|---|
| Organochlorine Pesticides by GC-HRMS (includes Technical Toxaphene) | Water / Effluent |
| | Soil / Sediment |
| | Biosolids / Influent |
| | Tissue |
| | Serum / Plasma |
| | Whole Blood |
| | Active High Vol Samples (XAD-2, PUFF) |
| | Passive High Vol Samples (SPMD, PED) |
| | Filter |
| Chloronaphthalenes by GC-HRMS | Water / Effluent |
| | Soil / Sediment |
| | Tissue |
| | Serum / Plasma |
| | Whole Blood |
| | High Volume XAD-2 |
| Polybrominated diphenyl ethers (PBDEs) by EPA Method 1614A by GC-HRMS (full List of Validated Congeners) | Water / Effluent |
| | Soil / Sediment |
| | Biosolids / Influent |
| | Tissue |
| | Serum / Plasma |
| | Whole Blood |
| | Filter |
| | Active High Vol Samples (XAD-2, PUFF) |
| | Passive High Vol Samples (SPMD, PED) |
| + Other brominated flame retardand (BFR) compounds PBEB, HBB, BTBPE, and DBDPE qualified as “semi-quantitative” | All matrices |
| Multi residue (“MRES”) Pesticides by GC-HRMS (EPA 1699 plus organonitrogen compounds) | Water / Effluent |
| | Soil / Sediment |
| | Biosolids / Influent |
| | High Volume XAD-2 |
| | Tissue |
| Acid Extractable Herbicides by GC-HRMS | Water / Effluent |
| | Soil / Sediment |
| | Biosolids / Influent |
| | High Volume XAD-2 |
| Polyfluorinated compounds (PFCs) by LC-MS/MS (Standard List) | Soil / Sediment |
| | Biosolids / Influent |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| Test Description and Instrumentation | Matrix |
|---|---|
| | Serum / Plasma |
| | Tissue |
| | Water / Effluent |
| | AFFF impacted groundwater |
| | Air Train Sampling |
| | High Volume XAD-2 / PUFF |
| Pyrethroids by GC-HRMS | Water / Effluent |
| | Soil / Sediment |
| | Biosolids / Influent |
| | High Volume XAD-2 |
| Carbamates by LC-MS/MS | Water / Effluent |
| | Soil / Sediment |
| | Biosolids / Influent |
| | High Volume XAD-2 |
| Glyphosate by LC-MS/MS | Water / Effluent |
| | Soil/Sediment |
| Mono Phthalate Esters by LC-MS/MS | Urine |
| Bisphenol A & Conjugates by LC-MS/MS | Water |
| Bisphenol A & Conjugates by LC-MS/MS | Urine |
| Bisphenol A by LC-MS/MS | Water |
| | Biosolid / Solid |
| Parabens & Conjugates by LC-MS/MS | Urine |
| Triclosan & Conjugates by LC-MS/MS | Urine |
| Triclosan by LC-MS/MS | Water (ambient) |
| Sterols & Hormones by GC-HRMS MLA-068 (mod. EPA 1698) | Ambient Water – Filtrate |
| | Ambient water – whole water |
| | Effluent |
| | Soil / Sediment |
| | Influent |
| | Biosolid |
| Telomer Alcohols by LC-MS/MS | Filter |
| | Water / Effluent |
| Hexabromocyclododecane (HBCD) by LC-MS/MS | Water / Effluent |
| | Soil / Sediment |
| | Biosolids / Influent |
| | Tissue |
| | Serum / Plasma |
| | Whole Blood |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| Test Description and Instrumentation | Matrix |
|---|---|
| | |
| Hormones by LC-MS/MS | Water (ambient) effluent |
| | Soil / Sediment |
| | Biosolids or Influent |
| | POCIS |
| Pharmaceutical and personal care products (PPCPs) (modified EPA 1694) by LC-MS/MS | Water (ambient) |
| | Final Effluent |
| | Soil / Sediment |
| | Biosolids / Influent |
| | Tissue<br>(Wet weight reporting)<br>Independent lipid analysis if required |
| | POCIS |
| Naphthenic Acids by LC-MS/MS | POCIS |
| | Water |
| | Solid |
| | Tissue |
| Tetrabromobisphenol A (TBBPA) by LC-MS/MS | Water |
| | Soil / Sediment |
| | Tissue |
| | Serum / Plasma |
| Octylphenol & Nonylphenols by LC-MS/MS | Tissue |
| Fluorotelomer Sulfonates by LC-MS/MS | Water |
| | Solid |
| Bisphenol-A by LC-MS/MS | Tissue |
| Polyfluorinated Phosphonates (PFPA) by LC-MS/MS | Aqueous |
| | Solid |
| Perfluoroalkyl Precursors (PrePFAA) by LC-MS/MS | Aqueous |
| | Solid |
| Select Polychlorinated biphenyl (PCB) Congeners by GC-LRMS | Serum |
| Parabens by LC-MS/MS | Water |
| | Biosolid |
| Metabolites (targeted metabolomics) | Tissue |

Note: Refer to appendix D, section 3 for abbreviations and acronyms

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

## TABLE 2 INSTRUMENTATION

| | |
|---|---|
| 1 | Micromass AutoSpec Ultima Series V High Resolution Mass Spectrometer System equipped with a Hewlett Packard 5890 Series II High Resolution Gas Chromatograph, a CTC A200S autosampler and an Alpha workstation. |
| 2 | Micromass AutoSpec Ultima Series M High Resolution Mass Spectrometer Systems equipped with a Hewlett Packard 6890 series High Resolution Gas Chromatograph, a CTC A200S autosampler and an Alpha workstation. |
| 2 | Micromass AutoSpec Ultima Series M High Resolution Mass Spectrometer Systems equipped with a Hewlett Packard 6890 or 6890N series High Resolution Gas Chromatograph, a CTC GC-PAL autosampler and an Alpha workstation. |
| 2 | Agilent 5973 Network Mass Selective Detectors equipped with an Agilent 6890N Network Gas Chromatograph, a CTC GC-PAL series autosampler and a workstation running Chemstation software. |
| 1 | Agilent 6890N Gas Chromatograph equipped with two Agilent G2397A Electron Capture Detectors, an Agilent 7683 autosampler and a workstation running Chemstation software. |
| 1 | HP 5972 Network Mass Selective Detectors equipped with an HP 5890 Series II Gas Chromatograph, a CTC A200SE autosampler and a workstation running Chemstation software. |
| 4 | Waters 2795 High Pressure Liquid Chromatograph equipped with a Micromass Quattro Ultima Mass Spectrometer and workstations running QuanLynx/ Masslynx software. |
| 1 | Waters 2795 High Pressure Liquid Chromatograph. |
| 1 | Waters 2690 High Pressure Liquid Chromatograph equipped with a Micromass Quattro Ultima Mass Spectrometer and workstations running QuanLynx/ Masslynx software. |
| 1 | Waters Premier Series High Resolution Mass Spectrometer System equipped with a Hewlett Packard 6890N series High Resolution Gas Chromatograph, a CTC GC-PAL autosampler and an Alpha workstation. |
| 1 | Agilent 1100 High Performance Liquid Chromatograph equipped with an Applied Biosystems API 4000 Mass Spectrometer |
| 1 | Agilent 6890N Network Gas Chromatograph with an Agilent 5975 Network Mass Selective Detector, a CTC GC-PAL series auto sampler and a workstation running Chemstation software. |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

## 3. ACCREDITATION SUMMARY

AXYS is accredited to ISO17025:2005 international quality standard for testing of specific compounds. The accreditation scope is summarized below; a compound specific scope of accreditation is maintained in AXYS document ACC-101 'Accreditation Scope'.

| | Methods | | Accrediting Organization | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Compound Class** | **AXYS** | **EPA** | **CALA** | **NYSDH** | **SNJDEP** | **FLDH** | **SWADE** | **MDH** | **VDCLS** | **MDHHS** | **ANAB** |
| Organochlorine Pesticides (LRMS) | MLA-007 | 625<br>8270 | W<br>S<br>T<br>Ser | W (NP)<br>S | | W (NP)<br>S | | | W (NP)<br>S | W (NP)<br>S | W (NP)<br>S |
| Organochlorine Pesticides (HRMS) | MLA-028 | | W<br>S<br>T<br>Ser | | | W (NP)<br>S | W (NP) | | | | W (NP)<br>S |
| Polychlorinated Biphenyls (PCBs, LRMS) | MLA-007 | 625<br>8270 | W<br>S<br>T | W (NP)<br>S | | W (NP)<br>S | | | W (NP)<br>S | W (NP) | W (NP)<br>S |
| | MLA-901 | | Ser | | | | | | | | |
| Polychlorinated Biphenyls (PCBs, HRMS) | MLA-010 | 1668 | W<br>S<br>T<br>Ser | W (NP)<br>S | W (NP)<br>S | W (NP)<br>S | W (NP)<br>S | | W (NP)<br>S | W (NP)<br>S | W (NP)<br>S |
| Chlorinated Dioxins/Furans | MLA-017 | 1613<br>8290 | W<br>S<br>T<br>Pulp<br>Ser | W (NP)<br>S | W (NP)<br>S<br>T | W (NP)<br>S<br>T | W (NP)<br>S | | W (NP)<br>S<br>T | W (NP)<br>S | W (NP)<br>S<br>T |
| Polycyclic Aromatic Hydrocarbons (PAH) | MLA-021 | 1625<br>8270 | W<br>S<br>T | W<br>S | | W (NP)<br>S | | | W (NP)<br>S | W (NP)<br>S | W (NP)<br>S |
| Perfluorinated Organic Compounds (PFC) | MLA-060 | | W | | W (NP)<br>W (DW) | W (NP)<br>W (DW) | | W (NP)<br>W (DW) | | | W (NP)<br>W (DW) |
| | MLA-041 | | S | | S | S | | S | | | S |
| | MLA-043 | | T | | T | T | | T | | | T |
| | MLA-042 | | Ser | | | | | | | | |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| | Methods | | Accrediting Organization | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Compound Class** | **AXYS** | **EPA** | **CALA** | **NYSDH** | **SNJDEP** | **FLDH** | **SWADE** | **MDH** | **VDCLS** | **MDHHS** | **ANAB** |
| Polybrominated Diphenyl Ethers (PBDPE) | MLA-033 | 1614 | W<br>S<br>T<br>Ser | | | | W (NP) | | | | |
| Hexabromo-cyclododecane (HBCDD) | MLA-070 | | Ser | | | | | | | | |
| Bisphenol A (BPA) | MLA-059 | | Urine | | | | | | | | |
| Phthalate Ester Metabolites (mPE) | MLA-059 | | Urine | | | | | | | | |
| Parabens | MLA-064 | | Urine | | | | | | | | |
| Tetrabromo-bisphenol A (TBBPA) | MLA-079 | | Ser | | | | | | | | |
| Pharmaceutical and Personal Care Products (PPCP) | MLA-075 | 1694 | W<br>S | | | | | | | W (NP)<br>S | |
| Metabolites (targeted metabolomics) | MLM-001 | | T | | | | | | | | |

CALA : Canadian Association for Laboratory Accreditation Inc., LAB ID A2637
NYSDH: New York State Department of Health, LAB ID 11674
SNJDEP: State of New Jersey Department of Environmental Protection, LAB ID CANA005
FLDH: State of Florida Department of Health, LAB ID E871007
SWADE: State of Washington Department of Ecology, LAB ID C404
MDH: Minnesota Department of Health, Lab ID 232-999-430
VDCLS: Commonwealth of Virginia, Department of General Services, Division of Consolidated Laboratory Services, LAB ID 460224
MDHHS Maine Department of Health and Human Services, LAB ID CN00003

Matrices:
W: Water/aqueous samples (NP = non-potable, DW = drinking water)
S: Solid samples
T: Tissue samples
Ser: Serum/Plasma samples

Notes: CALA accreditation is against the AXYS method shown (EPA methods in this case are method references).
US accreditation is against the EPA method shown, with the exception of FLDH and ANAB (the ANSI-ASQ National Accreditation Board) for which accreditation is against EPA and AXYS methods.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# II. QUALITY SYSTEM OVERVIEW

## 1. QUALITY POLICIES

AXYS Analytical Services Ltd's objective is to provide analytical data that meet established standards for consistency, accuracy, defensibility and fitness for purpose, at a fair price, providing the best possible value to the client. AXYS provides services to its clients in a professional, confidential, honest and forthright manner and adheres to the highest levels of business ethics. AXYS management is committed to the following quality policies to meet the objective.

1. To continually improve management systems and data quality, a QA Manager will oversee management of a quality assurance (QA) program. The QA Manager will be responsible for documenting the QA program in a Quality Manual and the Technical Director will ensure that this manual and supporting documentation are available to all staff. Staff are required to be familiar with the quality system documentation and to implement the policies and procedures in their areas.
2. AXYS quality management policies, procedures and practices will comply with the requirements of the current version of the ISO 17025 standard, the current version of the Canadian Association for Laboratory Accreditation (CALA) standard and the current version of the National Environmental Laboratory Accreditation Program (NELAP) standard. The QA Manager, Technical Directors, and Director of Operations have overall responsibility for ensuring adherence to this standard. Internal audits will be performed to ensure compliance with the documented quality practices, which incorporate the above standards.
3. Management systems will ensure that sufficient resources and trained staff are available to meet contractual commitments.
4. Staff will be trained in analytical methods, data integrity procedures, ethical and legal responsibilities, security procedures and in the purpose and use of the QA/QC program. Staff training records are maintained.
5. Documented sample handling and security procedures will ensure sample integrity from time of sample receipt to acceptance of the final data report.
6. AXYS will use validated, reliable and rugged test methods that are fit for purpose. Method precision, accuracy, detection limits and uncertainty estimates will be determined using recognized procedures. Method and laboratory performance will be monitored against established statistical control limits. AXYS will participate in interlaboratory comparison studies and performance evaluation programs, where available, to continually monitor the accuracy of data.
7. Samples will be analyzed in batches containing quality control (QC) samples. The results of batch QC samples will be used to assess the sample data quality and are routinely provided to clients with sample results.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

8. Only materials, reagents and supplies that meet required quality specifications will be used. Standard solutions used in methods will be validated against primary solutions of known purity and concentration.
9. To ensure traceability of results, only Class A volumetric glassware and syringes with demonstrated accuracy (bias and precision) will be used for the preparation of standard solutions, spiking of standard solutions to samples and all other volumetric measurements that can influence analytical accuracy. The accuracy of pipettors, balances and thermometers will be traceable to ISO17025:2005 compliant calibration and National Institute of Standards Technology (NIST) standards.
10. Data will be handled in accordance with documented data management protocols that ensure reports and statements to clients are accurate, impartial, include any necessary opinions and interpretations, and protect client and data confidentiality. Staff will receive training in data integrity procedures, in sign binding confidentiality, and in legal and ethical responsibility agreements.
11. A company wide security program will ensure security of samples, data, records and laboratory premises.
12. Records will be stored in a permanent form and retained on file following systematic data archival procedures in a secure environment. Hardcopy records (or exact electronic image) and electronic data are retained for a minimum of ten years.

## 2. QUALITY DOCUMENTATION

The quality system includes documented policies and procedures that apply to all aspects of the operations carried out at AXYS. These policies and procedures describe a comprehensive quality assurance/quality control program designed to ensure sample integrity, accuracy of results, traceability of results, client confidentiality, and the quality of goods and services.

The quality system in place at AXYS is described in a series of documents. A schematic diagram of the quality system documentation is presented in Figure 1.

### 2.1 QA/QC Policies and Procedures Manual

The QA/QC Policies and Procedures Manual (Quality Manual) describes the QA/QC policies and procedures that make up the quality system and serves as a QA/QC training guide for employees. This manual refers to AXYS' Analytical Methods and AXYS' Standard Operating Procedures (SOPs), which contain the standard operating procedures required to carry out all activities related to analyses performed at AXYS. The Quality Manual is a controlled document authorized by the QA Manager and AXYS' Technical Director. Controlled copies of the Quality Manual are available to all staff.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

## 2.2 Analytical Methods

AXYS uses validated methods that have been demonstrated to be rugged, reliable and adequate for the intended application. These methods are taken from several sources: recognized standard methods, methods mandated by regulation, literature methods and methods developed by AXYS based on literature methods. Each analysis is documented in an Analytical Method that describes the analytical process including sample storage, sample preparation, sample extraction and cleanup, instrumental analysis, data reduction, and calculation of final results. Each analytical method is approved by the QA Manager, the Senior Technical Director, and appropriate department Managers.

Controlled (numbered) copies of Analytical Methods are issued to specific work areas and are available to all staff. Analytical Methods are available electronically to all staff. Distribution lists for all Analytical Methods are maintained.

Analytical methods are documented in a standard format, described in Appendix C.

## 2.3 Standard Operating Procedures

AXYS' Standard Operating Procedures (SOPs) describe operating procedures required to perform tasks related to the analysis of samples. Each standard operating procedure is approved by the QA Manager, Senior Technical Director and Manager of the work area in which the SOP is used. Controlled (numbered) copies of SOPs are issued to specific work areas and are available to all staff. SOPs are also available electronically to all staff. Distribution lists for all SOPs are maintained.

SOPs are documented in a standard format, described in Appendix C.

## 2.4 Quality System Records

Records of performance evaluation testing, internal and external audits, management review, and corrective and preventative actions are maintained on file by the QA Manager and are used as input to process improvements.

## 2.5 Document Reviews

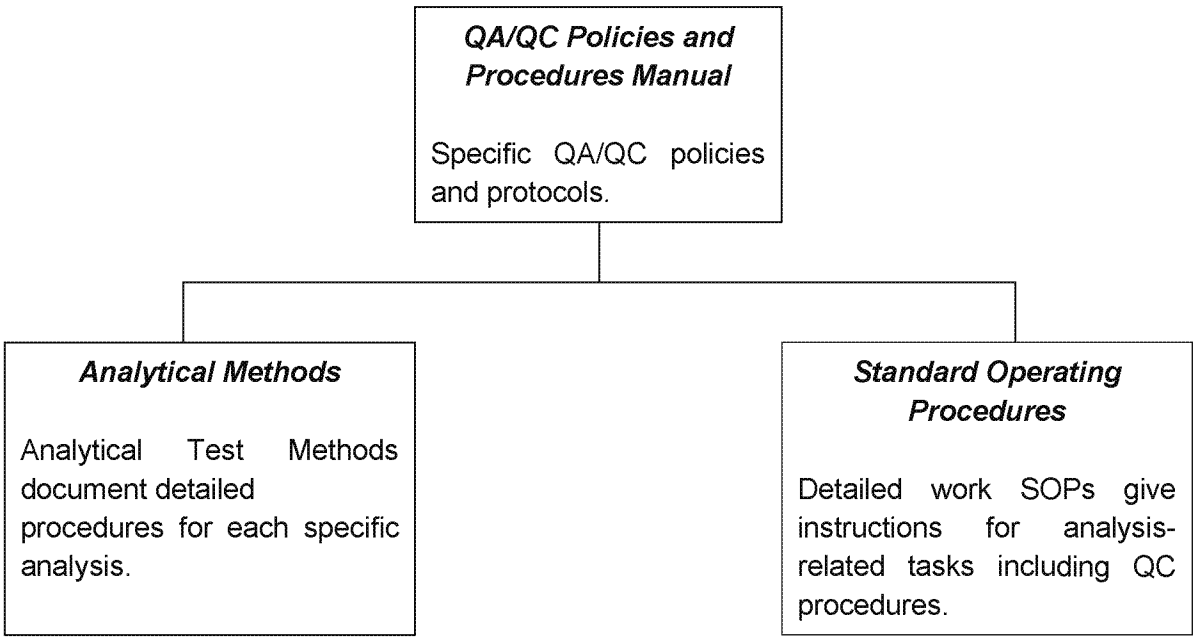
Method documents and standard operating procedures are reviewed periodically every three years to ensure that they are current.

The QA/QC Policies and Procedures Manual is reviewed annually.

Documents are additionally reviewed any time a documentation deficiency has been identified.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

## FIGURE 1 QUALITY SYSTEM DOCUMENTATION




Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

## 3. DOCUMENT CONTROL PROCEDURES

AXYS uses a software program called Q-Pulse to manage quality program documentation. Built-in program modules are used for managing the document control system, for documenting employee training, and for documenting non-conformances. Access to each module and the elements within is limited to designated staff as specified by the QA Manager.

A QA Chemist oversees the daily maintenance of the Q-Pulse system. Q-Pulse is used to perform the following functions:

- Maintain a directory of current documents, accessible to all staff as 'read only' documents.
- Maintain a directory of draft documents, accessible to staff responsible for reviewing and approving documents.
- Maintain a directory of previous versions of current documents, accessible to staff as required.
- Maintain a directory of archived (out of use) documents accessible only to documentation staff.
- Maintain a list of all documents in each directory.
- Maintain a distribution list for each document.
- Increment the revision (or version) number when a document is revised.
- Assign a new document number when one is created.
- Notify staff when a new document or new revision has been activated.
- Track staff acknowledgement of the new or revised document.
- Maintain a history of each document.
- Maintain a record of the documents distributed to each staff member.
- Record comments on draft documents and approval by each designated approver.
- Maintain a record of requests for revisions to documents.

Document control procedures are used to identify, distribute, and control the documents that are part of the quality system. Each document is assigned an identification number, revision number and date of issue. Each distributed hardcopy is controlled with a copy number. Document control procedures are designed to ensure that only current copies of documents are in use. The QA Manager is responsible for the implementation of document control procedures and for ensuring that the procedures are followed.

A QA Chemist oversees the document control system, assigning document numbers, issuing new and revised documents, removing outdated documents from circulation, and maintaining the document control system. The document control system consists of all current documents as well as all previous versions, draft and archived documents. A master list of all documents in use is maintained.

The organization of the document control system is described in Appendix C.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

AXYS' policies for the control of quality documentation are as follows:

1. Staff are required to work from current copies of quality documentation. Controlled copies of analytical methods and standard operating procedures are electronically distributed to AXYS' staff. Controlled copies of the Quality Manual are numbered and bound.

2. Upon leaving AXYS' employ, employees must return all quality documentation issued to them.

3. All quality documentation is the property of AXYS and is considered Proprietary and Confidential Business Information. Distribution of the quality documentation outside of AXYS requires the permission of the QA Manager or the Technical Director. The following statements must accompany documents released outside the company:
   *These documents are "Proprietary and Confidential Business Information".*
   *This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, (year). AXYS Analytical Services Ltd, 2045 Mills Road, Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800 FAX (250) 655-5811*

Internal hardcopies of the Quality Manual are provided as controlled documents; copies of the Quality Manual released externally are not controlled and are not updated. The QA Chemist records the contact name, name of company and date issued of uncontrolled copies.

Copies of revised method SOP documents are provided to accrediting organizations in compliance with the accrediting body requirements, and in all cases within 30 days of the document revision.

## 3.1 Document Preparation

The QA Chemist is responsible for the preparation and maintenance of the quality documentation under the supervision of the QA Manager. The Quality Manual, analytical methods and standard operating procedures are prepared by the QA Chemist according to the formats described in Appendix C, and procedures described in Standard Operating Procedures.

| | |
|---|---|
| SQA-004 | Document Control Procedures |
| SQA-005 | Creation of New Documents |
| SQA-006 | Revision of Documents |

The QA Chemist is responsible for the distribution of new quality documentation to each work area, the collection of outdated documentation, and maintenance of document control files.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

## 4. DEPARTURE FROM DOCUMENTED PROCEDURES

Employees are required to follow all documented procedures routinely, but in some circumstances it may be necessary to deviate from documented procedures. In such cases, the following policies apply.

- Requests for customized testing or requests for departures from documented procedures for existing client work are evaluated by a Client Services representative for compliance with client requirements and specifications and for commercial desirability. Candidate items are subject to approval by the Director of Marketing, Sales and Service, and, if approved, are submitted to the Director of Operations and the QA Manager for final authorization. Authorized procedures, the name of the approving individuals, and the date, are recorded in the Project Notes, along with the individual who approved the procedures and the date of approval.

- Reporting of results not meeting all documented quality or contract specifications requires assessment of the fitness for purpose by the Project Manager and approval by the Director of Marketing, Sales and Service and the QA Manager. Approval to report the data is documented in the LIMS workgroup notes with the name of the approving individuals and the date.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# THIS PAGE LEFT INTENTIONALLY BLANK

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# III. ORGANIZATIONAL STRUCTURE

AXYS Analytical Services Ltd is a privately owned company registered in British Columbia, Canada. A chart showing the organization of the company is presented in Figure 2.

The President of AXYS is responsible for the overall management of the company and serves as Senior Technical Director. The President reports to the AXYS Analytical Services Ltd Board of Directors. In case of absence, the Director of Operations and the Controller perform the President's management duties with oversight of the Delegated Back-up Technical Director.

The Director of Operations, the Director of Sales, Marketing and Service, the QA Manager and the Controller report to the President. Each of these individuals is responsible for the management and operation of a designated work area. Each has access to resources and has the authority to hire staff and purchase goods and services subject to approved planning limits.

The Senior Scientific Specialist maintains and develops relationships between AXYS and key clients, providing support to Project Managers, Client Services and Operations, through their technical knowledge and experience. Participation in technical marketing initiatives via scientific presentations and papers supporting the company competencies is integral to the role.

The Controller oversees financial and administrative operations including information technologies and human resources. The Laboratory Information Management System (LIMS) Manager reports to the Controller (with secondary report to the President).

The responsibilities of key AXYS staff are described below. Managers and Supervisors are responsible for training and monitoring staff performance, problem solving and ensuring policies and procedures are followed in their area of responsibility.

## 1. DIRECTOR OF SALES, MARKETING, AND SERVICE

The Director of Sales, Marketing, and Service develops business contacts, seeks business opportunities and markets AXYS' services. In case of absence, the President acts for the Director of Sales, Marketing, and Service.

## 2. PRESIDENT

The President has ultimate authority and responsibility for management of AXYS Analytical Services Ltd. and serves as the Senior Technical Director.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

## 3. DIRECTOR OF OPERATIONS

The Director of Operations, reporting to the President, is responsible for the daily operation of the laboratory. The Client Services Manager, the Sample and Extract Preparation Lab Manager, the Instrumental Analysis Manager, the Advanced Product Development Scientist and Sample Receiving staff report to the Director of Operations. The Director of Operations monitors laboratory performance to ensure that work is conducted in accordance with proper procedures and that quality performance standards are met. In the case of absence the President, or designate, acts in the role of Director of Operations.

### 3.1 Client Services Manager

The Client Services Manager reports to the Director of Operations and is responsible for the Client Services department, which carries out project management and data reporting. In case of absence, a Project Manager acts for the Client Services Manager.

### 3.2 Sample and Extract Preparation Lab Manager

The Sample and Extract Preparation Lab Manager is responsible for supervising the daily activities of Chemists and Lab Technicians working in the Sample Preparation and Extraction Lab. In the case of absence, the Director of Operations acts for the Sample and Extract Preparation Lab Manager.

#### 3.2.1 Lab Schedule Coordinator

The Lab Schedule Coordinator is responsible for scheduling work in the analysis and sample prep lab and is assigning analysis batches, determining the analytical requirements of each batch and communicating the requirements to staff on analysis Batch Lists. In the case of absence, an experienced Chemist from the Extraction Lab acts for the Coordinator.

#### 3.2.2 Technical Service Coordinator

The Technical Service Coordinator is responsible for organising the Chemists working in the Technical Service group and schedules work to meet production deadlines. In the case of absence, an experienced Chemist from the Technical Service group acts for the Coordinator.

### 3.3 Instrumental Analysis Manager

The Instrumental Analysis Manager is responsible for management of instrumental analysis and data production. In case of absence, the Director of Operations acts for the Instrumental Analysis Manager.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

### 3.3.1 Operations Coordinator

The Operations Coordinator reports to the Director of Operations and the Instrumental Analysis Manager and works with client services to co-ordinate incoming work as well as being responsible for scheduling Instrumental Analysis Chemists' work.

### 3.4 Advanced Product Development Scientist

The Advanced Product Development Scientist directs Chemists in the development of new methods and communicates with the Director of Operations, the Director of Sales, Marketing and Service, the Senior Scientific Specialist and the Scientific Director (Technical Transfer) to optimize development and transfer of new products to routine operations. In case of absence, the Director of Operations acts for the Advanced Product Development Scientist.

## 4. QUALITY ASSURANCE (QA) MANAGER

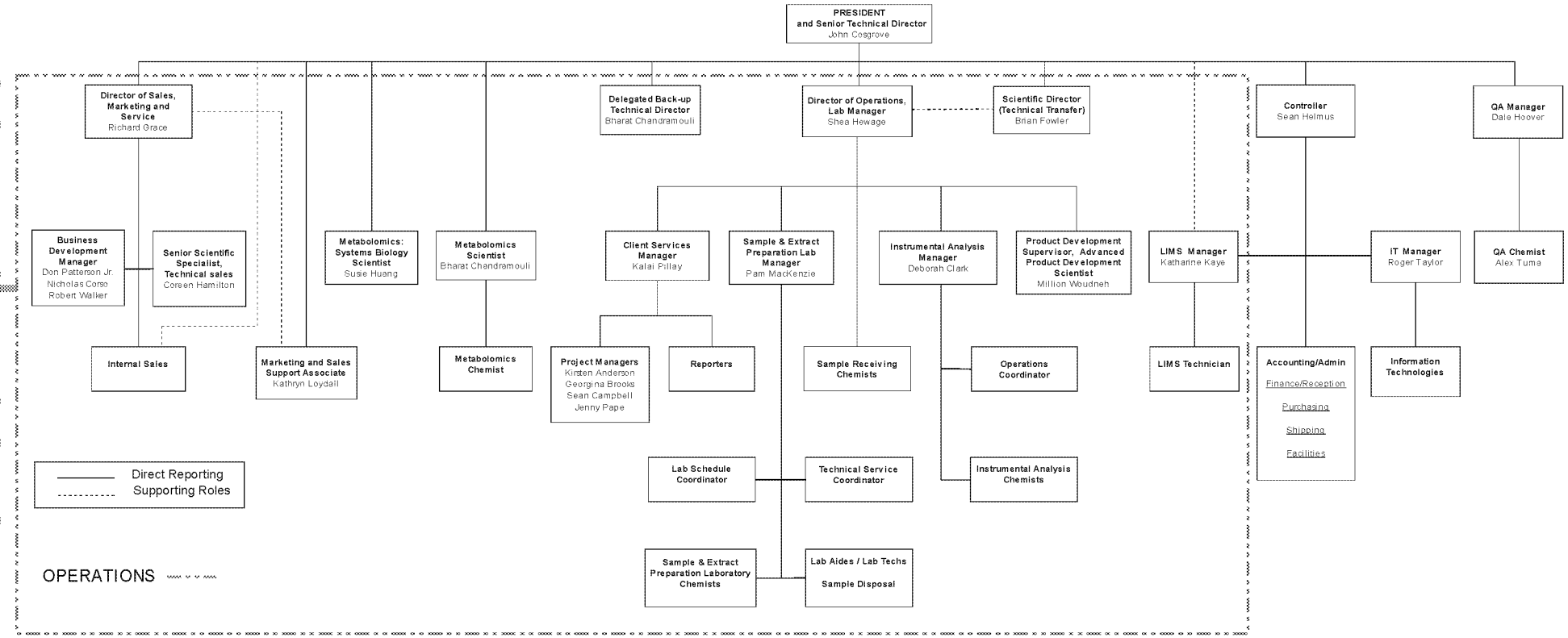
The QA (Quality) Manager is responsible for the quality program and operates independently of daily laboratory operations, reporting to the President. The QA Manager reports to the AXYS Board of Directors on any issues not resolved satisfactorily at the highest management level. The QA Manager has direct access to senior management and has the authority to amend operations and practices. The QA Manager is responsible for all aspects of the quality system including documentation, training, implementation, enforcement and maintenance and serves as a Technical Director in his area of responsibility. In case of absence, the QA Chemist acts for the QA Manager.

## 5. LABORATORY INFORMATION MANAGEMENT SYSTEM (LIMS) MANAGER

The LIMS Manager is responsible for the maintenance of the LIMS, the development of new procedures and their implementation into the workflow of the company, and for supervising LIMS Programmers. The LIMS Manager and Programmers act as back-ups for each other in case of absence.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

## Figure 2 AXYS ANALYTICAL SERVICES LTD – ORGANIZATIONAL CHART




*Note: This organizational chart is current at the date of issue of this document. Refer to QDO-005 "AXYS Organizational Chart (with Names)" for a current and more detailed organizational chart.*

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# IV. HUMAN RESOURCES

AXYS Analytical Services Ltd employs only qualified staff with the education, experience and expertise necessary for the job function. The Technical Director certifies that staff qualifications meet or exceed the minimum standards, which are documented in function specific job descriptions maintained on file in the central computer system and available to all staff.

Managers record performance evaluations and job descriptions in personnel files. The QA documentation system encompasses training records including a signed Ethical and Legal Responsibilities Statement, a Basic Training Checklist and, where applicable, certificates of Demonstration of Capability.

The Accounting Department maintains individual personnel files for all staff. Each personnel file contains a signed non-disclosure agreement, a career résumé, an orientation record, and an employment record. In addition, staff résumés, summarizing relevant experience, are maintained by AXYS administrative staff and are used for inclusion in work proposals.

Employees are issued a copy of the AXYS Employee Guide that documents the AXYS company policies, employee benefits, safety procedures and employee responsibilities. Employees are required to read AXYS' Safety Manual describing safety equipment and procedures.

SAF-001 Safety Manual

## 1. STAFF TRAINING

All AXYS staff receive on-the-job training. The training program has three components.

- Orientation
- Job Training
- QA/QC Training

### 1.1. Orientation and Basic Training

All new employees are familiarized with the overall operation of AXYS during an orientation process conducted during the first day of employment and must complete a Basic Training within 30 days of employment. At this time, administrative documents, including a non-disclosure (confidentiality) form and an IT policies form, are completed. The employee is given an Employee Guide and this is reviewed with the Manager/Supervisor. The employee receives instruction on data integrity procedures and signs an Ethical and Legal Responsibilities Statement. Safety features and procedures, and security procedures, as described in the AXYS' Safety Manual (SAF-001) are reviewed. The Manager documents the Basic Training by checking

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

the applicable items in FQA-010 (Basic Training Checklist). After completion the Basic Training Checklist is saved in the employees training record.

The signed non-disclosure and IT Policies forms are kept by the Accounting Department in the employee's personnel file. The signed Ethical and Legal Responsibilities Statement is filed with the employee's training record.

Details of the orientation process are described in the following Standard Operating Procedures.

| | |
|---|---|
| SQA-017 | Documentation of Employee Training |
| SQA-016 | Training in Data Integrity, Ethical and Legal Responsibilities |
| SAF-001 | Safety Manual |
| FQA-010 | Basic Training Checklist |

## 1.2. Job Training

Each staff member undergoes an initial training period under direction of the work-area Manager/Supervisor. Initial training procedures include the following:

- working closely with the Manager/Supervisor or an experienced analyst to acquire the skills and understanding necessary to the job function;
- supervision of all work;
- monitoring of all results to evaluate the effectiveness of training;
- testing of competency and understanding;
- documentation of training; and
- authorization to work independently.

Each Lab Chemist and Instrumental Analyst must prove his/her competence on test samples prior to working independently. The QA department maintains records of the initial training period as well as additional training or expertise gained. Where required, analyst capability is documented on an annual basis.

Job training is a continuous process. AXYS conducts seminars on a variety of analysis-related topics and workshops on specific methods. Employee participation is documented.

Training procedures are documented in the following Standard Operating Procedures.

| | |
|---|---|
| SLA-032 | Training a Laboratory Chemist |
| SIN-015 | Training Procedures for an Instrumental Analytical Chemist |
| SQA-017 | Documentation of Employee Training |

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

### 1.3. QA/QC Training

Staff are trained in quality assurance and quality control practices and the use of quality documentation. They receive on-the-job QA/QC training by their Manager/Supervisor following guidelines established by the QA Manager. All staff are required to read the Quality Manual and to sign (electronically or, for new employees FQA-039 form) a Quality Manual acknowledgement, which indicates that they understand and agree to follow AXYS' quality policies and procedures.

## 2. DATA INTEGRITY AND ETHICAL AND LEGAL RESPONSIBILITIES

An employee's Manager is responsible for providing initial training in data integrity, ethical and legal responsibilities, for ensuring that these responsibilities are fully understood and for updating training in this area when changes are made. In addition employees are required to renew their training in data integrity, ethical and legal responsibilities on an annual basis.

Data integrity procedures are documented in the following Standard Operating Procedure:

SQA-024 Data Integrity Procedures

Employees are required to conduct their work responsibly, in accordance with the ethical and legal requirements described below. Employees must:

1) Adhere to the confidentiality policies described in the non-disclosure agreement signed by each employee.
2) Perform work in accordance with documented analytical testing, QA/QC, and security policies and procedures. Ensure that any deviations from documented practices have been authorized.
3) Follow all documented record-keeping practices and adhere to documentation policies as described in the standard operating procedure SQA-019 "General Documentation Policies".
4) Report promptly to the department or QA Manager non-conforming practices, non-conforming data, and any situations or circumstances that could compromise data quality or defensibility.
5) Be honest, fair and impartial in quotes, reports and statements to clients.
6) Report to the QA Manager and Technical Director, in confidence, any undue commercial, financial, or other pressures that might adversely affect quality of work or create a conflict of interest. A conflict of interest arises when an employee has any interest beyond a professional interest in a sample, which may be perceived to affect the employee's professional judgement or objectivity.

Consequences of non-compliance with these guidelines could include termination of employment and civil or criminal prosecution.

The QA Manager monitors operational activities to ensure compliance with these requirements. Data integrity policy, procedures, application and effectiveness are reviewed annually by the QA Manager and Senior Technical Director.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# THIS PAGE LEFT INTENTIONALLY BLANK

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# V. FACILITIES

AXYS Analytical Services Ltd consists of well-equipped laboratories (~8000 sq ft), technical staff offices (~7000 sq ft), meeting rooms, stationery (storage, photocopier), general reception, sample receiving, sample storage (4°C and <-10°C) and solvent storage (new and waste solvent). AXYS' facilities are housed in three separate buildings, at the same location. Floor plans of the facilities are presented in Appendix G. The total area of AXYS' facilities is ~22,000 sq ft.

The ground floor of the north building houses the first aid room, glassware cleaning room, six wet chemistry laboratories, the sample preparation labs, laboratory staff offices, the standard solution preparation room equipped with vented, locked cupboards for standards storage, and the standards storage room equipped with refrigerators, freezers and vented storage cabinets for storage of working standards. Each wet chemistry laboratory is equipped with at least one fumehood, hot and cold running water and overhead fluorescent lighting. All laboratories are equipped with at least one electronic balance. The "New" laboratory (April 2000) is equipped with vacuum pumps for the rotary evaporators, minimizing the solvent loss to the environment, and a chilled, recirculating water system.

The upper floor of the north building contains AXYS' reception area and offices for management, technical staff, general accounting and administrative staff. In addition, washroom facilities, a meeting area and a lunch area are located on the second floor.

The ground floor of the south building houses the instrument laboratories.

The upper floor of the south building houses offices for Instrumental Analysis staff and for primary and secondary validation staff.

The west building houses metabolomics laboratory space, computer support services, facilities for sample receiving and storage, and purchasing and shipping/receiving offices.

Samples requiring refrigeration are stored in walk-in coolers (combined capacity ~3000 cubic feet), samples and extracts requiring frozen storage are stored in walk-in freezers (combined capacity ~5000 cubic feet), or in -80°C freezers, as required.

As a safety feature, excess new solvent is stored in an isolated facility (capacity ~1440 cubic feet). Waste solvent is stored in barrels and removed monthly by a waste disposal company.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# 1. QA SPECIFICATIONS OF FACILITIES

The analysis of samples for environmental contaminants at AXYS requires that some operating conditions be controlled in order to ensure sample integrity, to eliminate sources of contamination, and to maintain instrument stability.

## 1.1 Sample Storage

Samples received for analysis are stored under conditions appropriate to the matrix and analysis type. The following Standard Operating Procedure describes the sample storage requirements in detail.

SLA-003 Sample Receipt and Login

- Tissue samples, soil/sediment/sludge samples, ambient air sampling media (PUF, filter, XAD), and solvent extracts are generally stored frozen, at a nominal temperature of <-10°C.
- Aqueous samples, XAD resin columns with associated filters, and wet pulp are stored cool, at a nominal temperature of 4°C but not warmer than 6°C.
- Dry pulp, and oil/defoamer samples for dioxin precursor analyses are stored at ambient temperature in cupboards. Freeze-dried reference samples may be stored at ambient temperature where specified by the issuing agency.
- Samples for metabolomics analysis are stored in a freezer at -80ºC.

In order to prevent possible reactions initiated by light, samples are stored in the dark.

The temperature of all the cold sample storage facilities is monitored every business day. The following Standard Operating Procedures describe the procedures for monitoring the sample storage areas and the action to be taken when specified conditions are not met.

SLA-026 Monitoring Temperature of Freezers, Coolers and Refrigerators

***Walk-in Freezers and Coolers***

The walk-in freezers are maintained at a nominal temperature of <-10°C; the walk-in coolers are maintained at a nominal temperature of 4°C. A security company monitors the freezers and coolers and the alarm is triggered if the air temperature at the top of the freezer or cooler exceeds a specified temperature; designated staff are alerted by the security company should an alarm trigger at any time. The freezer and cooler temperatures are also monitored every business day by AXYS staff. The walk-in freezers and coolers are kept locked.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

***Refrigerators***

Several of the laboratories are equipped with refrigerators. The temperatures of both the freezer and refrigerator units are monitored every business day by a Lab staff member, except for refrigerators in the Instrument area, which are monitored by an Instrumental Analyst.

## 1.2 Facilities Maintenance

Maintenance service is available to staff at all times. Service outside regular business hours is available by contacting the appropriate individual on the After Hours Contact List.

QLI-020 After Hours Contacts List

## 1.3 Laboratory Conditions

Laboratories must be free of sources of contamination. Procedural blanks, analyzed with each batch of samples, are carefully monitored and checked for the presence of contaminants and interferences that may come from reagents, lab equipment, or the air. In order to eliminate possible sources of contamination, the following conditions must be satisfied for each laboratory.

1. The air entering the laboratories is cleaned by filtration of the intake air. The filters are inspected and replaced on an established schedule.

2. The use of plastic laboratory equipment is limited to approved analyses and lab areas.

3. Workbench surfaces must be made of non-porous materials. An alternate to a non-porous surface is to cover the lab bench in aluminum foil prior to starting an analysis.

4. Flooring materials must be made of hard, washable materials. Chairs or bench tops must be made of impervious material – the use of foam-padded chairs is not permitted.

5. The Lab Manager must approve cleaning products used in the laboratory.

6. No pesticides or herbicides shall be used in the AXYS buildings or on AXYS property without the written permission of the Technical Director or the QA Manager.

7. Samples known to be, or suspected to be, "high level" samples are worked up in isolation. The glassware used for these samples receives special pre-cleaning before it is processed through the normal cleaning procedure.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

8. The ventilation system, chemical storage, and safety features in each laboratory must satisfy Workers Compensation Board specifications. Refer to the AXYS safety manuals for further details.

### 1.4 Additional Conditions for Instrument Laboratories

In addition to the above-specified conditions for laboratories, instrument rooms must satisfy the manufacturer's specifications for the individual instrument. Details of the specifications are found in the instrument manuals kept in each instrument room.

1. The instrument rooms must be air conditioned to maintain a room temperature of 18-25°C, stable to within ±3°C. The absolute room temperature is not as critical to instrument stability as the variation in room temperature. A variation of ±3°C has been shown not to affect instrument stability.

2. All instruments must be on individual electrical breakers. In addition, all high resolution instruments must be on their own panels.

## 2. SAFETY FEATURES

Each laboratory has at least one fire extinguisher, one smoke detector and an eyewash station. Laboratories 1, 4 and the "New" lab are also equipped with overhead showers. The main hallway through the wet chemistry laboratories is equipped with a dry chemical extinguisher, a first aid kit, a $CO_2$ extinguisher, emergency lighting and the main fire alarm. There is also a well-equipped first aid room in Laboratory 1.5. Each laboratory is equipped with wall attachments to secure pressurized gas cylinders. A spill kit for handling chemical spills is kept in Laboratory 1 and in the "New" laboratory facility.

## 3. SAFETY PROCEDURES

Upon employment at AXYS, all staff are briefed on the Company safety policies and familiarized with safety features such as eye wash stations, fire extinguishers, first aid kit, safety showers and spill kit. In addition lab staff are briefed on lab safety policies, namely routine use of lab coats, safety glasses, closed toe shoes and fume hoods, as well as use of goggles, masks, respirators, and/or gloves when appropriate.

The AXYS Analytical Safety Committee is constituted and administered in compliance with current, applicable health and safety regulatory requirements (including those of WorkSafe BC). Its function is to ensure at a minimum regulatory compliance and, also to enhance workplace safety beyond minimum standards. It meets monthly to address safety issues, review processes and set policy.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

The AXYS Safety Manual is available to every employee. Employees must sign the Safety Manuals Acknowledgement Form after reading the manual. The form is filed in the employee's training file. The Safety Manual provides detailed information on all safety equipment and procedures.

SAF-001 Safety Manual

## 4. SECURITY FEATURES

Each building is monitored during non-work hours by a security system, which includes motion detectors and door alarms (which must be deactivated in order to enter the building). The last person to leave the building activates the security system. Smoke detectors, located in each building, are continuously monitored by a security system. Except for the main door of the west building leading to the IT Department, the doors to buildings are locked at all times. All building doors are locked during non-business hours. Each employee is issued an individually numbered key that permits access to the buildings.

## 5. SECURITY POLICY

The purpose of AXYS' security policy is to maintain the security of AXYS' facilities, integrity of samples submitted for analysis, and confidentiality of client data and other information. In order to achieve these goals the following policies and procedures are in place.

### 5.1 Security of Facilities

1. All exterior doors are always locked except the front doors to the west building, which are open Monday – Friday 7:00 a.m. – 5:00 p.m. The work areas in the west building are monitored by staff and the doors locked if no one is present.

2. Visitors are required to report to reception, wear a visitor's badge and be escorted by a staff member while in AXYS' facilities.

3. Work areas containing data or client information are kept locked outside regular work hours.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

## 5.2 Security of Samples

1. All samples are identified with an AXYS ID number that is a unique descriptor that is assigned by the LIMS. This ID number is attached to each sample container as soon as it is logged in at AXYS.

2. Samples are always kept in a secure storage facility maintained at appropriate atmospheric conditions until time of analysis. Access is limited to designated staff, each with a key to the storage facilities. The Accounting Department maintains a list of authorized key holders.

3. The storage location of samples is recorded. Sample Receiving Chemists are responsible for retrieving and returning samples to storage facilities.

4. Samples are under the direct care of a Lab Chemist when being worked on. The sample extracts are kept under the care of a Lab Chemist at his/her workplace until they are ready for instrumental analysis. The extracts are then transferred to the Instrument group who keeps the extracts in secure storage in the Instrument Lab.

## 5.3 Security of Data

AXYS has established the following data security policies that are the basis of AXYS' data security procedures. Details of data security procedures are describe in the following standard operating procedure:

SAD-028 Electronic Data - Security Policies and Features

1. Physical access to AXYS premises is restricted to authorized staff.
2. Separate and unique user ID/passwords are used to access the AXYS network and the LIMS. Network passwords are changed every 90 days and LIMS passwords every 180 days. Passwords must be a unique combination of 8 or more numeric plus alphabetical characters; they must also include characters from three of the following four categories: a) uppercase English letters; b) lowercase English letters; c) numbers; and, d) non-alphanumeric characters (e.g. ! @ # $, etc). Staff are required to keep passwords confidential.
3. Individual workstations are additionally protected with a screen saver password with a 5 minute time-out feature.
4. Assigned group login procedures are used as necessary for shared instrument computer workstations.
5. Access to computer systems is controlled on an 'as needed' basis using user-name/password login procedures and role assignments.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

6. Alterations to data are tracked through audit trails that can be monitored.
7. Procedures that authorize and track changes to software and hardware are required. Hardware maintenance must be documented.
8. Unauthorized access to AXYS' network from external sources is prevented through the use of up-to-date firewall technology.
9. All data must be backed up in a secure manner on a regular schedule. Archival backup must be readily retrievable.
10. All staff must sign a confidentiality agreement and receive annual training in data integrity, legal and ethical responsibilities.
11. Staff will receive data integrity training on an annual basis.
12. Staff will receive training on security features associated with instrument software as appropriate by use.

Uncontrolled if printed

## 6. COMPUTING CAPABILITIES

Computer workstations are in use throughout the operation of AXYS Analytical Services. The workstations are networked to servers (Windows Server 2008/2012) which are maintained by the Information Technology (IT) Department. These servers are protected against power fluctuations and outages by Uninterruptible Power Supplies (UPS). Every employee has a unique login/password that provides the appropriate level of access for that employee to carry out his or her job function. Network password changes are required at least once every 90 days. All employees have access to e-mail. All workstations run Symantec EndPoint software for protection against computer viruses. This software is updated automatically from a central server. AXYS also maintains a secure FTP site for the transfer of client data. The AXYS network is Internet-connected and firewalled through a secure SonicWALL gateway appliance.

AXYS also operates a Laboratory Information Management System (LIMS) used to log in and track samples and report results. The LIMS consists of a PowerEdge R510 server with UNIX Server software as the operating system and Oracle as the database. The LIMS software is LV Environmental LIMS (Seedpak) developed by LabVantage Solutions. AXYS' file server is fully backed up monthly; differential backup is performed every night (Mon-Fri).

| | |
|---|---|
| SAD-031 | LIMS Applications: Control and Life Cycle Management |
| SAD-024 | Computer Network Management and Security |
| SAD-019 | Computer Backup |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# THIS PAGE LEFT INTENTIONALLY BLANK

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# VI. CONTRACT MANAGEMENT

## 1. CONTRACT MANAGEMENT

### 1.1 Bidding Process

AXYS carries out the analysis of samples on a fee-for-service basis. AXYS generally undertakes analyses of samples under written client instructions ("Contract") and authorization. The Contract may be a "Standing Offer" (a fixed price contract for a defined period of time) or a specific contract for a client's project. Contracts for work may be obtained through a competitive bidding process in which proposals are solicited from qualified laboratories, but may also be secured by an authorized quote plus relevant technical and project specifications prepared by the Sales, Marketing and Service Department. Guidance on pricing, products, services and authorization limits are located in the product and service guide.

AXYS' project management team, including Operations staff, Scientific Directors, the QA Manager, and the LIMS group as necessary, review Requests for Proposals (RFP). Reviews evaluate the requirements of the proposed work against AXYS' technology, methodology, available capacity, resources and staffing levels. The team determines if AXYS can meet the requirements of the quote, request, or proposal and a decision is made whether or not to proceed with a bid. The proposal requirements and review considerations are documented in the formal proposal response to the RFP or in Project Notes and/or by e-mail.

To generate a quote or bid on a proposal, the assigned Project Manager, the Internal Sales, or the Sales and Marketing Co-ordinator in consultation with the Account Manager, prepares a quote/proposal document and opens a dedicated quote/proposal file. The quote/proposal document presents AXYS' capabilities and price bid to the client. The proposal file contains all information related to the bid, including additional information received, amendments, records of the proposal review, and records of discussions with the client.

A successful proposal results in the awarding of a contract. The assigned Project Manager (or designate), with support from the Client Services Manager, Operations staff, and/or Scientific Directors as necessary, reviews the contract to verify the technical requirements, the price, and project specific business clauses. The review process is formally completed and documented by signature of the President (or designee, generally a Director level manager) on the contract, indicating that AXYS has the ability to meet all the requirements and accepts the contractual obligations. A client file is opened with the signing of a contract, and all documents in the quote/proposal file are moved to the contract file, including any documentation of the contract review. In cases where AXYS carries out ongoing routine work for a client, the contract need only be reviewed at the initial stage, provided the contract requirements remain unchanged. Re-review by Project Managers and the Technical Director occurs in response to material changes in contractual terms, as necessary.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

Contracts secured on the basis of a price quote or a standing offer may be reviewed and approved by Project Managers in accordance with their approval limits (Table 3), provided the work is either "routine", or has been previously performed for the client under approved terms, and provided there is sufficient operational capacity. Otherwise the Client Services Manager, Director of Sales, Marketing and Service or President performs the review and may approve subject to their relevant approval limits. Once the contract has been approved, a contract file is opened and a Project Manager is assigned.

No review process other than operational capacity constraints is required for the analysis of in-house QC samples or performance evaluation samples that are approved by management as part of maintaining AXYS' accreditation status or business strategy.

**Table 3 Pricing Approval Limits**

| Position | Approval Limits from Book Pricing (exception pricing limits) |
|---|---|
| Project Manager | $10,000 |
| Internal Sales (Sale and Marketing Coord.) | $25,000 |
| Client Services Manager | $50,000 + exceptions |
| Business Development Manager | $100,000 + exceptions |
| Sales Director | $500,000 + exceptions |
| Director of Operations | $500,000 + exceptions |
| Instrumental Analysis Manager | $250,000 |
| President | $1,500,000 + exceptions |
| Product Development Project Manager | See Sales/ Ops |

### 1.2 Project Management

Project Managers are assigned to contracts. They obtain all necessary information on the expected work from the Account (Sales) Manager. The Account Manager consults with the client about the receipt of samples, types of analyses to be completed, method selection, subcontractors, reporting of data, special needs or custom procedures, and maintain records of all correspondence and conversations. The Project Manager reviews the sampling and sample receipt information, ensure the samples have been preserved and handled appropriately and finalize details of the project requirements with the client. Project Notes, which summarize the details of the project, are completed and made available electronically to all staff. Project Managers may participate in priorities meetings to review project work status. Project Managers may also perform certain data checking duties carried out by Instrumental Analysts.

### 1.3 Workload Management

The Director of Operations, Operations Coordinator and the Lab Schedule Coordinator are responsible for establishing work priorities. Weekly priority meetings are held with the Director of Operations, Instrumental Analysis Manager, Lab Manager, Operations Coordinator, Lab Schedule Coordinator and Client Services Manager to monitor progress of work, assess the overall

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

workload, and confirm weekly work project schedules. The ability to take on additional work is also reviewed.

### 1.4 Work Scheduling

The Lab Schedule Coordinator and the Operations Coordinator determine daily schedules for their work areas based on information or direction provided in the priority meetings and on deadlines entered into LIMS. Available resources (e.g. glassware, equipment and instruments), staffing levels and staff expertise are considered in the preparation of the daily schedule. Also taken into account are resources required to accommodate potential extract re-injections, recolumning and dilutions. The Director of Operations discusses potential work and schedules with the Lab Manager and the Instrumental Analysis Manager. The departmental Managers and departmental Coordinators discuss to ensure feasibility and appropriate updating to the departmental production schedules to keep other all areas informed.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# THIS PAGE LEFT INTENTIONALLY BLANK

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# VII. SAMPLE HANDLING PROCEDURES

## 1. SUBMISSION OF SAMPLES

The Sales, Marketing and Service department arranges with a client for the submission of samples for analysis. Each client is assigned a unique contract number and a client file is created. The contract number is non-identifying and assures the anonymity of a client.

A Sample Receiving Chemist is informed of the expected shipment of samples and of any special requests from a client concerning the handling/storage of samples. Upon request, clients are advised of the proper methods for collecting, preserving, and shipping samples. AXYS will arrange for sample collection if requested by a client or required by a grant-supported project.

AXYS may be requested to analyze samples that are considered agricultural hazards or biological hazards. AXYS is required to have a permit, issued by the Canadian Food Inspection Agency (CFIA), to import samples that are identified as agricultural hazards. These samples are a potential hazard to the local ecosystem and local agriculture and are handled and disposed of according to CFIA protocols. These procedures are described in an AXYS standard operating procedure. Samples that are identified as biological hazards are a health concern to AXYS staff and must be handled and disposed of according to standard operating procedures. The AXYS Analytical Safety Manual describes AXYS policies for protecting staff from potential biological hazards.

| | |
|---|---|
| SLA-079 | Agricultural Hazard Protocols for Soils |
| SLA-082 | Handling of Human Biohazardous Samples |
| SAD-014 | Sample Disposal |
| SAF-001 | AXYS Analytical Safety Manual |

Appropriate sample containers are provided to a client upon request. Glass containers with fluoropolymer or foil-lined lids are used for most organic analyses; HDPE containers are used for a number of LC analyses. Glass containers, purchased with a certificate of cleanliness, are proofed on a lot basis prior to acceptance as suitable for sample containers. Approved sample containers are shipped to the client. Alternatively, a client may request that certified clean jars be shipped directly from the distributor, without AXYS' proofing procedures. Each analytical method describes the sample requirements including appropriate sample container, preservation requirements and storage conditions of samples.

Bottle labels, analyses request forms and chain-of-custody forms are provided with the containers. Complete sampling kits (stainless steel scoops, scalpels, rinse solvents, etc.) and instructions for proper sampling and preservation are also included upon request. These instructions are communicated to the client by the Project Manager and are consistent with sample handling requirements detailed in each method.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Procedures for assigning contract numbers and the proofing and shipping of sample containers are described in the following Standard Operating Procedures.

| | |
|---|---|
| SLA-003 | Sample Receipt and Login |
| SAD-013 | Shipping and Receiving Procedures |
| SLA-094 | Proofing Laboratory Equipment, Sampling Media, Solvents and Sample Containers |

Uncontrolled if printed

## 2. SAMPLE CONTROL PROCEDURES

Sample control procedures include procedures for sample receipt, sample log-in, sample storage, sample handling, and sample disposal. The procedures used at AXYS are in place to ensure samples are properly identified and stored, and the location known.

### 2.1 Sample Acceptance Criteria

Samples received by AXYS are checked for compliance with the following sample acceptance criteria:

1. Documentation:
   - i. A chain-of-custody or sample log accompanies the samples.
   - ii. The chain-of-custody is signed and completed, in ink, providing the following information:
     - Sample identification
     - Location, date and time of collection
     - Collector's name
     - Preservation type
     - Sample matrix
     - Analyses requested
   - iii. If soil samples:
     - Soil permit number (for any foreign country)
     - Domestic movement certificate number (or confirmation of non-requirement)

   *All of the above information must be provided for samples being analyzed under NELAP standards. Otherwise, the requirement for location, date and time of collection and collector's name is provided at the discretion of the client.

2. Samples are submitted in the containers appropriate to the analytical method.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

3. Samples are individually labelled, in ink, with a unique sample identification. The sample identification on the sample container must match the sample identification on the custody papers.

4. The samples are received in good condition, meaning the following criteria are satisfied:
   i. Sample containers are tightly sealed with no sign of leakage, breakage or other damage or contamination.
   ii. Custody seals are intact.
   iii. Samples are received at the temperature appropriate to the analytical method.
   iv. There is adequate sample for the analysis.
   v. Holding times for the analytical method have not been exceeded.

The client is contacted in all cases where the sample acceptance criteria are not satisfied. Where possible, remedial action is taken. Remedial action may include the following:

- client provides additional documentation
- client provides a replacement sample
- AXYS transfers sample to another container
- client provides additional sample
- AXYS returns sample to client
- AXYS disposes of sample

AXYS will proceed with the analysis, despite the failure of the samples to meet criteria, upon client approval. Where necessary, data are flagged as not meeting sample acceptance criteria, indicating specifically the non-conformance. The flag appears as a footnote on the data report or in the narrative accompanying the report.

## 2.2 Receipt of Samples

The Shipper/Receiver or a Sample Receiving Chemist signs for incoming samples. The Sample Receiving Chemist collects the shipping and chain-of-custody documents, and verifies the sample count and identification against a client's sample log sheet. If a client has not provided a list, the Sample Receiving Chemist generates one at the time. The Sample Receiving Chemist inspects the samples for physical damage, loss due to leakage, breakage of seals, contamination by foreign materials, evidence of storage under improper conditions, etc. The Sample Receiving Chemist checks that the samples meet the sample acceptance criteria. Receipt of the samples and their condition are documented. The details of receipt date/time, courier, waybill number, type of sample, condition of sample, and analysis requested are entered into the LIMS Sample Receiving Log by the Sample Receiving Chemist. As proof of receipt to both the client and the laboratory, a sample acknowledgement is sent to the client and a copy is placed in the client file.

If any of the sample acceptance criteria are not met, the Sample Receiving Chemist notifies the Project Manager who determines the appropriate action based on their specific knowledge of contract requirements and customer needs.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Where necessary, a Sample Receiving Chemist adds preservatives to a sample, according to standard operating procedures. The Sample Receiving Chemist also documents the sample preservation.

Procedures for receiving samples are described in the following Standard Operating Procedures.

SLA-003 Sample Receipt and Login

## 2.3 Sample Log-In

Using the LIMS, the Sample Receiving Chemist logs in each sample under the client's contract number, recording the analyses requested, client's sample identification information, type of sample container, storage location of sample, date and time received, and date due. The LIMS assigns a unique number to each sample. A LIMS-generated chain-of-custody (COC) is printed. The LIMS COC must be approved by the Project Manager prior to distribution and release of the samples for analysis. The Sample Receiving Chemist labels each sample with the contract number and AXYS sample number. The labels are generated by the LIMS. Where the long-term integrity of the LIMS generated label is in question, an additional back-up label using an alternate labelling medium is attached.

## 2.4 Sample Storage and Retrieval

A Sample Receiving Chemist places samples in storage. Procedures for the logging, labelling, and storage of samples are described in the following Standard Operating Procedures. Sample storage requirements are specified in each analytical method.

SLA-003 Sample Receipt and Login
SLA-004 Sample Control Procedures

When samples are needed for analysis, a Sample Receiving Chemist retrieves the samples from the storage location. A Chemist in the Sample Preparation Lab Group sub-samples the appropriate quantity for the analysis and returns the remaining sample to the Sample Receiving Chemist for storage.

## 2.5 Sample Preparation

Samples are prepared for analysis in the Sample Preparation area. The samples are homogenized according to procedures described in the following Standard Operating Procedures. Chemists who carry out sample preparation document the sample preparation procedures. A Sample Receiving Chemist returns the samples to storage when the preparation procedures are complete.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Procedures for the preparation of samples are described in the following Standard Operating Procedures.

| | |
|---|---|
| SLA-011 | Compositing Samples |
| SLA-012 | Dissection of Samples |
| SLA-013 | Procedures for Homogenization of Solids and Tissues |

## 2.6 Consumption of Samples

It is AXYS policy to maintain some sample in reserve, as backup.

Should a Lab Chemist conclude that there is insufficient sample for all requested analyses, they notify a Project Manager. A Lab Chemist may not consume a sample without the permission of the Project Manager. This permission is not given unless the client has given approval.

It is the responsibility of the Lab Chemist to inform a Sample Receiving Chemist that a sample has been consumed in the analytical process. The Sample Receiving Chemist records the information in the LIMS.

## 2.7 Disposal of Samples

All samples and sample extracts remain under specified storage conditions until such time as the sample is disposed of or returned to the client.

The AXYS policy to retain samples and extracts is outlined in SAD-014. Should a client request that AXYS hold samples and extracts for a specified time or dispose of them differently, AXYS, will negotiate in good faith to meet the request.

# 3. CHAIN-OF-CUSTODY PROCEDURES

All samples received at AXYS are subject to chain-of-custody procedures. The AXYS standard chain-of-custody is established by AXYS' security policies and sample receipt and log-in procedures, whereby:

1) access to AXYS facilities is controlled;
2) access to sample storage areas is limited;
3) upon receipt, samples are signed for and logged-in with anonymous identification numbers. An audit trail for the process is maintained.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Samples are received at the laboratory in sealed sample containers that in turn are packed in a sealed box or cooler. The seals and samples are carefully examined by the Sample Receiving Chemist to ascertain whether they have been tampered with and stored/shipped appropriately. Any discrepancies are noted on the login records. Preservatives are added as required. Samples are then stored in secure storage facilities under sample appropriate storage conditions, until analyzed. Maximum holding times prior to analysis (as described in the analytical method) are strictly adhered to.

Chain-of-custody documents are maintained and record each transfer of the samples and sample extracts and who has possession of the samples. Access to laboratories and instrument rooms is limited and subject to AXYS' security policies (Chapter V, Section 5). Samples and sample extracts remain in locked storage facilities until the client indicates that samples may be disposed of. Data are stored in secure files under anonymous code numbers. In addition, AXYS' facilities are protected by an electronic security system as part of routine security measures.

Chain-of-custody procedures are described in the following Standard Operating Procedures.

SLA-003 Sample Receipt and Login

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# VIII. ANALYTICAL TESTING PROCEDURES

## 1. METHOD MANAGEMENT

The methods used by AXYS are the responsibility of the QA Manager and the Technical Director. Methods must be approved and signed prior to use by the QA Manager, the Technical Director, and the appropriate department Manager(s). Only current copies of controlled documents may be used by staff to control processes.

Revisions to methods must have the approval of the QA Manager, the Technical Director and the Lab Manager. Procedures for the request, approval and revision of methods are described in Standard Operating Procedures.

SQA-005 Creation of New Documents
SQA-006 Revision of Documents

### 1.1 Method Validation

Methods are validated using data from the analysis of multiple samples (spiked matrix samples, spiked blanks and/or certified reference materials) prior to routine implementation. Statistical treatment of the data generates precision and recovery statements. Method validation data are compiled and kept on file by the QA Manager. Procedures for the validation of a method are described in the following Standard Operating Procedure.

SQA-002 Method Validation Procedures

Methods are also validated on an ongoing basis by monitoring the QC samples analyzed with every batch of samples. Methods are re-validated when significant changes are made to the methodology.

#### 1.1.1 Detection Limits

Detection limits are determined using the appropriate protocol for the application. Protocols and application are described in Appendix D, Section 2.

### 1.2 Measurement Uncertainty

Uncertainty estimations are determined for accredited methods using recognized procedures.

Uncertainty estimates are reported if required:

- by the client,
- to establish data as “fit for purpose”,

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

- for compliance with regulation.

Procedures for the determination of measurement uncertainty are described in the following standard operating procedure.

SQA-022 Estimation of Measurement Uncertainty

## 1.3 Method Control

All methods are the property of AXYS and are considered proprietary information. These methods cannot be reproduced without the permission of the QA Manager or the Technical Director. Each method has a document number and is printed on AXYS second-page letterhead stationery. Each copy is controlled with a unique copy number and the copyholder is recorded. Photocopies of the methods are not permitted for use. It is the responsibility of the QA Chemist to ensure that only current methods are distributed for use and the responsibility of each Manager/Supervisor and analyst to ensure that only current method documentation is used.

## 1.4 Method Numbers

Each method is assigned a unique AXYS method number, which includes a revision number. The method number is the same as the document number. The system for naming documents is described in Appendix B. The method number is reported on the final analysis report.

## 1.5 Method Specifications

Each method contains method performance specifications including detection limits, surrogate standard recoveries, blank levels, agreement between duplicate tests, reference sample recoveries, and instrumental calibration and performance criteria. The specifications are referred to by Instrumental Analysts, to confirm the acceptability of data. Method performance criteria are the responsibility of the QA Manager who may revise the performance specifications based on changes in methodology. Method performance is monitored through examination of analysis data and associated QA/QC results.

## 1.6 Custom Methods

Clients may request a customized analysis requiring the use of non-routine procedures. The customized procedures must be approved according to AXYS' policies for departures from documented procedures (Chapter II, Section 4). The sample is analyzed using the analytical method closest in methodology to the customization requested. Where required, deviations from documented methods are described in the narrative of a data package sent to a client.

The extent of validation of the customized procedures is dependent upon contract requirements and is directed by the QA Manager or Technical Director.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

### 1.7 Methods Inventory

An inventory of all current analytical methods is maintained in Q-Pulse and is available to all staff.

## 2. TEST PROCEDURES

Samples received for analytical testing are logged in, labelled with AXYS ID numbers, and stored by a Sample Receiving Chemist, as described in Chapter VII, Sample Handling Procedures. Samples are analyzed in batches consisting of test samples and quality control (QC) samples. Each batch usually consists of up to 20 test samples, a procedural blank and QC samples as specified by the method (a duplicate, CRM, IRM, matrix spike or spiked sample). The Lab Schedule Coordinator is responsible for determining the composition of analysis batches, including the samples to be analyzed and the accompanying QC samples as well a for assigning an analysis batch to a Lab Chemist. The analysis batch is assigned a unique batch number (work group) by the LIMS. All information pertaining to the batch is recorded on a Batch List that accompanies the samples during work-up and instrumental analysis, and accompanies the analytical data during data interpretation, validation and reporting.

The analysis of samples involves sample preparation procedures, laboratory extraction procedures, instrumental analysis of extracts, interpretation of instrumental data and calculation of results, data validation and final report preparation. The analytical process is presented in the form of a flow diagram (Figure 3). The steps involved are described below.

### 2.1 Sample Preparation Procedures

Chemists in the Sample Preparation area carry out sample preparation procedures. These procedures may include sample preservation, dissection, homogenization, and preparation of sample composites. Procedures are described in the following Standard Operation Procedures.

| | |
|---|---|
| SLA-011 | Compositing Samples |
| SLA-012 | Dissection of samples |
| SLA-013 | Procedures for Homogenization of Solids and Tissues |
| SLA-014 | Thawing Solid and Tissue Samples |
| SLA-043 | Removing Sampling Media from Field Sampling Equipment |
| SLA-077 | Sample Transfer Procedures |
| SLA-084 | Preparation of Aqueous samples for Extraction |

### 2.2 Extraction Procedures

Extraction procedures are described in detail in AXYS' analytical method documents. They are carried out by trained Lab Chemists. Most extraction procedures involve the following steps:

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

- addition of surrogate standards;
- extraction of organic compounds from the sample matrix with appropriate solvents or solid phase extraction (SPE);
- clean up of the extract by a variety of column chromatography techniques to remove interferences;
- the concentration of the extract to a small volume in preparation for instrumental analysis; and
- the addition of recovery standard to extract in order to monitor surrogate recovery.

It is the responsibility of each Lab Chemist to perform the extraction procedure according to the approved, written analytical method.

The quality, reproducibility, and reliability of analytical results depend upon the consistent use of the same analytical procedures, reagents, and techniques. Deviations from the written method are not permitted unless specified in writing by the Project Manager, QA Manager, or Technical Director (see Chapter II-5; Departures from Documented Procedures).

The Lab Chemist documents the extraction procedure by completing a Batch List and appropriate work-up sheets covering all procedures. Each critical step of the analysis procedure is documented, initialled and dated by the analyst. A second analyst verifies that the correct standard solution was used to spike each sample batch by inspecting the vial of standard used and initialling the Batch List. The work-up sheets and Batch List accompany the extracts to instrumental analysis and final data review. All comments, additional work and corrective actions are documented on the work-up sheets or in the LIMS. Work-up sheets are kept on file for future reference. When the extraction procedure is complete, the analyst updates the LIMS to indicate the extracts are ready for instrumental analysis.

Procedures for completing a Batch List and completing worksheets are described in the following Standard Operating Procedures.

| | |
|---|---|
| SLA-027 | Completing a Worksheet |
| SLA-033 | Procedures for Making an Analysis Batch |

## 2.3 Instrumental Analysis Procedures

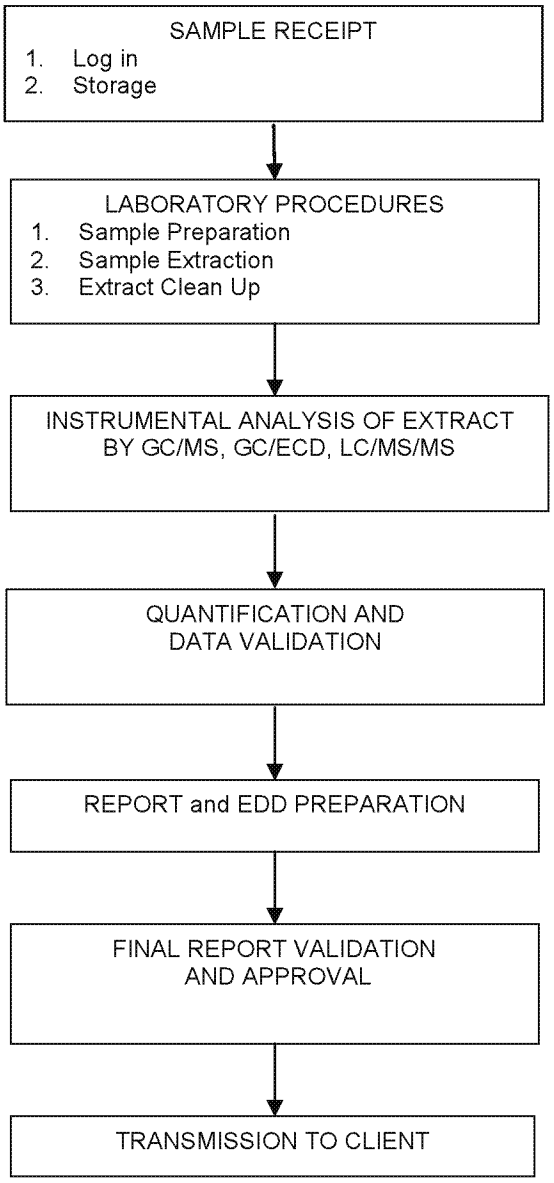
Instrumental analyses are routinely performed by GC/MS, high-resolution GC/MS, GC/ECD, and LC/MS/MS under the supervision of the Instrumental Analysis Manager. The instrumental analyses are performed only by trained Instrumental Analysts, following the procedures in the instrument Operating Manuals and in the AXYS Analytical Methods.

Instrumental Analysts are responsible for ensuring that the instruments used in the analysis of samples are properly maintained, tuned, calibrated, correctly set up for the specific analysis, and meet all specifications established by the analytical method and instrument manufacturer. In addition, a number of specific QA/QC checks are performed as part of each

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

## FIGURE 3 FLOW DIAGRAM OF TESTING PROCEDURES




Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

analytical method. Instruments must satisfy the calibration and performance specifications outlined in the method prior to commencing the analysis. Typically, samples within a workgroup (including QC samples) are run consecutively. Once the analysis is complete, Instrumental Analysts update the LIMS to indicate that data are available for interpretation.

Procedures for performing the instrument QA/QC checks are described in the following Standard Operating Procedures.

| | |
|---|---|
| SIN-012 | Checking Quality of GC/MS Data |
| SIN-020 | Determination of GC Column Resolution |
| SIN-021 | Window an Analysis |
| SIN-022 | Instrument Sensitivity Checks |
| SIN-023 | GC/LRMS Calibration and Demonstration of Linearity |
| SIN-028 | Frequency of Initial Calibration – GC/MS |
| SIN-032 | HR GC/MS Determination of Linearity |
| SIN-036 | Monitoring LC Column Performance |
| SIN-037 | Frequency of Initial Calibration - LC/MS/MS |

Instrumental Analysts perform a number of routine checks on a regular basis to keep the instruments in good operational order.

### 2.3.1 Operational Checks

***Mass Calibration/Mass Resolution***

The quadrupole mass spectrometers, (low resolution, GC/LRMS) are mass calibrated a minimum of twice weekly or more frequently if required by instrument changes or special requirements. Instrumental tuning to unit mass resolution at m/e 219 is performed daily; fragmentation resolution is demonstrated using DFTPP where required by method or contract.

An Instrumental Analyst verifies the high resolution mass spectrometer (GC/HRMS) tuning prior to any analysis. The tune is considered acceptable if it meets the specific method's mass resolution specification. If the tune is not acceptable, the mass spectrometer is retuned and fully mass calibrated. For specific USEPA method applications, mass calibration is viewed and verified every twelve hours, as described in the following standard operating procedure.

| | |
|---|---|
| SIN-011 | Mass Calibration and Initiating an Analysis Run – HR GC/MS |
| SIN-029 | Tuning and Mass Calibration of Low Resolution MS, Including the Use of a Tuning Standard |
| SIN-034 | Mass Calibration of Waters-Micromass Quattro Ultima MS/MS |

Initial calibration of the LC/MS/MS is performed by analysis of a series of calibration solutions covering the working response range and is repeated as necessary to maintain consistency of response for the calibration verification test (single point) analyzed at least every 20 samples. Mass calibration and tuning are verified with every initial linearity calibration.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

### 2.3.2 Preventive Maintenance Procedures

***Gas Chromatographs***

Routine maintenance of gas chromatographs is performed as required. Maintenance includes changing the septa, cleaning the injectors, and installing new silylated injection liners. The columns are changed, trimmed, or restored as needed to meet GC resolution standards.

***Mass Spectrometers***

The mass spectrometers are maintained routinely as required to retain good sensitivity and consistent mass calibration and tuning parameters. The sources and the quadrupole rods are cleaned and the transmission efficiency checked regularly. Operators maintain the vacuum systems as required; the rotary vacuum pumps are serviced at least twice a year.

***Electron Capture Detector (ECD)***

Routine maintenance of ECD detectors is performed as required. When the background signal becomes elevated outside operating parameters the detector lines are flushed with solvent. Micro ECD inserts are replaced as required.

***Liquid Chromatograph/Mass Spectrometer (LC/MS/MS)***

The liquid chromatograph is regularly flushed with solvent to maintain cleanliness and proper working order. Fluid levels for refrigeration systems and vacuum pumps are routinely checked. Mass spectrometer maintenance includes cleaning of the extraction cone and cover as well as the baffle, probe and affected areas. Cleaning is carried out as necessary. Columns are changed as necessary.

***Maintenance Logs***

Routine instrument maintenance for the high resolution GC/MS instruments is recorded on instrument run lists that are retained. Non-routine instrument service and any instrument repair are recorded in instrument logbooks. For all other instrumentation, logbooks are used to record all maintenance and repairs. Logbooks are retained.

## 2.4 Primary Data Validation Procedures

Instrumental Analysts are responsible for assessing the overall quality and acceptability of the instrumental data prior to commencing data interpretation procedures. They follow Standard Operating Procedures to examine the chromatograms and to identify individual compounds by comparison with calibration standards analyzed before and after the sample.

1. Instrumental sensitivity, chromatographic quality, GC column separation, peak width, instrument linearity, and evidence of contamination from high level samples are checked to ensure they meet quality standards.
2. The Instrumental Analyst verifies sample IDs, correct addition of quantification standards and correct bracketing of samples with calibration standards.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

3. The Instrumental Analyst checks to ensure compliance with QC specifications such as detection limits, surrogate recoveries, procedural blank levels, relative response factor stability, target recoveries and duplicates agreement.

Sample extracts with incomplete data or unacceptable chromatograms are sent back for additional laboratory work-up, instrumental analysis or repeat analysis. Instrumental Analysts record in detail all requests for additional laboratory work-up, instrumental analysis or repeat analysis in a LIMS Request for Additional Work form. A note of the request is also entered into the LIMS Work Group Notes and must be verified and signed off by the Project Manager.

Instrumental data that are acceptable are then coded for the target analytes. Only peaks that satisfy the identification criteria are quantified. Data are coded and quantified automatically by the computer. The results are verified by an Instrumental Analyst to confirm correct peak assignment. Peak integrations are corrected for any cases where the chromatography software has not performed the integration properly and the error in the integration is apparent from inspection of the chromatogram. These errors may typically arise from incorrect target peak selection due to the presence of closely eluting peaks, incorrect estimation of the noise threshold by the computer due to the presence of peaks eluting close to the noise determination window, or peak shouldering. For all cases of manual re-integration the raw data file showing the original integrations as performed by the chromatography system are retained on file at AXYS such that this information could be provided to data validators if requested. Manual integration is never performed arbitrarily or to compensate for sub-standard chromatography.

SCO-022 Manual Integration of Chromatographic Peaks

The following Standard Operating Procedure describes in detail the procedures for performing the QA/QC checks on instrumental data. Procedures for interpreting data specific to a particular analysis are described in the instrumental method documents.

SCO-025 Instrumental GC Data Evaluation Procedures
SCO-026 Instrumental LC Data Evaluation Procedures

Verified data are submitted for final reporting prior to a check by an Instrumental Analyst.

## 2.5 Calculation of Results

The internal standard (or isotope dilution) method of quantification is preferentially used to calculate the final concentrations of target analytes. The calculations used are documented in Appendix A. The identification of target analytes and the calculation of their concentrations are carried out using HP Enviroquant/Prolab, VG OPUSquan, TargetLynx/QuanLynx or AB Sciex Analyst software. An Instrumental Analyst verifies the identification and calculations.

The following steps are performed during the calculation:

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

- correlate the individual chromatographic run with calibration standards run before and after the sample;
- calculate the relative response factors for each analyte from the calibration standards;
- calculate the concentrations (in units appropriate for the matrix, e.g. ng/g, µg/L, etc.) of the individual compounds in the samples;
- calculate the detection limit for each analyte based on a minimum area coded for each analyte; and
- report the percent recovery of the internal standards and, by inference, the analytes.

For each specific analysis and set of standards, a quantification method is written. A unique alphanumeric number identifies each quantification method. The creation of quantification methods is the responsibility of a Senior Instrumental Analyst. The quantification routine is prepared by one individual in the group and checked by another. Each method is checked by hand and then checked on test samples prior to use.

Procedures for the calculation of concentration, detection limits and surrogate recoveries are described in Standard Operating Procedures.

The Standards Use List presents a summary of the quantification methods currently in use. This list is prepared by the Senior Instrumental Analysts and is retained on file as a controlled document.

FST-012 Standards Use List

## 2.6 Data Validation

Instrumental Analysts who are trained in secondary validation procedures review data to ensure they meet method, laboratory and contract performance standards and verify that the final data reports are accurate. Instrumental Analysts who are trained in secondary validation procedures are authorized to approve final data reports.

Where quantification of a native compound is performed using alternate ions other than the primary ions specified in the method, the following data flagging conventions apply:

i) If quantification using the alternate ions has been validated and documented (i.e. in an IPR report), a comment in the narrative (or batch cover page for non-DP reports) is sufficient notification of the use of alternate ions. No other flagging is required.
ii) If quantification has not been validated (i.e. not summarized in an IPR report), the H-'information value' flag will be applied to the reported results and explained in a narrative comment.

In cases where results do not meet method and project specifications, appropriate corrective action is performed. This may include a repeat of instrumental analysis, additional clean up of the extract, or a repeat extraction. If necessary, the client is contacted to obtain additional sample or to discuss the corrective measures.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

In situations where it is necessary to report non-conforming data, the data are flagged and qualified with footnotes on the analysis report explaining the non-conformance and the limitations or impact on interpretation of the results. In addition or alternately, the non-conformance and the limitations or impact on interpretation of the results are described in a narrative that accompanies the data.

Pertinent QC information and comments related to an analysis batch are recorded in the Work Group Notes by the Lab Manager, Lab Chemists, and Instrumental Analysts. Instrumental Analysts are responsible for ensuring that any deviations from documented procedures or from acceptance specification, any extra work and any data quality decisions are documented in the LIMS work group notes and that all deviations and non-conformances are identified and explained in the final data reports.

The following checks are carried out on each analysis batch.

### 2.6.1 Quality Control Samples

The results of quality control samples analyzed with the batch must meet specifications presented in the analytical method.

### 2.6.2 Detection Limits

Detection limits on a sample-specific basis must meet method or contract specifications, or be sufficient for detection of target compounds.

### 2.6.3 Percent Recovery of Surrogate Standards

The ratio of the internal standard (or surrogate) response to the recovery standard response is used to determine the percent recoveries of the internal standards (or surrogates). The percent recoveries are used as an in-lab quality control parameter. Although concentrations from isotope dilution analyses are automatically corrected for incomplete surrogate recovery, surrogate recoveries are an indication of overall data quality and must fall within ranges specified in the analytical method.

Standard Operating Procedures describe data validation and release authorization.

SQA-001 Data Validation Procedures

## 2.7 Data Reporting

Final data reports are generated by the LIMS, with the exception of final data reports that require a high degree of customization, which are prepared by Data Reporters. Electronic files of all final results are maintained.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

Data reports, including preliminary data, require authorization by an Instrumental Analysis Chemist qualified in secondary data validation, the QA Manager or the Technical Director for reporting to the client. A final data report is issued for each sample, including QC samples (procedural blanks, duplicates, reference samples). All final sample data reports are signed (hand written or electronic signature) to document the authorization for reporting. All preliminary data reports are clearly identified as "Preliminary Data".

It is AXYS' policy that where both an original signed hard copy and electronic copy of the data report exist, the hard copy is the authorized report. Should any discrepancies arise between electronic data and the authorized report, the hard copy is deemed to be correct. Authorized data are reported using confidential data transmission procedures.

Authorized data are initially reported to clients by e-mail or, rarely, FAX. Original final data reports are mailed or sent by courier to clients soon thereafter. If requested, data are reported in an electronic format acceptable to the client. Confidential data transmission procedures are described in the Standard Operating Procedure. Data Reporters prepare hard copy data reports and electronic data deliverables.

SAD-005 Transmission of Reports

A final data report contains the following information:

- all sample information including AXYS ID number, client ID, sample size;
- analysis information including method number, type of instrument used;
- analyte concentrations in the samples and the sample basis on which they are reported, i.e. wet, dry, lipid, etc.;
- additional analytical data if requested; i.e., percent moisture, percent lipid;
- detection limits for each analyte;
- percent recovery of surrogate standards;
- footnotes which qualify data and explain terminology;
- signature and title of person authorizing data;
- a statement that, where applicable, the results meet requirements of the NELAP standard
- where required, date of sample receipt, time of sample collection, date of sample preparation and sample analysis; and,
- a statement that the results reported relate only to the sample tested.

Data reports are prepared according to standard procedures.

SAD-030 Preparation of Final Reports using LIMS

Upon request, a client will be provided with the following additional information:

- description of the analytical method and QA/QC protocols;

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

- other QA/QC data or checks such as instrument response control charts;
- chromatograms and all work and calculation sheets; and
- a data package with supporting information, prepared as described in the following standard operating procedure.

SAD-023 Data Package Preparation

The format of a final data report and data reporting criteria are described in Appendix C. AXYS also provides results in a format specified by the client or by the analytical method.

Uncontrolled if printed

## 2.8 Record Keeping

For each sample received and analyzed at AXYS Analytical Services Ltd, test records are kept. These records include:

- sample receipt records
- sample preparation records
- LIMS Chain-of-custody
- sample work-up sheets
- chromatograms
- instrumental records
- calculated results
- Batch Lists
- final reports
- related QC sample analysis records

These test records ensure the ability to trace a sample test result through the analytical process. Hard copy and electronic test records are kept for ten years, or longer if required by contract.

Client records that include correspondence, invoices and contracts, are retained for 10 years.

In the event of a transfer of ownership or if the company ceases business AXYS would contact clients to arrange for transfer of retained records as required.

Record management protocols are documented in the following SOP:

SAD-022 Record Management

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# IX. QUALITY CONTROL MEASURES

## 1. QUALITY CONTROL SAMPLES

Quality Control (QC) samples are analyzed routinely to monitor method performance. The choice of QC samples depends on method QC requirements, a client's requirements and batch size. The QC samples analyzed at AXYS are described below.

### 1.1 Procedural Blank (BLK)

A procedural blank is a sample that is analyzed in a manner identical to the test samples. The sample contains a matrix known to be free of target analytes. A procedural blank is analyzed with every batch of samples.

The purpose of a procedural blank is to monitor the level of target analytes present from sources other than the samples such as reagents, glassware, and airborne contaminants. Procedural blanks serve as a check of the quality of the materials and reagents used in the analysis. Procedural blank results must fall below concentrations specified by the analytical method.

Should a procedural blank be higher than the method specification, there is the possibility that the samples are similarly contaminated. This is especially critical for samples with low analyte concentrations. The actual extent of the contamination in the blank will dictate whether the entire batch is repeated or whether results are flagged or explained in a narrative that accompanies the data.

If procedural blank contamination persists, the analysis is halted until the source of contamination is found and eliminated.

### 1.2 Laboratory Sample Duplicate

A laboratory sample duplicate is a sample that is analyzed twice in the same analysis batch. This involves analyzing two separate sub-samples taken from a single sample container provided by the client for analysis.*

A laboratory sample duplicate is analyzed with every non-aqueous batch of seven to twenty test samples, provided sufficient sample is available. Analysis of laboratory sample duplicates for aqueous samples is performed only with prior negotiation with the client.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Results are evaluated against defined precision limits for acceptability.*. Procedures for defining control limits are documented in Standard Operating Procedures.

SQA-002 Method Validation Procedures

Should the results for sample duplicates exceed precision limits, the cause is determined and remedial action as appropriate to correct any analytical deficiencies is performed.

* Note: Precision limits apply only to sample duplicate sub-samples taken from a single sample container provided by the client. Samples designated by the client as duplicate samples but submitted in individual containers are designated as client (field) duplicates and are not subject to laboratory precision limits.

Uncontrolled if printed

## 1.3 Reference Samples

A reference sample is a sample that contains "known" quantities of some or all of the target analytes. Reference samples are used to demonstrate the accuracy of methods and the on-going laboratory performance. There are many different types of reference samples used at AXYS Analytical Services. A reference sample is analysed with every batch of samples.

### 1.3.1 Certified Reference Materials (CRMs)

These are reference materials that are accompanied by a certificate of analysis and are supplied by internationally recognized agencies. These certified values have been determined by multiple laboratory analyses. These types of reference samples are used, wherever possible, to validate a method. However, they are not available for all types of analyses.

### 1.3.2 Reference Materials (RMs)

These are reference samples obtained from commercial suppliers or governmental agencies for which the target concentrations have been determined by consensus. They are used in conjunction with CRMs or when CRMs are not available for method validation.

### 1.3.3 Internal Reference Materials (IRMs)

These are reference samples in which the analyte concentrations have been determined by repetitive analysis at AXYS or by intercalibration studies. They may be used as "known" samples when a CRM is unavailable. They are either naturally contaminated material or a matrix fortified with target compounds.

### 1.3.4 Laboratory Control Sample (LCS)

May also be referred to as Spiked Matrix Material (SPM) or On-going Precision and Recovery (OPR) sample.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

This is a sample of an uncontaminated matrix or a matrix with low levels of target analytes to which a known quantity of authentic target analyte is added. Spiked matrix samples are used most often as reference samples in an analysis batch.

The analytical results for the reference samples are compared to the certified or expected values. The agreement between the two sets of concentrations must meet the method specifications in order for the data to be accepted.

Where reference sample results do not meet QC requirements, additional reference results are examined or diagnostic tests are performed, to determine if a systematic error exists. Should a problem be identified, analysis is halted and corrective action is taken. Affected results are identified and depending on the nature of the problem, the samples are re-analyzed or the results are corrected for bias displayed by multiple QC reference samples.

### 1.4 Spiked Blank (SPB)

A spiked blank is a procedural blank to which a known quantity of authentic target analytes has been added. Spiked blanks are generally used in method validation studies to determine method performance, independent of matrix effects. They may also be analyzed as routine QC reference samples when an appropriate blank matrix is not available.

### 1.5 Unspiked Matrix (USM)

This is a sample of the uncontaminated matrix used to prepare a spiked matrix sample. It is analyzed to determine the levels of target analytes in the matrix prior to spiking. The concentration of analytes in an unspiked matrix should not normally be significant compared with the spiked amount added. If the contribution is significant, a correction must be applied.

### 1.6 Matrix Spike (MS) / Matrix Spike Duplicate (MSD)

A matrix spike (MS) sample is a test sample that has been spiked with a known quantity of analytes; the spiked sample may be analyzed in duplicate (MSD). The sample is also analyzed unspiked and the recovery of the analyte spike is determined by comparison of the spiked and unspiked sample analysis results. The primary purpose of MS/MSD tests is to establish the applicability of the analytical approach and procedure to the sample matrix of interest, not to evaluate routine laboratory performance. MS/MSD tests are performed as appropriate for method validation purposes and may also be analyzed where specified by the analytical method or when requested by the client. Usually the client will specify the sample to be analyzed; if not, AXYS chooses a sample from among those with sufficient quantity to allow for multiple sub-samples.

Procedures for the preparation of the above QC samples and for performing the appropriate QA/QC checks on the analytical results are described in the following Standard Operating Procedures.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

SLA-016 Preparation of Quality Control Samples
SQA-001 Data Validation Procedures

## 2. INSTRUMENT QUALITY CONTROL CHECKS

The instruments used in the analysis of extracts are required to meet specifications described in each analytical method in order to ensure reliable instrumental data. A number of parameters are monitored on a method-specific basis and sample-specific basis, as a means of ensuring specifications are met. The checks carried out are described below.

### 2.1 Instrument Linearity

Quantification linearity of the GC/MS, GC/ECD, and LC/MS/MS systems is verified by a multipoint calibration procedure at least every 90 days, whenever significant instrument adjustment/maintenance is performed, or as specified by the method. The frequency of multipoint calibration for methods employing 'continuing calibration' procedures is documented in the following Standard Operating Procedures.

SIN-028 Frequency of Initial Calibration – GC/MS
SIN-037 Frequency of Initial Calibration – LC/MS/MS

The degree of linearity over the working range must meet the specifications established by the analytical method prior to commencing the analysis.

### 2.2 Window Standards

Window standards, analyzed for some GC/MS methods, are run when there is a change in GC conditions, column or retention times in calibration solutions, or as stated in the analytical method.

### 2.3 Resolution Standards

Gas chromatographic resolution is demonstrated prior to analysis.

a) A GC Resolution Standard is analyzed on an established schedule or after changes to the GC system. GC Resolution standards, their test frequencies and acceptance criteria are detailed in each analytical method, where applicable. The GC resolution standard may be a separate solution or it may be combined with calibration solutions.

b) On-going GC Resolution is monitored by monitoring the separation of resolution standard components in the calibration standards and in samples (if present). Peak width of analytes and internal standards is also monitored as an indication of column performance.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

### 2.4 Sensitivity

Instrument sensitivity must be maintained throughout the analysis procedure to ensure detection limit specifications are met. A sensitivity standard is run on a regular basis. The peak areas of surrogate and recovery standards in the calibration solution and samples are monitored on an on-going basis to ensure adequate instrument sensitivity. Acceptance criteria for sensitivity standards are detailed in the analytical method. Sensitivity is also evaluated on an *ad hoc* basis by monitoring the response for particular compounds (normally recovery standards) in calibration solutions and samples.

### 2.5 Instrumental Response Calibration

Relative response factors, determined at least once every 12 hours by analysis of standard calibration solutions containing the target compounds and quantification references, must fall within pre-defined limits. Instrumental servicing and/or re-calibration are performed as required to maintain the response factors within specifications.

### 2.6 Injection Blank (to Monitor Instrumental Injection Carryover)

Solvent blanks are typically injected after a calibration verification or bracketing calibration standard to monitor the rate of instrumental injection carryover. The maximum acceptable level of carryover is 0.3% of the preceding injection, and is determined according to procedures in the Standard Operating Procedure.

SCO-025 Instrumental Data Evaluation Procedures

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# THIS PAGE LEFT INTENTIONALLY BLANK

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# X. QUALITY ASSURANCE MEASURES

Quality assurance (QA) measures have been implemented to maintain control of the materials, equipment, conditions and procedures used in the analytical testing procedures. These measures, described below, are conducted on an ongoing, routine basis.

## 1. PURCHASING OF GOODS AND SERVICES

The AXYS policy for the purchasing of goods and services is as follows:

- Goods and services will be purchased only from reputable and reliable vendors, according to standard operating procedure

  SAD-006 Purchasing of Goods and Services

- Vendors of critical services, equipment and consumables which affect the quality of the tests performed by AXYS must be qualified annually. The qualification consists of reviewing the vendor's current certifications, assessing their ability to deliver reliably and in a timely fashion, and verifying that the vendor's products have consistently passed any applicable QA checks performed by AXYS. Records of the vendor qualifications are maintained.

- All methods specify the quality (specifically grade and manufacturer where applicable) of reagents and materials required.

- Wherever possible, the highest purity reagents will be purchased.

- All chemical standards purchased will be of documented purity and/or concentration.

- No substitutions are allowed without permission of the Technical Director, QA Manager or Lab Manager.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# 2. LABORATORY QA MEASURES

## 2.1 Reagent Checks

The quality of all reagents used in the analytical procedures is specified in each written analytical method. Manufacturer's specifications and in-house checks of reagents are used to ensure the quality.

*Chemical Reagents* Where necessary, reagents are subject to cleaning procedures prior to use. Cleaning procedures are described in each written analytical method.

*Solvent Checks* New batch lots of solvent are checked for impurities prior to use by analyzing the solvent. Records of the analysis are kept on file.

*Column Packings* Batches of prepared column packings are checked following standard operating procedures. The preparation of packings and cut-point results are documented.

*Reagent Water* Contaminant-free Seastar ultrapure water or Canadian Springs bottled water is purchased and used as a reagent in analysis procedures.

Procedural blank data are monitored for the presence of interferences or contaminants that may come from reagents, solvents, column packings and/or reagent water.

If a reagent is shown to be contaminated it is not used.

Procedures for proofing solvents are described in the following Standard Operating Procedure.

SLA-094 Proofing Laboratory Equipment, Sampling Media, Solvent and Sample Containers

## 2.2 Glassware Checks

Glassware is typically washed thoroughly and baked prior to use in the laboratory, to ensure that it is free of organic contaminants. Some analyses performed at AXYS require that glassware proofs be carried out regularly as a part of the analysis. In this case, all the pieces of glassware used in an analysis batch are solvent rinsed or extracted and the rinse/extract analyzed for the presence of target analytes, in order to determine the contribution to the total concentration from the glassware. The contribution must be below method specifications or the analysis is not started.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

Glassware used in the cleaning of 'high' and 'ultra high' level samples undergoes special cleaning procedures prior to being returned to use. Glassware used with 'ultra' high samples must be proofed prior to return to use.

AXYS, upon request, ships clean sample containers to clients. These containers are purchased with a certificate of cleanliness and are regularly proofed for contaminants. The analysis results from the proofs are kept on file. The containers must meet established acceptance criteria for 'cleanliness' prior to use.

The procedures for cleaning glassware, performing a glassware proof and shipping sample bottles are described in the following Standard Operating Procedures.

| | |
|---|---|
| SLA-001 | Cleaning of Laboratory Items |
| SLA-002 | Glassware and Laboratory Equipment Proofs |
| SAD-013 | Shipping and Receiving Procedures |

## 2.3 Volumetric Measurements

To ensure the accuracy of volumetric measurements is adequate for the application the following practices are followed:

Only Class A volumetric glassware and designated Hamilton syringes are used in the preparation of standard solutions. Some standards, such as LC calibration standards, may be prepared using disposable tip pipettes instead of syringes.

Hamilton syringes or calibrated variable volume pipettes are used to dispense standard solutions for daily analysis.

Records of syringe and pipette accuracy are maintained as described in the following standard operating procedure:

| | |
|---|---|
| SLA-088 | Demonstration of Spiking Bias and Precision |

## 2.4 Balance Checks

Balance calibration meeting ISO 17025 requirements are performed annually. The accuracy of any standard weight used in the lab is verified by comparison to certified weights with calibration meeting ISO 17025 requirements.

The accuracy of the balance calibration is verified daily using reference weights. Records of this verification are maintained in individual balance logbooks kept with the balances.

Logbooks documenting the calibration and repairs of each balance are maintained.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

Procedures for accuracy checking, calibration, daily verification of calibration, and maintenance of the balances are described in the following Standard Operating Procedures.

SLA-023 Use of Balances

## 2.5 Thermometer Checks

**All** thermometers used for monitoring sample shipments received, sample storage facilities, water baths and the drying oven require calibration to meet ISO17025 standard with a minimum annual frequency. Additionally, thermometer accuracy may be verified internally on-demand following procedures in SLA-046.

SLA-046 Verification of Thermometers

## 2.6 Controlled Environment Checks

***Temperature***

The temperatures of the sample storage facilities and instrumental laboratories are monitored to ensure compliance with specifications described in Chapter V, 1.1 and 1.3.

Procedures for monitoring the cooler, freezer and refrigerator temperatures are described in the following Standard Operating Procedure.

SLA-026 Monitoring Temperature of Freezers, Coolers and Refrigerators

***Air***

Air filters that clean the intake air are changed on an established schedule to ensure a clean air supply. The date last changed is recorded on the unit.

## 2.7 Equipment Inventory Control

An inventory list of equipment used in analytical testing is maintained in the LIMS. This equipment inventory records the item, the inventory control number, manufacturer, model, serial number, and maintenance and calibration intervals. Each new piece of equipment is assigned an inventory control number and entered onto the list prior to putting the equipment into use. The Lab Manager is responsible for all laboratory equipment. The Instrumental Analysis Manager is responsible for all instrumental equipment. Items are removed from the list only if they are no longer in AXYS' possession.

## 2.8 Equipment Maintenance

Equipment maintenance logs record all maintenance and repairs carried out on balances, laboratory equipment (e.g. rotary evaporators, water baths), sample homogenization equipment,

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

ovens and refrigerators, and instrument logbooks record non-routine maintenance and repairs of GC/MS, GC/ECD, and LC/MS/MS instruments.

Equipment that requires servicing is labelled as "Not in Service". The repair is documented in the maintenance log (subfolder of G:\Information\Equipment Records\). The Manager/Supervisor is required to sign off on the repaired equipment prior to its return to service.

## 3. PROFICIENCY TESTING (PT)

PT samples in support of accreditation, obtained from the accrediting body or from a NELAP approved vendor, are analyzed semi-annually where available; each successive study is performed within 5 to 7 months of the previous study. The results achieved for PT samples are used as an external measure of method accuracy and laboratory performance.

AXYS also participates in relevant interlaboratory comparison studies offered by government agencies, international organizations, and clients.

Where PT samples or other means of external accuracy testing are not available for an accredited test, internally developed reference samples or routine laboratory spiked control samples are used as proficiency demonstrations; comparative evaluation of results from multiple analysts are conducted periodically, with a minimum frequency of one year.

## 4. AUDIT PROCEDURES

### 4.1 Internal Audits

Internal audits to assess compliance with the quality system and to evaluate analytical procedures, work practices and the quality system effectiveness are conducted at least annually. The frequency of internal audits is adjusted based on the laboratory's performance. Details of audits and actions taken to correct deficiencies are maintained by the QA Manager and presented to the management team. The QA Manager is responsible for establishing and implementing audit procedures. The following Standard Operating Procedure describes the procedures for conducting an audit and responding to an audit report.

SQA-008 Internal Quality Audit Procedures

#### 4.1.1 Quality System Management Review

An annual management review is conducted by the President to evaluate the effectiveness of the quality program. The management review includes examination of the following:

- results of recent audits, both internal and external;
- results of recent performance evaluation samples;
- quality control activities;
- client feedback/complaints (nature, frequency);

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

- non-conformances (nature, frequency, root cause);
- corrective and preventive actions;
- quarterly managerial reports;
- staffing levels;
- staff training and effectiveness of training;
- resources;
- suitability of policies and procedures;
- changes in the volume and type of work; and
- management meeting records.

The results of the review are documented in a report and provided to the laboratory management team. The President is responsible for ensuring that all resultant actions are carried out within an agreed upon timeframe.

### 4.2 External Audits

Agencies that grant primary accreditation, perform on-site assessments on a regular schedule (generally bi-annually). In addition, AXYS may also be audited as part of a bidding process or as a condition of a specific contact. Records of the audit findings and any corrective actions are maintained by AXYS.

### 4.3 Performance Audits

Performance audits, which quantitatively evaluate the analytical data generated, are conducted by participation in interlaboratory studies and performance evaluation tests. AXYS participates in these studies on an ongoing basis and maintains records of results, findings, and any actions taken based on the results.

## 5. PERFORMANCE MONITORING

Analytical data, QC/QA results, and operational practices are continually monitored by staff for compliance with established Quality Systems standards. Trends or circumstances that indicate potential out of control situations trigger investigation and corrective action where necessary. Any samples analyzed during out of control periods are evaluated for impact and re-analyzed as warranted.

The compliance rate of QC sample results (blank levels, spiked compound recoveries, sample surrogate recoveries) against method specified requirements is measured on a method, matrix and compound specific basis and summarized in monthly reports provided to laboratory managers. Results falling below acceptable compliance rates for the application, or trends indicating potential method performance problems, trigger corrective action investigations.

Control charts are used to track selected critical or diagnostic performance parameters such as procedural blank concentrations, reference sample recoveries and surrogate

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

recoveries. Further details on the use of control charts are described in the following Standard Operating Procedures:

SQA-007 Control Chart Procedures

## 6. SUBCONTRACTING

A client may request an analysis that is not carried out at AXYS. In such cases, AXYS arranges, with the client's approval, to subcontract the analysis to another laboratory. The selection of a subcontract laboratory depends upon the subcontracting laboratory's ability and qualifications to perform the required analysis to meet the clients requirements with regard to methodology, turn-around time and price. AXYS will subcontract analyses to a laboratory specified by the client.

AXYS maintains information on subcontracting laboratories, documenting methods used and laboratory qualification including certification or accreditation status. The QA Manager approves a list of qualified subcontract laboratories. The Project Managers confirm that the data received meet the client's specifications and are acceptable.

Samples are received and logged in at AXYS prior to being sent to the subcontract laboratory. A Release Chain of Custody is generated from LIMS and is sent with the sample(s) to the subcontracting laboratory.

Procedures for the subcontracting of samples are described in the following Standard Operating Procedure.

SAD-002 Subcontracting Procedures

## 7. CORRECTIVE ACTIONS

Corrective actions are initiated when non-conformances are identified. All individuals working at AXYS are responsible for identifying non-conformances to the Manager/Supervisor or QA Manager. Reports of non-conformances and corrective actions taken are kept on file and reviewed by the QA Manager.

When data quality fails to meet quality objectives, the problem and appropriate corrective measures are documented on the individual sample work-up sheets and also in the LIMS workgroup comments section, which is also used to document any issues that cannot be explained sufficiently on a per sample basis. Corrective actions may include a repeat of the instrumental analysis, additional clean-up of the extract, or a complete re-analysis. The procedures for data checking and corrective actions are described in the following standard operating procedure:

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.



Non-conformances that require further attention beyond routine remedial actions are documented in a Q-Pulse non-conformance report describing the problem, the person responsible for correcting it, and the date that action is required. Actions include cause analysis, identification and implementation of corrective actions, monitoring the effectiveness of corrective actions, and possible internal audits. Details of corrective and preventive actions performed are completed along with identification of the cause and any contributing factors. The non-conformance reports are reviewed by the QA Manager who closes the reports when remedial actions are judged sufficient. These reports are reviewed as part of the internal audit process.

The non-conformance reports are available to laboratory staff through the Q-Pulse document management system.

Where method or laboratory performance is identified as non-conforming, the analysis is suspended pending correction. Department Managers have the authority to suspend operations within their areas of responsibility; the Technical Director and the QA Manager have authority to suspend operations within or across departments. QA Manager authorization is required for resumption of suspended analyses. Appropriate remedial action is taken for any analyses that were performed during a period of non-conformance; should the non-conformance affect results reported to clients, the clients are notified and results flagged or withdrawn as appropriate.

## 7.1 Client Complaints

Concern or questions expressed by a client, or an agent acting on behalf of the client, regarding a product or service provided by AAS including accuracy of results, reliability of results, report format, completeness, conformance to contractual agreement, fitness for purpose, delivery, confidentiality, turn around time, billing, or staff responsiveness to client needs may constitute client complaints. A judgment call between a client requiring service and a client with a complaint must be made. During the normal course of interactions with clients it is common to receive questions from clients that require explanation (technical service) regarding any of these categories. It is imperative that communication (preferably direct if the situation has any degree of complexity that cannot be readily answered) with the client occur to 1) fully understand and assess the situation, and to 2) provide answers, immediately if available or after consultation with an AXYS resource. If this has been completed and the client is still unsatisfied the issue is deemed a client complaint.

If questions regarding accuracy of results are raised, AXYS will carry out any reasonable amount of additional work to satisfy the client, be it repeat of the analysis, re-injection of the sample extract or re-examination of the data.

Client complaints are recorded in the Q-Pulse non-conformance register along with findings of investigations, corrective actions and preventative actions. QA Manager approval is required to close non-conformance report following satisfactory resolution.

Uncontrolled if printed

Controlled hardcopies may not be photocopied. Electronic copies anywhere other than the Q-Pulse Current Document Register are uncontrolled. Currency of uncontrolled documents **must** be verified against the controlled electronic copy.



ED_004850_00001502-00165

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Detailed procedures for handling a client complaint are described in the following Standard Operating Procedure.

SAD-011 Settlement of Client Complaints

## 8. CONFIDENTIALITY

Analytical results obtained by AXYS are the property of the client and are confidential, as is the identity of the client. AXYS staff are not permitted to discuss clients' identity, samples or results with the public. The results obtained may often have legal or regulatory implications or be of a sensitive nature. Consequently, it is of utmost importance that AXYS be able to assure client confidentiality and guarantee the security and confidentiality of results. Measures are in place to ensure confidentiality is maintained.

1. Each client is assigned a unique identification code and all data are filed by client identification code number and not by client name.
2. A unique AXYS sample identification code is assigned to each sample and used throughout the analytical process.
3. Access to electronic data is limited and the data are password protected. The computers handling data are located in work areas that are kept locked outside normal working hours.
4. All analytical data and reports are filed in a secure filing system with limited access.
5. Safe transmission practices are in place for the reporting of data.
6. Each staff member at AXYS is required to sign a non-disclosure agreement, thus further safeguarding a client's identity and analytical results.

The procedures for secure computing practices, filing of data, and safe transmission of data are described in the following Standard Operating Procedures.

SAD-005 Transmission of Reports
SAD-022 Record Management
SAD-024 Computer Network Management and Security
SAD-028 Electronic Data - Security Policies and Features

## 9. PROPER RECORD KEEPING

In order to ensure the defensibility of analytical results the following procedures must be followed by all staff.

1. All hand-written records must be recorded in ink.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

2. All corrections must be made with a single line through the item without obscuring the original entry. Use of correction fluid is not allowed. The new entry must be dated and initialled by the person making the corrections.
3. All documentation entries that require a signature or initials must be signed or initialled with a reason (e.g., "approved by", "entered by").
4. Data reports must be authorized with a signature and a title. Only the Project Manager, authorized Instrumental Analysts, the QA Manager, and the Technical Director may authorize the reporting of results to clients.

Record keeping procedures are fully described in the following standard operating procedure:

SQA-019 General Documentation Policies

## 10. MONITORING PRACTICES

AXYS has implemented a variety of procedures that monitor the critical steps of the analysis procedures and ensure that documentation practices are adhered to. These procedures include the following:

- A spike witness program whereby another analyst, trained in spiking procedures, witnesses the addition of surrogate and native spiking solutions.
- Verification of the records for standard preparation by a second individual.
- Verification of all analyte quantification routines by another individual, trained in data interpretation.
- Review of all sample login information, analysis related information, and calculated results by an Instrumental Analyst.
- Review of reporting templates and databases by a Project Manager or Instrumental Analyst.
- Supervisory review of logbooks and independent review of lab worksheets
- Random, in-depth data package audits conducted by the QA group.
- Internal audits conducted by the QA group.

## 11. PROCESS IMPROVEMENT

AXYS management is committed to the continual improvement of practices and processes. AXYS' quality system incorporates a number of measures to monitor laboratory performance and identify opportunities for improvement. These measures include the following:

1. Internal audits, conducted on a regular basis, to monitor compliance with documented practices and to identify areas of non-conformance or opportunities for improvement.
2. Participation in intercalibration studies and analysis of performance evaluation samples.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

3. Monitoring of data trends vs. control parameters to ensure processes are in control.
4. Encouragement of staff to identify areas of improvement and bring these to the attention of management.
5. Procedures for staff members to request corrective or preventative actions.
6. Compliance monitoring to evaluate the effectiveness of actions taken.
7. Annual managerial reviews that consider staff and client feedback, data quality trends, method performance, audit reports, managerial reports, non-conformance records and effectiveness of training programs.
8. Solicitation of feedback from customers (informally and through a scheduled satisfaction survey) regarding data quality and service satisfaction.

The results of management reviews and the above records are used to develop plans for process improvement.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# XI. STANDARDS

The analytical methods used at AXYS rely on the use of solutions containing known quantities of surrogate or internal standards, recovery standards, and authentic analytes. These standard solutions are prepared at AXYS using commercially available standards as starting materials. It is the concentrations of these standard solutions that are used to determine analyte concentrations in samples, percent recovery of spiked authentics and percent recovery of surrogate standards. Standard solutions are prepared accurately and reliably and are handled correctly to ensure the most accurate results possible.

The preparation, validation, storage and control of standards are the responsibility of a Technical Service Chemist.

## 1. CATEGORIES OF STANDARDS

There are four general categories of standards in use at AXYS. They are as follows:

### 1.1 Certified Reference Materials (CRMs)

Certified Reference Materials are reference materials which are accompanied by a certificate of analysis and are supplied only by recognized agencies or institutions. The concentration of each analyte has been determined by multiple analytical methods. CRMs are usually matrix-specific and are widely used for analytical method validation. Those CRMs that are supplied as solutions in pure solvents can be used directly for standard solution validation.

### 1.2 Primary Standards

Primary standards are commercially obtained chemical standards. These may be pure compounds or mixtures of compounds in solution. They may be crystals, powders or liquids. The concentration or purity is normally determined by the commercial supplier and certificates of analysis are available. Primary standards are generally not used directly in test methods but are used to prepare stock standard solutions.

### 1.3 Stock Standards

These are solutions prepared from primary standards. They are generally more concentrated than is required for direct use in test methods and are diluted to prepare working standard solutions.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

## 1.4 Working Standards

These are solutions prepared at AXYS from stock solutions. These standards are used routinely in test methods. It is the responsibility of each analyst to understand the use of these standards in the analytical process, to handle the solutions correctly, and to accurately add the standards to the sample or sample extract in order to ensure the best possible accuracy of results. Working standards are validated prior to use to verify purity and accuracy. The types of working standards in use at AXYS are described below.

### 1.4.1 Surrogate Standard

Surrogate standard solutions are composed of, wherever possible, deuterated or $^{13}C$-labelled analogues of the target analytes. If these are not available, the surrogates are compounds with a chemical structure and behaviour that mimics closely that of the target analyte. An aliquot of surrogate standard solution is added to every sample, usually prior to the extraction procedure. The surrogate standards serve as internal standards from which the analytical results are calculated. The accurate addition of a known volume of surrogate standard solution is critical to the accuracy of the final concentration.

### 1.4.2 Recovery Standard

Recovery standards are, whenever possible, deuterated or $^{13}C$-labelled analogues of target analytes. If these are not available, compounds with a chemical structure and behaviour that mimic closely that of target analytes are chosen.

A known amount of recovery standard is added to the final extract, just prior to instrumental analysis and is most often used as a quantification standard to determine percent surrogate recoveries. Percent surrogate recoveries are an indication of overall data quality and must fall within specified ranges documented in each analytical method. Recovery standards are also used to monitor instrument response. Recovery standards may also serve as internal standards for quantification of target compounds.

### 1.4.3 Cleanup Standard

Cleanup standards are, whenever possible, deuterated or $^{13}C$-labelled analogues of target analytes. A known amount of cleanup standard is added to the sample extract after extraction, but prior to cleanup. The recovery of the cleanup standard is a measure of the cleanup efficiency and of any losses incurred during sample extract cleanup procedures.

### 1.4.4 Authentic Standard

Authentic standards contain known quantities of authentic target analytes. Spiked matrices and spiked blanks are prepared by adding an aliquot of authentic standard solution to a matrix known to have low levels of the analytes. The determined concentrations are compared with the expected concentrations, based on the volume of authentic solution added. The degree of agreement between the determined and expected concentrations is an indication of the accuracy.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

### 1.4.5 Calibration Standards

Calibration standards are a series of solutions used to determine the concentration versus response relationship of the instrument. They are prepared with known amounts of authentic, surrogate and recovery standards; the authentic compound concentrations vary over the working response range of the instrument while the concentrations of surrogate and recovery standard are constant. Each solution is analyzed and the response factors (RFs) or calibration regression relationship are calculated. Instrument linearity of response is demonstrated by this calibration data. The calibration data are used to convert instrumental response to concentrations in samples.

### 1.4.6 Window Standards

Window standards are mixtures of select target analyte compounds that are used to identify the retention time of the first and last eluting compounds in a suite of target compounds. They are run to ensure that each compound or group of compounds elutes from the GC column within the expected time window.

### 1.4.7 Sensitivity Standard

This standard is a solution containing authentic target analytes in which each analyte concentration approaches the instrumental detection limit. The signal:noise ratio for this solution must be within method specifications to satisfy instrument detection limit specifications. This solution is usually the least concentrated of the linearity series of solutions.

### 1.4.8 GC Column Resolution Standard

This standard is a solution that contains closely eluting components of an analysis suite, which must be adequately separated by the gas chromatograph.

## 2. NAMING OF STANDARDS

AXYS has developed an in-house system of identifying primary standards, stock solutions, and working solutions. The system used for naming these standards is described in Appendix B.

## 3. PREPARATION OF STANDARD SOLUTIONS

Stock and working standard solutions are prepared using primary standards as starting materials. All standards prepared from these materials have concentrations based on the purity and/or concentration of the primary standards. These concentrations are used in the calculations of final analyte concentrations.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Standard solutions are prepared according to established procedures. Standard solutions are prepared in batches, in quantities sufficient to last approximately one year. The solutions are stored in ampoules in quantities sufficient to last no more than a week under normal workloads.

Procedures for the log-in of primary standards and CRMs, preparation of standard solutions, and documentation of standard preparation are described in the following Standard Operating Procedures.

| | |
|---|---|
| SAD-006 | Purchasing of Goods and Services |
| SLA-009 | Preparation of Standards |

Uncontrolled if printed

## 4. DOCUMENTATION OF STANDARD PREPARATION

Details and results of standard preparation and validation are recorded in Standard Data Sheet Files. Each standard solution is given a unique identification number. Each solution has an individual Standard Data Sheet File giving the details of preparation, the composition of the solution, the concentration of each component, the solvent type plus the lot number used for dilution, and the date prepared. Standard Data Sheet Files are available electronically to all staff. A Technical Service Chemist is responsible for the maintenance of all Standard Data Sheet Files.

## 5. VALIDATION OF PREPARED STANDARD SOLUTIONS

New solutions are validated by analyzing the solution and comparing the results against a validated solution or a certified solution.

Once the solutions have been validated, the solutions can be used in the analysis of samples.

Procedures for the validation of standard solutions are described in the following Standard Operating Procedure.

| | |
|---|---|
| SQA-003 | Standard Solution Validation |

## 6. STORAGE AND CONTROL OF STANDARDS

A Technical Service Chemist is responsible for the security of the standards and access to the standards cupboard is limited to authorized staff.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

## 6.1 Certified Reference Materials

Each Certified Reference Material is logged with a unique Standard Control (SC) number into the LIMS by a Technical Service Chemist. The LIMS record documents the components in the standard, the purity and/or concentration, the lot number, date received, manufacturer, etc. In the event that a problem is identified with a CRM it can be traced back to a particular container.

AXYS maintains a LIMS inventory and a list of certified reference materials in use and keeps on file the certificate of analysis for each CRM. An inventory list of certified reference materials is maintained and kept by the QA Manager.

Unless otherwise specified on the certificate instructions, certified reference materials are stored at ambient temperature, in the dark, in a locked cupboard in Laboratory 7.

## 6.2 Primary Standards

Each primary standard is logged with a unique Standard Control (SC) number into the LIMS by a Technical Service Chemist. The LIMS record documents the components in the standard, the purity and/or concentration, the lot number, date received, manufacturer, etc. In the event that a problem with a standard solution is identified, it can be traced back to the original starting material.

Primary standards for which ambient temperature storage is appropriate are stored in the dark, in locked, vented storage cupboards in Laboratory 1.5. Primary standard solutions that have been opened and of which an aliquot has been taken are resealed in a glass ampoule prior to storage. Primary standards that require refrigeration or freezing are kept in a locked standards refrigerator or freezer in Laboratory 1.5. The LIMS generates every day a primary standard inventory list, which includes the expiry day of each standard.

Primary standards are used only by those Chemists authorized to prepare standards, under the direction of the Technical Services Coordinator.

## 6.3 Stock Standard Solutions

Stock standard solutions for which ambient temperature storage is appropriate are stored in clear glass ampoules in the dark, in locked, vented storage cupboards in Laboratory 1.5. Stock standard solutions that require refrigeration or freezing are kept in a locked standards refrigerator or freezer in Laboratory 1.5. The LIMS generates every day a stock standard solution inventory list, which includes the expiry day of each solution.

Stock standard solutions are used only by those Chemists authorized to prepare standards, under the direction of the Technical Services Coordinator.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

### 6.4 Working Standards

Working standards are stored in clear glass ampoules at ambient temperature in the storage cupboard in Laboratory 7. The working solutions that are in current use by Lab Chemists may where appropriate be stored in "Reacti-vials" in one of the laboratory refrigerators. The LIMS generates every day a working standard inventory list, which includes the expiry day of each standard.

Calibration standard solutions for which ambient temperature storage is appropriate are stored in Instrument Lab 2. Calibration standard solutions requiring cool or frozen storage are stored in a refrigerator or freezer in the Instrument Lab

All working standard solutions are stored under the controlled premises security measures.

## 7 STABILITY OF STANDARDS

The following expiry dates are applicable to standards and standard solutions used in the routine analytical testing procedures. They do not apply to special compounds used in customized analysis or research projects.

### 7.1 Certified Reference Materials

Certified Reference Materials, which are provided with an expiry date from the manufacturer, are replaced when expired. Certified Reference Materials without an expiry date are assigned an expiry date of five years from the date of purchase. Upon expiry, the certified concentrations are checked against a valid CRM. If the results indicate that no change has occurred in the CRM concentrations, the expiry date is extended another five years. Otherwise, the CRM is replaced when next required.

### 7.2 Primary Standards

Primary standards received without an expiry date are assigned an expiry date based upon the known stability of the compound. An expiry date of five years from date of purchase is given to stable compounds. An expiry date provided by the manufacturer for a primary standard is assessed based on knowledge of the chemistry of the compound, and the expiry date may be extended beyond that of the manufacturer. Upon expiry, primary standards are checked against a valid CRM and the expiry date extended if valid. Otherwise the primary standard is replaced when next required.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

### 7.3 Stock Standards

Stock standard solutions stored in ampoules have an expiry date equal to that of the primary standard from which they originate, or of two years from the preparation date, whichever is sooner. Solutions that are stored in ampoules may be used after the expiry date upon validation.

### 7.4 Working Standards

Working standards in ampoules have an expiry date equal to that of the stock or primary standard from which they originate, or of one year from the preparation date, whichever is sooner. Working standards for PCDD/F, PCB, PBDPE, AEH and alkane analyses have an expiry date of 2 years from validation; working standards for other analyses have an expiry date of 1 year from validation unless otherwise specified. Solutions that are stored in ampoules may be used after the expiry date upon validation.

Working standards stored in reacti-vials have an expiry date of one month, one week for working standards made up in volatile solvents. Standards stored in reacti-vials may not be used after the expiry date.

Working Standards for PFCs are stored in polypropylene test or centrifuge tubes and have expiry dates as outlined in SQA-026 (Routine PFC Standards).

Calibration standards for sterols and tetracyclines have an expiry date of two months. Working authentic standards for tetracyclines have an expiry date of 4 months.

Standards are not stored in volumetric flasks.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# THIS PAGE LEFT INTENTIONALLY BLANK

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# APPENDIX A INTERNAL STANDARD METHOD OF QUANTIFICATION: SAMPLE CALCULATIONS

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# THIS PAGE LEFT INTENTIONALLY BLANK

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# Internal Standard Method of Quantification – Constant RRF

The concentration of each compound of interest is routinely calculated by the isotope dilution or internal standard procedure against a known amount of quantification standard added to the sample.

Where the quantification standard is added to the sample at the very beginning of the analysis it is called a 'surrogate standard'. In the special case where the surrogate is the isotopically labelled analogue of the native compound the procedure is called 'isotope dilution' quantification. Where the surrogate is not the labelled analogue of the native compound the procedure is referred to as internal standard quantification. Final concentrations determined against surrogate compounds are recovery corrected for any losses that occurred during the analysis procedure.

Where the quantification standard is added just prior to instrumental analysis it is called a 'recovery standard' and the quantification procedure is also called internal standard quantification. Final concentrations determined against recovery standards are not recovery corrected for any losses that occurred during the analysis procedure. Recovery standards may be used to quantify target compounds or surrogate compounds.

Concentrations are calculated as described in the following equation:

$$Conc_x = \frac{A_x}{A_{si}} \times \frac{W_{si}}{W} \times \frac{1}{RRF_{x,si}}$$

where 'internal standard' is either a surrogate standard or a recovery standard and

$A_x$ = area of the target compound peak from the sample chromatogram;

$A_{si}$ = area of internal standard peak used to quantify $x$;

$W$ = weight or volume of sample taken for analysis;

$W_{si}$ = weight of internal standard added to sample; and

$RRF_{x,si}$ = relative response factor of $x$ to $si$ as determined by analysis of the calibration standard solution and defined below.

$$RRF_{x,si} = \frac{A_t}{A_s} \times \frac{W_s}{W_t}$$

where $A_t$ = area of target peak in the calibration solution;

$A_s$ = area of internal standard peak in the calibration solution;

$W_t$ = weight of target compound in the calibration solution; and

$W_s$ = weight of internal standard in the calibration solution.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Detection limits are also calculated using the above equations with the minimum detectable peak area used for $A_x$. The minimum detectable peak area is calculated as a multiple of the maximum noise (2.5 or 3 times, depending upon the method) in the GC/MS channel of interest (height of noise x area/height ratio of a typical peak x multiple).

Recoveries of surrogate standards are calculated using the following equation:

$$\%\,Recovery = \frac{A_{si}}{A_{rs}} \times \frac{W_{rs}}{W_{si}} \times \frac{1}{RRF_{si,rs}} \times 100$$

where $A_{si}$ and $A_{rs}$ = the areas of the surrogate standard peak and the recovery standard peak from the sample chromatogram;

$W_{rs}$ and $W_{si}$ = the weights of recovery standard and surrogate standard added to the sample, and

$RRF_{si,rs}$ = the response factor of the surrogate standard relative to the response of the recovery standard as determined by analysis of the calibration solution and defined below.

$$RRF_{si,rs} = \frac{A_s}{A_r} \times \frac{W_r}{W_s}$$

where $A_s$ and $A_r$ = the areas of the surrogate standard and recovery standard peaks from the calibration solution chromatogram; and

$W_s$ and $W_r$ = the weights of surrogate standard and recovery standard in the calibration solution.

Concentration, detection limit and internal standard recovery calculations are routinely carried out using commercially available software programs.

In special cases it may be necessary to convert recovery corrected concentrations to non-recovery corrected concentrations to meet specific contract needs. Where recovery corrected concentrations have been determined by quantification against a surrogate compound, non-recovery corrected concentrations can be determined as follows:

$$C_{NRC} = C_{RC} \times (\%R_S/100)$$

Where: $C_{NRC}$ = the non-recovery corrected concentration
$C_{RC}$ = the recovery corrected concentration
$\%R_S$ = the surrogate percent recovery.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# APPENDIX B NAMING CONVENTIONS

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# THIS PAGE LEFT INTENTIONALLY BLANK

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# *AXYS ANALYTICAL SERVICES LTD*
# *NAMING CONVENTIONS*

AXYS' naming conventions rely on the use of code letters to identify analysis type, matrix type, standard solutions, QA/QC samples, and additional procedures carried out on samples. Table 4 summarizes the codes in current use. The applications of these codes to the naming of standard solutions, QA/QC samples, and analytical methods are described in this appendix.

## 1. STANDARD SOLUTIONS

Standard stock, calibration, surrogate, authentic and recovery solutions are identified by a code of the following form:

**'AA ZZZ B - TTT / XX',**

*where*

**AA** = a 2 letter code indicating the analysis type from LIMS (Reports → Reports to Preview → LIMS → Analysis Codes) ;
**ZZZ** = the recipe number, a unique combination of components and concentration;
**B** = the dilution code starting at the letter 'A' and increments with each solution. Each letter represents a solution made by a dilution of the same stock solution. For linearity solutions, 'A' is the most dilute; for all other types of standards, 'A' is the most concentrated.
**TTT** = the type of standard from Table 4;
**XX** = sequential batch number, each batch made from a dilution of the same stock solution.

| | | |
|---|---|---|
| *example:* | DX001A-STK/01 | is a dioxin/furan stock solution, the recipe number is 001 and it is undiluted. This is the first batch. |
| | DX001B-STK/01 | is the first batch of a diluted stock made from the above. |
| | DX004A-CAL/03 | is the third batch of dioxin/furan calibration solution, recipe 004. |

**Note:** When a standard is newly made from original prime standards, it is a new "recipe" and is assigned a new recipe number, even though the components and concentrations are similar to a previously made solution.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

## 2. TEST SAMPLES

The codes described below are appended to a sample ID under the circumstances described and appear on the sample IDs on final data reports.

1. Sample ID – samples submitted to AXYS Analytical Services for analysis are identified with a unique AXYS ID number consisting of the log-in ID (a letter 'L', followed by a 4-5 digit number) and a number assigned to an individual sample. This number is generated by the LIMS. Samples with the same log-in ID are sequentially numbered.
   *example:* L1500-1 – first sample in log-in L1500
   L1500-25 – twenty-fifth sample in log-in L1500

2. Repeated Samples - analysis is repeated using another subsample
   - designated by an 'R' to sample ID for first repeat
   - a space between sample ID and suffix
   - add a numeral suffix to 'R' for multiple repeats
   *example:* L1500-50 R - first repeat
   L1500-50 R2 - second repeat
   The following code letters are appended to a sample ID to indicate extra work carried out on an extract. A space must appear after the sample ID before adding the codes associated with extra work.

3. Repeat of Clean Up/Instrumental Analysis
   In the special case where clean up and injection are repeated using an <u>unused portion of the original extract</u>, append 'RX#' to the original ID where # is a sequential number.
   *example:* L1500-50 RX - First repeat using an unused portion of sample extract L1500-50
   L1500-50 RX2 - Second repeat using an unused portion of sample extract L1500-50

4. Recolumned Samples - analyzed extract is subject to additional clean-up steps (e.g. chromatography, washing) after initial instrumental analysis has been performed.
   - designated by an 'L' to sample ID
   - add a numeral suffix to 'L' for multiple re-column steps
   *example:* L1500-50 L - first recolumn
   L1500-50 L2 - second recolumn

5. Reinjected Samples - instrumental analysis is repeated by injecting another aliquot of extract from the same microvial.
   - designated by an 'i' to sample ID
   - add a numeral suffix to 'i' for multiple re-injections
   *example:* L1500-50 i - first repeat injection
   L1500-50 i2 - second repeat injection

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

6. Dilution of Extract - analyzed extract is diluted in the original microvial and re-analyzed.
   - designated by adding suffix 'W' to sample ID
   *example:* L1500-50 W

7. Transfer of Extract - extract is transferred to another microvial, mainly as a consequence of dilution to improve chromatography or to bring into linear range.
   - designated by adding the suffix 'N#' to the sample ID where # is incremented each time the extract is transferred to a new microvial
   *example:* L1500-50 N - extract transferred to a new microvial
   L1500-50 N2 - extract again transferred to another new microvial

8. Respiked Samples - **additional** labelled standard added, typically after dilution and transfer to a new microvial. Usually preceded by an 'N'
   - designated by suffix 'K' to sample ID
   *example:* L1500-50 NK

9. Recolumn to Remove Specific Target Analytes – extract is columned to remove specific target analytes.
   - designated by adding suffix 'P' to sample ID
   *example:* L1500-50 P

10. Concentration of Extract - extract in microvial is concentrated
    -designated by adding suffix 'M' to sample ID
    *example:* L1500-50 M

11. Combined Extract - extract in microvial is combined with another extract. Combination of extracts is carried out only under the direction of a Project Manager
    -designated by adding suffix 'C' to sample ID
    *example:* L1500-50 C

12. Multiple Remedial Procedures – test suffixes are combined and added to sample ID.
    *example:* L1500-50 Li3 - sample was recolumned, then recolumned extract reinjected three times.

**NOTES:**

i) The codes R, RX, N, and NK are prefixes to LIMS product names. The other codes are statuses in the LIMS. The codes are appended to the sample IDs as suffixes in the "Extra Work" module of the LIMS.

ii) The only codes appended to the sample ID on the analysis worksheets are R and RX and applicable numerical suffixes (R#, R#X#).

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

## TABLE 4 NAMING CODES

| TTT | STANDARD TYPE | Code | QA/QC SAMPLE TYPE | TEST SAMPLE SUFFIXES | |
|---|---|---|---|---|---|
| AUT | Authentic | A | Authentic Spike | C | Extract combined |
| CAL | Calibration# = A,B,C.* | BLANK | Lab Blank | i | Reinjection |
| REC | Recovery | CAL | Opening or Closing Cal Std. | L | Extra clean-up of extract |
| RSN | Resolution | CRM | Certified Reference Material | K | Respike of Quant Std |
| SEN | Sensitivity | CUBLK | Clean Up Blank | M | Concentration of extract |
| STK | Stock | CUTPT | Cut Point | N | Dil'n, portion in new microvial |
| SUR | Surrogate | DUP | Duplicate | P | Recolumn to remove selected analytes |
| SUX | Native-like target used as surrogate | DUP2 | Replicate 2 | R,# | Repeat Analysis |
| WIN | Window | DUP3 | Replicate 3 | RX,# | Repeat clean up of unused extract |
| | | FMSPRF | Proof of the FMS | W | Dilution of extract |
| | | FORMS5 | Form5 data | Y | A subsequent portion of an extract from a larger retained back-up portion |
| | | HEXANE | Hexane plug run on instruments | | |
| | | INSTBLANK | Instrument Blank with Surrogates | | |
| | | IPR | Initial Precision and Recovery | | |
| | | IRM | Internal Reference Material | | |
| | | LCS | Laboratory Control Spike | | |
| | | MDL | MDL study | | |
| | | MDLVER | Verification of MDL | | |
| | | MS | Matrix Spike | | |
| | | MSD | Matrix Spike Duplicate | | |
| | | OPR | Ongoing Precision and Recovery | | |
| | | PROOF | In-House Proofs | | |
| | | R | Recovery Spike | | |
| | | RSN | Resolution standard | | |
| | | S | Surrogate Spike | | |
| | | SA | Surrogate and Authentic Spike | | |
| | | SAMP | Client Sample | | |
| | | SAR | Surr / Auth / Rec Standard Mixture | | |
| | | SAR2 | Second Source SAR | | |
| | | SEN | Sensitivity Standard | | |
| | | SOLVENT | Solvent plug run on instruments | | |
| | | SPB | Spiked Blank | | |
| | | SPEX | Spiked Extracted Matrix | | |
| | | SPIKELOT | Spike lot concentrations | | |
| | | SPM | Spiked Matrix | | |
| | | SPMDUP | Spiked Matrix (Duplicate) | | |
| | | SPMREP | Spiked Matrix (Replicate > 2) | | |
| | | SR | Surr / Rec Standard Mixture | | |
| | | SRM | Standard Reference Material | | |
| | | STK | Stock Solution | | |
| | | TEST | Test samples | | |
| | | TOLUENE | Toluene plug run on instruments | | |
| | | USM | Unspiked Matrix | | |
| | | WIN | Window standard | | |

* Calibration series are named such that "A" is the lowest concentration.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

## 3. QUALITY CONTROL SAMPLES

Quality control (QC) samples are named by the LIMS, assigning a unique identification number based on the work group number.

The QC samples are named using the following format:

WG #####-1xx

where: ##### is the workgroup number
xx is a number, beginning with 01 and incremented for every QC sample in the work group

For every work group, the numbering of the QC samples starts at 101. There is a field in the LIMS for indicating the QC sample type associated with the QC sample ID.

Typically, the procedural blank is assigned as WG#####-101
and the reference sample as WG#####-102

The codes used to indicate extra work carried out on an extract may also be appended to the name of quality control samples, if applicable.

## 4. ANALYSIS BATCHES

Each analysis batch (work group) has a unique, sequential number assigned by the LIMS. The number is preceded by the letters WG.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

## 5. INSTRUMENTATION

Each instrument used in analytical testing procedures has been assigned an instrument code number. These codes are used to identify the instrument used for each sample analyzed.

| CODE | INSTRUMENT |
|---|---|
| **GC/MS** | |
| 1 | Micromass (GC/HRMS) |
| 2 | Micromass (GC/HRMS) |
| 3 | Micromass (GC/HRMS) |
| A | Agilent (GC/LRMS) |
| B | Micormass (GC/HRMS) |
| C | Micromass (GC/HRMS) |
| D | Agilent (GC/LRMS) |
| H | HP (GC/LRMS) |
| M | Waters Premier-M (HRMS) |
| **GC/ECD** | |
| E | Agilent (GC/ECD) |
| F | Agilent (GC/ECD) |
| **LC/MS/MS** | |
| G | Waters (LC/MS/MS) |
| J | Waters (LC/MS/MS) |
| K | Waters (LC/MS/MS) |
| P | Waters (LC/MS/MS) |
| Q | Waters (LC/MS/MS) |
| R | AB Sciex (LC/MS/MS) |

## 6. CHROMATOGRAMS

### 6.1 Low Resolution GC/MS and GC/ECD Instruments

The data files for samples run on a particular day are stored in a directory named with the date, as follows:

Directory: YY MM DD AA

*where* YY is the last two digits of the year
MM is the month
DD is the day
AA is the analysis type

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

The GC/MS and GC/ECD files for all samples analyzed, including test samples, QC samples, calibration solutions and solvent blanks are assigned a file name in the form 'AA YW XXXX'

*where* AA is analysis type
Y is the last digit of the current year
W is the last digit of the numerical instrument code, and
XXXX is a sequential chromatogram number.

Example: PB450218 is a PCB chromatogram run on Instrument 05, in 2004.

The sample chromatograms are numbered sequentially irrespective of analysis type. At the beginning of each calendar year, the sequential number 'XXXX' starts again at 0001.

## 6.2 High Resolution GC/MS and Waters LC/MSMS Instruments

A set of samples queued up for analysis by high resolution GC/MS is designated by a file name. This file name has the same format:

AAYW_XXX

*where* AA is analysis type
Y is the last digit of the current year
W is the last digit of the instrument code, and
XXX is a sequential file number.

The instruments automatically identify each sample with a sequential sample number (Z) starting with Sample #1 for the first sample in the set.

Each chromatogram is identified as follows:

AAYW_XXX Sample: #Z.

| | | |
|---|---|---|
| Example: | PB21_013 | S:1 |
| | PB21_013 | S:2 |
| | PB21_013 | S:3 |
| | PB21_013 | S:4 |

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

## 6.3 AB Sciex LC/MSMS Instruments

Data are stored in a file named as follows:

AAAAYW_XXX_DD-MMM-YYYY

*where* AAAA is analysis type
Y is the last digit of the current year
W is the last digit of the instrument code, and
XXX is a sequential file number.

Example - MABA3R_010_06-Nov-2013 – filename for Metabolomics, Amines and Biogenic Amines data run in 2013 on instrument R, 10th batch of the year, run date 06-Nov-13.

Note that the individual sample results filenames do not contain the date, only the sequential file number.

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

## 7. ANALYTICAL METHODS

The quality system at AXYS requires that each analytical method be identified by a method number. This number appears on all laboratory work-up sheets and on final data reports. The convention for numbering methods is to use the document number, including the revision number and version number as the method number.

### Customized Methods

Upon the request of a client and with the approval of the Project Manager or QA Manager, a method may be modified to suit a client's needs. Such modifications require full documentation and may require a method number. Modifications include changes to the extraction procedure, quantification procedure, instrumental procedure, the use of different surrogates, and/or quantification of non-routine target analytes.

i. For a routine AXYS method, modified for a client, the method number remains the same, and the modifications are documented on the Project Notes and, where necessary, in the case narrative that accompanies the data.

ii. For unusual samples for which new methodology is developed, the QA Chemist develops a method number and documents the methodology.

## 8. INSTRUMENTAL ANALYSIS METHODS

Detailed instrumental analysis procedures (instrumental operating instructions, data interpretation procedures and calculation of results) may also be documented in separate instrumental methods. The methods are uniquely named, using the document control number, in the following format:

MIN-XXX Rev #

Where: - XXX is the same 3 digit code that is used in the document control number of the associated written analytical method (i.e. PCDD/F instrument method is MIN-017 and written analytical method is MLA-017)
- # is the incremental revision number

## 9. MICROVIAL LABEL CODES

The following analysis codes are used for the specific identification of microvial contents for work-ups producing multiple analysis extracts and to aid in management of instrumental data files. The list of analysis codes is subject to update and is a controlled file in the AXYS LIMS (Reports → Reports to Preview → LIMS → Analysis Codes). Following is an example listing of the codes:

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| Code Abbr. | Analysis |
|---|---|
| AB | Acid Base Neutral Extractables |
| AE | inactive: Acid Extractable Non-Cl Phenols |
| AP | Alkyl Phenols |
| BB | Polybrominated Biphenyls (PBB) |
| BC | inactive: Bromochlorodioxins |
| BD | Polybrominated Dioxins/Furans |
| BE | Brominated Diphenyl Ethers (BDE) |
| BF | Brominated Flame Retardants (BFRs) |
| BP | Bisphenol-A |
| CA | inactive: Chloroanisoles |
| CE | Chlorinated Diphenyl Ethers |
| CG | inactive: Chloroguaicols |
| CL | Chlorinated Pesticides |
| CM | Carbamates |
| CN | Mono ChloroNaphthalenes |
| CO | inactive: Coplanar PCB Congeners |
| CP | inactive: Chlorophenolics |
| CS | Client Standards |
| CV | inactive: Chloroveratroles |
| DC | inactive: Chlorinated DX/HCB/ Coplanar PCBs |
| DW | Dioxins/Furans/WHO PCB/TEQ |
| DX | Dioxins/Furans |
| EP | Environmental Phenols |
| EX | inactive: Exotics |
| EZ | Enzyme check |
| FA | inactive: Fatty Acids |
| FC | Perfluorinated Compounds |
| FK | Perfluoroalkyl Precursors |
| FO | Fluorinated Phosphonic Acids |
| FP | inactive: Fipronil |
| FR | Flame Retardants group |
| FS | FluoroTelomer Sulphonates |
| FT | FluoroTelomer Alcohols |
| GL | Glyphosate |
| HB | Acid Extractable Herbicides (AEH) |
| HC | Petroleum Hydrocarbons |
| HD | Hexabromocyclododecane (HBCDD) |
| HM | Hormones |
| HP | Hopanes |
| MABA | Metabolomics: Amino Acids and Biogenic Amines |
| MBIA | Metabolomics: Bile Acids |

| Code Abbr. | Analysis |
|---|---|
| MFAA | Metabolomics: Fatty Acids |
| MHEX | Metabolomics: Hexoses |
| MLIP | Metabolomics: Lipids |
| MP | PAH Metabolites |
| MR | MultiResidue Pesticides |
| MS | inactive: Methyl Sulphones |
| MU | inactive: Musk |
| MX | Metabolomics group |
| NA | Naphthenic Acids |
| ON | OrganoNitrogen |
| OP | OrganoPhosphorus |
| OT | inactive: Organotins |
| PA | Parabens |
| PB | Polychlorinated Biphenyls (PCBs) |
| PE | inactive: Phthalate Esters |
| PF | Paraffins |
| PH | PolyAromatic Hydrocarbons |
| PM | Phthalate Ester Metabolites |
| PP | Pharmaceutical and Personal Care Products group |
| PR | DX/F Precursors |
| PY | Pyrethroid |
| QA | PPCP APos List 1 |
| QB | PPCP ACyc List 2 |
| QC | inactive: PPCP ANeg (part of QF) |
| QD | inactive: PPCP BPos (part of QG) |
| QE | PPCP APos List 5 |
| QF | PPCP ANeg List 3 |
| QG | PPCP BPos List 4 |
| QH | PPCP APos List 6 |
| RA | inactive: Resin Acids |
| RC | OrganoChlorinated Flame Retardants |
| RN | Retenoids |
| RP | OrganoPhosphate Flame Retardants |
| ST | Sterols |
| TB | Tetrabromo Bisphenol-A |
| TP | Toxaphene |
| TR | Triclosan |
| TY | inactive: 3,5,6-Trichloro-2-Pyridinol |
| TZ | inactive: Atrazine |
| VO | inactive: Volatile Organics |

The microvial labels are coloured to indicate the general analysis type. The labels are coloured as follows:

| Colour | Analysis Codes |
|---|---|
| Orange | CL, CO, DC, MR, ON, OP, PB, PF, TP |
| Yellow | DX |
| Blue | CN, HM, PE, PH, ST |
| Pink | BB, BD, BE, BF |
| Purple | MU |
| White | All other |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# APPENDIX C DOCUMENT CONTROL SYSTEM

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# THIS PAGE LEFT INTENTIONALLY BLANK

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# DOCUMENT CONTROL SYSTEM

## 1. ORGANIZATION AND NAMING

All documents related to the quality system and testing procedures carried out at AXYS are subject to document control procedures. These procedures ensure that only current documents are available for and used by staff, that appropriate record keeping procedures are in place and that there is the ability to reconstruct all steps of the testing procedures. Document control procedures include the unique identification of all documents and a system for approving, issuing, revising, and maintaining the documentation.

All documents in use at AXYS are uniquely identified by a document number. This number indicates that the document has been authorized for use. The document number consists of a document identifier, revision number and date; for method documents an additional version number may be appended. The document number appears, in the format described below, in the header or footer of all pages in the document.

All documents are created with the company name appearing on the document. Each page is numbered and shows the total number of pages.

Document Control Number for methods:
*Identifier Rev. ## (mmmyy) Ver. ## (example MLA-001 Rev. 02 (Jan99) Ver. 05)*

Document Control Number for documents other than methods:
*Identifier Rev. ##, DD-Mon-YYYY (example SLA-001 Rev. 02, 23-Jan-2011)*

*Identifier:* This is an alphanumeric code that consists of a three letter code indicating the category and sub-category to which the document belongs followed by three numbers indicating a sequential number within the category or sub-category.

*Rev. ##:* Revision number (##) indicating the revision of the document. ## is a number and is incremented when a new document revision is issued.

*Ver. ##:* Version number (##) indicating the version of the method document (applicable for method documents only). ## is a number and is incremented when a new method document version is issued.

*DD-Mon-YYYY or mmmyy:* Date of issue of the revision of the document.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

The table below is a guideline for when a method modification requires a new method number, revision number or version number.

| Description of change | Example | Typical validation or justification |
|---|---|---|
| ***Modifications requiring a new method number*** | | |
| Development or change of instrumental technology type | Change from LC-MS/MS to GC-MS or from GC-LRMS to GC-HRMS | Sensitivity, specificity, bias, precision in QC and real sample matrix |
| Systematic change of DL >20 times | Change of ng to pg detection limit targets | Sensitivity, specificity, bias, precision in QC and real sample matrix |
| ***Modifications requiring a new revision number (method number remains the same)*** | | |
| General quantification type | Isotope dilution vs. internal standard, internal standard vs. external standard | Sensitivity, specificity, bias, precision, DL in QC and real sample matrix |
| Quantification model | Quadratic regression vs. linear | Bias, precision, DL in QC and real sample matrix |
| Extraction type | Change from Soxhlet to ASE extraction | Recovery, precision, DL in QC and real sample matrix |
| Extraction solvent | Change from toluene to dichloromethane | Bias, precision, DL in QC and real sample matrix |
| Clean-up type | Gravity columns to SPE | Bias, precision, DL in QC and real sample matrix |
| Systematic change of DL 5-20 times | Change of x10 lower DLs due to new instrument of same type with better sensitivity | Sensitivity, specificity, bias, precision, DL in QC and real sample matrix |
| Addition of new matrix type using novel extraction, clean-up and instrumental techniques | Addition of sludge matrix using SPE extraction where SPE extraction has never been validated by lab for sludge | Bias, precision, DL in QC and real sample matrix |
| Any loosening of performance criteria affecting recovery or precision of an accredited test parameter | Change of OPR recovery limits from 70-130% to 50-150% | Bias, precision |
| ***Modifications requiring a new version number (method and revision numbers remain the same)*** | | |
| Any document correction or improvement | Correcting information or adding more detailed information to method | As appropriate |

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

| Description of change | Example | Typical validation or justification |
|---|---|---|
| Any refinement of an existing extraction, clean-up of instrumental technique for the purpose of improved, efficiency , ruggedness or defensibility | Adjustment of column packing or elutes, adjustment of extraction technique within a particular type, optimization of instrumental conditions | Demonstration of the improvement |
| Any improvement in performance specifications | Tightening OPR limit from 50-150% to 70-130% | Sensitivity, specificity, bias, precision, DL in QC and real sample matrix as appropriate to changed aspect |
| Addition of proven clean-up procedures | Addition of alumina clean-up to PCB analysis | Bias, precision, DL in QC and real sample matrix |
| Instrumental quantification ions yielding equivalent or better performance | Change of PFHxS ion to xx from xx | Sensitivity, specificity, bias, precision, DL in QC and real sample matrix |
| Addition of labeled quantification references | Change PFBS quantification from to $^{18}O_2$-PFHxS | Recovery, precision, DL in QC and real sample matrix |
| Addition of new matrix type using proven extraction, clean-up and instrumental techniques | Addition of water matrix using liquid/liquid extraction, addition of solids using Soxhlet extraction | Bias, precision, DL in QC and real sample matrix as appropriate to changed aspect |
| Systematic change of DL < 5 times | Change of DL by x3 made possible by lowered background | MDL study as appropriate |
| Adjustment of method calibration range | Extension of calibration range for lower reporting limit | Multi-level calibration fit, MDL study as appropriate |
| Adjustment of routine surrogate routine amount or final extract volumes | Increase routine surr spike x2 and increase extract volume to improve chromatography. | Batch OPR, Blank |

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

Table 5 presents the identifier codes for categories and sub-categories of documents as well as the individual responsible for each category.

**TABLE 5 CATEGORIES OF DOCUMENTS**

| Category | Sub-Categories | Identifier Code | Responsibility |
|---|---|---|---|
| Forms | Work Sheets<br><br>QA/QC Forms<br>Standards Forms<br>Client Services Forms<br>Sample Control Forms<br><br>Method Forms | FWO-<br><br>FQA-<br>FST-<br>FCL-<br>FSA-<br><br>FME- | Lab Manager<br>QA Manager<br>Technical Service Coordinator<br>Client Services Manager<br>Lab Manager<br>QA Manager |
| Analytical Methods | Laboratory Method and Lab Contract Method<br>Instrumental Methods<br>Summary Methods | MLA- and MLC-<br>MIN-<br>MSU- | Director of Sales, Marketing and Service, Director of Operations and QA Manager<br>Instrumental Analysis Manager<br>Client Services Manager |
| QA/QC Documents | Documents<br>Specification Charts<br>Lists | QDO-<br>QSC-<br>QLI- | QA Manager<br>QA Manager<br>QA Manager |
| Standard Operating Procedures | Administration<br><br>Chromatography<br><br>Coding<br>Instrumental<br>Laboratory<br><br>QA/QC | SAD-<br><br>SCH-<br><br>SCO-<br>SIN-<br>SLA-<br><br>SQA- | Controller, Client Services Manager, LIMS Manager or Director of Operations<br>Lab Manager<br>Instrumental Analysis Manager<br>Instrumental Analysis Manager<br>Lab Manager<br>QA Manager |
| IPR Reports (Initial Precision and Recovery) | Sub-Categories according to analysis type | Prefix I (e.g. IDX-) | QA Manager |
| MDL Studies (Method Detection Limits) | Sub-Categories according to analysis type | Prefix D (e.g. DDX-) | QA Manager |

The QA Chemist assigns document numbers, maintains a master list of all forms and documents in current use and maintains a file of both current and archived documents.

All details of document control procedures are described in the following SOP.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015. AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.



## 2. DOCUMENTATION FORMAT

AXYS has developed standard formats for the documentation of analytical methods, standard operating procedures and final analysis reports. These formats are described in the following sections as is the system of maintaining and filing these documents.

In order to protect the proprietary information presented in the Quality Manual, the SOPs and analytical methods, each of these documents is printed with the following confidentiality statement, which appears at the top of each page.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, (year). AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800 FAX (250) 655-5811.

### 2.1 Analytical Methods

Analytical methods are subject to document control procedures and the document number appears as a footer. The document number is also the method number.

The documentation of the laboratory method is the responsibility of the QA Chemist, who also assigns a document number to the method.

Laboratory analytical methods are prepared with the following minimum elements in the following numbered sections.

| | |
|---|---|
| Cover Page: | AXYS Method Number, Method Title<br>Method Scope,<br>Authorizing Signatures |
| References | List of relevant external method descriptions |
| Changes from Previous Revision or Version | List of changes made to method since last revision |
| Table of Contents | List of text sections, tables, appendices with page numbers |
| INTRODUCTION Section | |
| A. Analytes of Interest | List of routine and optional analytes |
| B. Contamination or Interferences: | Potential interferences and preventive and/or corrective actions. |
| C. Safety: | Precautions to be taken |

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| | |
|---|---|
| D. Pollution Prevention and Waste Management: | Controls in place |
| E. Definitions: | Defines terms, generally references AXYS' glossary |
| F. Method Performance: | Statement regarding method performance as determined through validation |
| ANALYIS PROCEDURES Section | |
| 1. Preservation and Storage: | Preservation, storage conditions, recommended hold times |
| 2. Sample Pretreatment and Preparation: | Sample pre-treatment procedures. |
| 3. Materials and Reagents: | Quality of reagent, cleaning procedures, preparation of solutions, column packing materials and standard solutions, storage and shelf life as applicable |
| 4. Quality Assurance/Quality Control: | Describes QA/QC samples, analysis batch composition, including Method Specification Tables as applicable |
| 5. Extraction Procedures: [1] | Work-up procedures for each type of matrix with identification of default procedure where options exist |
| 6. Clean up Procedures: [1] | Chromatographic clean-up procedures of the extract and preparation for instrumental analysis with identification of default procedure where options exist |
| 7. Instrumental Analysis: | Instrument operating conditions and calibration procedures with identification of default procedure where options exist |
| 8. Qualitative and Quantitative Determination | Criteria for positive identification of analytes and for determination of concentrations |
| 9 Reporting Criteria and Practices: | Date reporting criteria and practices |
| 10. Summary of Modifications to Reference Method (optional | |
| Adidtional Tables (optional) | supporting information for method |
| Appendices:(optional) | Procedures for optional analyses or supporting information for method |

Notes:

[1] Extraction and clean-up may be combined in Section 5 as appropriate. Section 6 may be noted as intentionally blank, or be titled "Preparation for Instrumental Analysis" as appropriate.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

## 2.2 Instrument Methods

Methods describing the instrumental analysis of extracts are named and numbered as described in Appendix B. The method number is the document number.

Instrument methods are documented for use according to a standard format. In general, an instrument method includes the following sections, where applicable:

| | |
|---|---|
| Analysis Type | class of compounds |
| Target Compounds | Applicable targets |
| Instruments | instrumentation suitable for the method |
| Instrument Acquisition | experiment ID, GC program, Column, Injection volume, carrier gas, injector Temp, mass resolution, tuning protocol, ions acquired, typical retention times |
| Linearity Specifications | calibration standards and acceptance criteria |
| Opening Calibration Verification Specifications | criteria for opening CAL/VER solution |
| Closing Calibration Verification Specifications | criteria for closing CAL/VER solution |
| Window Standard Specifications | window standard and acceptance criteria |
| Sensitivity | sensitivity standard and acceptance criteria |
| Other Specifications | Additional criteria specified by method |

The instrumental methods are filed in separate three-ring binders and kept in the instrument laboratories.

# 3. STANDARD OPERATING PROCEDURES

The document number for Standard Operating Procedures (SOPs) appears in the header of the SOP. SOPs are identified with a category code defined in Table 5.

Standard operating procedures (SOPs) are generally written according to the following standard format. An example of the SOP format appears on the following page.

The header contains the following information:

| | |
|---|---|
| Title: | Title of SOP |
| Area: | Category that SOP belongs to |
| SOP#: | Document identifier |
| Rev. No.: | Revision number |
| Date: | Date of issue |
| Page: | Page number/total number of pages |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# AXYS Analytical Services Ltd
# Standard Operating Procedure

**Title:** **SOP #:**
**Area:** **Rev. No.:**
**Date:**
**Page:**

Uncontrolled if printed

**Purpose:**

**Scope:**

**Requirement and Authority:**

**Definitions of Terms used:**

**Equipment and Reagents:**

**Procedures:**

**Corrective Actions**:

**QA/QC Measures:**

**References and Related Documents:**

**Approval**:

Approved *DD-Mmm-YYYY* (*Name of the President and Senior Technical Director*)
(*Name of the Department Manager*)
(*Name of the QA Manager*)

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

The SOP should contain the following sections, as appropriate.

- Purpose
- Scope
- Requirement and Authority
- Definitions
- Equipment and Reagents
- Procedures
- Corrective Actions
- QA/QC Measures
- References and Related Documents
- Approval Signatures and Date

At a minimum, an SOP should have Purpose, Scope and Procedures sections. When a new SOP is written, it is assigned to an appropriate category and assigned the next sequential number. Each SOP bears the authorizing signatures of the QA Manager, Technical Director and work area Manager/Supervisor responsible for the SOP and date of approval. When an SOP is revised, the revision number is incremented and the date changed to the date of revision.

## 4. ANALYSIS REPORT FORMAT

All final analytical data generated at AXYS are presented in an analysis report, issued in a standard reporting format, with allowances for customization based on client requests. The reports are checked and approved by Instrumental Analysts trained in secondary data validation procedures.

### 4.1 AXYS Method Report Format

Data from all samples, including QC samples, the linearity samples, the calibration verification sample and, where applicable, the windowing standard are reported on standardized forms containing the header information presented in Table 6. Templates for the standardized forms are maintained by the Reporting Group or the LIMS. Alternately, AXYS will report data in a format specified by the client.

Data from each sample, including the procedural blank, are reported on a standardized Form 1A and B and Form 2. Data from the OPR sample are reported on standardized Forms 8A and 8B. Data from the MS/MSD sample are reported on standardized Forms 8C, 8D, 8E and 8F. Data from the linearity, calibration verification sample, windowing sample, and CAL/VER relative retention times are reported on Forms 3, 4, 5 and 6 respectively.

Reports for test samples contain the data and information presented in Table 6.

Analysis reports are printed on AXYS stationery.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

## 4.2 Signature

Final analysis reports are signed to authorize release to clients, the name and the function of the person are included with the signature. Signatures may be electronic.

## 4.3 Footnotes

Footnotes are used on analysis reports to flag data, qualify results, and define terms used in the report.

## 4.4 Rounding

Rounding is performed by Excel, the software used to report final results. Numbers ending in '5' are rounded up.

## 4.5 Significant Figures

Analytical data are reported with the number of significant figures presented in Table 7, however AXYS will report data with the number of significant figures specified by the client.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

## TABLE 6 REQUIREMENTS FOR ANALYSIS REPORTS

| HEADER INFORMATION | Analysis Report |
|---|---|
| Analysis | ✓ |
| Lab Name | ✓ |
| Client (Contract) No. | ✓ |
| Client Sample ID | ✓ |
| Date Sample Received | ✓ |
| Date/Time Sample Collection | ✓ |
| AXYS Sample ID | ✓ |
| Matrix Type | ✓ |
| Sample Size | ✓ |
| Method No. | ✓ |
| Instrument Type | ✓ |
| Instrument Column ID | ✓ |
| Report Date[1] | ✓ |
| Revised Report Date | ✓ |
| Extraction Date/Shift | ✓ |
| Analysis Date/Time | ✓ |
| Initial Calibration Date | ✓ |
| Extract Volume | ✓ |
| Injection Volume | ✓ |
| Dilution Factor | ✓ |
| Concentration Units | ✓ |
| % Moisture | CR |
| % Lipid | CR |
| Sample Data File Name | ✓ |
| Blank Data File Name | ✓ |
| Cal Ver Data File Name | ✓ |
| **TEST SAMPLE DATA** | |
| Target Analytes | ✓ |
| Surrogates | ✓ |
| IUPAC No.[3] | ✓ |
| CAS No.[3] | ✓ |
| Coelutions (where applicable) | ✓ |
| Concentrations | ✓ |
| Detection Limits | ✓ |
| Flags | ✓ |
| Ion Abundance Ratios[2] | ✓ |
| Relative Retention Time[2] | ✓ |
| % Surrogate Recoveries | ✓ |
| Recovery Std Area Response | CR |
| Toxic Equivalents | CR |
| Footnotes | ✓ |

[1]Date appears in footer.
[2]Reported when required by analytical method.
[3] Reported for some analyses only.
CR = reported if required by client

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

## TABLE 7 GUIDELINES FOR REPORTING SIGNIFICANT FIGURES

| | DETERMINED VALUE | COMMENTS |
|---|---|---|
| % Moisture | <1% 2 sig fig<br>≥1% 3 sig fig<br>too small to determine | Report < detection limit, 1 sig fig |
| % Lipid | <1% 2 sig fig<br>≥1% 3 sig fig<br>too small to determine | Report < detection limit, 1 sig fig |
| Sample Size | 3 sig fig | |
| % Surrogate Recovery | 3 sig fig | |
| Concentrations | Maximum 3 sig fig | Fewer than 3 sig figs may be reported based on professional judgement of the data evaluator. |
| Detection Limits | Maximum 3 sig fig | Fewer than 3 sig figs may be reported based on professional judgement of the data evaluator. |

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# APPENDIX D AXYS GLOSSARY

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# THIS PAGE LEFT INTENTIONALLY BLANK

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# 1. DEFINITIONS

The following definitions describe the terms used in AXYS' quality documentation and analytical methods.

| | |
|---|---|
| Accreditation | The formal recognition by an accrediting agency of the compliance of a laboratory to predetermined standards. |
| Accuracy | The degree of agreement between a value and the true value. Determination of analytical method accuracy requires determination of bias and precision. |
| Analyte | A compound that is extracted from the sample and its concentration determined. |
| Analyte Table | The calculation routine used to quantify target analytes as carried out by OPUSquan computer software. |
| Audit | A systematic evaluation to determine quantitative and qualitative specifications of some operational function or activity. |
| Authentic (Native) | An unlabelled target analyte, present in standard solutions, used for calibration and preparation of reference samples. |
| AXYS ID | The unique identification number assigned by AXYS to a sample, used to identify the sample throughout the analytical process. |
| Batch | A set of test samples and associated QC samples analyzed by the same process and for which the analysis is started on the same day. Also referred to as a workgroup. |
| Bias | The systematic component of error in an analytical result. Results may be referred to as either high or low biased if they show systematic departure from the true value. |
| Bracket | The set of samples and time period encompassed between the analysis of two consecutive calibration standards. |
| Bracketing Calibration | A single-point calibration standard analyzed at the beginning and end of a bracket. |
| CALA | Canadian Association for Laboratory Accreditation, whose main objective is to promote and maintain a high level of assurance in analytical test data. Conducts on-site audits and proficiency testing programs. |
| Calibration | The determination, by measurement of comparison, of the correct value of each instrumental measurement. |
| Calibration Standard | A solution used to calibrate an instrument. |
| Calibration Verification (CAL/VER) | Mid-point linearity calibration standard analyzed to confirm the stability of the instrument calibration. |
| Chain of Custody (COC) | An unbroken trail of accountability that ensures the physical security of samples. |
| Clean-up Standard | Standard containing one or more labelled analogues added prior to clean-up procedures to evaluate completeness of extraction and measures losses during cleanup. |
| Co-elution | The simultaneous elution of two or more compounds from a chromatographic column, making the peak identification ambiguous. |
| Confirming Ion | An ion monitored in the mass spectrum, which is required to be present to positively identify an analyte. |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| | |
|---|---|
| Continuing Calibration | A calibration procedure that evaluates the instrument response over time, at least once every twelve hours, to confirm ongoing compliance with initial multi-level calibration responses. |
| Control Chart | A graph that plots individual quality control parameters over time and compares them to the established limits for the parameter. A means of detecting non-conformance and observing trends in parameters. |
| Control Limits | The range of values within which quality control parameters must lie for satisfactory method performance. |
| Corrective Action | An action taken to correct an existing non-conformity. |
| Data Reduction | Process by which instrumental data are converted to concentrations. |
| Daughter ion | An ion resulting from reaction of a particular parent ion in the 2nd stage of a tandem mass spectrometer. Most analytes have at least a few parent-daughter ion transitions that are very specific for that analyte and suitable for quantification. |
| Detection Limit (DL) | The lowest concentration that can be different from zero with a specified level of confidence. |
| Document Control | Process by which quality documentation (and revisions) is reviewed, authorized, and distributed to ensure the use of the correct version. |
| Duplicate | The identical analysis of two sub-samples of the same sample, used to evaluate precision. |
| Eluate | The solvent that elutes from a chromatography column. |
| Extraction Standard | A standard containing one or more labelled compound(s) added to the sample prior to extraction to assess losses during extraction. |
| Holding Time | The maximum allowable storage time prior to analysis of the sample or sample extract under the specific requirements of the analytical method |
| Information value | Concentration is estimated. Compound identity has been confirmed based on retention time and spectral matching against the compound in a calibration standard but accuracy of quantification has not been established since all requirements to establish accuracy of quantification have not been performed or met. Further quantitative work would be required for confirmation of accuracy. |
| Initial Calibration | A calibration procedure used to establish the value of RRFs used in the quantification procedures of all subsequent samples. |
| Initial Precision and Recovery (IPR) | A set of samples analyzed prior to implementing a method, which show that the method can be performed within the required method specifications. |
| Instrument Linearity | Multipoint calibration procedure used to demonstrate the linear calibrated range of an instrument. |
| Interlaboratory Study | A study in which several laboratories analyze the same sample(s). The results are compared and are used as a test of accuracy and precision. |
| Internal Standard | A compound added to a sample or extract and used for quantification of components present in the sample or extract. If the internal standard is added at the beginning of the analysis it is referred to in AXYS terminology as a 'surrogate' standard; if the internal standard is added to the extract just prior to instrumental analysis it is referred to in AXYS terminology as a 'recovery' standard. |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| | |
|---|---|
| Ion Abundance Ratio | For a specific analyte, the ratio of the responses of the mass spectral ions used to identify the analyte. The theoretical ratio is determined empirically for fragment ions, and is based on natural ion abundance for isotopic cluster ions. |
| Isotope Dilution | A quantification method that uses isotopically labelled analogues of analytes added prior to extraction for quantification. |
| ISO17025 standard | International ANS/ISO/IEC Standard 17025, General requirements for the competence of testing and calibration laboratories. All references in this manual refer to the current published version of this standard. |
| Labelled | A compound that contains an isotopically labelled atom. |
| LIMS | Laboratory Information Management System, a database and software system used to record and track information relating to samples. |
| Matrix | The substrate that contains the analytes of interest. |
| Matrix Spike (MS) | A sample prepared by adding a known amount of target analyte to a specific amount of matrix, for which the target analytes have already been determined independently. Used to measure bias. |
| Matrix Spike Duplicate (MSD) | A replicate of the matrix spike, used to measure precision. |
| Method Performance | The specifications which QC parameters must satisfy, indicating that the method is carried out satisfactorily |
| Multiple Ion Detection (MID) | A GC/MS program to acquire data only for the analytes of interest and to disregard other data, also referred to as SIM. |
| Native | See authentic |
| Nominal | The designated values based on calculation. |
| Non-conformance | An indication or judgement that a product has not met established specifications. A departure from documented procedures. |
| On-going Precision and Recovery (OPR) | A reference sample analyzed to show continuing conformance to method performance specifications. |
| Organically Clean | Free of organic contaminants, as measured by proof samples for the target analytes of interest. |
| Parent Ion | An ion from the 1st stage of a tandem mass spectrometer chosen for a particular analyte to be fragmented into daughter ions in the 2nd stage. |
| Percent Recovery | A method performance parameter used as an indication of analyte losses due to extraction and clean-up procedures. |
| Performance Evaluation Sample (PE) | A characterized sample having designated reference values, which is used in the evaluation of laboratory performance. |
| Precision | The component of accuracy defining random variation. The degree to which a number of observations of measurement obtained under the same conditions conform to themselves. |
| Primary Standard | A standard of documented purity and authenticity, obtained from commercial sources |
| Procedural Blank | QC sample type, with no sample matrix or with a clean matrix, analyzed in an identical manner to the test samples. Analyzed to determine the background contribution of analytes to samples from extraction and workup. |
| Proof | An analysis of lab equipment, lab reagents or sampling media to provide evidence of the level of contamination in these items. |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| | |
|---|---|
| Quality Assurance (QA) | An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product meets defined standards of quality with a stated level of confidence. |
| Quality Control (QC) | The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users. |
| Quality Control Samples | Samples designed to show conformance to method performance specifications, i.e., procedural blank, duplicate, reference sample. At least one QC sample is analyzed with every batch, |
| Quality Manual | A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability and implementation of a laboratory to ensure the quality of its product. |
| 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 and services. The quality system provides the framework for carrying out the required QA and QC. |
| Quantification Ion | An ion monitored in the mass spectrum and measured for each analyte. The area is used in the calculations to determine the concentration of that analyte. |
| Recolumn | Additional chromatographic clean-up of an extract, having determined that routine clean-up procedures were insufficient. |
| Recovery Standard | A particular type of 'internal standard'. A known amount of standard added to an extract prior to instrumental analysis and used for quantification of components present in the extract. |
| Reference Samples | A QC sample designed to show accuracy of the method – usually a certified reference material or spiked matrix sample. |
| Reinjection | A repeat injection of a sample extract. |
| Resolution | The measure of separation between two closing eluting chromatographic peaks. The larger the separation, the greater the resolution. |
| Relative Response Factor (RRF) | The ratio of the slope provided by the calibration for the analyte and corresponding standard. |
| Retention Time (RT) | The time to elute a specific chemical from a chromatographic column, measured from the time of injection until the time it appears at the detector. The RT is specific to a chromatographic column, carrier gas and flow rate. |
| Relative Retention Time (RRT) | The ratio of RTs for two chemicals where the denominator represents a reference chemical. The RRT is specific to a chromatographic column, carrier gas and flow rate. |
| Sample History | The sample collection, chemical preservation, sample container, storage conditions, holding times, and sample pre-treatment requirements for an analytical method. |
| Sensitivity | A measure of an analytical instrument's ability to detect compounds near the stated instrument detection limit. |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| | |
|---|---|
| Selected Ion Monitoring (SIM) | A GC/MS program to acquire data only for the analytes of interest and to disregard other data, also referred to as MID. |
| Spike | A known amount of a standard solution added to a sample or QC sample. |
| Stock Standard | A standard solution prepared from primary standards and used to prepare working standards. |
| Subsample | A homogenous portion of a sample, representative of the characteristics of the sample as a whole, used in the analysis. |
| Surrogate Standard | A substance with properties that mimic the analyte of interest. The surrogate is used to monitor matrix effects and sample processing losses; it may also be used as an internal standard for quantification of analytes. |
| Target Analyte | The compounds to be determined by the analytical method. |
| Tentatively Identified Compound (TIC) | Compound identity and concentration are estimated. The compound was not present in the calibration standard, or if present, all qualitative requirements were not performed or met. Identification was based on predicted retention time and approximate spectra matching. Quantification was based on estimated response for the general compound type. Certainty of detection and accuracy of quantification have not been established and further qualitative and quantitative work would be required for confirmation of the result. |
| Traceability | The property of a result of a measurement whereby it can be related to appropriate accuracy standards through an unbroken chain of comparisons. |
| Valley Height | A measure of resolution between two closely eluting peaks, as measured by the ratio of the valley height to the height of the shorter peak or as defined by the method. |
| Window | A viewing window in the chromatogram determined by the scan range of the instrument for a particular ion mass. |
| Working Standard | A standard solution used in the analysis of a sample. |
| Workgroup (WG) | A set of test samples and associated QC samples analyzed by the same process and for which the analysis is started on the same day, identified by a unique number. Also referred to as an analysis batch. |

## 2. DETECTION LIMIT AND REPORTING LIMIT DEFINITIONS

**Detection Limit (DL)** is a general term. It is the lowest concentration that can be distinguished from zero with a stated degree of confidence. Detection limit statements must include information on how they were derived; specific naming conventions (such as SDL, MDL, IDL) may be used to convey this information.

Equivalent term(s): Limit of Detection (LOD)

**Method Detection Limit (MDL)** - determined as specified by EPA Fed. Reg. 40 CFR Part 136 Appendix B (no iteration option). The 99% confidence level MDL is determined based on analysis of a minimum of 7 replicate matrix spikes fortified at 1-5 times the estimated detection

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

limit. MDL is determined as required based on accreditation, contract and workload requirements.

**Sample Specific Detection Limit or Sample Detection Limit (SDL)** – determined individually for every sample analysis run by converting the area equivalent of 3.0 times (2.5 times for EPA 1600 series methods) the estimated chromatographic noise height to a concentration in the same manner that target peak responses are converted to final concentrations. The SDL accounts for any effect of matrix on the detection system and for recovery achieved through the analytical work-up.

Equivalent term(s): Estimated Detection Limit (EDL) from EPA method 8290.

**Instrument Detection Limit (IDL)** – determined by converting the area equivalent of 3.0 times the estimated chromatographic noise height to a solution concentration using the applicable calibration model & data. Determined by analysis of solvent solutions during initial method implementation or method development and verified on established schedule for sample analysis.

**Quantification Limit (QL)** – the lowest concentration that can be quantified with a defined degree of accuracy. AXYS defines **QL** as the sample concentration equivalent to the lowest calibration standard falling above the MDL.

**Reporting Limit (RL)** – the lowest concentration reported. **RL** may be contract specific and can be equal to SDL, MDL, QL, or some other stipulated concentration greater than the SDL. Reporting conventions used with **RLs** may include flagging concentrations below MDL, QL, or some other agreed upon concentration. Where not specified by contract, AXYS defines **RL** as equal to SDL for GC analyses and as the greater of SDL or QL for LC analyses. For LC/MS/MS analyses, AXYS will upon request report concentrations falling below the QL but above the SDL with a flag to denote that the accuracy of quantification is unknown.

**Lower Method Calibration Limit (LMCL)** – The sample concentration equivalent to the lowest calibration standard. For co-eluting compounds, the sum of the concentrations of the individual compounds that actually are present in the calibration standard are used.

Terms that may be encountered requiring specific definition based on source or application:

Contract Required Quantification Limit (CRQL)
Method Calibration Limit (MCL)
Method Limit (ML)
Practical Quantification Limit (PQL)
Quantification Detection Limit (QDL)

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

## 3. ACRONYMS

| | |
|---|---|
| AEH | AXYS' designation for "acid extractable herbicides" |
| AFFF | Aqueous film forming foam |
| BDE | Brominated Diphenyl Ethers (PBDPE) |
| BHC | USEPA term used for hexachlorocyclohexane |
| BLK | Procedural Blank |
| CAEAL (prior to Aug2008) | Canadian Association for Environmental Laboratories |
| CALA (after Aug2008) | Canadian Association for Laboratory Accreditation |
| CAL-VER | Calibration Verification solution |
| CLAM | Continuous low-level aquatic monitoring (used for analytical sampling) |
| COC | Chain of custody |
| CRQL | Contract Requirement Quantification Limit |
| DBD | Dibenzodioxin |
| DBF | Dibenzofuran |
| DCM | Dichloromethane |
| ECD | Electron Capture Detector |
| ECNI | Electron Capture Negative Ion |
| EPA | (United States) Environmental Protection Agency |
| EPF | Equipment Proof |
| FID | Flame Ionization Detector |
| FPD | Flame Photometric Detector |
| GC | Gas Chromatography |
| GC-ECD | Gas chromatograph with electron capture detector |
| GC-ECNI MS | Gas chromatograph with electron capture negative ion mass spectrometer |
| GC-HRMS | Gas chromatograph with high resolution mass spectrometer |
| GC-LRMS | Gas chromatograph with low resolution mass spectrometer |
| GPF | Glassware Proof |
| HCB | Hexachlorobenzene |
| HCH | Hexachlorocyclohexane |
| HR | High Resolution |
| IHQC | In House Quality Control |
| IPR | Initial Precision and Accuracy |
| LC | Liquid chromatography |
| LC-MS/MS | Liquid chromatograph with tandem mass spectrometer |
| LIMS | Laboratory Information Management System |
| LR | Low Resolution |
| MDL | Method Detection Limits |
| MID | Multiple Ion Detection |
| MOS | Mono-Ortho-Substituted |
| MPT | Method Performance Test |
| MRES Pest | AXYS' designation for "multi residue pesticides" |
| MS | Mass Spectrometer |
| NELAP | National Environmental Laboratory Accreditation Program |
| NOS | Non-Ortho-Substituted |
| NP | Nonylphenol (AP) |
| NYSDoH | New York State Department of Health |
| OCP | Organochlorine Pesticides |
| OPR | On-going Precision and Recovery |
| PAH | Polynuclear Aromatic Hydrocarbons |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

| | |
|---|---|
| PBB | Polybrominated Biphenyl(s) |
| PBDD | Polybrominated Dibenzodioxin(s) |
| PBDF | Polybrominated Dibenzofuran(s) |
| PBDE | Polybrominated Diphenylethers (PBDPE) |
| PCB | Polychlorinated Biphenyl(s) |
| PCDD | Polychlorinated Dibenzodioxin |
| PCDF | Polychlorinated Dibenzofuran |
| PE | Performance Evaluation |
| PE | Phthalate Esters |
| PED | Polyethylene strip sampling device (used for analytical sampling) |
| PFC | Perfluorinated Organic Compounds |
| POCIS | Polar organic compound integrative sampler (used for analytical sampling) |
| PUF | Polyurethane Foam Plug |
| PUFF | Polyurethane foam filter |
| QA | Quality Assurance |
| QC | Quality Control |
| RRF | Relative Response Factor |
| RRT | Relative Retention Time |
| RSD | Relative Standard Deviation |
| RT | Retention Time |
| SDL | Sample Detection Limits |
| SIM | Select Ion Monitoring |
| SOP | Standard Operating Procedure |
| SPMD | Semipermeable membrane device (used for analytical sampling) |
| TEQ | Toxic Equivalents |
| WG | Work Group |
| XAD-2 | Proprietary name for a styrene-divinylbenzene copolymer adsorbent resin |

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# APPENDIX E REVISION HISTORY OF QUALITY MANUAL

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# THIS PAGE LEFT INTENTIONALLY BLANK

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# Revision History of Quality Manual

The following amendments have been made to the QA/QC Policies and Procedures Manual Revision 24 and have been incorporated into Revision 25. All amendments have been authorized by the QA Manager.

| Chapter, Section | Page | Amendment |
|---|---|---|
| I, Table 2 | 15 | Added additional model information to the instruments list |
| I, Section 3 | 16 | Removed withdrawn accreditation for MLA-007, organochlorine pesticides by GC-ECD. Changed ACLASS to ANAB. |
| II | 19 | Clarified that all records (hardcopies and electronic) are retained for a minimum of ten years |
| III, sections | 26-28 | Removed "Process and Product Improvement Scientist". Clarified that the President is the Senior Technical Director. Clarified the roles of the Director of Operations. Moved the Client Services Manager from section 2.1 to section 3.1. Removed the Lab Manager as a secondary function for the Director of Operations; the Lab Manager is a separate position. |
| III, Figure 2 | 29 | Updated organizational chart, added footnote about QDO-005 "AXYS Organizational Chart (with names)" |
| IV | 30 | Removed the Safety Manual Acknowledgement Form - this function is maintained through Q-Pulse's electronical document distribution acknowledgements |
| IV, 1.1 | 30-31 | Added information about the Basic Training |
| V | 34 | Added information about the metabolomics lab and -80°C freezers |
| V, 4 | 38 | Corrected that the IT department is situated in the west building (not the administrative areas) |
| V, 5.3 (2) | 39 | Clarified the prescribed syntax of passwords |
| V, 6 | 40 | Updated server information |
| VIII, X | 63, 78 | Deleted reference to obsolete SOP SAD-009 and replaced with SAD-022 |
| IX, 1.2 | 64-65 | Expanded the explanation of the Laboratory Sample Duplicate |
| X, 11 | 80 | Removed point 9. about the Product Improvement Scientist. |
| App. C | 114 | Updated the approval layout to current practice. |
| App. G | 164 | Added a comment that instructions for CAS database searches are in the QA Sharepoint Wiki. |

The following amendments have been made to the QA/QC Policies and Procedures Manual Revision 23 and have been incorporated into Revision 24. All amendments have been authorized by the QA Manager.

| Chapter, Section | Page | Amendment |
|---|---|---|
| I, table 2 | 15 | Added new instrument (Agilent 6890N Network Gas Chromatograph with an Agilent 5975 Network Mass Selective Detector) |
| I, 3 | 16-17 | Updated the accreditation scope with new accreditation acquired, deleted expired California accreditation. |
| III, sections 2.1, 3, 3.1 and 3.3 | 27-28 | Updated positions. |
| III, Figure 2 | 29 | Updated the organizational chart |
| VIII, 1 | 52 | Clarified that only current copies of controlled documents may be used by staff to control processes. |
| IX, 1.2 | 64 | Exempted aqueous samples from the requirement to run a duplicate with every batch of 7-20 samples. |
| X, 1 | 70 | Added details on vendor qualification |
| App. B, 9 | 104 | Updated analysis codes for microvial labels. |

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

The following amendments have been made to the QA/QC Policies and Procedures Manual Revision 22 and have been incorporated into Revision 23. All amendments have been authorized by the QA Manager.

| Chapter, Section | Page | Amendment |
|---|---|---|
| I, Table 1 | 10 | Updated Table 1 "Scope of Products" |
| I, section 3 | 16 | Added metabolomics to the accreditation scope. |
| II, section 2.5 | 19 | New section about document reviews. |
| III, Figure 2 | 28 | Updated organizational chart |
| VIII, section 2.6 | 60 | Added policy for quantification of native compounds using alternate ions. |
| X, sections 2.7 and 2.8 | 72 | Removed the QA chemist as responsible for the equipment record. Clarified that the equipment record is in the LIMS. Clarified the location of the maintenance log. |
| X, section 7 | 76 | Added positions with the authority to suspend and resume non-conforming operations |
| Appendix B | 100 | Added AB Sciex instrumental file naming format |
| App. D, sect. 3 | 127-128 | Updated abbreviations/acronyms. |
| Appendix F | 153-160 | Updated and added floor plans. |

The following amendments have been made to the QA/QC Policies and Procedures Manual Revision 21 and have been incorporated into Revision 22. All amendments have been authorized by the QA Manager.

| | Chapter, Section | Page | Amendment |
|---|---|---|---|
| | I, Table 1 | 10-13 | Updated "Scope of Products" to current status |
| | I, Table 2 | 14 | Added new Agilent HPLC and AB Sciex MS. |
| | I, section 3 | 15 | NYSDH: Updated accreditation summary with DX/F in solid matrix and indicated which analyses are primary or secondary accreditations. Deleted "pending" for CALA PAH in water. |
| | II, section 1 | 17 | Point 2: Changed "Technical Director" to "Technical Directors".<br>Point 6: Added clarification that methods must be "fit for purpose". |
| | III, Section 1 | 25-26 | Updated the responsibilities of the Director of Sales, Marketing and Service and of the Client Services Manager |
| | III, Section 1.1 and 3 | 26 | Updated the responsibilities of the Client Services manager and the Director of Operations. Deleted the Reporting Supervisor position. |
| | III, Section 3.3 | 27 | Updated the responsibility of the Product Development Scientist |
| | III, Figure 2 | 28 | Updated organizational chart |
| | V | 33 | Updated facilities description, deleted warehouse. |
| | V, section 1.1 | 34-35 | Added that metabolomics samples are stored in a freezer at -80ºC. Clarified who is responsible for temperature monitoring of freezers and refrigerators. |
| | VI, sections 1.1 and 1.2, table 3 | 41-42 | Updated contract management procedures to reflect current practice. |
| | VII, section 1 | 45 | Added that HDPE sample containers are used for a number of LC analyses. |
| | VII, section 2.3 | 48 | Clarified that the LIMS CoC must be approved by the Project Manager only before samples are released internally for analysis. |
| | VIII, section 2.2 | 54 | Added SPE to the extraction procedures list. |
| | VIII, section 2.4 | 58 | Clarified that the note about additional work that is entered into LIMS' Work Group Notes must be verified and signed off by the Project Manager. |
| | VIII, section 2.5 | 58 | Added AB Sciex Analyst to the list of analysis calculation software.. |
| | X, section2.1 | 70 | Changed "de-ionized water" to "Seastar ultrapure water or Canadian Springs bottled water" |
| | X, section 6 | 75 | Clarified that for samples submitted to subcontracting laboratories a Release |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

| | | | |
|---|---|---|---|
| | | | Chain of Custody document is generated from LIMS and sent together with the samples. |
| | XI, section 1.4.3 | 80 | Added description of cleanup standard |
| | Appendix B, section 5 | 98 | Added new instrument R (AB Sciex). Added missing instrument names |
| | Appendix C, table 5 | 108 | Updated document responsibilities. |
| | Appendix D, section 1 | 120-121 | Added definitions for Parent Ion and Daughter Ion |
| | Appendix G | 159 | Expanded the description of CAS # policy to include more detail |

The following amendments have been made to the QA/QC Policies and Procedures Manual Revision 20 and have been incorporated into Revision 21. All amendments have been authorized by the QA Manager.

| Date | Chapter, Section | Page | Amendment |
|---|---|---|---|
| | I, sect. 3 | 15-16 | Added Virginia state accreditation. Added PBDPE in NP water for the SWADE scope. Added water as "pending" matrix for CALA accreditation. |
| | I, sect. 1, point 9 | 18 | Added pipettors to the list of instruments that need to undergo traceable calibration. |
| | III, sect. 1 and 3 | 26 | Corrected title of the Client Services Manager. Updated Director of Operations description |
| | III, sect. 3.1 | 26 | Corrected title of the Lab Manager |
| | III, sect. 3.4 | 27 | Added section 3.4 "Process and Product Improvement Scientist" |
| | iii, Figure 2 | 29 | Updated organizational chart |
| | V, Sect. 1.3 | 36 | Deleted obsolete instruction to cover lab bench on the north wall of lab 1 with Al foil. The bench has been replaced by stainless steel counters. |
| | V, sect. 2 | 37 | Updated location of the first aid room. |
| | VI, Sect 1.4 | 44 | Clarified Work Scheduling tasks and responsibilities. |
| | VIII, sect. 2.3 | 57 | Updated list of current SIN documents for instrument QA/QC checks and mass calibration |
| | VIII, sect. 2.4 | 59 | Added SIN-026 to list of documents for instrument data evaluation |
| | iX, sect. 2.1 | 67 | Added SIN-037 to list of documents for instrument linearity determination |
| | X, sect. 2.5 | 72 | Deleted reference to use of IR or digital thermometers for drinking water applications |
| | X, sect. 3 | 73-74 | Updated PT sample description |
| | X, sect. 5 | 75 | Updated performance monitoring description |
| | XI, sect. 6.2/3 | 85 | Updated location of prime and stock standards |
| | App D, Sect 2 | 125 | Added definition of LMCI (Lower Method Calibration Limit) including policy for coeluting compounds |

The following amendments have been made to the QA/QC Policies and Procedures Manual Revision 19 and have been incorporated into Revision 20. All amendments have been authorized by the QA Manager.

| Date | Chapter, Section | Page | Amendment |
|---|---|---|---|
| | I | 10-13 | Expanded description of product classes. Replaced Table 1 column of method class status with a reference to the current Product and Service Guidelines. |
| | I, 3 | 15-16 | Added new accreditation |
| | II | 18 | Added the requirement for NIST traceability of thermometer calibrations meeting ISO 17025 standards |

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

| | | | |
|---|---|---|---|
| | III | 28 | Updated organizational chart |
| | VII | 45 | Changed "Teflon" to "fluoropolymer". |
| | VII, . 2.7 | 49 | Provided reference to SAD-014 for details about sample and extract retention policies. |
| | VIII | 62 | Clarified record retention times. Deleted reference to obsolete SAD-022. |
| | IX, 1.6 | 65 | Expanded description of MS/MSD test applicability |
| | X 2.5 | 71-72 | Revised thermometer calibration/verification requirements |
| | X 3. | 73 | Added information on the frequency of accreditation PE studies |
| | Appendix C | 105 | Clarified method numbering system |
| | Appendix C | 109-110 | Clarified instructions for formatting of method documents |
| | Appendix H | 161 | Added definitions for report flags H, TIC and MAX |

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev.18 and have been incorporated into Revision 19. All amendments have been authorized by the QA Manager.

| Date | Chapter | Page | Amendment |
|---|---|---|---|
| 20 May 2011 | I, Appendix .B | 5, 89 | Updated instrument lists to include one new LC/MS/MS |
| 20 May 2011 | I Section 3 (table) | 6 | Added EPA 8270D and 8081B method codes. Replaced reference to Appendix D with reference to document ACC-101 Accreditation Scope. Updated several accreditation entries. |
| 20 May 2011 | II 1.2 | 7 | Text clarified that current versions of CALA and NELAP standards apply |
| 20 May 2011 | II, section 3 | 11-12 | Minor corrections of document distribution procedures. |
| 20 May 2011 | II, section 4 | 13 | Expanded the explanation of authorization for departure from documented procedures. |
| 20 May 2011 | III | 15 | Changed title Scientific Director (Opportunities) to Senior Scientific Specialist |
| 20 May 2011 | III, Figure 2 | 18 | Updated organizational chart. |
| 20 May 2011 | IV | 19 | Corrected reference to the Safety Manual (now SAF-001) |
| 20 May 2011 | VI | 31 | Replaced verbal agreement with authorized quotation process |
| 20 May 2011 | VII | 35 | Updated the reference to the Safety Manual |
| 20 May 2011 | VII 2.1 | 36 | AXYS Sample Acceptance Criteria: Added requirements for soil samples (pertaining to Agricultural Hazards) |
| 20 May 2011 | VII | 40 | Updated reference to SLA-003 for Chain-of-Custody instructions. |
| 20 May 2011 | X | 66 | Expanded description of client complaint resolution process |
| 20 May 2011 | Appendix B | 90, 91 | Deleted reference to an outdated system of analysis level codes. Updated the list with analysis codes. |
| 20 May 2011 | Appendix C, section 1 | 95-97 | Added a few definition clarifications.<br>Added guideline for when method changes trigger a new method number, method revision number or method version number. |
| 20 May 2011 | Appendix C, sections 2.1 and 3 | 99, 101 | Clarified document distribution procedures. |
| 20 May 2011 | Appendix D | 106 (formerly) | Deleted Appendix D (separate document ACC-101 now applies).<br>All subsequent appendices renumbered as a consequence of the deleted Appendix D. |

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 17 and have been incorporated into Revision 18. All amendments have been authorized by the QA Manager.

| Date | Section | Page | Amendment |
|---|---|---|---|
| June 2010 | I | 5 | Added Water 2795 HPLC |
| June 2010 | III | 15 | Corrected that the LIMS Manager reports to the Controller. |
| March 2010 | III, 3.1.1 | 16-17 | Deleted the position "Sample Preparation Coordinator". Updated that the Lab Schedule coordinator now also schedules sample preparation work. Deleted |

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| | | | |
|---|---|---|---|
| | | | the title of "senior" Chemist. Changed Product Development Manager to be Product Development Scientist. Corrected that in case of absence the Director of Operations acts for the Instrumental Analysis Manager and the Product Development Scientist. |
| March 2010 | III | 19 | Figure 2: Updated the org. chart. |
| June 2010 | IV | 20 | Clarified that Managers record performance evaluations and job descriptions in personnel files. |
| June 2010 | V | 23 | Updated volume of walk-in coolers to a total of ~3000 cubic feet |
| June 2010 | V, sect. 3 | 27-28 | Updated information pertaining to the new Safety Manual SAF-001. Added closed toe shoes as item under lab safety policies. |
| June 2010 | V, sect. 5.3 | 29 | Clarified that LIMS passwords are changed every 180 days. |
| March 2010 | V-6 | 30 | Deleted central server "Dell PowerEdge 2900". Replaced "Unix-based firewall" with "SonicWall Gateway Appliance". Replaced "Optiplex" LIMS server with "R510". Reference to SAD-031 added. |
| June 2010 | VI, sect. 1.3 | 34 | Added that the President also attends the weekly work priority meetings. |
| June 2010 | VII, sect. 2.2 and 2.5 | 39-40 | Clarified that Sample Receiving Chemists are responsible for sample preservation (instead of Sample Preparation). |
| June 2010 | VII, sect. 2.7 | 41 | Changed that sample extracts are kept for 90 days after invoicing (instead of one year). |
| June 2010 | VIII, sect. 2.1 | 43 | Added list of sample preparation SOPs |
| June 2010 | VIII, sect. 2.1 | 45 | Added references to sample preparation SOPs. |
| June 2010 | VIII, sect. 2.4 | 49 | Renamed section to "Primary Data Validation Procedures". |
| June 2010 | VIII, sect. 2.7 | 50 | Clarified Data Reporting routines. |
| June 2010 | VIII, sect. 2.7 | 51 | Replaced SAD-001 "Analysis Report Preparation" by SAD-030 "Preparation of Final Reports using LIMS". |
| June 2010 | VIII, sect. 2.8 | 54 | Deleted "data coding forms' from the list of the records. |
| June 2010 | IX, sect. 2.1 | 58 | Corrected linearity calibration frequency to be at least 90 days (instead of 60). |
| June 2010 | X, sect. 2.5 | 61 | Clarified requirement to calibrate and validate thermometers. |
| June 2010 | X, sect 7 | 67 | Deleted reference to archived SOP SIN-025 |
| June 2010 | X, sect. 7.1 | 68 | Corrected Sales and Marketing department to be Client Services. |
| June 2010 | XI, sect. 1.3 and 1.4 | 69-70 | Clarified that working standards are direclty validated (not stock standards) |
| June 2010 | Spp. B, sect. 5 | 91 | Corrected instrument code for one LC/MS/MS to be P (instead of L) |
| March 2010 | App. C, sect. 2.1 | 100 | Added that method references should be included in AXYS' methods. |
| June 2010 | App. C, sect 4.2 | 102 | Clarified report signing responsibilities |
| March 2010 | I-6 | 6 | Added PPCP accreditation details |
| March 2010 | Appendix D | 119 ff | Deleted CALA accreditation for endrin aldehyde in tissue. Added CALA accreditation for PPCP in aqueous and solid samples. |
| March 2010 | Appendix E | 128 | Added a definition for ISO17025 standard and a statement that the term ISO17025 refers to the current version of the standard. |
| June 2010 | App. E, sect. 3 | 134 | Added IHQC to Acronym list |
| May 2010 | Appendix G | 154-157 | Updated floor plans: North Building (both floors) and South Building (both floors). |
| | Appendix I | | Added flag H "information only value" |

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 16 and have been incorporated into Revision 17. All amendments have been authorized by the QA Manager.

| Date | Section | Page | Amendment |
|---|---|---|---|
| Oct 2009 | | 1-165 | Fixed pagination by adding bookmark to the last page (must not be deleted) |
| Oct 2009 | All | | Reference to ISO 17025 as current version. |
| Sep 2009 | Chapter I | 1 | Revised section 1 about affiliated companies. |
| Sep 2009 | Chapter I | 5 | Updated detector for Water HPLC 2690 (deleted diode array detector, changed to be MS/MS detector) |
| Sep 2009 | Chapter I | 6 | Updated section 3. Accreditation Summary |
| Sep 2009 | Chapter II | 12 | Added description of the requirement to notify accrediting organizations of SOP changes |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| | | | |
|---|---|---|---|
| Sep 2009 | Chapter III | 15-17 | Corrected position names (Product Improvement Scientist, Technical Service Chemists, Technical Service Coordinator) |
| Sep 2009 | Chapter III | 19 | Updated org. chart |
| Sep 2009 | Chapter IV | 21-22 | Added that an IT Policies form is signed by new employees |
| Sep 2009 | Chapter V | 28 | Safety Features: Deleted reference to Halon fire extinguishers (not used anymore). |
| Sep 2009 | Chapter V | 29 | Updated paragraph about AXYS Analytical Safety Committee. Corrected unlocked door in w building to be Mon-Fri 7 am – 5 pm |
| Sep 2009 | Chapter V | 30-31 | Updated section 5.3 Security of Data and Section 6 Computing Capabilities to reflect current SAD-028 |
| Sep 2009 | Chapter VI | 33 | Added the LIMS group to the RFP reviewers |
| Sep 2009 | Chapter VI | 34-35 | Section 1.3 Workload Management and section 1.4 Work Scheduling: Corrected positions and responsibilities. |
| Sep 2009 | Chapter VII | 38 | Corrected sample documentation requirements |
| Sep 2009 | Chapter VIII | 46 | Corrected that worksheets now are generic for the whole batch, not individual for each sample |
| Sep 2009 | Chapter VIII | 47 | Corrected Flow Diagram of Testing Procedures by adding EDD preparation into the Report box |
| Sep 2009 | Chapter VIII | 50 | Corrected how a request for additional work is done and recorded. |
| Sep 2009 | Chapter IX | 55-56 | Deleted evaluation instructions in section 1.2 Sample Duplicate, instead referring to method specs and SOPs |
| Sep 2009 | Chapter X | 63 | Section 2.3 Volumetric Measurement: Added pipette pertaining clarification |
| Sep 2009 | Chapter X | 67 | Section 4.2 External Audits: Added SWADE and MDH as biannual auditors |
| Sep 2009 | Chapter XI | 72, 75-78 | Chapter XI Standards: Corrected position names (to be Technical Service Chemist and Technical Service Coordinator), updated documentation of standard solutions to be stored on the network only, updated that documentation of CRT, primary standards, stock standards and working standards is done in LIMS, updated storage conditions and locations, added detail for expiry dates of working standards |
| Sep 2009 | Appendix B | 86, 87, 89, 94-95 | Updated the definition of the term "AA" in the standard solution, corrected the definition of test sample code N, updated Table 4 Naming Codes, updated Instrument table in section 5 (Instrumentation), updated analysis code table and microvial label colour codes in section 9 (Microvial Label Codes), |
| Sep 2009 | Appendix B | 91 | Updated instrument list |
| Sep 2009 | Appendix C | 100 | Added IPRs and MDLs to table 5 (Categories of Documents) |
| Sep 2009 | Appendix D | 118 | Added PFC accredited analytes for MDH |
| Sep 2009 | Appendix G | 149, 151 | Updated floor plans for the lower floors of the North and the South Buildings. |

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 15 and have been incorporated into Revision 16. All amendments have been authorized by the QA Manager.

| Date | Section | Page | Amendment |
|---|---|---|---|
| Dec 2008 | Introduction Table 1 | 2 | Updated 'Scope of Fully Commercialized Products' |
| Dec 2008 | Introduction Table 2 | 4 | Added 1 new HRMS instrument to 'Instruments' |
| Dec 2008 | Chapter III | 15- 17 | Updated job titles for summary job descriptions |
| Dec 2008 | Chapter III, 3.5 | 17 | Name 'R&D' changed to 'Product Development' |
| Dec 2008 | Chapter III, figure 2 | 19 | Updated organizational chart |
| Dec 2008 | Chapter IV | 21 | Added reference to staff minimum qualifications requirement |
| Dec 2008 | Chapter IV | 23 | Added reference to SOP SQA-024 Data Integrity Procedures |
| Dec 2008 | Chapter IV | 23 | Added reference to annual management review of data integrity plan |
| Dec 2008 | Chapter VIII | 54 | Added reference to transfer of records to client if business ceases |
| Dec 2008 | Appendix B Table 4 | 88 | Deleted columns named 'Analysis Type' |
| Dec 2008 | Appendix B | 90 | Added Premier instrument code |
| Dec 2008 | Appendix B, 6.2 | 91 | Added LC/MS/MS to naming conventions covered |
| Dec 2008 | Appendix E | 126 | Changed CAEAL to CALA and changed all document references to CALA |
| Dec 2008 | Appendix H | 155 | Added Appendix for CAS number usage policy |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

| | | | |
|---|---|---|---|
| Dec 2008 | Appendix I | 159 | Added Appendix for data flagging conventions |

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 14 and have been incorporated into Revision 15. All amendments have been authorized by the QA Manager.

| Date | Section | Page | Amendment |
|---|---|---|---|
| Aug 2007 | Table 1, Table 2 | 2 | Table 1 content updated, Table 2 deleted |
| Aug 2007 | Table 3 | 4 | Deleted Finnigan Incos 50 GC/MS and HP5890 GC/ECD instruments |
| Aug 2007 | 3. Accreditation | 5 | Added PCDD/F to accreditation by CDPH .<br>Added accreditation by FLDH and by NJDEP.<br>Added accreditation for pesticides in water by SWADE |
| Aug 2007 | Chapter III, figure 2 | 19 | Updated organizational chart |
| Aug 2007 | 4.4.1 | 64 | Added "Quality control activities" to the list for management review |
| Aug 2007 | Appendix B, Table 5 | 87 | Added "SPEX" as the code for "Spiked Extract" |
| Aug 2007 | Appendix D | 108-117 | Addition of new analytes (PCDD/F) accredited in California.<br>Addition of analytes accredited by NJDEP (PCDD/F and PFC)<br>Addition of pesticides to analytes accredited by SWAPE |
| Aug 2007 | Appendix E | 126 | Added policy for reporting concentrations below QL for LC/MS/MS |

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 13 and have been incorporated into Revision 14. All amendments have been authorized by the QA Manager.

| Date | Section | Page | Amendment |
|---|---|---|---|
| March 2007 | Table 3 | 4 | Deleted instruments VG-70 SE (x2), HP 5890 GC (x1) and Tekmar headspace.autosampler. Changed Autospec Ultima autosamplers to read CTC A200 S rather than 200 SE. |
| March 2007 | Headers<br>Document Control<br>Procedures<br>Documentation<br>Format | All, except first 13 and 110 | Modified copyright statement |
| March 2007 | Table –WASDE accreditation | 5 | Corrected PCB method from 1614 to 1668 |
| March 2007 | Table –WASDE accreditation | 21, 22 | Changed the Quality Manual acknowledgement to be done only electronically. |
| March 2007 | Several locations | | Changed "Quality Manager" to "QA Manager" |
| March 2007 | Appendix D: Scope of accreditation | 109 | Added analytes for FIDOH accreditation 1-Jan-2007 (total tetra-, penta-, hexa- and heptadioxins and -furans in solids and tissue) |
| March 2007 | Figure 2; Organizational Chart | 19 | Updated |
| March 2007 | Table 1, Table 2 | 2-3 | Moved a number of analyses from Table 2 (Scope of Specialty Analyses) to Table 1 (Scope of Routine Analyses). |

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 12 and have been incorporated into Revision 13. All amendments have been authorized by the QA Manager.

| Date | Section | Page | Amendment |
|---|---|---|---|
| Nov 2006 | Global Changes | | Entire text revised to include revised job titles and supervisory responsibilities.<br>Deleted references to GC/FID.<br>Update SOP references and titles. |
| Nov 2006 | Responsibility, Dist. | i | Deleted President as signatory to QA Manual. Added statement about |

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| | | | |
|---|---|---|---|
| | & Control | | management support and procedures being binding on employees.<br>Deleted Quality Policy Statement; policies are included in Ch. II. |
| Nov 2006 | Ch I, 2. | 1 | Revised business hours and number of employees. |
| | | 3 | Table 2 Scope of Analyses updated. |
| Dec 2006 | Ch 1, 3 | 5 | Added tables to list accredited method for each accrediting agency. Included pending Florida accreditation. Reference to Appendix D added. |
| Nov 2006 | Ch II, 1 | 7 | Deleted Quality Objectives, included them in Quality Policies. Added AXYS' objective statement. Revised some quality policies added some new policies. |
| | CH II, 2 | 8 | Deleted Reference to Method and SOP Manuals, reference just to Methods or SOP |
| | Ch II, 2.1 | 8 | Added reference to electronic QA Manual |
| | Ch II, 2.2 | 9 | Moved information about source of methods, method format, and method control from Ch VIII to this section. |
| | Ch II, 2.3 | 9 | Moved information about SOP format and SOP control from Ch VIII to this section. |
| Dec 2006 | Ch II, 2.4 | 9 | Added this section to list quality documents kept on file. |
| Nov 2006 | Ch III | 15-19 | Chapter rewritten and Figure 2 revised to describe changes in organizational structure.<br>Deleted section on 'Assigned Responsibilities' |
| Dec 2006 | Ch IV, 1.1 | 21 | Used "data integrity" to replace legal and "ethical responsibilities". |
| | Ch IV, 1.2 | 22 | Added Evaluation of effectiveness of training to what is monitored. |
| | Ch IV, 2 | 23 | Added Data Integrity as part on Legal and Ethical Training. Revised point #7. Added criminal/civil prosecution to consequences on not adhering to policies. |
| Nov 2006 | Ch V, Section 1.1 | 26 | Revised responsibility for monitoring sample storage temperatures to 'staff'. Changed frequency of monitoring from daily to every business day. |
| | Section 1.3 | 27 | Changed responsibility for approving cleaning products to Lab Manager. |
| | Section 4, 5.1 | 29 | Revised description of building security to describe changed system for locked doors. Revised hours of operation |
| Nov 2006 | Ch VI | 33-35 | New chapter - Moved Contract Management from Ch III to its own chapter. Revisions made to procedures for reviewing proposals and contracts. |
| Nov 2006 | Ch VIII, Section 1.1 | 43 | Added Section 1.1.1 about detection limits. |
| Nov 2006 | Ch VIII, Sect. 2.2, 2,4 | 45,49 | Included extra work being documented in the LIMS. |
| | Section 2.6.2 | 52 | Revised section on Detection Limit. Deleted reference to procedures in EPA Federal Register 40. |
| Dec 2006 | Ch VIII, 2.7 | 52 | Added requirement to include a statement on reports that data applies only to sample. |
| Dec 2006 | Ch VIII, 2.8 | 54 | Added related QC records to records that are maintained. |
| Nov 2006 | Ch IX, Section 1.1 | 55 | Revised requirement for BLK, deleting option of no matrix. |
| Dec 2006 | Ch X, 4.1.1 | 65 | Added effectiveness of training to items considered in management review. |
| | Ch X, 7 | 67 | Added point that all staff may identify non-conformances. Added actions taken for non-conformances. Added statement that clients are notified if non-conformance affects data. |
| | Ch X, 11 | 70 | Added this section on Process Improvement. |
| Nov 2006 | Ch XI | 71-77 | Replaced Standards Chemist with Technical Specialist |
| Nov 2006 | Ch XI, Section 1.4.2 | 72 | Expanded definition of Recovery standard. |
| | Section 1.4.4 | 73 | Added information on linearity solutions to this section. Deleted stand-alone section. |
| Nov 2006 | Ch XI, Section 7 | 76 | Included expiry date of 2 years for alkane working standards. |
| Nov 2006 | Appendix B | 83 | Table 4 revised to update Analysis Types, delete obsolete codes |
| Nov 2006 | Appendix C | 95 | Table 5 updated responsibilities for documents |
| Dec 2006 | Appendix D | 107 | Added tables of accredited analytes. |
| Nov 2006 | Appendix E, Sect. 1 | 123 | Deleted 'Labsyst' and detection limit definitions from glossary. |
| | Sect. 2 | 127 | Added this section with Detection Limit Definitions. |
| Nov 2006 | Appendix G | 150 | Updated some floor plans. |

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 11 and have been incorporated into Revision 12. All amendments have been authorized by the QA Manager.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| Date | Section | Page | Amendment |
|---|---|---|---|
| Aug 2006 | Global Changes | | Entire text revised to include revised job titles and supervisory responsibilities |
| | | | Project Mangers, Reporters and Sample Receiving moved to Client Services |
| | | | |
| Mar-2006 | Global changes | | Client Services changed to Sales, Marketing and Service. |
| | | | Project Manager changed to Senior Project Manager. |
| | | | Project QC Chemist 3 changed to Project Manager. |
| | | | VP Production assigned responsibility for Instrument group. |
| | | | Entire text revised to include revised job titles and supervisory responsibilities. |
| Mar-2006 | Ch. I, 3 | 3<br>5 | Updated Tables 1 and 2, to include Superfund Methods, acid extractable herbicides, multi-pesticide residues and PE metabolites.<br>Revised CALA accredited test to included PFCs. |
| Mar-2006 | Ch. III,<br><br><br>Section 1.2 | 15-22<br><br><br>17 | Rewrote section to describe a revised organizational structure that includes renaming several positions, restructuring supervision of Extraction Lab, VP Production supervision of Instrument group and Project Management group.<br>Deleted Reference to use of form FLC-012. |
| Mar-2006 | Ch. V | 26 | Revised description of west and south buildings to include new location of coding, accounting and IT groups. |
| Mar-2006 | Ch. VII, 2.7 | 52 | Revised to include the use of LIMS reporting. |
| Mar-2006 | Ch. IX, 2.8<br><br>Section 6.0 | 64<br><br>67 | Revised reference to equipment maintenance logbooks to equipment maintenance log for lab and sample prep equipment. Deleted reference to managerial review of logbook.<br>Revised description of subcontracting, there Is no longer a single Project QC chemist supervising the area. |
| Mar-2006 | Ch. X, 6.2,6.3 | 75 | Revised so that Standards Chemist is responsible for standards. |
| Mar-2006 | Appendix C, 4 | 104 | Revised to allow for customization of reports. Deleted reference to AXYS 2nd page stationary for reporting data. |
| Mar-2006 | Appendix G | 117 | Updated floor plans for south building. |

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 10 and have been incorporated into Revision 11. All amendments have been authorized by the QA Manager.

| Date | Section | Page | Amendment |
|---|---|---|---|
| Oct. 2005 | General | | Corrections made to grammar and spelling. |
| Oct 2005 | I, 3 | 5 | Deleted reference to BC EDQA program. Put CALA accredited tests in a table. |
| Oct 2005 | VII, 2.3 | 47 | Modified section on mass calibration for HR MS. |
| Oct 2005 | X, 7 | 77 | Included 2 year expiry date for PCB 1668A working stds. |
| Oct 2005 | IX, | 67 | Replaced incorrectly printed page with correct page. |

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 9 and have been incorporated into Revision 10. All amendments have been authorized by the QA Manager.

| Date | Section | Page | Amendment |
|---|---|---|---|
| August 2005 | Quality Policy Statement | ii | Included ensuring security of "data". |
| August 2005 | II, 3 2) | 9 | Revised approval of methods to include appropriate Managers |
| August 2005 | V, 1.3 2) | 29 | Added exception of PFC analysis, which uses polypropylene labware. |
| August 2005 | VI, 2.7 | 39 | Revised retention of samples and extracts to "1 year from invoicing" |
| August 2005 | VII, 1.1<br>VII, 2<br>VII, 2.3.2 | 41<br>43<br>47 | Revised signing of methods to include appropriate Managers<br>Added Lab Coordinator composed analysis batches.<br>Added specification for calibration and instrument performance check for LC/MS/MS. |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| | | | |
|---|---|---|---|
| August 2005 | IX, 6.0 | 66 | Revised requirement for subcontract labs to be ISO 17025 accredited where possible |
| August 2005 | Appendix A | 81 | Added "Constant RRF' to title, Internal Standard Method of Quantification |
| July 2005 | Global change | | Lab Services changed to Sample Preparation Group.<br>Technical Specialist changed to Standards Chemist.<br>Replaced "Method Specification Table" with analytical method.<br>Replaced Senior Analyst with Manager SR&D |
| July 2005 | Table 1, Table 2 | 2 | Updated Scope of Analysis. |
| July 2005 | Table 3 | 3 | Updated Instrumentation. |
| July 2005 | I, 3 | 5 | Added PBDE to CALA accredited analyses.<br>Revised table of NYSDOH/California State accredited analyses. |
| July 2005 | II, 1 6) | 7 | Included ensuring security of "data". |
| July 2005 | III | 15-22 | Revised Org. chart and text to describe recent organizational changes, including creation of Support Research and Development Group and Scientific Director positions, and new Technical Director, VP Production supervision of Project Management Group. |
| July 2005 | V<br>V, 1.1 | 27<br>29 | Included offsite warehouse facilities in description of AXYS facilities.<br>Added Instrument Chemist responsible for monitoring Instrument refrigerator. |
| July 2005 | IX, 2.3 | 63 | Added variable pipettor as acceptable volumetric glassware. |
| July 2005 | X, 7 | 77 | PCDD/F working standard have 2-year expiry date. |
| July 2005 | Appendix B | 88 | Updated Table 4 to include additional Analysis Type codes. |
| July 2005 | Appendix B, 5 | 90 | Updated Instrument Codes. |
| July 2005 | Appendix C | 98 | Revised document responsibilities. |
| May 2005 | IX, 10 | 69 | Added this section to describe monitoring practices. |
| April 2005 | II, 2, pt 2 | 7 | Added requirement for training in data security procedures. |
| April 2005 | V, 5.1 | 31 | Added requirement for visitor to wear visitor badge. |
| April 2005 | V, 5.3 | 32 | Added policies for security of data and reference to SAD028. |
| February 2005 | Global Change | | "VP Client Services" replaced with "VP Market Development and Client Services". |
| February 2005 | Global Change | | "Technical Group" replaced by Support Research and Development (SR&D) Group. Manager of the group revised from Technical Director to Manager of SR&D. |
| February 2005 | Various | | Removed all references to Standards Council of Canada as an accrediting agency for AXYS. |
| December 2004 | IV<br>IV, 2 | 23<br>26 | Included that Technical Director certifies staff have appropriate qualifications.<br>Added requirement for annual training in legal and ethical responsibilities. |
| February 2005 | VI, 1 | 35 | Added paragraph to refer to special handling procedures for agricultural and biohazardous samples. |

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 8 and have been incorporated into Revision 9. All amendments have been authorized by the QA Manager.

| Date | Section | Page | Amendment |
|---|---|---|---|
| July 2004 | Global Change | | "Chief Technical Officer" replaced with "Technical Director". |
| July 2004 | Global Change | | "QC Chemist" replaced with "Project QC Chemist". Responsibilities of QC Chemist become responsibilities of Project QC Chemist. |
| July 2004 | Global Change | | "batch sheet" replaced with "Batch List". |
| July 2004 | Global Change | | "project sheet" replaced with "Project Notes". |
| July 2004 | Responsibility, Distribution and Control | i | Included statement that QA manual is available electronically. |
| July 2004 | Amendments | iii | Frequency of Quality Manual revision changed to 'reviewed annually and revised as warranted'. |
| July 2004 | I | 2,3,4 | Tables 1, 2, and 3 updated. |
| July 2004 | I | 5 | Added EPA 1668A to NELAP accredited methods and solids to Washington State accreditation. Added '(modified)' to some accredited methods. |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| | | | |
|---|---|---|---|
| Aug 2004 | II, 2, pt 10 | 8 | Included exception for precursor data, retained 1 year |
| Aug 2004 | II, 5 | 13 | Authorization has changed to include Project QC Chemist 3 for customized procedures, Lab Manager for SOPs and methods. Deleted requirement to document departures in client file. |
| July 2004 | III | 15-23 | Revised section to reflect changes in organizational structure and staff responsibilities, including elimination of position of Chief Operating Officer, appointment of Lab Manager and of Director of Business Development, amalgamation of QC Chemists with Project Management, LIMS reporting to President. Data Packaging moved to Project Management. |
| June 2004 | III, Figure 2 | 16 | Organizational Chart revised. |
| July 2004 | III, 1.2.1 | 17 | Added procedures for documenting contract and proposal review. |
| July 2004 | IV | 25 | Responsibility for training records changed to QA Department. |
| July 2004 | V | 29,30, 31 | Frozen storage changed to <-10°C. |
| July 2004 | V, 3 | 33 | Safety manuals available to all staff, not issued to all staff. |
| June 2004 | V, 6 | 35 | Updated information re Server and computer network. |
| Aug 2004 | VI, 2.7 | 41 | Changed retention time for samples and extracts to 1 year from final reporting. Exception is precursor samples that are held for 3 months from date of receipt. |
| July 2004 | VII, 2.3.2 | 50 | Included recording HRGC//MS routine instrument maintenance on run list. |
| July 2004 | VII, 2.5 | 51 | Revised responsibility for Standards Use List and quantification methods to Coder 3. |
| July 2004 | IX, 2.1 | 64 | Deleted specific reference to Seastar Water as reagent water. |
| July 2004 | IX, 2.2 | 64 | Added requirement for proofing glassware. |
| July 2004 | IX, 2.4 | 65 | Balance is traceable to ISO 17025 standards. |
| July 2004 | IX, 2.7 | 66 | Responsibility for Equipment List revised to Lab Manager. |
| June 2004 | X, 6 | 77 | Removed reference to Lab 7 being air-conditioned. Removed reference to "during work hours" for accessibility to standards. |
| June 2004 | X, 6.1 | 77 | Removed "The container of CRM currently in use is kept in the laboratory." |
| June 2004 | X, 6.1, 6.2 | 77 | Replaced "the Purchaser" with "a chemist in the Technical Group". |
| Aug 2004 | Appendix B, 2 Pt 8 | 89 | Revised definition of K, to included addition of a labelled standard, after dilution, usually accompanied by 'N'<br>Deleted Reference to 'Y' code, no longer used by technical group. |
| July 2004 | Appendix B, Table 4 | 90 | Deleted column with matrix codes, as they are no longer used in naming. Deleted several analysis codes, CA, CG, CJ, CV, MR, PN, TZ, VO and added some new codes, ST, FP, BCDX. Deleted LIN code from STD codes. Revised some QC sample codes. |
| Aug 2004 | Appendix B, 5 | 92 | Updated Instrument codes |
| July 2004 | Appendix B, 8 | 94 | Revised naming of Instrument methods to current system, deleted outdated system. |
| Aug 2004 | Appendix B, 9 | 95 | Updated table with colour codes for labels |
| June 2004 | Appendix C, Table 5 | 100 | Added MLC (Lab Contract) category. Updated responsibility for documents |
| Aug 2004 | Appendix C, 2.2 | 102 | Deleted Table 6 with outdated format for instrument methods. Revised the section to describe new format. |
| Aug 2004 | Appendix C, 4.2 | 105 | Included Project Manager as signatory on methods |
| Aug 2004 | Appendix D | 109 | Minor corrections to definitions, including valley height, where taller was revised to shorter. |
| Aug 2004 | Appendix G | 131 | Updated floor plans. |

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 7. The QA Manager has authorized all amendments.

| Date | Section | Page | Amendment |
|---|---|---|---|
| Oct-2002 | Cover Page | | "Approved By" and "Date" added to cover page. |
| Oct-2002 | Title Page | | Page removed - information now incorporated on Cover. |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

| | | | |
|---|---|---|---|
| Apr-2003<br>Jun-2003 | Preliminary Statements | Pg i<br>Pg iii | Included President and Technical Director as signers of manual.<br>Deleted mission statement. |
| Oct 2002 | Preliminary Statements | Pg ii | C. Hamilton's title change to "Technical Director". |
| May-2003 | Preliminary Statements | Pg iv | Revised amendment procedures, manual issued semi-annually. Deleted table with amendments. |
| Apr-2003 | Global | | Revised QA Checker to Project QC Chemist |
| May-2003 | Global | | Responsibilities of VP Extraction Lab assumed by Technical Director<br>Position of Chief Analyst introduced |
| Apr-2003 | I, 2 | Pg 2 | Revised hours of operation |
| May-2003 | I, 2 | Pg 3,4 | Revised Scopes, moving MDT, non 2,3,7,8 PCDD/F to Specialty Analyses |
| Apr-2003 | I,3 | Pg 6 | Deleted Pesticides as part of Wash. accreditation |
| Apr-2003<br>May-2003 | II, 2 | Pg 2<br><br>Pg 3 | Point 5, included uncertainty estimates<br>Point 9, included Hamilton syringes<br>Changed length of time paper records kept to 5 years |
| Apr-2003<br>July- 2003 | II, 3 | Pg 4 | Revised individuals signing methods, SOPs, Quality Manual<br>Deleted names of those issued manuals. Included reference to distribution lists. |
| Oct-2002 | II, 4 | Pg 7 | Only copies issued internally are controlled by recording number, date of issue, name of department and contact person.<br>Copies issued externally are not controlled and not updated, but a record is kept of contact name, company name and date of issue. |
| Nov-2002 | II, 4.1 | Pg 8 | Title of SQA-005 changed to read "Creation of New Documents". |
| July-2003<br>April 2003<br>July-2003 | III | Pg 1 | President changed to John Cosgrove.<br>Deleted Purchaser reporting to President.<br>Changed substitute for Client Services Manager |
| Apr-2003 | III Figure 2 | Pg 2 | Revised Org. Chart to reflect organizational changes. |
| May-2003 | III, 1.2.2 | Pg 3 | Revised Project Management section to include both Managers and PCs |
| May-2003 | III, 1.2.3 | Pg 4 | Tracking meetings held with Technical Director |
| May-2003 | III, 2 | Pg 5 | Revised supervision of Ext'n Lab to Technical Director. Revised substitutes in case of absence. |
| Nov-2002 | III, 2.4 | Pg 6 | Revised to include Chief Analyst as supervisor<br>Added "The Chief Analyst is assisted by the Technical Specialist and Lab Chemists". |
| May-2003 | III, 3<br>III, 3.2 | Pg 7 | Substitute for VP Prod'n changed to Instrument Supervisor<br>Deleted Data Interpretation Manager. |
| Apr-2003 | III, 3.4 | Pg 8 | Changed title of QA Checker to QA/Project QC Chemist |
| Apr-2003 | III, 4 | Pg 9 | Moved Purchasing/Shipping to be under supervision of COO |
| Apr-2003 | III, 6 | Pg 10 | Revised Assigned Responsibilities |
| Apr-2003 | IV | Pg 1 | Described more fully the training records kept by QA.<br>Included reference to both safety manuals. |
| Apr-2003 | IV, 1.2 | Pg 3 | Specified which analysts prove competency |
| Oct-2002 | V | Pg 1 | Deleted reference to distilling apparatus<br>Change capacity of walk-in coolers to 1,500 cubic feet.<br>Change capacity of walk-in freezers to 5,000 cubic feet. |
| Apr-2003 | V, 1.1 | Pg 2 | Person monitoring cold storage revised to Lab Technician |

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

| | | | |
|---|---|---|---|
| | | | Under section Walk-in Freezers and Coolers, added "The freezer and cooler temperatures are also monitored daily by the Lab Technician." |
| July-2003 | V, | Pg 3 | Added Facilities Maintenance section |
| July-2003 | V, I.3, Pt 6 | Pg 4 | Revised to allow pesticides or herbicides with permission |
| May-2003 | V, 1.2 | Pg 5 | Revised requirement for electrical breakers for instruments |
| May-2003 | V, 3 | Pg 6 | Specified distribution of safety manuals and included references. |
| Apr-2003<br>May-2003 | V, 5,2 | Pg 7 | Pt #2 Added Accounting Dept maintains list of key holders.<br>Pt #3 Sample Receiving Chemist responsible for sample storage/retrieval<br>Pt #4 Revised to include storage of extract in Instrument lab |
| Oct-2002 | VI 2.2 | Pg 3 | Delete Shipper/Receiver as collecting the shipping and chain-of-custody documents, etc. |
| Apr-2003 | VI, 2.5 | Pg 4 | Added sample preservation to this section.<br>Changed responsibility for storage of samples to Sample Receiving Chemist |
| May-2003 | VII, 1 | Pg 1 | Added Chief Analyst to those issued methods. |
| Nov-2002 | VII, 1.1 | Pg 1 | Change title of SQA-005 to "Creation of New Documents".<br>Change title of SQA-006 to "Revision of Documents". |
| Apr-2003 | VII, 1.1 | Pg 1 | Added VP Ext'n Lab and VP Prod'n as signatories to methods |
| Apr-2003 | VII, 1.3 | Pg 2 | Added this section on Measurement Uncertainty |
| Oct-2002 | VII, 1.4 | Pg 2 | "Technical Director" added for permission to reproduce methods. |
| Apr-2003 | VII, 2.2 | Pg 4 | Deleted surrogate for sol'ns that are verified, all sol'ns are verified |
| May-2003 | VII, 2.3.2 | Pg 8 | Added routine maintenance for ECDs, FIDs, and LC/MS |
| Apr-2003 | VII, 2.4 | Pg 9 | Deleted Mass resolution as item checked by coders<br>Added requirement for additional work documented in LIMS |
| Apr-2003 | VII, 2.5 | Pg 10 | Added cal'n routine made and checked by 2nd person |
| Oct-2002 | VII, 2.6 | Pg 11 | Delete "samples" from "every batch consists of…."<br>Added non-conformances documented in narrative |
| Oct-2002 | VII, 2.8 | Pg 15 | Added "Records falling under NELAP requirements are retained for a minimum of five years. Client records are retained indefinitely. In the event of a<br>Transfer of ownership or if the company ceases business, AXYS would contact clients regarding their records." |
| Apr-2003 | VIII, 1.1, 1.2, 1.3 | Pg1-2 | Added frequency of analysis of Blanks, Duplicates and Ref Samples |
| Apr-2003 | VIII, 1.2 | Pg 1 | Deleted reference to correcting for blank conc., added flagging data |
| Apr-2003 | VIII, 2 | Pg 5 | Changed bi-monthly to 60 days, added LC/MS/MS |
| Apr-2003 | IX,1 | Pg 1 | Deleted reference to VP's list of approved suppliers<br>Added QA Manager as allowing substitutions of goods and services |
| Apr-2003 | IX, 2.1 | Pg 2 | Deleted Distilled water and reference to extracted water |
| Apr-2003 | IX, 2.2 | Pg 3 | Included reference to bottles with cleanliness certificate |
| July-2003 | IX, 2.3<br>IX, 2.4 | Pg 3 | Deleted use of Class B glassware for use in analyses<br>Revised Balance checks section |
| May-2003 | IX, | Pg 4 | Added Thermometer Checks as Section 2.5 |
| Apr-2003 | IX, | Pg 5 | Added this section (2.8) to describe procedures for equipment Not in Service |
| May-2003 | IX,4.1 | Pg 7 | Revised, deleted section 4.1.2 |
| May-2003 | X,1.4.2 | Pg 2 | Included Rec. Std. Used to monitor instrument response |

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| | | | |
|---|---|---|---|
| May-2003 | X | Pg 1 | Added Chief Analyst as supervisor of Standards Prep. |
| May-2003 | X, 4 | Pg 4 | Added Data Sheets available electronically. |
| Oct-2002 | Appendix A | Pg 2,3 | First three paragraphs revised extensively.<br>Deleted "daily runs" replace with "analysis"<br>Revised minimum detectable area to include multiple of 2.5 or 3. |
| May-2003 | Appendix B, A | Pg 2 | Added more specific details to naming of standard sol'ns |
| Nov-2002<br>Apr-2003 | Appendix B, Table 4 | Pg 4 | Added "PFOS Polyfluorooctylsurfactants"<br>Added C, P, M, and Y codes |
| July-2003 | Appendix B | Pg 10 | Added section I. Microvial Label Codes |
| May-2003 | Appendix C, Table 5 | Pg 3 | Replaced VP Lab with Technical Director |
| Oct-2002 | Appendix C, 2.1 | Pg 4, 5 | Added Optional Analyses, Interferences, Method Performance, Pollution and Waste Management, Appendices to method format |
| May-2003 | Appendix C, 3 | Pg 6 | Added additional sections to be included in SOP |
| May –2003 | Appendix C, Table 6 | Pg 7 | Revised format of instrumental methods |
| May-2003 | Appendix C, 4 | Pg 10<br><br><br><br>Pg 11 | Revised this section, eliminating description of Axys style report, this is now specified by client. EPA style report section becomes standard report format.<br>Table 7, deleted Axys Style report column, updated items included in reports. |
| May-2003 | Appendix C, 4.3 | Pg 11 | Deleted initialling of EPA style report by QA/Project QC Chemist |
| May-2003 | Appendix C, 4.6 | Pg 12 | Increased by 1 the # of. sig figs on % moisture, % lipid<br>Deleted req'ment to round surr. Rec.>100% to nearest 10%<br>Sig Figs is max 3 for conc. and SDL – may be less if deemed by checker |
| May-2003 | Appendix E, 2,1 | Pg 1<br>Pg 3<br><br>Pg 4<br>Pg 6 | Analyte table, specified for QPUSquan only<br>Continuing Cal, specified "at least" very 12 hrs.<br>Holding time, revised to include sample and sample extract.<br>Matrix Spike, added used for measurement of bias.<br>Valley height, added height of "taller" peak |
| Nov-2002<br>May-2003 | Appendix E, 2. | Pg 6<br>Pg 7 | Add "LR Low Resolution"<br>Added PFOS |

The following amendments have been made to the QA/QC Policies and Procedures Manual Rev. 6. All amendments have been authorized by the QA Manager.

| Date | Section | Amendment |
|---|---|---|
| Sep-2002 | Global Changes made throughout the manual. | VP Sales changed to VP Client Services/Technical Director.<br>Technical Director replaced by Technical Director.<br>VP QA/QC changed to VP Quality Assurance.<br>Project QC Chemist changed to Project Manager.<br>Assistant Project QC Chemist changed to Sample Receiving Chemist.<br>Environmental Analytical Chemist changed to Lab Chemist.<br>Instrumental Analytical Chemist changed to Instrument Chemist.<br>Data Interpretation Chemist changed to Coder.<br>Project QC Chemist changed to QA Checker.<br>Data Reporter changed to Reporter.<br>Purchasing and Receiving Clerk replaced with Purchaser and |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| | | | |
|---|---|---|---|
| | | | Shipper/Receiver.<br>Supervisor changed to Manager.<br>SOP numbers replaced with Q-Pulse numbers.<br>AXYS Analytical Methods Manual changed to AXYS Methods Manual. |
| Sep-2002 | I, 2 | Pg 2 | Number of employees changed to 125. |
| Sep-2002 | I ,2 Table 1 | Pg 3 | Deleted EPA Methods 8270C and 8082A. |
| Sep-2002 | I, 2 Table 2 | Pg 4 | Added EPA Methods 8270C and 8082A. |
| Sep-2002 | I, 2 Table 3 | Pg 5 | Revised to included new instrumentation. |
| Sep-2002 | I, 3 | Pg 6 | Deleted CALA accreditation for DBD, DBF.<br>Added accreditation with Washington State Dept of Ecology. |
| Sep-2002 | II, 2 8)<br><br><br>10) | Pg 2 | Changed to "Accuracy of balance is verified".<br>Replaced NIST Class S weights with "weights traceable to nationally recognized standards".<br>Added that electronic records kept 10 years. |
| Sep-2002 | II, 3 2)<br><br><br>3) | Pg 3 | Replaced authorized with "approved by QA Manager, Chief Operations Manager, Technical Director, VP Extraction Lab and VP Production".<br>Replace authorized with "approved and signed by QA Manager, COO or VP of the work area".<br>Deleted designate for signing SOPs, methods.<br>Added that additional copies of manuals available to staff. |
| Sep-2002 | II, 4 | Pg 5 | Added description of Q-Pulse for managing documentation.<br>Changed responsibility distribution and collection of documentation to Documentation Chemist. |
| Sep-2002 | II, 4.1 | Pg 6 | Deleted QA Manager responsible for quality documentation; added responsibility for ensuring an effective overall system. |
| Sep-2002 | II, 5 | Pg 7 | Deleted point about modifications to methods and incorporated departures from methods in with departures from SOPs.<br>Added Project Manager as approver of non-conforming data<br>Deleted reference to documenting non-conformance on Batch List.<br>Added requirement for date on approval of all departures. |
| Sep-2002 | III | Pg 1-9<br><br><br>Pg 2 | Section revised to describe changes in organizational structure including new position and responsibilities of COO and Technical Specialist.<br>Revised organizational chart. |
| Sep-2002 | IV | Pg 1 | Deleted reference to responsibility for job descriptions. |
| Sep-2002 | IV | Pg 2 | Changed "Ethical Conduct" to "Ethical and Legal. Responsibilities". |
| Sep-2002 | IV, 4 | Pg 3 | Deleted reference to QA testing by QA Manager. |
| Sep-2002 | V | Pg 1-2 | Section revised to describe new use of physical space. |
| Sep-2002 | V, 1.1 | Pg22<br>Pg 4 | Added air sampling media to samples stored frozen.<br>Combined freezer and cooler sections.<br>Deleted chest freezers as sample storage. |
| Sep-2002 | V, 1.2 | Pg 5 | Added the exclusion of foam-padded chairs from labs. |
| Sep-2002 | V, 5 | Pg78 | Identified West building as having an unlocked door during office hours. |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| | | | |
|---|---|---|---|
| Sep-2002 | VI, 1 | Pg 1 | Revised person responsible for instructions to client to Client Services group under direction of Project Manager. |
| Sep-2002 | VI, 2.2 | Pg 3 | Included Shipper/Receiver as one who signs for samples. |
| Sep-2002 | VI, 2.3 | Pg 4 | Added use of backup label where necessary. |
| Sep-2002 | VII, 1 | Pg 1 | Revised AXYS Methods Manual to have only current methods.<br>Deleted reference to 5 sections of manual. |
| Sep-2002 | VII, 1.1 | Pg 2 | Added QA Manager as method approver and signer. |
| Sep-2002 | VII, 1.2 | Pg 2 | Deleted reference to validation of custom methods. |
| Sep-2002 | VII, 1.3 | Pg 3 | Revised responsibility for ensuring current document in use to Manager and individual analysts. |
| Sep-2002 | VII, 1.4 | Pg 3 | Deleted reference to matrix specific method number and included document number as the method number. |
| Sep-2002 | VII, 2 | Pg 5 | Added section 2.1 Sample Preparation. |
| Sep-2002 | VII, 2.1 | Pg 6<br>Pg 7 | Figure 3 Deleted HPLC, GC/FID from Inst. Analysis<br>Deleted Lab Supervisor as having authority to approve method deviations.<br>Added verification of addition of surrogate std.<br>Deleted reference to notebooks maintained by analysts. |
| Sep-2002 | VII, 2.2.1 | Pg 8 | Added EPA requirement for tuning, calibration every 12 hours. |
| Sep-2002 | VII, 2.5 | Pg 12 | Added QA Checkers responsible for documenting method and QA specification deviations in LIMS and on data report. |
| Sep-2002 | VII, 2.7 | Pg 16 | Added sample receipt records to list of records kept. |
| Sep-2002 | VIII, 1.3 | Pg 2 | Specified use of CRMs for method validation. |
| Sep-2002 | VIII, 2 | Pg 4 | Revised Inst. Linearity verification to bimonthly. |
| Sep-2002 | IX, 2.4 | Pg 3 | Revised to describe use of weights traceable to national standards to verify accuracy of balances. |
| Sep-2002 | IX, 4 | Pg 5 | Deleted section on control charts. |
| Sep-2002 | IX, 7.1 | Pg 8-9 | Deleted use of Client Complaint form and added use of Q-Pulse Complaint module. |
| Sep-2002 | X | Pg 1-8 | Responsibility for standards changed to Technical Specialist. |
| Sep-2002 | X, 7 | Pg 8 | Revised expiry date policy for standard solutions. |
| Sep-2002 | Appendix B, B(a) | Pg B-2 | Deleted description of AXYS ID prior to 1998. |
| Sep-2002 | Appendix B, Table 4 | Pg B-4 | Revised Table 4- deleted additional worksheet odes, revised codes for sample storage. |
| Sep-2002 | Appendix B, E | Pg B-6 | Revised instrument codes to include new instruments. |
| Sep-2002 | Appendix B, G | Pg B-7-9 | Described revised system for numbering methods and naming custom methods. |
| Sep-2002 | Appendix C, 1 | Pg C-2-5 | Revised document naming system to conform to Q-Pulse naming. |
| Sep-2002 | Appendix C, 2 | Pg C-5-6 | Revised to deleted matrix specific method numbers.<br>Revised format of methods. |
| Sep-2002 | Appendix C, 3 | Pg C-7-8 | Revised to describe Q-Pulse numbers for SOPs. |
| Sep-2002 | Appendix E | Pg D-2<br>Pg D-3 | Added “Bias” to glossary.<br>Added “CRQL” to glossary.<br>Added “Internal Standard” to glossary. |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

| | | |
|---|---|---|
| Sep-2002 | Appendix F | Revised to include distinction between surrogate and recovery standards. |
| Sep-2002 | Appendix G F-1-5 | Replaced floor plans with up-to-date plans. |

The following amendments were made to the QA/QC Policies and Procedures Manual Rev. 5. All amendments were authorized by the QA Manager.

| Date | Section | Amendment |
|---|---|---|
| Aug 12/99 | II, 2 pg 8 | QA Manager changed to QA Manager. |
| " | II, 3. 2) pg 10 | Methods Approval Chemist changed to Senior Chemist or designate. |
| " | II, 3. 3) pg 10 | Added "or designate". |
| " | II, 4 pg 13 | QA/QC Document Control Chemist changed to QA/Project QC Chemist. |
| " | III pg 16 | Organizational Chart revised to reflect current job titles. |
| " | III pg 15-19, 23 | Job titles changed to be consistent with those in Organizational Chart. |
| " | IV pg 24, 30, 33 | Job titles changed to be consistent with those in Organizational Chart. |
| " | V pg 35-37 | Job titles changed to be consistent with those in Organizational Chart. |
| " | V, 3. pg 39 | Updated Chain-of-Custody Procedures. |
| " | VI pg 40, 42, 43, 45, 46, 49, 50 | Job titles changed to be consistent with Organizational Chart. |
| " | VI, 2.6 pg 51 | Clarified policy of preliminary data requiring authorization. |
| " | VIII, 6 pg 64 | Updated Subcontracting Procedures. |
| " | VIII pg 54, 63 | Job titles changed to be consistent with Organizational Chart. |
| " | IX pg 67, 71-73 | Job titles changed to be consistent with Organizational Chart. |
| " | Appendix B, B, 4 B-3 | "X" becomes "RX". |
| " | Appendix B, H, 3(ii) B-9 | Job titles changed to be consistent with Organizational Chart. |
| " | Appendix C, C-2, C-5, C-6 | Job titles changed to be consistent with Organizational Chart. |
| Sept 23/99 | III pg 16 | Organizational Chart revised to add new Group Leaders |
| " | III pg 17 | Added new Group Leaders |
| " | III pg 23 | Assigned Responsibilities revised to add new Group Leaders |
| May 15/00 | III pg 16 | Revised Organization Chart |
| May 15/00 | IV pg 23 | Revised Assigned Responsibilities |
| May 15/00 | I pg 5 | Updated Instrumentation Table |
| May 15/00 | Appendix B pg B-6 | Updated Instrument Codes |
| Sep 26/00 | I. 3. pg 6/6a | Added table of NYSDOH accredited methods and statement that policies and procedures are in accordance with NELAC standards. |
| Sep 26/00 | II. 2. 2) pg. 8 | Added training in methods and ethical and legal responsibilities. Added training records are maintained. |
| | pg. 6a | Deleted IAETL membership added CCIL membership |
| Sep 26/00 | VI. 2.6 pg. 51 | Reference to Transmission of Data SOP. |

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| Date | Section | | Amendment |
|---|---|---|---|
| | | | Added title to person signing data. Added requirement for NYSDOH certificate number on NYSDOH reports |
| Sep 26/00 | VIII. 7. | pg. 65 | Added "Corrective Actions" section. |
| Sep 26/00 | VIII 9. (new) | pg. 66 | Added "Proper Record Keeping" section. |
| Oct 30/00 | Appendix C. 4.1 | C-10 | Added Receipt, Analysis data, date of sample receipt. |
| Oct 30/00 | Appendix C 4.3 | C-10 | Added requirement for title with signature. |
| Nov 6/00 | III. 6.1 | pg. 21 | Added personnel are trained in ethical and legal responsibilities. |
| Nov 6/00 | III. 6.4 (new) | pg. 22/22a | Added Ethical and Legal Responsibilities section. |
| Nov 6/00 | V. 1. | pg. 35 | Added Receiving Clerk informed of shipment of samples. |
| Nov 6/00 | V. 2.1 (new) | pg. 36 | Added Sample Acceptance Policy. |
| Nov 6/00 | V. 2.2. | pg. 36a | Deleted reference to log-in sheet. Added verifying sample acceptance criteria. |
| Nov 6/00 | V. 2.3. | pg. 36b | Deleted reference to log-in sheet. |
| Dec 29/00 | III. 6.1 | pg. 21 | Deleted reference to conflict of interest. Added Ethical Conduct Statement. Added reference to QA-QC-16. |
| 09-Apr-01 | Appendix E | | Added Appendix E with Glossary of Definitions. |
| 09-Apr-01 | III | pg. 15-20 | Revised to describe new organizational structure. |
| 09-Apr-01 | III | pg 23 | Revised Assigned Responsibilities. |
| 09-Apr-01 | III | pg. 16 | Revised Organization Chart. |
| 11-Apr-01 | I | pg. 1 | Revised reference to AXYS Group. |
| 11-Apr-01 | II | pg. 2 | Deleted organizational chart of AXYS Group. |
| 02-May-01 | II. 5. | pg. 14 | Revised authority for approval. |
| 03-May-01 | III | pg 16 | Revised Organization Chart |
| 07-May-01 | III. 2.3 III, 9.4 | pg 18 | Deleted word Laboratory. Amended Ethical & Legal Responsibilities in accordance with QA/38 Rev 03. |
| 23-May-01 | II. 5 | pg 14 | Deleted Vice President |
| Sep-01 | Global changes | | QA/QC Manager changed to QA Manager.<br>Senior Chemist changed to Technical Director.<br>Sample and Laboratory Preparation Chemist changed to Environmental Analytical Chemist.<br>Laboratory Supervisor changed to VP Extraction Lab. |
| Sep-01 | Management Endorsement | pg i | Replaced with Quality Policy Statement. |
| Sep-01 | Responsibility, Distribution and Control | pg ii | Deleted numbered copy of QA manual issued to staff – replaced by QA manual available to all staff. |
| Sep-01 | Amendment pages iii-iv | | All amendments of QA manual, Rev 5 moved to Appendix F. |
| Sep-01 | I | pg 2-4 | Revised Scope of Analyses.<br>Revised Table 2 – Instrumentation. |
| Sep-01 | I, 3 | pg 6 | Revised to include accreditation by State of California, Dept. of Health Services.<br>Deleted reference to CCIL membership. |
| Sep-01 | II, 2, 1) | pg 8 | Revised distribution of QA manual. |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

| Date | Section | | Amendment |
|---|---|---|---|
| Sep-01 | II, 2, 2) | pg 8 | Deleted testing of staff. |
| Sep-01 | II, 3 | pg 10 | Revised distribution of QA manual. |
| Sep-01 | II, 3.1 | pg 12 | Moved to Section 4. |
| Sep-01 | II, 4 | pg 13 | Deleted reference to forms, replaced with documents.<br>Deleted reference to distribution of numbered copies of QA manual to staff. |
| Sep-01 | III | pg 15-19 | Rewritten to reflect new organizational structure, including revising organizational chart. |
| Sep-01 | III | pg 20 | VPs Products/Extraction Lab responsible for tracking. |
| Sep-01 | III | pg 20-22a | Put into new chapter. |
| Sep-01 | IV | pg 24-27 | Revised to include new lab, revised floor plans moved to Appendix G. |
| Sep-01 | IV, 1.1 | pg 29 | Responsibility for monitoring temp. of sample storage changed to Lab Services Group.<br>Specifications for sample storage revised. |
| Sep-01 | IV, 3 | pg 32 | Revised Safety Committee meetings to monthly – only Analytical staff on committee. |
| Sep-01 | IV, 5.1 | pg 33 | Deleted point 4. Expanded Point 1. Point 3, deleted whenever staff member is not present. |
| Sep-01 | IV, 6 | pg 34 | Revised description of computing facilities. |
| Sep-01 | IV, 7 | pg 34 | Deleted this section. |
| Sep-01 | V, 1 | pg 35 | Changed responsibility for sample receipt to Assistant Project QC Chemist. |
| Sep-01 | V, 3 | pg 39 | Changed responsibility for sample receipt to Assistant Project QC Chemist. |
| Sep-01 | VI, 1.1 | pg 41 | Added Method revisions approved by Technical Director and QA Manager. |
| Sep-01 | VI, 1.6 | pg 43 | Revised method inventory available to all staff. |
| Sep-01 | VI, 2 | pg 43 | Changed responsibility for sample receipt to Assistant Project QC Chemist<br>Deleted Group Leader. |
| Sep-01 | VI, Fig 7 | pg 44 | Added Report Preparation. |
| Sep-01 | VI, 2.1 | pg 45 | Deviations permitted by Project QC Chemist. |
| Sep-01 | VI, 2.3 | pg 47 | Deleted "instructions in AXYS Analytical Methods Manual". |
| Sep-01 | VI, 2.3, 2.4 | pg 48, 49 | Deleted reference to hand-coded data. |
| Sep-01 | VI, 2.4 | pg 49 | Responsibility of calculation routines changed to VP Production. |
| Sep-01 | VI, 2.5 | pg 50 | Changed number of samples in batch to 20. |
| Sep-01 | VI, 2.6 | pg 51 | Responsibility for reporting changed to Data Management.<br>Deleted Vice President as authorized to sign data reports, added President. |
| Sep-01 | VI, 2.7 | pg 52 | Added sample prep records, LIMS COC as records that are kept. Deleted QA/QC summary form. |
| Sep-01 | VII, 1 | pg 53 | Deleted "2 QC samples with every batch". |
| Sep-01 | VIII, 2.1 | pg 59 | Added reagent water. |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

| Date | Section | | Amendment |
|---|---|---|---|
| Sep-01 | VIII, 2.6 | pg 61 | Changed responsibility for equipment inventory to Documentation Chemist. |
| Sep-01 | VIII, 5.1 | pg 62 | Revised management review. |
| Sep-01 | VIII, 5.2 | pg 63 | Revised Quality System Review. |
| Sep-01 | VIII, 5.3 | pg 63 | Deleted this section. |
| Sep-01 | VIII, External Audits | pg 63 | Deleted external audit as annual audit. |
| Sep-01 | VIII, Performance Audits | pg 63 | Deleted reference to blind replicates. |
| Sep-01 | VIII, 6 | pg 64 | Deleted Purchasing and Receiving Clerk log-in of samples. |
| Sep-01 | VIII, 9.4 | pg 66 | Deleted Vice-President as authorizing data, replaced with President. |
| Sep-01 | IX, 4 | pg 91 | Deleted location of Standard Preparation Data Sheets. |
| Sep-01 | Appendix A | p A-3 | Deleted in-house software, replaced with commercially available software. |
| Sep-01 | Appendix B | p.B-2 | Deleted B.2, duplicates. |
| Sep-01 | Appendix B | p B-3 | Revised Table 3. |
| Sep-01 | Appendix B, E | p B-6 | Revised Table. |
| Sep-01 | Appendix B. F | pg B-7 | Revised naming system. |
| Sep-01 | Appendix B, G | pg B-8 | Deleted this section. |
| Sep-01 | Appendix B, H | pg B-8 | Deleted this section |
| Sep-01 | Appendix B, H, 2 | pg B-9 | Deleted this section. |
| Sep-01 | Appendix B, H, 3 | pg B-9 | Deleted point iii. |
| Sep-01 | Appendix B, I | pg B-10 | Deleted HPLC. |
| Sep-01 | Appendix C | pg C-10 – 12 | Revised to include EPA report format |

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# THIS PAGE LEFT INTENTIONALLY BLANK

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# APPENDIX F AXYS ANALYTICAL SERVICES FLOOR PLANS

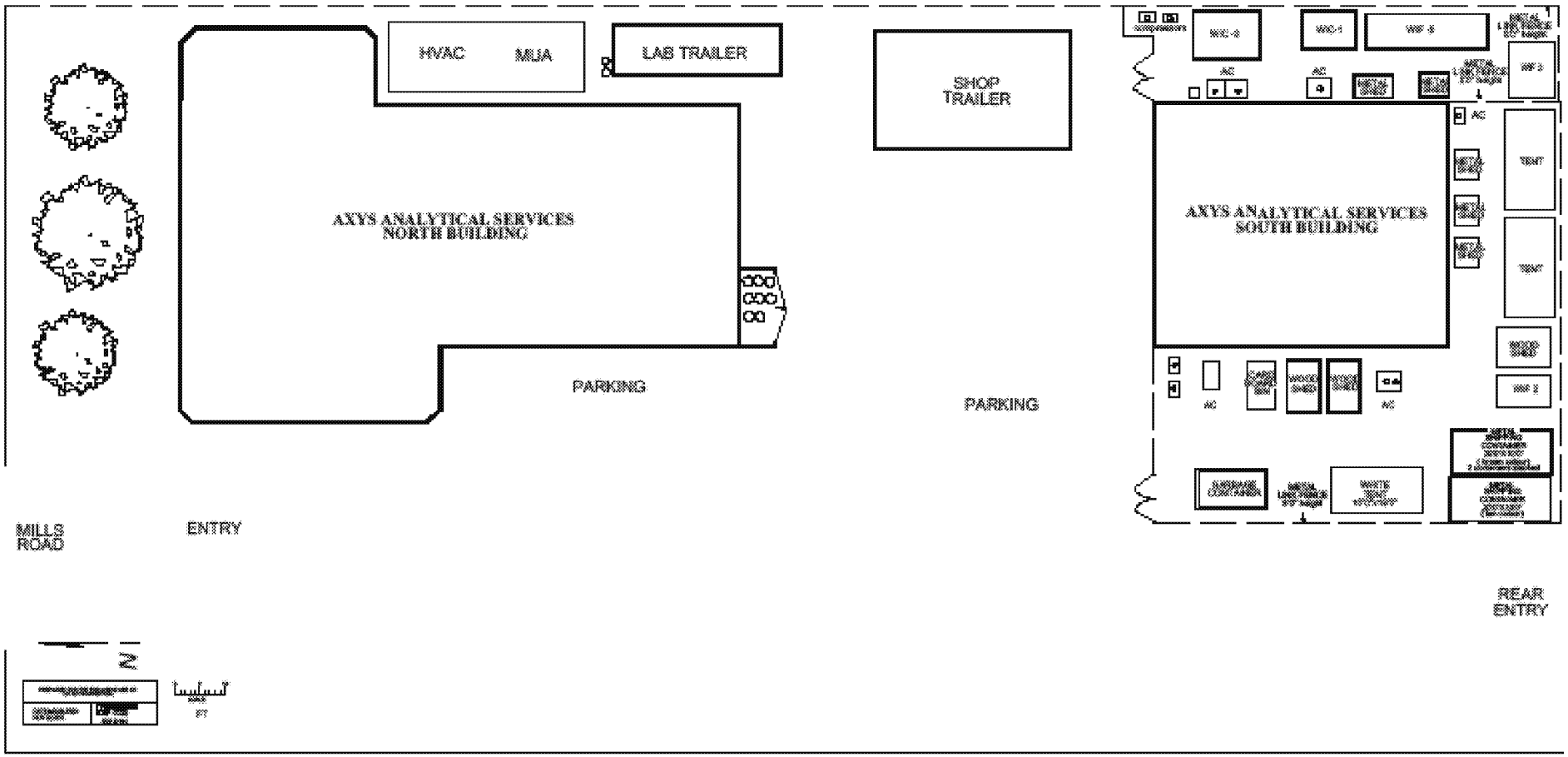
This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# THIS PAGE LEFT INTENTIONALLY BLANK

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

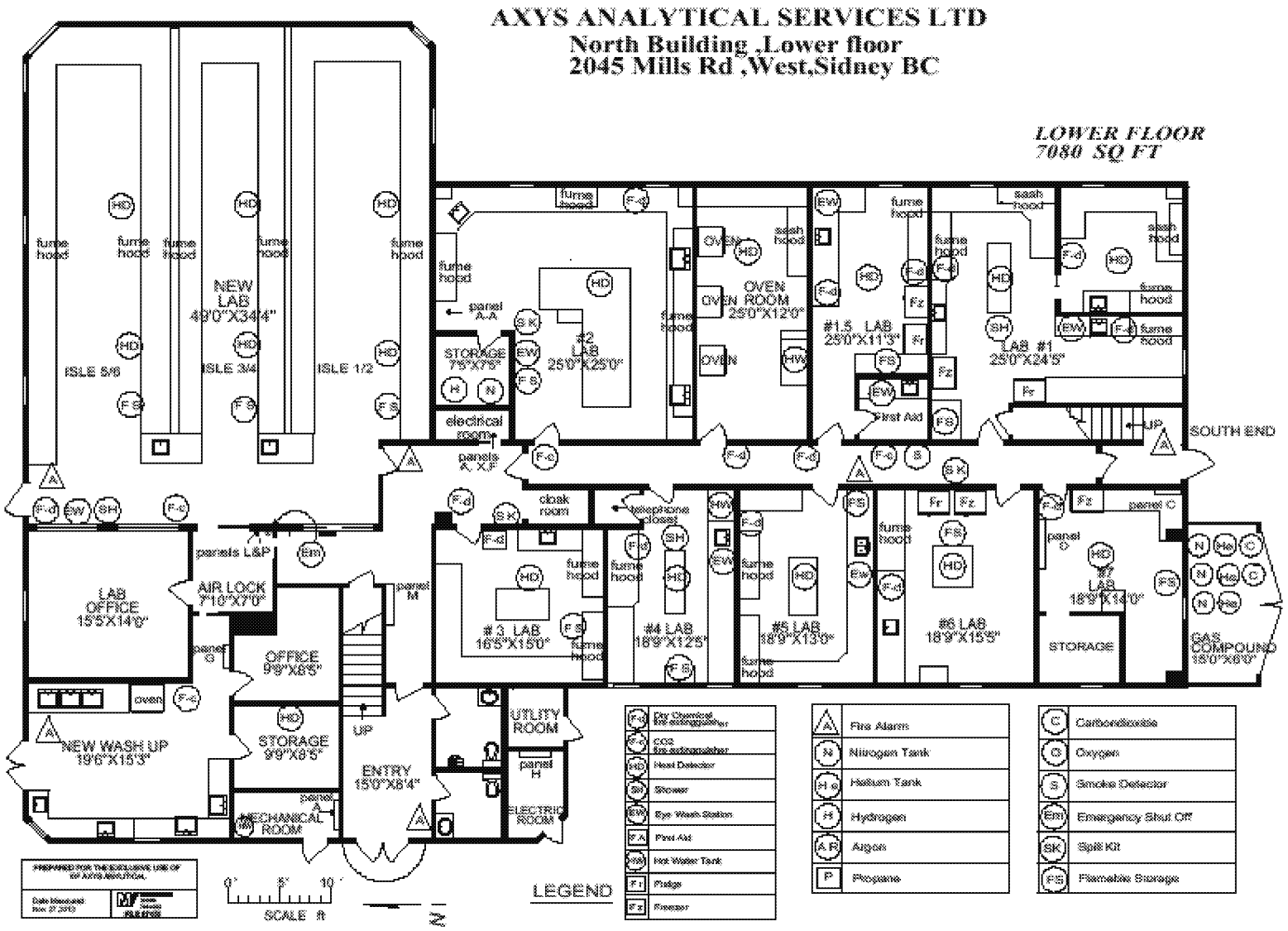
**Figure F-1 AXYS Analytical Services, Facility Footprint**




Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

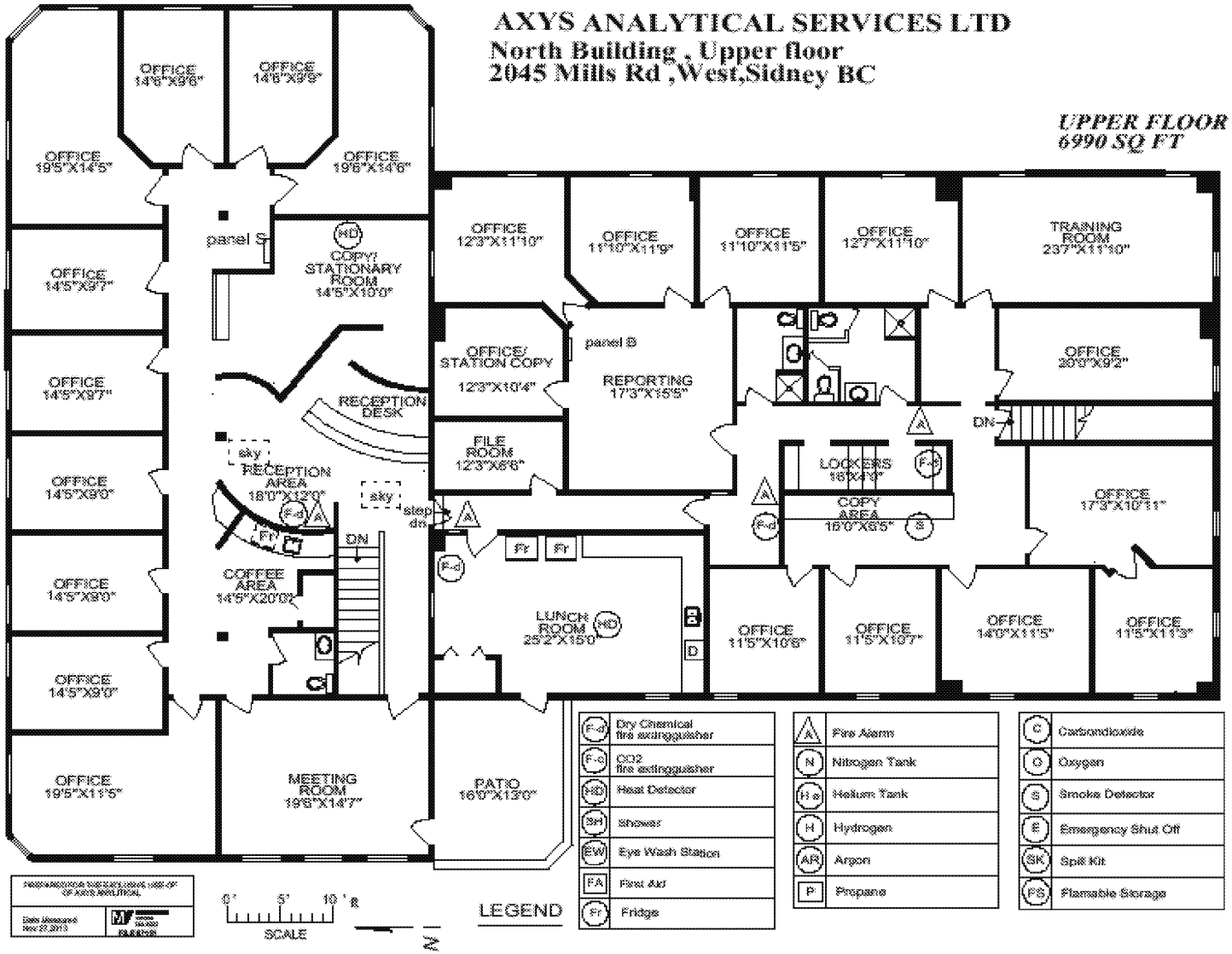
## Figure F-2 North Building, Lower Floor




Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

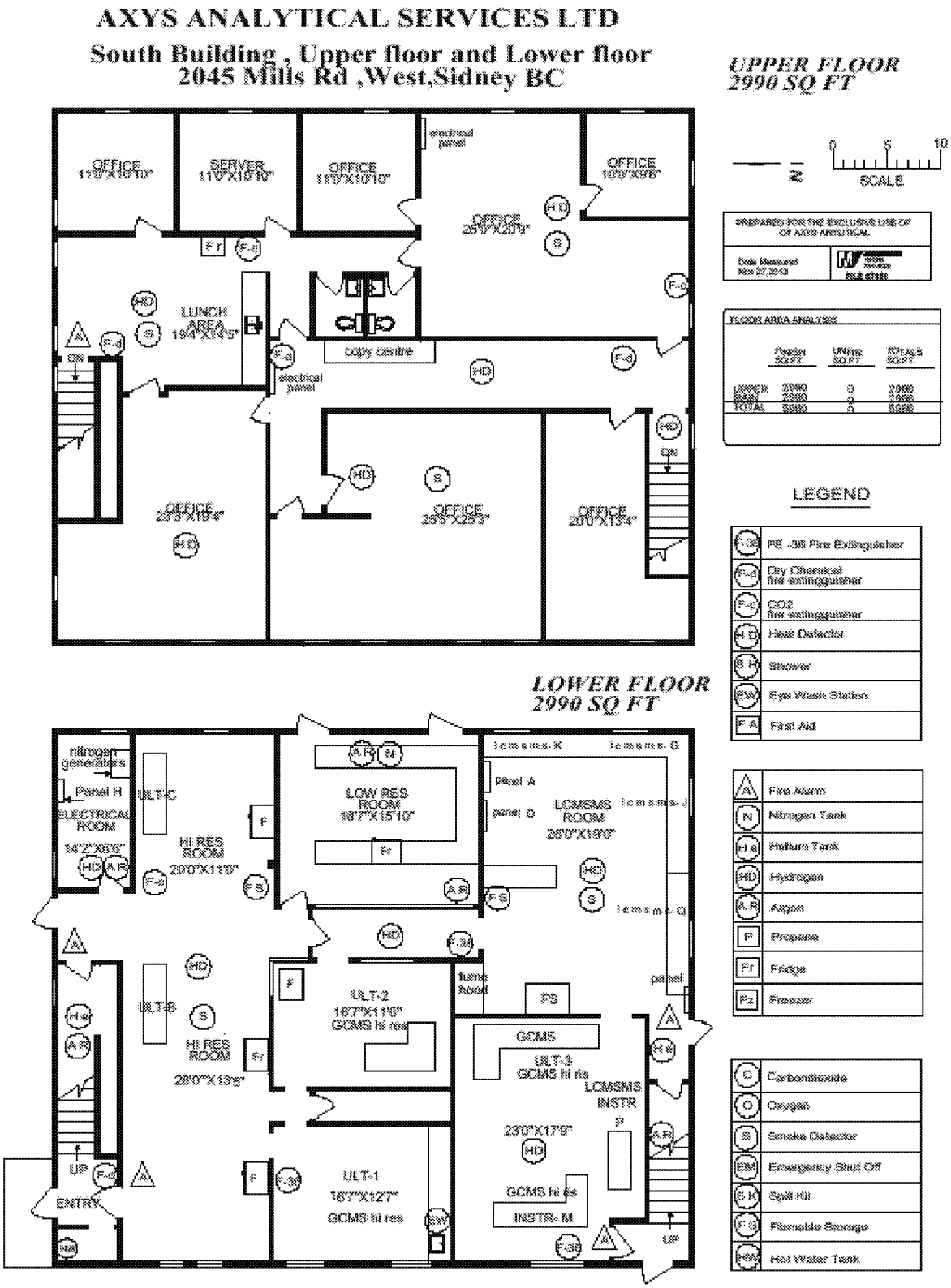
## Figure F-3 North Building, Upper Floor




Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

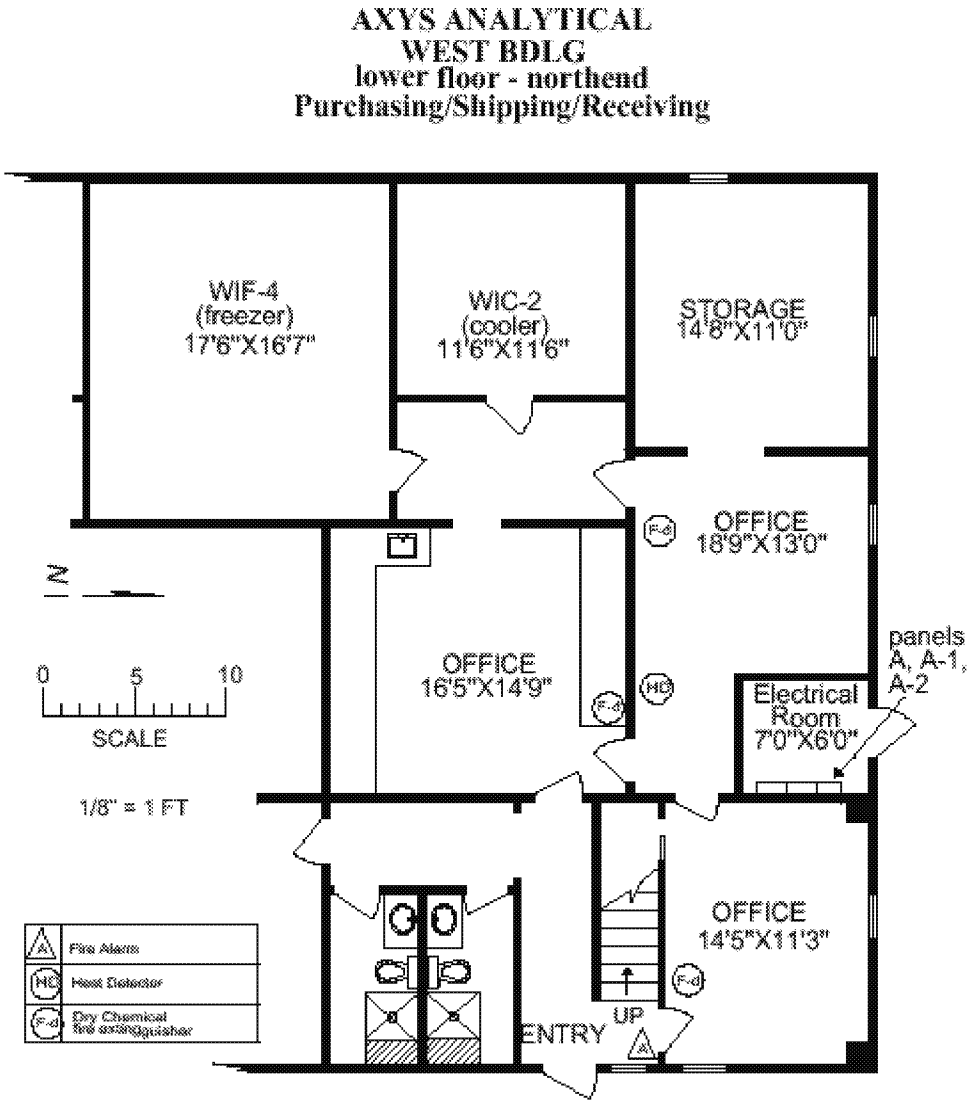
## Figure F-4 South Building, Both Floors




Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

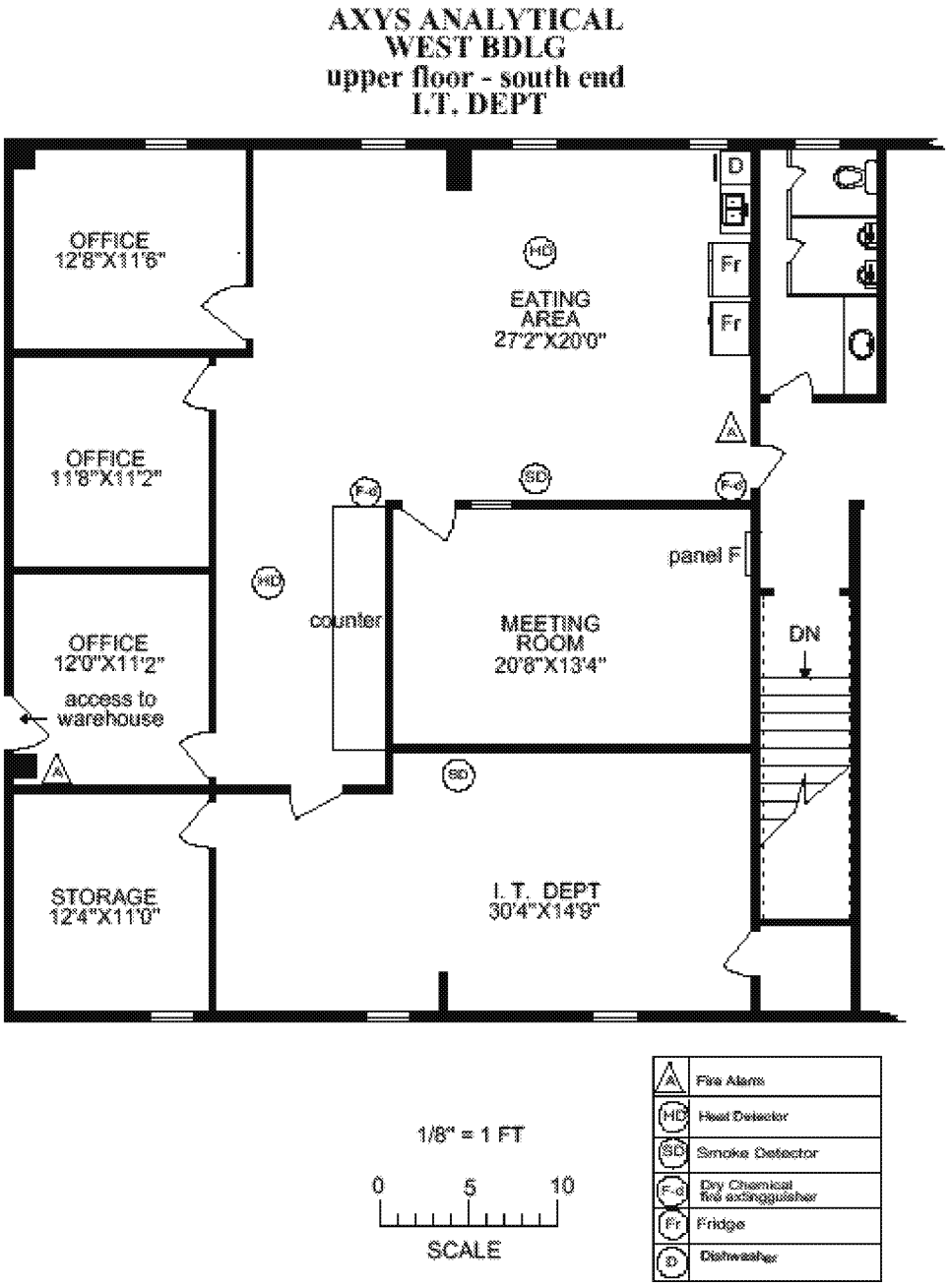
## Figure F-5 West Building, Lower Floor




Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

## Figure F-6 West Building, Upper Floor




Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

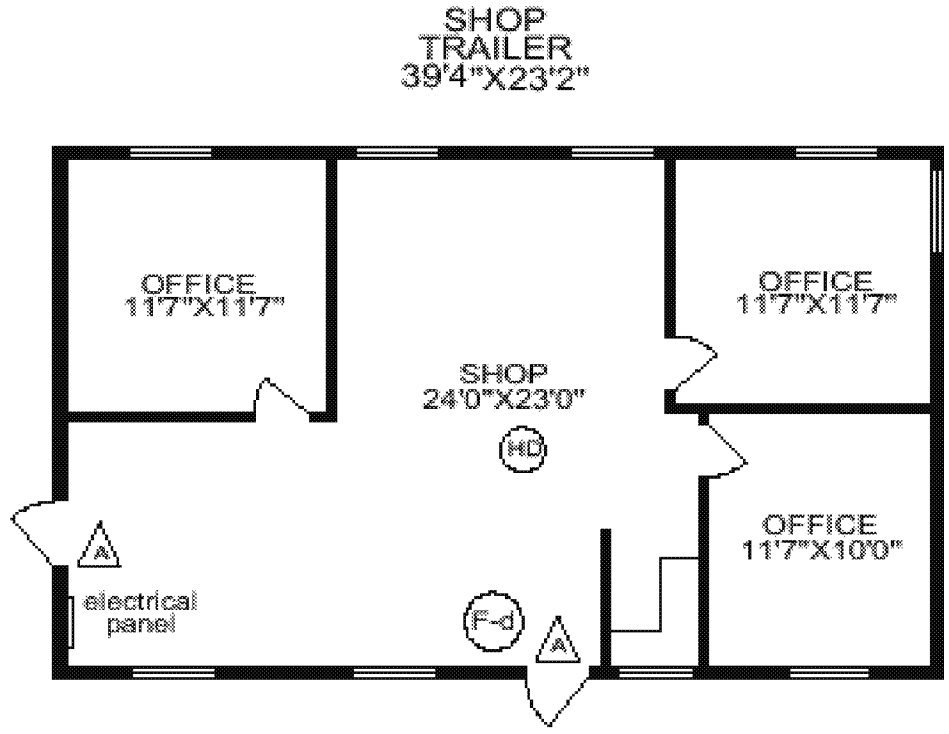
**Figure F-7 South Building Compounds**

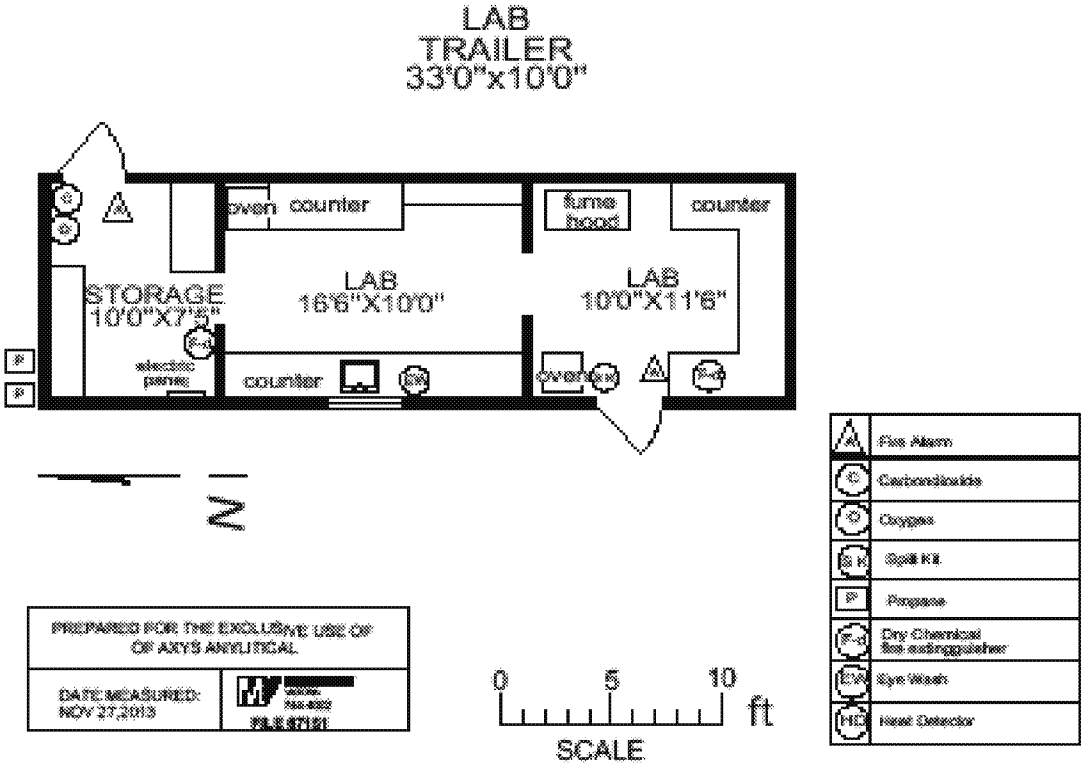
**Error! Objects cannot be created from editing field codes.**

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

**Figure F-8 Trailers**




Uncontrolled if printed

Controlled hardcopies may not be photocopied. Electronic copies anywhere other than the Q-Pulse Current Document Register are uncontrolled. Currency of uncontrolled documents **must** be verified against the controlled electronic copy.

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# APPENDIX G CHEMICAL ABSTRACT (CAS) NUMBER USAGE POLICY

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# THIS PAGE LEFT INTENTIONALLY BLANK

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# Chemical Abstract (CAS) Number Usage Policy

1. All CAS numbers used and reported will be supported by a CAS database search. A copy of the database search will be initialed by QA staff to indicate approval and a scanned copy will be maintained on file.
2. Approved CAS numbers will be entered to the LIMS database by Reporting, QA or LIMS staff. The 'approved' field in LIMS will be completed by QA or LIMS staff.

The AXYS LIMS database will be the standard source of CAS numbers for AXYS reports. Use of any other CAS numbers on reports will require the written approval and justification of both the QA Manager and the Project Chemist. Correspondence with the client including the original request, the AXYS reply to the client granting the exception, and a record of the AXYS approval with a description of justification are maintained in the CLIENT File and also recorded or referenced in each applicable Project Note.

Instructions for performing database searches for CAS numbers are in the QA Wiki (in Sharepoint.)

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# THIS PAGE LEFT INTENTIONALLY BLANK

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

# APPENDIX H DATA FLAGGING CONVENTIONS

Uncontrolled if printed

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# THIS PAGE LEFT INTENTIONALLY BLANK

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

Uncontrolled if printed

# Data Flagging Conventions

## AXYS FORMAT FLAGS

| | | |
|---|---|---|
| C | = | co-eluting congener |
| ND | = | not detected |
| NDR | = | peak detected, but did not meet quantification criteria, result reported represents the estimated maximum possible concentration |
| D | = | dilution data |
| J | = | concentration less than LMCL |
| B | = | analyte found in sample and the associated blank |
| N | = | authentic recovery is not within method/contract control limits |
| V | = | surrogate recovery is not within method/contract control limits |
| G | = | lock mass interference present |
| N/A | = | not available OR not applicable |
| NQ | = | data not quantifiable |
| OLR | = | exceeds calibrated linear range, see dilution data |
| Z | = | compound not requested |
| X | = | results reported separately (original report and separate reports) |
| P | = | deletes target or surrogate off report (Excel reports only) |
| T | = | analyte recalculated against alternate labelled compound(s) or internal standard |
| H | | concentration is estimated (information only value) |
| TIC | | compound identity and concentration are estimated |
| MAX | | concentration is an estimated maximum value |

## EPA FORMAT FLAGS

| | | |
|---|---|---|
| C | = | co-eluting congener |
| U | = | not detected |
| R/K | = | peak detected, but did not meet quantification criteria, result reported represents the estimated maximum possible concentration |
| D | = | dilution data |
| J | = | concentration less than LMCL |
| B | = | analyte found in sample and the associated blank |
| N | = | authentic recovery is not within method/contract control limits |
| V | = | surrogate recovery is not within method/contract control limits |
| G | = | lock mass interference present |
| N/A | = | not available OR not applicable |

This document is the Intellectual Property of AXYS Analytical Services Ltd and contains Proprietary and Confidential Business Information. It may not be reproduced or distributed without written permission of the owner. © AXYS Analytical Services Ltd, 2015.
AXYS Analytical Services Ltd, 2045 Mills Road W., Sidney, BC, Canada, V8L 5X2. Tel. (250) 655-5800, fax (250) 655-5811.

| | | |
|---|---|---|
| NQ | = | data not quantifiable |
| E | = | exceeds calibrated linear range, see dilution data |
| X | = | results reported separately (original report) |
| X | = | results from recolumn/reinjection/repeat data (separate report) |
| P | = | deletes target or surrogate off report (Excel reports only) |
| T | = | analyte recalculated against alternate labelled compound(s) or internal standard |

**EPA 8290 FORMAT FLAGS**

| | | |
|---|---|---|
| U | = | not detected |
| J | = | concentration less than LMCL |
| B | = | analyte found in sample and the associated blank |
| EMPC | = | estimated maximum possible amount |
| E | = | exceeds calibrated linear range, see dilution data |
| C | = | co-eluting congener |
| D | = | dilution data |
| X | = | results reported separately (original report) |
| X | = | results from recolumn/reinjection/repeat data (separate report) |

X only used when required, the rest of the flags will always be present

Uncontrolled if printed

# Summary of AXYS Method MLA-041 Rev. 09 Ver. 03:

# Analytical Procedure for the Analysis of Perfluorinated Organic Compounds in Solid Samples by LC-MS/MS

AXYS Method MLA-041 describes the analysis of perfluorinated organic compounds (PFC) in solid (sediment, soil) and biosolids samples. Typical detection limits are in the range of 0.1 – 0.2 ng/g for a 5 g sample.

**Target Analytes**

| | |
|---|---|
| Perfluorobutanoate (PFBA) | Perfluorobutanesulfonate (PFBS) |
| Perfluoropentanoate (PFPeA) | Perfluorohexanesulfonate (PFHxS) |
| Perfluorohexanoate (PFHxA) | Perfluorooctanesulfonate (PFOS) |
| Perfluoroheptanoate (PFHpA) | Perfluorooctane sulfonamide (PFOSA)[1] |
| Perfluorooctanoate (PFOA) | |
| Perfluorononanoate (PFNA) | |
| Perfluorodecanoate (PFDA) | |
| Perfluoroundecanoate (PFUnA) | |
| Perfluorododecanoate (PFDoA) | |

## EXTRACTION

Sample size may be up to 5 g dry weight for solid samples or up to 5 g wet weight (max. 0.5 g dry weight) for biosolid samples. After addition of isotopically labelled surrogate standards the sample is extracted by shaking one time with dilute acetic acid solution and then two times with methanolic ammonium hydroxide solution, each time collecting the supernatants.

## COLUMN CHROMATOGRAPHY CLEANUP

The supernatants are combined and treated with ultra pure carbon powder. The resulting solution is diluted with water and cleaned up by solid phase extraction (SPE) using disposable cartridges containing a weak anion exchange sorbent. The eluate is spiked with recovery standards and analyzed by LC-MS/MS. Calibration solutions are processed through the same SPE cleanup procedure.

The final extract volume is 4 mL.

## INSTRUMENTAL ANALYSIS

Analysis of the sample extract is performed on a high performance liquid chromatography reversed phase C18 column using a solvent gradient. The column is coupled to a triple quadrupole mass spectrometer run at unit mass resolution in the Multiple Reaction Monitoring (MRM) mode.



ED_004850_00001502-00258

Analytes, Ions and Quantification References

| Target Analyte | Typical Retention Time (minutes) | Parent Ion Mass | Daughter Ion Mass | Quantified Against |
|---|---|---|---|---|
| Perfluorobutanoate (PFBA) | 5.0 | 213 | 169 | $^{13}C_4$-PFBA |
| Perfluoropentanoate (PFPeA) | 5.8 | 263 | 219 | $^{13}C_2$-PFHxA |
| Perfluorohexanoate (PFHxA) | 6.2 | 313 | 269 | $^{13}C_2$-PFHxA |
| Perfluoroheptanoate (PFHpA) | 6.6 | 363 | 319 | $^{13}C_2$-PFHxA |
| Perfluorooctanoate (PFOA) | 7.0 | 413 | 369 (169)[1] | $^{13}C_2$-PFOA |
| Perfluorononanoate (PFNA) | 7.4 | 463 | 419 | $^{13}C_5$-PFNA |
| Perfluorodecanoate (PFDA) | 7.9 | 513 | 469 | $^{13}C_2$-PFDA |
| Perfluoroundecanoate (PFUnA) | 8.5 | 563 | 519 | $^{13}C_2$-PFDA |
| Perfluorododecanoate (PFDoA) | 9.0 | 613 | 569 | $^{13}C_2$-PFDoA |
| Perfluorobutane sulfonate (PFBS) | 6.3 | 299 | 80 (99)[1] | $^{18}O_2$-PFHxS |
| Perfluorohexane sulphonate (PFHxS) | 7.2 | 399 | 80 (99/119)[1] | $^{18}O_2$-PFHxS |
| Perfluorooctane sulfonate (PFOS) | 8.2 | 499 | 80 (99)[1] | $^{13}C_4$-PFOS |
| Perfluorooctane sulfonamide (PFOSA) | 9.9 | 498 | 78 | $^{13}C_8$-PFOSA |
| **Surrogate Standard** | | | | |
| $^{13}C_4$-Perfluorobutanoic acid ($^{13}C_4$-PFBA) | 5.0 | 217 | 172 | $^{13}C_2$-PFOUEA |
| $^{13}C_2$-Perfluorohexanoic acid ($^{13}C_2$-PFHxA) | 6.2 | 315 | 270 | $^{13}C_2$-PFOUEA |
| $^{13}C_2$-Perfluorooctanoic acid ($^{13}C_2$-PFOA) | 7.0 | 415 | 370 | $^{13}C_4$-PFOA |
| $^{13}C_5$-Perfluorononanoic acid ($^{13}C_5$-PFNA) | 7.4 | 468 | 423 | $^{13}C_2$-PFOUEA |
| $^{13}C_2$-Perfluorodecanoic acid ($^{13}C_2$-PFDA) | 7.9 | 515 | 470 | $^{13}C_2$-PFOUEA |
| $^{13}C_2$-Perfluorododecanoic acid ($^{13}C_2$-PFDoA) | 9.0 | 615 | 570 | $^{13}C_2$-PFOUEA |
| $^{18}O_2$–Perfluorohexanesulfonate ($^{18}O_2$-PFHxS) | 7.2 | 403 | 84 (103)[1] | $^{13}C_2$-PFOUEA |
| $^{13}C_4$–Perfluorooctanesulfonate ($^{13}C_4$-PFOS) | 8.2 | 503 | 80 (99)[1] | $^{13}C_2$-PFOUEA |
| $^{13}C_8$–Perfluorooctanesulfonamide ($^{13}C_8$-PFOSA) | 9.9 | 506 | 78 | $^{13}C_2$-PFOUEA |
| **Recovery Standard** | | | | |
| $^{13}C_2$-2H-Perfluoro-2-decenoic acid ($^{13}C_2$-PFOUEA) | 7.3 | 459 | 394 | - |
| $^{13}C_4$-Perfluorooctanoic acid ($^{13}C_4$-PFOA) | 6.9 | 417 | 372 | - |

[1] Alternate transition within brackets, may be used if necessary to avoid interference.

## CALIBRATION

A series of at least five calibration solutions prepared in an aqueous matrix similar in composition to the sample extract is used to establish initial multi-level calibration. The calibration solutions contain the analytes of interest covering the working range of the instrument together with labelled surrogate and recovery standards. A mid-level calibration solution is analyzed at least after every 12 hours to demonstrate calibration stability. All calibration solutions are processed through SPE cleanup.

Nominal Concentrations of Calibration Solutions

| | Concentration (ng/mL) | | | | | | | | Authentic Standard Amount Added to sample (ng) |
|---|---|---|---|---|---|---|---|---|---|
| | CAL A | CAL B | CAL C | CAL D | CAL E | CAL F | CAL G | CAL H | |
| **Native Compound** | | | | | | | | | |
| PFBA | 0.125 | 0.312 | 1.25 | 5 | 25 | 50 | 125 | 312 | 20 |
| PFPeA | 0.125 | 0.312 | 1.25 | 5 | 25 | 50 | 125 | 312 | 20 |
| PFHxA | 0.125 | 0.312 | 1.25 | 5 | 25 | 50 | 125 | 312 | 20 |
| PFHpA | 0.125 | 0.312 | 1.25 | 5 | 25 | 50 | 125 | 312 | 20 |
| PFOA | 0.125 | 0.312 | 1.25 | 5 | 25 | 50 | 125 | 312 | 20 |
| PFNA | 0.125 | 0.312 | 1.25 | 5 | 25 | 50 | 125 | 312 | 20 |
| PFDA | 0.125 | 0.312 | 1.25 | 5 | 25 | 50 | 125 | 312 | 20 |
| PFUnA | 0.125 | 0.312 | 1.25 | 5 | 25 | 50 | 125 | 312 | 20 |
| PFDoA | 0.125 | 0.312 | 1.25 | 5 | 25 | 50 | 125 | 312 | 20 |
| PFBS | 0.25 | 0.625 | 2.5 | 10 | 50 | 100 | 250 | 625 | 40 |
| PFHxS | 0.25 | 0.625 | 2.5 | 10 | 50 | 100 | 250 | 625 | 40 |
| PFOS | 0.25 | 0.625 | 2.5 | 10 | 50 | 100 | 250 | 625 | 40 |
| PFOSA | 0.125 | 0.312 | 1.25 | 5 | 25 | 50 | 125 | 312 | 20 |
| **Surrogate Standards** | | | | | | | | | **Surrogate Standard Amount Added to sample (ng)** |
| $^{13}C_4$-PFBA | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 |
| $^{13}C_2$-PFHxA | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 |
| $^{13}C_2$-PFOA | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 36 |
| $^{13}C_5$-PFNA | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 |
| $^{13}C_2$-PFDA | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 |
| $^{13}C_2$-PFDoA | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 |
| $^{18}O_2$-PFHxS | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 18 |
| $^{13}C_4$-PFOS | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 18 |
| $^{13}C_8$-PFOSA | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 |
| **Recovery Standards** | | | | | | | | | |
| $^{13}C_2$-PFOUEA | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 10 |
| $^{13}C_4$-PFOA | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 |

ANALYTE IDENTIFICATION

Positive identification of target PFC, surrogate standard and recovery standards require:

- ≥ 3:1 signal:noise for parent ion to daughter ion transition.
- Compound retention time must fall within 0.4 minutes of the predicted retention times from the daily Calibration Verification. Native compounds with labelled surrogate standards must elute within 0.1 minutes of the associated labelled surrogates.

## QUANTIFICATION

Target compounds are quantified using the internal standard method, comparing the area of the quantification ion to that of the $^{13}C$-labelled standard and correcting for response factors. Linear quantification equations are determined from a multi-point calibration series with $1/X^2$ weighting fit and expressed as below:

$$Y = \text{slope} \times X + \text{intercept}$$

where: $Y = \text{response ratio} = \left(\frac{\text{area of Target}}{\text{area of Surr}} \times \text{weight of Surr (ng)}\right)$ , and

$X = \text{weight of target (ng)}$

The slope and intercept are used to convert raw peak areas in sample chromatograms to final concentrations as follows:

$$\text{Sample Conc.} = \left(\frac{\text{area of Target}}{\text{area of Surr}} \times \text{weight of Surr (ng)} - \text{intercept}\right) x \left(\frac{1}{\text{slope}}\right) x \left(\frac{1}{\text{sample size (g)}}\right)$$

where Surr is the surrogate standard

The recovery of the surrogate standard is calculated (by internal standard quantification against the recovery standard using an average RRF) and monitored as an indication of overall data quality. Final target concentrations are recovery corrected by this method of quantification.

## REPORTING LIMITS

Concentrations and detection limits for the target analytes are reported. Typical reporting units for all data are ng/g on a dry weight basis.

The following are commonly requested reporting limits:

*Method Detection Limit (MDL)* - determined as specified by EPA Fed. Reg. 40 CFR Part 136 Appendix B (no iteration option). The 99% confidence level MDL is determined based on analysis of a minimum of 7 replicate matrix spikes fortified at 1-10 times the estimated detection limit. MDL is determined as required based on accreditation, contract and workload requirements.

*Lower Method Calibration Limit (LMCL)* - determined by prorating the concentration of the lowest calibration limit for sample size and extract volume. The following equation is used:

LMCL = ((lowest level cal conc.) x (extract volume))/sample size. Typical extract volume for PFCs in solids is 4 mL.

For the analysis of PFCs it is AXYS standard to report sample concentrations using the LMCL as the lower reporting limit. In cases where the SDL is higher than the LMCL, the SDL will be used as the lower reporting limit.

The SDL is defined as follows: *Sample Specific Detection Limit or Sample Detection Limit (SDL)* – determined individually for every sample analysis run by converting the area equivalent of 3.0 times (2.5 times for EPA 1600 series methods) the estimated chromatographic noise height to a concentration in the same manner that target peak responses are converted to final concentrations. The SDL accounts for any effect of matrix on the detection system and for recovery achieved through the analytical work-up.

## QUALITY ASSURANCE / QUALITY CONTROL

All samples are analyzed in batches of the following composition:

- Batch Size - Each batch consists of test samples and additional QC samples.
- Blanks – Blanks are analyzed with a minimum frequency of 5% of client samples (i.e. each batch of up to 20 client samples contains a procedural blank.) 20 mL of reagent water is used as the blank sample matrix.
- Duplicates – Where sufficient sample is available a duplicate sample is normally analyzed with each analysis batch containing greater than six (6) test samples, or as required by contract.
- OPR (Spiked Reference Sample) - OPRs are analyzed with a minimum frequency of 5% of client samples (i.e. each batch of up to 20 client samples contains an OPR.) An aliquot of native standard (typically 20 µL equivalent to 10 ng per analyte) is added to 5 g of an approved clean solid matrix to prepare the spiked reference sample.
- Matrix Spike/Matrix Spike Duplicate may be analyzed upon client request.
- Surrogate/Authentic/Recovery (SAR) solution is an optional diagnostic test that may be prepared and analyzed with a batch.

QC Specification Table: Procedural Blank Levels and OPR Recoveries

| Analyte | | Procedural Blank Level ng/sample [1] | Acceptable Matrix Spike in OPR (% Recovery) |
|---|---|---|---|
| Perfluorobutanoate | (PFBA) | < 0.25 | 70 – 130 |
| Perfluoropentanoate | (PFPeA) | < 0.25 | 60 – 130 |
| Perfluorohexanoate | (PFHxA) | < 0.25 | 70 – 130 |
| Perfluoroheptanoate | (PFHpA) | < 0.25 | 70 – 130 |
| Perfluorooctanoate | (PFOA) | < 0.25 | 70 – 130 |
| Perfluorononanoate | (PFNA) | < 0.25 | 70 – 130 |
| Perfluorodecanoate | (PFDA) | < 0.25 | 70 – 130 |
| Perfluoroundecanoate | (PFUnA) | < 0.25 | 40 – 130 |
| Perfluorododecanoate | (PFDoA) | < 0.25 | 70 – 130 |



ED_004850_00001502-00262

| Analyte | | Procedural Blank Level ng/sample [1] | Acceptable Matrix Spike in OPR (% Recovery) |
|---|---|---|---|
| Perfluorobutanesulfonate | (PFBS) | < 0.25 | 60 – 130 |
| Perfluorohexanesulfonate | (PFHxS) | < 0.25 | 60 – 130 |
| Perfluorooctanesulfonate | (PFOS) | < 0.25 | 70 – 130 |
| Perfluorooctane sulfonamide | (PFOSA) | < 0.25 | 60 – 130 |

[1] Reporting limits (based on the lowest calibration standard - CAL A in Table 3 - and routine final extract volume of 4 mL) may exceed the stated blank criteria.

QC Specification Table: Surrogate Standard Recoveries, Calibration and Samples

| Surrogate Standard | | Recovery Range [1] |
|---|---|---|
| $^{13}C_4$-Perfluorobutyric acid | ($^{13}C_4$-PFBA) | 20 - 150% |
| $^{13}C_2$-Perfluorocaproic acid | ($^{13}C_2$-PFHxA) | 40 - 150% |
| $^{13}C_2$-Perfluorooctanoic acid | ($^{13}C_2$-PFOA) | 40 - 150% |
| $^{13}C_5$-Perfluorononanoic acid | ($^{13}C_5$-PFNA) | 40 - 150% |
| $^{13}C_2$-Perfluorodecanoic acid | ($^{13}C_2$-PFDA) | 40 - 150% |
| $^{13}C_2$-Perfluorododecanoic acid | ($^{13}C_2$-PFDoA) | 40 - 150% |
| $^{18}O_2$-Perfluorohexanesulfonate | ($^{18}O_2$-PFHxS) | 40 - 150% |
| $^{13}C_4$-Perfluorooctanesulfonate | ($^{13}C_4$-PFOS) | 40 - 150% |
| $^{13}C_8$-Perfluorooctanesulfonamide | ($^{13}C_8$-PFOSA) | 20 - 130% |

[1] Lower surrogate recoveries may be reported for individual samples where dilution analysis or spiked sample results demonstrate acceptable accuracy.

QC Specification Table: Other Parameters

| QC Parameter | Specification |
|---|---|
| **Instrument Sensitivity** | Daily, S:N ≥ 3:1 for all analytes for lowest calibration standard. |
| **Initial Calibration (native compounds)** | Daily, ($1/x^2$) weighed linear regression.<br>Calculated concentrations must be within 30% of actual concentration.<br>Surrogate recoveries must fall within the same limits as for the samples in the table above. |
| **Continuing Calibration Verification (native compounds)** | Every 12 hours or more frequently; determined concentrations must be within 30% of actual concentrations.<br>Surrogate recoveries must fall within the same limits as for the samples in the table above. |
| **Instrumental Carryover and Instrument Background** | Every Initial Calibration, Cal/Ver, or SPM: ≤ 0.3% carryover and area response of analytes in instrument blank ≤ 800. |
| **Duplicate Samples or MS/MSD** | If conc. > 5 times R.L., RPD < 40%<br>If conc. < 5 times R.L., difference between pairs < R.L. |

**AXYS Analytical Services Ltd.**

Method Summary

# Analytical Procedure for the Analysis of Perfluorinated Organic Compounds in Aqueous Samples and Solvent Extracts by LC-MS/MS by AXYS Method MLA-060 Rev. 11 Ver. 01

Method MLA-060 describes the analysis of perfluorinated organic compounds (PFC) in aqueous samples and solvent extracts. Four method options are available:

Option 1: Analysis of PFCs in filtered aqueous samples, processed using solid phase extraction.

Option 2: Analysis of PFCs in unfiltered aqueous samples (whole water samples) containing up to 50 mg of suspended solids per sample, processed using solid phase extraction.

Option 3: Analysis of medium to high levels of PFCs in unfiltered aqueous samples (whole water samples) using direct sample injection. This is the preferred option for analysis of aqueous samples with high levels of surfactant activity.

Option 4: Analysis of PFCs in solvent extracts that may originate from various sources, e.g., from POCIS (Polar Organic Compound Integrative Sampler) samples. Solvent extracts don't undergo cleanup by solid phase extraction.

Typical quantification limits are in the range of 0.5 - 2 ng/L for aqueous samples by Option 1 or 2, 0.16-0.33 ng/mL for aqueous samples by Option 3, and 0.25-0.5 ng/mL for solvent extracts by Option 4.

## ANALYTES OF INTEREST

| | |
|---|---|
| Perfluorobutanoate (PFBA) | Perfluorobutanesulfonate (PFBS) |
| Perfluoropentanoate (PFPeA) | Perfluorohexanesulfonate (PFHxS) |
| Perfluorohexanoate (PFHxA) | Perfluorooctanesulfonate (PFOS) |
| Perfluoroheptanoate (PFHpA) | Perfluorooctane sulfonamide (PFOSA) [1] |
| Perfluorooctanoate (PFOA) | |
| Perfluorononanoate (PFNA) | |
| Perfluorodecanoate (PFDA) | |
| Perfluoroundecanoate (PFUnA) | |
| Perfluorododecanoate (PFDoA) | |

## EXTRACTION AND CLEANUP

Sample size may be up to 1000 mL for aqueous samples analyzed by Option 1 or 2, and 0.75-50 mL for aqueous samples analyzed by Option 3. Samples are stored in HDPE (high density polyethylene) containers. After any option specific pre-treatment samples are spiked with surrogate standards. Samples analyzed by option 1 or 2 are extracted by solid phase extraction (SPE) using weak anion exchange cartridges; wash and elution procedures are chosen to meet various analysis requirements. Samples analyzed by option 3 or 4 don't undergo solid phase extraction. The extracts are spiked with recovery standards and analyzed by LC-MS/MS.



ED_004850_00001502-00264

## QUALITY ASSURANCE / QUALITY CONTROL

All samples are analyzed in batches. The composition of a batch is detailed on a batch sheet. Each batch has the following composition:

- Batch Size - Each batch consists of test samples and additional QC samples.
- Blanks – Blanks are analyzed with a minimum frequency of 5% of client samples.
- Duplicates – With each analysis batch containing greater than six (6) test samples, or as required by contract, a duplicate sample is analyzed, provided there is sufficient sample.
- Matrix Spike/Matrix Spike Duplicate analyzed upon client request.
- OPR (Spiked Reference Sample) – OPRs are analyzed with a minimum frequency of 5% of client samples.
- Surrogate/Authentic/Recovery (SAR) solution is an optional diagnostic test that may be prepared and analyzed with a batch.

### QC Specifications for Options 1 and 2: Procedural Blank Levels and OPR Recoveries

| Analyte | | Procedural Blank Level ng/sample [2] | OPR Recovery Range (%)[1] |
|---|---|---|---|
| Perfluorobutanoate | (PFBA) | <0.25 | 80 – 120 [1] |
| Perfluoropentanoate | (PFPeA) | <0.25 | 80 – 120 [1] |
| Perfluorohexanoate | (PFHxA) | <0.25 | 80 – 120 [1] |
| Perfluoroheptanoate | (PFHpA) | <0.25 | 80 – 120 [1] |
| Perfluorooctanoate | (PFOA) | <0.25 | 80 – 120 [1] |
| Perfluorononanoate | (PFNA) | <0.25 | 80 – 120 [1] |
| Perfluorodecanoate | (PFDA) | <0.25 | 80 – 120 [1] |
| Perfluoroundecanoate | (PFUnA) | <0.25 | 80 – 120 [1] |
| Perfluorododecanoate | (PFDoA) | <0.25 | 80 – 120 [1] |
| | | | |
| Perfluorobutanesulfonate | (PFBS) | <0.25 | 70 - 130 |
| Perfluorohexanesulfonate | (PFHxS) | <0.25 | 70 – 130 |
| Perfluorooctanesulfonate | (PFOS) | <0.25 | 70 – 130 |
| | | | |
| Perfluorooctane sulfonamide | (PFOSA) | <0.25 | 70 – 130 |

[1] Marginal exceedance allowance – recovery for two compounds may be 75-125% and for one compound 70-130%.

[2] Reporting limits (based on the lowest calibration standard and routine final extract volume of 4 mL) may exceed the stated blank criteria.



ED_004850_00001502-00265

## QC Specifications for Options 3 and 4: Procedural Blank Levels and OPR Recoveries

| Analyte | | Procedural Blank Level ng/sample [2] | OPR Recovery Range (%) [1] |
|---|---|---|---|
| Perfluorobutanoate | (PFBA) | < 0.25 | 70 – 130 |
| Perfluoropentanoate | (PFPeA) | < 0.25 | 80 – 120 [1] |
| Perfluorohexanoate | (PFHxA) | < 0.25 | 80 – 120 [1] |
| Perfluoroheptanoate | (PFHpA) | < 0.25 | 80 – 120 [1] |
| Perfluorooctanoate | (PFOA) | < 0.25 | 80 – 120 [1] |
| Perfluorononanoate | (PFNA) | < 0.25 | 80 – 120 [1] |
| Perfluorodecanoate | (PFDA) | < 0.25 | 80 – 120 [1] |
| Perfluoroundecanoate | (PFUnA) | < 0.25 | 80 – 120 [1] |
| Perfluorododecanoate | (PFDoA) | < 0.25 | 80 – 120 [1] |
| | | | |
| Perfluorobutanesulfonate | (PFBS) | < 0.25 | 70 – 130 |
| Perfluorohexanesulfonate | (PFHxS) | < 0.25 | 70 – 130 |
| Perfluorooctanesulfonate | (PFOS) | < 0.25 | 70 – 130 |
| | | | |
| Perfluorooctane sulfonamide | (PFOSA) | < 0.25 | 70 – 130 |

[1] Marginal exceedance allowance – recovery for two compounds may be 75-125% and for one compound 70-130%.

[2] Reporting limits (based on the lowest calibration standard and routine final extract volume of 1 mL for Option 3 and 4 mL for Option 4) may exceed the stated blank criteria.

## QC Specifications: Surrogate Standard Recoveries (Calibration Solutions and Samples)

| Surrogate Standard | Recovery Range [1] |
|---|---|
| $^{13}C_4$-Heptafluorobutyric acid ($^{13}C_4$-PFBA) | 20 - 150% |
| $^{13}C_2$-Perfluorocaproic acid ($^{13}C_2$-PFHxA) | 40 - 150% |
| $^{13}C_2$- Perfluorooctanoic acid ($^{13}C_2$-PFOA) | 40 - 150% |
| $^{13}C_5$-Heptadecafluorononanoic acid ($^{13}C_5$-PFNA) | 40 - 150% |
| $^{13}C_2$- Perfluorodecanoic acid ($^{13}C_2$-PFDA) | 40 - 150% |
| $^{13}C_2$-Perfluoro-n-(1,2)dodecanoic acid ($^{13}C_2$-PFDoA) | 40 - 150% |
| $^{18}O_2$-Perfluorohexanesulfonate ($^{18}O_2$-PFHxS) | 40 - 150% |
| $^{13}C_4$-Perfluorooctanesulfonate ($^{13}C_4$-PFOS) | 40 - 150% |
| $^{13}C_8$-Perfluoro-1-octanesulfonamide ($^{13}C_8$-PFOSA) | 40 - 150% |

[1] Lower recoveries may be accepted based on application and professional judgment



ED_004850_00001502-00266

### QC Specification Table: Other Parameters

| QC Parameter | Specification |
|---|---|
| Instrument Sensitivity | Daily, S:N ≥ 3:1 for all analytes for lowest calibration standard. |
| Initial Calibration (native compounds) | Run initially, and as required to maintain calibration verification and instrument sensitivity.<br>(1/x) weighted quadratic, exclude origin.<br>Calculated conc. 75-125 % of actual (lowest cal may be 70-130%), $R^2$ > 0.990.<br>Surrogate recoveries must fall within the same limits as for the samples in the table above. |
| Continuing Calibration Verification (native compounds) | Run every 20 samples or more frequently, quantify against I-CAL.<br>Calculated conc. 70-130% of actual for a maximum of three compounds with the remainder 80–120 % of actual.<br>Surrogate recoveries must fall within the same limits as for the samples in the table above. |
| Instrumental Carryover and Instrument Background | Every Initial Calibration, Cal/Ver, or SPM: ≤ 0.3 % carryover and area response of analytes in instrument blank ≤ 800. |
| Duplicate Samples or MS/MSD | If conc. > 5 times R.L., RPD < 40%<br>If conc. < 5 times R.L., difference between pairs < R.L. |

## ANALYSIS BY LC-MS/MS

Analysis of sample extracts for perfluorinated organics by HPLC-MS/MS is performed on a high performance liquid chromatograph coupled to a triple quadrupole mass spectrometer. The mass spectrometer is run at unit mass resolution in the Multiple Reaction Monitoring (MRM) mode.

### Instrument specifications:

| | |
|---|---|
| Instrument | Waters 2690 or Waters 2795 HPLC, Micromass Quattro Ultima MS/MS |
| LC Column | Waters Xterra MS $C_{18}$ Reverse Phase C18, 10.0 cm, 2.1 mm i.d., 3.5 µm particle size (or equivalent) |
| Ionization | Negative Ion Electrospray |
| Acquisition | MRM mode, unit resolution |
| Injection Volume | 15 µL |



ED_004850_00001502-00267

**LC-MS/MS Operating Conditions:**

| LC Gradient Program | | | | General LC Conditions | |
|---|---|---|---|---|---|
| **Time (min)** | **Flow mixture [1]** | **LC Flow Rate Program** | **Gradient Curve** | Column Temp (°C) | 40 |
| 0.0 | 15% eluent A<br>85% eluent B | 0.15 mL/min | 1 | Max Pressure (bar) | 300 |
| 1.0 | 15% eluent A<br>85% eluent B | 0.15 mL/min | 1 | **MS Conditions** | |
| 5.0 | 70% eluent A<br>30% eluent B | 0.20 mL/min | 4 | Source Temp (°C) | 120 |
| 8.5 | 100% eluent A | 0.20 mL/min | 4 | Desolvation Temp (°C) | 300 |
| 11 | 100% eluent A | 0.20 mL/min | 4 | Capillary Voltage (kV) | 2.75 |
| 11.3 - 14.5 | 15% eluent A<br>85% eluent B | 0.20 mL/min | 2 | Gases | ~70 L/hr cone<br>~300 L/hr desolvation |

[1] Eluent A = 90% acetonitrile (aqueous)
Eluent B = 13 mM ammonium acetate in 0.1% acetic acid (aqueous)

Initial calibration of the LC-MS/MS instrument is performed by the analysis of six or more calibration solutions. A mid-level calibration standard is analyzed to verify the initial calibration after every 12 hours injected at a minimum.

## ANALYTE IDENTIFICATION

Positive identification of target PFC, surrogate standard and recovery standards require:

- ≥ 3:1 S:N for parent ion to daughter ion transition.
- Compound retention time must fall within 0.4 minutes of the predicted retention times from the daily Calibration Verification. Natives with labelled surrogate standards must elute within 0.1 minutes of the associated labelled surrogates.

## QUANTIFICATION AND DATA REPORTING PROCEDURES

Target compounds are quantified using the internal standard method, comparing the area of the quantification ion to that of the $^{13}C$-labelled standard and correcting for response factors.

Quadratic calibration equations are determined from a multi-point calibration series with 1/X weighing fit as described by the following general equation:

$Y = a + bX + cX^2$ (general quadratic equation)

where Y = (area target/area surr) x weight surr
X = weight target
a,b,c are empirical constants



ED_004850_00001502-00268

Concentrations in samples are determined as:

$$Sample\ Conc = \frac{-b \pm \sqrt{b^2 - 4c\left(a - \left(\frac{area\ of\ target}{area\ of\ sur}\ x\ weight\ sur\right)\right)}}{2c\ x\ sample\ size}$$

The recovery of the surrogate standard is calculated **(by internal standard quantification against the recovery standard using an average RRF)** and monitored as an indication of overall data quality. Final target concentrations are recovery corrected by this method of quantification.

Sample Specific Detection Limits (SDL) are determined .by converting the area equivalent of 3.0 times the estimated chromatographic noise height to a concentration in the same manner that target peak responses are converted to final concentrations. The SDL accounts for any effect of matrix on the detection system and for recovery achieved through the analytical work-up.

Results are reported to the greater of the SDL or the concentration equivalent to the lowest calibration standard analyzed.

**Analytes, Ions and Quantification References**

| Target Analyte | Typical Retention Time (minutes) | Parent Ion Mass | Daughter Ion Mass | Quantified Against |
|---|---|---|---|---|
| **Target Analytes** | | | | |
| Perfluorobutanoate (PFBA) | 5.0 | 213 | 169 | $^{13}C_4$-PFBA |
| Perfluoropentanoate (PFPeA) | 5.8 | 263 | 219 | $^{13}C_2$-PFHxA |
| Perfluorohexanoate (PFHxA) | 6.2 | 313 | 269 | $^{13}C_2$-PFHxA |
| Perfluoroheptanoate (PFHpA) | 6.6 | 363 | 319 | $^{13}C_2$-PFHxA |
| Perfluorooctanoate (PFOA) | 7.0 | 413 | 369 (169)[1] | $^{13}C_2$-PFOA |
| Perfluorononanoate (PFNA) | 7.4 | 463 | 419 | $^{13}C_5$-PFNA |
| Perfluorodecanoate (PFDA) | 7.9 | 513 | 469 | $^{13}C_2$-PFDA |
| Perfluoroundecanoate (PFUnA) | 8.5 | 563 | 519 | $^{13}C_2$-PFDA |
| Perfluorododecanoate (PFDoA) | 9.0 | 613 | 569 | $^{13}C_2$-PFDoA |
| Perfluorobutanesulfonate (PFBS) | 6.3 | 299 | 80 (99)[1] | $^{18}O_2$-PFHxS |
| Perfluorohexanesulfonate (PFHxS) | 7.2 | 399 | 80 (99/119)[1] | $^{18}O_2$-PFHxS |
| Perfluorooctane sulfonate (PFOS) | 8.2 | 499 | 80 (99)[1] | $^{13}C_4$-PFOS |
| Perfluorooctane sulfonamide (PFOSA) | 9.9 | 498 | 78 | $^{13}C_8$-PFOSA |



ED_004850_00001502-00269

| Target Analyte | Typical Retention Time (minutes) | Parent Ion Mass | Daughter Ion Mass | Quantified Against |
|---|---|---|---|---|
| **Surrogate Standard** | | | | |
| $^{13}C_4$-Heptafluorobutyric acid ($^{13}C_4$-PFBA) | 5.0 | 217 | 172 | $^{13}C_2$-PFOUEA |
| $^{13}C_2$-Perfluorocaproic acid ($^{13}C_2$-PFHxA) | 6.2 | 315 | 270 | $^{13}C_2$-PFOUEA |
| $^{13}C_2$-Perfluorooctanoic acid ($^{13}C_2$-PFOA) | 7.0 | 415 | 370 | $^{13}C_4$-PFOA |
| $^{13}C_5$-Heptadecafluorononanoic acid ($^{13}C_5$-PFNA) | 7.4 | 468 | 423 | $^{13}C_2$-PFOUEA |
| $^{13}C_2$-Perfluorodecanoic acid ($^{13}C_2$-PFDA) | 7.9 | 515 | 470 | $^{13}C_2$-PFOUEA |
| $^{13}C_2$-Perfluorododecanoic acid ($^{13}C_2$-PFDoA) | 9.0 | 615 | 570 | $^{13}C_2$-PFOUEA |
| $^{18}O_2$–Perfluorohexanesulfonate ($^{18}O_2$-PFHxS) | 7.2 | 403 | 84 (103)[1] | $^{13}C_2$-PFOUEA |
| $^{13}C_4$–Perfluorooctanesulfonate ($^{13}C_4$-PFOS) | 8.2 | 503 | 80 (99)[1] | $^{13}C_2$-PFOUEA |
| $^{13}C_8$-Perfluorooctane sulfonamide ($^{13}C_8$-PFOSA) | 9.9 | 506 | 78 | $^{13}C_2$-PFOUEA |
| **Recovery Standard** | | | | |
| $^{13}C_2$-2H-Perfluoro-2-decenoic acid ($^{13}C_2$-PFOUEA) | 7.3 | 459 | 394 | - |
| $^{13}C_4$-Perfluorooctanoic acid ($^{13}C_4$-PFOA) | 6.9 | 417 | 372 | - |

[1] Alternate transition within brackets, may be used if necessary to avoid interference.



ED_004850_00001502-00270

# ATTACHMENT A2

## EUROFINS LANCASTER QUALITY ASSURANCE MANUALS AND SOPS

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-WI -9011637 | **Revision** | 21 |
| **Effective Date** | May 26, 2015 | **Status** | Effective |
| **Historical/Local Document Number** | Analysis 0224, 0228, 0332, 0368, 1504, 1505, 1506, 7322, 7332, 7333, 7334, 7335, 7336, 7337, 7338 | | |
| **Local Document Level** | Level 3 | | |
| **Local Document Type** | TEST - Testing Document | | |
| **Local Document Category** | ANALYSIS-ES - Analysis-Environmental Science | | |

| | |
|---|---|
| **Prepared by** | Nicole Veety |
| **Reviewed and Approved by** | Erik Frederiksen;Review;Thursday, May 21, 2015 4:41:54 PM EDT<br>Barbara Reedy;Approval;Friday, May 22, 2015 8:08:20 AM EDT |

## Revision Log:

| Revision: 21 | | Effective Date: This version |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Scope | Current requirements | Updated MCL values. |
| Sample Collection, Preservation, and Handling | Regulatory update | Stipulate orthophosphate samples must be field filtered. |
| Quality Control Standards 3.c. | Method Update | Updated requirements for LCS values. |

| Revision: 20 | | Effective Date: May 4, 2015 |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Scope | Method update | Changed MCL violation limits to current PA DEP requirement |

**Reference:**

1. Method 300.0, Methods for Chemical Analysis of Water and Wastes USEPA 600, Revision 2.1, 1993

2. Test Methods for Evaluating Solid Wastes, SW-846 Method 9056, September 1994.

3. Test Methods for Evaluating Solid Wastes, SW-846 Method 9056A, February 2007

4. ICS-1000, *Chromatography System Operator's Manuel*, Dionex Corporation, Document No.031879, Revision 02, September 2005.

5. Method 4110, *Standard Methods for the Examination of Water and Wastewater*, 21st Edition, 2005, pp. 4-3 to 4-7.

6. Chromeleon®, *Chromatography Management System*, Tutorial and User Manual 6.70, April 2005, or 6.80, March 2007, Dionex Corporation.

7. *Installation Instructions and Troubleshooting Guide for the Ionpac AG14 Guard Column and AS14 Analytical Column*, Dionex Corporation, Document No. 031199, Revision 04, December 10, 1998.

8. *Installation Instructions and Troubleshooting Guide for the Anion Self-Regenerating Suppressor (ASRS-ULTRA)*, Dionex Corporation, Revision 04, Document No. 031367, April 8, 1999.

9. *Chemical Hygiene Plan*, current version.

10. ICS-1100, *Chromatography System Operator's Manual*, Dionex Corporation, Document No. 065289, Revision 01, March 2009.

## Cross Reference:

| Document | Document Title |
|---|---|
| Analysis #1352, 10129 | Reagent Water Extraction (as Preparation for Analysis on the Ion Chromatograph or Autoanalyzer) |
| 1-P-QM-PRO-9015459 | Quality Control for Auto-Analyzer Analyses Performed in Instrumental Water Quality |
| 1-P-QM-QMA-9017309 | Determining Method Detection Limits and Limits of Quantitation |
| 1-P-QM-QMA-9017313 | Establishing Control Limits |
| 1-P-QM-QMA-9017328 | Reagents and Standards |

## Scope:

This method covers the determination of the following inorganic anions in reagent water, drinking water, surface water, wastewater, and groundwater using an ion chromatography system: bromide, chloride, fluoride, nitrate-N, nitrite-N, orthophosphate, and sulfate. The limits of quantitation and method detection limits are found in the analysis information file.

This method is used on solids after a reagent water extraction. See analysis 1352. The limits of quantitation for anion analysis of a solid are also found in the analysis information file.

For EW samples: values of 10.0 mg/L for $NO_3$, 1.0 mg/L or > for $NO_2$, and 2.0 mg/L or > for fluoride are MCL violations and must be reported to the client within 1 hour of analysis. These must also be reported to the PA DEP within 24 hours of analysis.

## Basic Principles:

A small volume of sample is introduced into an ion chromatograph. The anions of interest are separated and measured, using a system comprised of a guard column, separator column, suppressor, and conductivity detector. Separations are due to differences in the equilibrium distribution of sample components between the mobile phase (eluent) and stationary phase (column exchange resin). Retention times for various anions depend on several factors such as ionic charge, ionic size, pH, resin type, eluent concentration, and flow rate.

**Definitions:**

1. Blanks – includes PBWs and PBSs
2. CCB – Continuing Calibration Blank
3. CCV – Continuing Calibration Verification
4. DOC – Demonstration of Capability
5. ICB – Initial Calibration Blank
6. ICV – Initial Calibration Verification
7. LCS/LCSD – Laboratory Control Sample/ Laboratory Control Sample Duplicate
8. LCSW/LCSDW – Laboratory Control Sample Water / Laboratory Control Sample Duplicate Water
9. LCSS/LCSDS - Laboratory Control Sample Solid / Laboratory Control Sample Duplicate Solid
10. MS/MSD – Matrix spike/matrix spike duplicate
11. LIMS – Laboratory Information Management Systems
12. LOQ – Limit of Quantitation
13. MDL – Method Detection Limit
14. PB/PBW/ PBS –Preparation Blank/ Preparation Blank Water/Preparation Blank Solid.
15. QC – Quality Control

16. RPD – Relative Percent Difference

17. Method Blank - equivalent to a Preparation Blank. A designated sample designed to monitor for sample contamination during the analysis process. A volume of reagent laboratory water is typically used to monitor water sample analysis. The blank demonstrates that no artifacts were introduced during the analysis process.

18. Parallax – The computer system that is used for Environmental work to track client samples and report results for those samples, unless spreadsheets or certificates of analysis reports are attached by the technical department. Also referred to as the LIMS.

19. SOP- Standard Operating Procedure

**Interferences:**

Interferences occur when substances with retention times that are similar to and overlap those of the anion of interest are present. Often, large amounts of an anion interfere with the peak resolution of an adjacent anion. Use sample dilution to solve most interference problems.

Potential sources of interference which lead to false readings or elevated baselines are contaminated reagents, glassware, or other sample-processing apparatus. Samples containing particulate matter >0.45 microns require filtration to prevent damage to instrument columns and flow systems. If any samples on a batch are filtered, the corresponding PBW and LCSW must also be filtered.

Known coelution is caused by carbonate and other small organic anions such as acetate and formate. At certain fluoride concentrations or in certain sample matrices, this interference is not significant. It is the analyst's responsibility to perform a spike in any sample matrix that has interferences potentially affecting the fluoride determination. If repeatability and accuracy are not obtained in the sample matrix, it is recommended that this method not be used for fluoride.

**Safety Precautions and Waste Handling:**

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

There are no special safety precautions for this method. Follow routine laboratory safety steps. Discard all acid waste in the acid waste containers.

**Personnel Training and Qualifications:**

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability (DOC).

Analysts are considered proficient when they have successfully completed a DOC. DOC consists of four check samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. A DOC is performed annually and is maintained in the analyst's training records.

**Sample Collection, Preservation, and Handling:**

Samples must be collected in unpreserved, clean glass or polyethylene containers. Samples for fluoride must be collected in plastic. Samples must be stored at 0° to 6°C, not frozen. The holding time for samples is 28 days except for samples requiring orthophosphate, nitrate nitrogen and/or nitrite nitrogen analysis. Samples requiring one or more of these analyses must be run within 48 hours of collection. Regulatory samples for orthophosphate must be field filtered within 15 minutes of collection.

Waters – Samples with particulate matter >0.45 microns must be filtered before analysis. The corresponding LCSW and PBW of filtered samples on a batch must also be filtered.

Blanks (rinse blanks – RB, equipment blanks – EB, field blanks – FB) and GLP samples must initially be run at a dilution factor of one. Most other samples are initially analyzed at a dilution factor of five, which increases the reporting limits by a factor of five. The analyst must increase this dilution factor further (if necessary) to obtain raw results that are less than the most concentrated calibration curve standard for the anion(s) of interest.

**NOTE**: Refer to Project Notes in Parallax for client/project specific requirements for each sample.

Highly alkaline or highly acidic samples must be neutralized before injection. Often, sample dilution is used in lieu of neutralization.

If appropriate, samples are prescreened for chloride and sulfate. For sulfate, add approximately 0.2 to 0.3 g of $BaCl_2$ using a measuring spoon (1 scoop) to one culture tube of sample. The amount of sulfate in the sample is estimated based upon the resulting turbidity. For chloride, add a few drops of 0.1 N AgNO3 to one culture tube of sample. The chloride is estimated based upon the resulting turbidity.

**Apparatus and Equipment:**

1. Dionex system ICS-1000, or ICS-1100 Ion Chromatograph
2. PC, with Windows XP (or equivalent)
3. Hard disk, monitor, keyboard, mouse, and printer
4. Chromeleon® software, Version 6.70 (or newer), Dionex Corporation, 2005
5. Lancaster Laboratories' LIMS system with IDAT
6. Automatic sampler
7. Anion guard column, 4 × 50 mm, Dionex AG14, or equivalent

8. Anion analytical column, 4 × 250 mm, Dionex AS14, or equivalent

9. Anion suppressor, Dionex anion self-regenerating suppressor, ASRS-Ultra, or equivalent

10. Conductivity cell detector

11. Analytical balance, capable of accurately weighing to 0.0001 g

**Reagents and Standards:**

**NOTE:** All chemicals used must be ACS reagent grade unless otherwise noted. See 1-P-QM-QMA-9017328 for the appropriate labeling and documentation of reagents and standards. It is acceptable to use different volumes or weights in the preparation of reagents or standards as long as the ratios remain equivalent.

1. Concentrated eluent solutions, 0.5 M $NaHCO_3$ and 0.5 M $Na_2CO_3$

| | |
|---|---|
| Sodium bicarbonate ($NaHCO_3$) | 42.00 ± 0.05 g |
| Sodium carbonate ($Na_2CO_3$) | 53.00 ± 0.05 g |

   a. Prepare separate stocks for each component by dissolving each reagent listed above in reagent water and diluting to 1 L in a volumetric flask.

   b. Store stock solutions at 0° to 6°C not frozen.

   c. Stable for 30 days.

2. Working eluent for AS14 column, 1.0 mM $NaHCO_3$/3.5 mM $Na_2CO_3$

   a. Combine 32 mL of sodium bicarbonate concentrated eluent and 112 mL of sodium carbonate concentrated eluent.

   b. Dilute the solution to 16 L with reagent water.

   c. Stable for 7 days at room temperature.

3. Orthotolidine - Purchased. See label for expiration date. Store at room temperature.

4. Sodium Thiosulfate - Purchased. See label for expiration date. Store at room temperature.

5. $BaCl_2$ (anhydrous) – Purchased. Store at room temperature. See label for expiration date.

6. 0.1 N $AgNO_3$ – Purchased. Store at room temperature. See label for expiration date.

**Calibration:**

1. Stock standards for calibration

| | |
|---|---|
| Sodium fluoride (NaF) | 2.2100 g |
| Sodium chloride (NaCl) | 1.6485 g |
| Sodium nitrite($NaNO_2$) | 4.9257 g |
| Potassium bromide (KBr) | 1.4893 g |
| Potassium nitrate($KNO_3$) | 7.2179 g |
| Sodium sulfate($Na_2SO_4$) | 1.4787 g |
| Potassium Phosphate ($KH_2PO_4$) | 4.3937 g |

Dry each of the above compounds at 105°C ± 5°C for 30 minutes (± 5 minutes). Weigh each compound to ± 0.0003 g.

**Cal Standard 1** is composed of F, NO2-N, and NO3-N. Weigh out and quantitatively transfer each compound into a 1000-mL volumetric flask.

**Cal Standard 2** is composed of $Cl^-$. Weigh out and quantitatively transfer into a 1000-mL volumetric flask.

**Cal Standard 3** is composed of Br and PO4. Weigh out and quantitatively transfer into a 1000-mL volumetric flask.

**Cal Standard 4** is composed of SO4. Weigh out and quantitatively transfer into a 1000-mL volumetric flask.

Dilute to volume with reagent water. The concentration of each of the standard solutions is 1000 mg/L. Store at 0° to 6°C not frozen. The solutions are stable for 30 days.

**NOTE:** Salt standards that are stored in a dessicator must be covered with parafilm, not ground glass stoppers.

**NOTE:** As an alternative, these anion standards are available for purchase with a concentration of 1000 mg/L each. Store purchased standards at room temperature. See label for expiration date.

2. Detection limit standard

   a. Using a volumetric pipette, add 1.0 mL of the Cal Standard 1, 4.0 mL of the Cal Standard 2, 5.0 mL of the Cal Standard 3, and 10 mL of the Cal Standard 4 to a 100-mL volumetric.

   b. Dilute to volume with reagent water.

   c. This standard is 10 mg/L with respect to F, $NO_2$-N, and $NO_3$-N, 40 mg/L with respect to Cl, 50 mg/L with respect to Br and $PO_4$, and 100 mg/L with respect to $SO_4$.

   d. Prepared fresh each time the instrument is recalibrated and store at room temperature.

      **NOTE:** If using the purchased standards, pipette the above specified volume of each of the anions contained in the various calibration standards.

3. Intermediate calibration standard

   a. Using a volumetric pipette, add 1.0 mL of the Cal Standard 1, 2.0 mL of the Cal Standard 2, 5.0 mL of the Cal Standard 3, and 5.0 mL of the Cal Standard 4 to a 100-mL volumetric.

   b. Dilute to volume with reagent water.

   c. This standard is 10 mg/L with respect to F, $NO_2$-N, and $NO_3$-N, 20 mg/L with respect to Cl, and 50 mg/L with respect to Br, $PO_4$, and $SO_4$.

   d. This standard must be prepared fresh each time the instrument is recalibrated.

      **NOTE:** If using the purchased standards, pipette the above specified volume of each of the anions contained in the various calibration standards.

      **NOTE:** See the above Table for the preparation of the Low Level Calibration

4. Working calibration standards and continuing calibration verification (CCV)

   Pipette the specified volume of the appropriate calibration standard into a volumetric flask. Dilute to volume with reagent water. Prepare fresh daily according to the table below:

| Regular Anion | | | | Mg/L - Anions | | | |
|---|---|---|---|---|---|---|---|
| | Std | Std Volume (mL) | Final Volume (mL) | F/ $NO_2$, $NO_3$ | Cl | Br, $PO_4$ | $SO_4$ |
| Cal 1 | Det. Limit Std | 1.0 | 100 | 0.1 | 0.4 | 0.5 | 1.0 |
| Cal 2 | Int. Cal Standard | 4.0 | 100 | 0.4 | 0.8 | 2.0 | 2.0 |
| Cal 3 | Int. Cal Standard | 10.0 | 100 | 1.0 | 2.0 | 5.0 | 5.0 |
| Cal 4 | Int. Cal Standard | 20.0 | 100 | 2.0 | 4.0 | 10.0 | 10.0 |
| Cal 5 | Int. Cal Standard | 30.0 | 100 | 3.0 | 6.0 | 15.0 | 15.0 |
| CCV/LCS | Int. QC Standard | 30.0 | 200 | 0.75 | 3.0 | 7.5 | 7.5 |

| Low Level Anion | | | | | Mg/L - Anions | | |
|---|---|---|---|---|---|---|---|
| | Std | Std Volume (mL) Br/ $PO_4$ | $SO_4$ | Final Volume (mL) | Br | $PO_4$ | $SO_4$ |
| | Det. Limit Std | 0.25 | 2.0 | 50 | | | |
| | Int. Cal Standard | 0.25 | 2.5 | 50 | | | |
| Cal 1 | Det. Limit Std | 0.5 | | 50 | 0.05 | 0.05 | 0.4 |
| Cal 2 | Det. Limit Std | 1.0 | | 50 | 0.10 | 0.10 | 0.8 |
| Cal 3 | Det. Limit Std | 2.0 | | 50 | 0.2 | 0.2 | 2.0 |
| Cal 4 | Int. Cal Standard | 5.0 | | 50 | 0.5 | 0.5 | 5.0 |
| Cal 5 | Int. QC Standard | 10.0 | | 50 | 1.00 | 1.00 | 10.0 |
| CCV/LCS | Int. Cal Standard | 4.5 | | 50 | 0.45 | 0.45 | 4.5 |

**NOTE:** A reagent water blank is analyzed prior to the calibration and must contain no anions of interest. Therefore all anions must be < the MDL or re-calibration must occur.

**Quality Control Standards:**

A. Normal Anion Protocol:

1. Stock standards for quality control

   a. Prepare as stock standards for calibration using reagents from a different manufacturer.

   b. Bromide, phosphate and sulfate are combined together as QC Standard 3.

   c. The concentrations for the anions are the same as the concentrations listed for stock standards for calibration.

   d. Stable for 30 days.

   e. Store at 0° to 6°C not frozen.

   **NOTE:** As an alternative, these anion standards are available to purchase separately with a concentration of 1000 mg/L each. Store purchased standards at room temperature. See label for expiration date.

2. Intermediate quality control standard

   a. Using a volumetric pipette, add 0.25 mL of the QC Standard 1, 1.0 mL of the QC Standard 2, and 2.5 mL of the QC Standard 3 to a 50-mL volumetric.

   b. Dilute to volume with reagent water.

   c. This standard is 5 mg/L with respect to F, $NO_2$-N, and $NO_3$-N, 20 mg/L with respect to Cl, and 50 mg/L with respect to Br, $PO_4$, and $SO_4$.

d. Prepare daily and store at room temperature.

**NOTE:** If using the purchased standards, pipette the above specified volume of each of the anions contained in the various calibration standards.

3. Working control standards

ICV and LCSW:

a. Pipette 15 mL of the intermediate quality control standard into a 100-mL volumetric flask, which contains about 80-mL reagent water.

b. Dilute to volume with reagent water.

c. This standard must be prepared daily. True values of this standard are:

| | |
|---|---|
| $NO_2$-N, $NO_3$-N, F | 0.75 mg/L |
| Cl | 3.0 mg/L |
| Br, $PO_4$, $SO_4$ | 7.5 mg/L |

B. Low Level Anion Protocol

1. Stock standards for quality control

a. Prepare as stock standards for calibration using reagents from a different manufacturer.

b. Bromide, phosphate and sulfate are prepared seperately.

c. The concentrations for the anions are the same as the concentrations listed for stock standards for calibration.

d. Stable for 30 days.

e. Store at 0° to 6°C not frozen.

**NOTE:** As an alternative, these anion standards are available to purchase separately with a concentration of 1000 mg/L each. Store purchased standards at room temperature. See label for expiration date.

2. Intermediate quality control standard

a. Using a volumetric pipette, add 0.25 mL of the Bromide Standard, 0.25 mL of the Phosphate Standard, and 1.5 mL of the Sulfate Standard to a 50-mL volumetric.

b. Dilute to volume with reagent water.

c. Prepare daily and store at room temperature.

**NOTE:** If using the purchased standards, pipette the above specified volume of each of the anions contained in the various calibration standards.

3. Working control standards

ICV and LCSW:

a. Pipette 4.5 mL of the intermediate quality control standard into a 50-mL volumetric flask, which contains about 40-mL reagent water.

b. Dilute to volume with reagent water.

c. This standard must be prepared daily. True values of this standard are:

| | |
|---|---|
| Br | 0.45 mg/L |
| $PO_4$ | 0.45 mg/L |
| $SO_4$ | 2.70 mg/L |

**Procedure:**

1. Check chromatography setup for proper installation according to the following flow diagram:

   Anion Self-Regenerating Suppression

   injection valve → guard column → anion column → ASRS suppressor → conductivity cell → ASRS suppressor →waste

2. Check working eluent reservoirs. If levels are getting low, replenish as needed.

3. Start up the ion chromatograph using Table I as a guide.

   **NOTE:** Prime the analytical pump before turning on if the system has not been used for a few days or if the working eluent has been changed.

4. Do not begin any injections until the pressure of the system has equilibrated and the conductivity reading has stabilized.

5. Using Chromeleon®, set up the ion chromatograph with the method, program file, and sequence files to be used. Refer to the *Chromeleon® User's Guides* for more detailed instructions on the use of the software.

   a. A new sequence table is started with each daily batch of samples. The daily sequence table is identified with a six-digit number containing the following information:

| RUN# | 03 | 360 | X |
|---|---|---|---|
| | \| | \| | \| |
| | yr | \| | \| |
| | Julian day | | \| |
| | | | Where x is the system # |

b. A program file is identified as the template as this information does not change from the sequence under which the system was calibrated. Calibrations last for up to one month.

c. All data files are saved in the sequence with which they are run.

6. Inject aliquots of reagent water until a stable baseline results.

7. Prepare standards and sample dilutions.

8. The dilution factor must be entered for each sequence file. For solids, the sample weight is entered into the volume column. The dilution factor for solids is calculated by multiplying the final volume of the extract (typically 50-mL) by the dilution performed.

9. When calibrating the system, use a blank and the working calibration standards. After the calibration standards, analyze the following: batch QC, ICV, ICB, independent QC standard.

10. Samples are injected. A CCV and CCB are required after every 10 injections.

11. All injections must be documented with the following:

    a. Sample name

    b. Dilution factor

    c. Batch number

    d. Method used

    e. Data file

    f. Sample weight (g) - enter in volume column (if applicable)

g. Final volume (mL) - enter in dilution column and multiply by dilution factor (if applicable)

**Calculations:**

This analytical method has been validated using peak areas for quantitation. The calibration fit is linear, equally weights all calibration points, and ignores zero.

The equation of the line is:

$$y = K_0 + K_1 x$$

**Where:**

y = the area

$K_1$ = the slope

x = the concentration

$K_0$ = the y intercept.

Chromeleon® software performs the above determinations each time the calibration is updated. After the calibration is completed, Chromeleon® determines x (concentration) using the above equation. For the waters report format, Chromeleon® automatically multiplies this result by the dilution factor that has been entered by the analyst. For the solids report format, Chromeleon® performs the calculation using the analyst's inputted values for sample weight in grams and dilution factor. (The value entered in the dilution factor column is the volume extracted [normally 50 milliliters] × any dilution made by the analyst).

**Statistical Information/Method Performance:**

1. The method detection limit (MDL) must be determined every 6 months by following the procedure outlined in 1-P-QM-QMA-9017309.

2. The quality control acceptance windows must be generated by following the procedure outlined in 1-P-QM-QMA-9017313.

**Quality Assurance/Quality Control:**

Check standards are used to establish retention times at the beginning of each calibration. The retention window assigned to each analyte is set with each calibration. Refer to the Initial Calibration for each analyte's specific window. The windows are set from 0.200AG to 1.00 AG. The window is +/- a set time from the greatest peak within the window around each established retention time. The time input is in minutes. For example, 1.00 AG corresponds to 60s, therefore 0.200 AG corresponds to 12 seconds.

A. For waters and solids:

1. Calibration

a. The ion chromatography system must be recalibrated at least monthly, or whenever the calibration verification requirements of ±10% are not met.

b. For each analyte of interest, a blank and calibration standards at 5-concentration levels must be used to calibrate the instrument.

(1) The concentrations for cal 1 must recover within 50% of the true value. The concentrations for this cal are equal to the reporting limit for each anion.

(2) The calibration curves for the anion(s) of interest must have a correlation coefficient (r) of ≥ 0.995 for the curve to be valid.

**NOTE:** Chromeleon® returns an $r^2$ value for the correlation coefficient. The square root of this value is the "r" value, which is used to evaluate the curve.

c. The linearity of the calibration range must be verified every 6 months or whenever a significant change in instrument response is observed or expected. A minimum of 3 calibration standards must be analyzed. The results of these standards must not deviate from the true values by >10%. If this criterion is not met, linearity must be re-established. The values of the three standards are taken from the calculated values of the standards used for the calibration curve.

2. An ICV standard must be analyzed after every calibration. An acceptable result is a result which does not deviate from the true value by >±10%. If this criterion is not met for any anion(s) of interest, the cause for the out-of-spec condition must be determined if possible. Corrective action must be taken and the ICV reanalyzed. Upon reanalysis, if the acceptance criterion still is not met for the anion(s) of interest, the instrument must be recalibrated. If the acceptance criterion is met, the analysis is in control. Any samples affected by the original out-of-spec ICV must be repeated. All corrective action taken must be documented. Refer to 1-P-QM-PRO-9015459.

   **NOTE:** If referencing Method 9056, results for the anions must not deviate from the true value by >±5%.

3. An ICB must be analyzed after every calibration. An acceptable result is a result < the MDL for the anion(s) of interest. If this criterion is not met for the anion(s) of interest, the cause for the out-of-spec condition must be determined if possible. Corrective action must be taken and the ICB reanalyzed. Upon reanalysis, if the acceptance criterion still is not met for the anion(s) of interest, the instrument must be recalibrated. If the acceptance criterion is met, the analysis is in control. Any samples affected by the original out-of-spec ICB must be repeated. All corrective action taken must be documented. Refer to 1-P-QM-PRO-9015459.

4. Samples must be analyzed in batches not exceeding 20 samples per batch.

5. Sample results must not exceed the concentration of the highest standard. If a sample result falls above this value, the sample is diluted and run again. The sample result for any diluted sample must be >10% of the concentration of the highest standard for it to be considered acceptable data.

6. A batch blank (PBS, or PBW) must be analyzed for the anion(s) of interest in every batch. An acceptable result is a result < the MDL for the anion(s) of interest. If this criterion is not met, the cause for the out-of-spec condition must be determined and corrective action taken, if possible. The batch blank is reanalyzed once. Upon reanalysis, if the acceptance criterion still is not met for the anion(s) of interest, all samples associated with the batch blank must be re-prepared and reanalyzed. If the acceptance criterion has been met for a reanalyzed blank, all sample results associated with the batch blank are valid. All corrective action taken must be documented. Refer to 1-P-QM-PRO-9015459.

7. A LCSS or LCSW must be prepared and analyzed for the anions of interest in every batch. The current acceptance window of the LCSW is 90% to 110%. If this criterion is not met, the cause for the out-of-spec condition must be determined if possible. Corrective action must be taken and the LCS reanalyzed. Upon reanalysis, if the acceptance criterion is still not met, all samples associated with that LCS must be re-prepared and reanalyzed.

   If the acceptance criterion is met, the sample results are valid. All corrective action that was taken must be documented. Refer to 1-P-QM-PRO-9015459.

8. Based upon client requirements (when appropriate) a LCSDS or LCSDW is also prepared and analyzed under the same conditions as the LCS. The acceptable range is the same as that of the LCS. If this criterion is not met, the cause for the out-of-spec condition must be determined, if possible. Corrective action must be taken and the LCS and LCSD reanalyzed. Upon reanalysis, if the acceptance criterion is still not met, all samples associated with the LCS and LCSD must be re-prepared and reanalyzed. If the

acceptance criterion is met, the sample results are valid. All corrective action that was taken must be documented. For the acceptable RPD between the LCS and LCSD, refer to the current statistical windows in the LIMS. If the RPD is outside these criteria, consult your group leader to determine if reanalysis is necessary.

9. A CCV and CCB must be analyzed after every 10 injections. An acceptable result for the CCV is a result which does not deviate from the true value by >±10%. An acceptable result for the CCB is a result < the MDL. If the CCV and/or CCB do not meet this acceptance criterion, all samples since the last compliant CCV/CCB and before the next compliant CCV/CCB must be reanalyzed for the out-of-spec analyses. The cause of the out-of-spec condition must be determined and corrective action, if taken, must be documented. Refer to 1-P-QM-PRO-9015459.

   **NOTE:** If referencing Method 9056, results for the anions must not deviate from the true value by >±5%.

10. If the instrument has been idle for a period of 4 hours or more, the analysis must be restarted with a CCV and CCB. If these results are acceptable, sample analysis proceeds. If the CCV and/or CCB results are not acceptable, the instrument must be recalibrated.

11. A duplicate must be prepared and analyzed for every 10 samples in the batch (not to exceed 20 samples). For the acceptable RPD, refer to the LIMS. The cause of the out-of-spec condition must be determined if possible and corrective action, if taken, must be documented.

12. A MS must be prepared and analyzed for every 10 samples in the batch (not to exceed 20 samples). See LIMS for current windows.

# Table I

## Ion Chromatographic Operating Conditions

| | | ICS-1100 | ICS-1000 |
|---|---|---|---|
| System Power | | On | On |
| Service Air Valve (In-house air) | | N/A | N/A |
| Helium Pressure Valve | | N/A | N/A |
| High Limit Switch | | 3000 psi | 3000 psi |
| Analytical Pump Flow Rate | | 1.2 mL/min | 1.2 mL/min |
| Low Limit Switch | | 0 psi | 0 psi |
| ASRS current | | 24 mA | 39 mA |
| Detector Range (Full Scale) | | 10 µS | 10 uS |
| Operating Pressure | | 1200-2200 psi | 1200-2200 psi |
| Temperature Compensation | | 1.7 %/ºC | 1.7 %/°C |
| Sample Loop | | Approx. 50 µL | Approx. 50 µL |
| Analytical Pump | | On | on |

## Table II

## Ion Chromatography Shutdown Conditions

| | ICS-1000/ICS-1100 |
|---|---|
| Analytical Pump | Off |
| Service Air Valve (In-house air) | Closed |
| Helium Pressure Valve | N/A |
| ASRS Suppressor Current | N/A |
| System Power | Off |
| Analytical Pump | Off |

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-GDL-9015377 | **Revision** | 13 |
| **Effective Date** | Aug 8, 2014 | **Status** | Effective |
| **Historical/Local Document Number** | DOD - Environmental Quality Policy Manual | | |
| **Local Document Level** | Level 1 | | |
| **Local Document Type** | POL - Policy | | |
| **Local Document Category** | ES - Environmental Sciences | | |

| | |
|---|---|
| **Prepared by** | Christiane Sweigart and Kathryn Brungard |
| **Reviewed and Approved by** | Duane Luckenbill;Review;Tuesday, July 29, 2014 11:25:24 AM EDT<br>Robert Strocko;Review;Wednesday, July 30, 2014 1:34:51 PM EDT<br>Dorothy Love;Approval;Wednesday, July 30, 2014 2:00:20 PM EDT |

Uncontrolled Copy

# Environmental Quality Policy Manual

**Eurofins Lancaster Laboratories Environmental, LLC**

2425 New Holland Pike
Lancaster, PA 17601
Phone: 717-656-2300
Fax: 717-656-2681

Reviewed and Approved by:
Vice-President/Technical Director
Microbiology Technical Director
Quality Assurance Manager
(as documented on page 1)

Uncontrolled Copy

# Table of Contents


**1. INTRODUCTION ..... 8**

1.1. Mission Statement ..... 8
1.2. Quality Policy ..... 8
1.3. Statement of Values ..... 9
1.4. Sample Flow-Through Diagram ..... 10
1.5. Certifications, Accreditations, and Registrations ..... 11

**2. ORGANIZATION AND PERSONNEL ..... 11**

2.1. Company Overview and History ..... 11
2.2. Organizational Structure ..... 12
2.3. Management Responsibilities ..... 13
2.4. Overview of the Quality Assurance Program ..... 13
2.5 Quality Assurance Responsibilities ..... 14
2.6. Communication of Quality Issues to Management ..... 15
2.7. Personnel Qualifications and Responsibilities ..... 15
2.8. Relationship of Functional Groups and the Quality Assurance Program ..... 15
2.9. Balancing Laboratory Capacity and Workload ..... 16
2.10. Identification of Approved Signatories ..... 16
2.11. Personnel Training ..... 16
2.12. Regulatory Training ..... 18
2.13. Employee Safety ..... 18
2.14. Client Services/Project Management Responsibilities ..... 19
2.15. Confidentiality ..... 19
2.16. Business Conduct ..... 20
2.17. Operational Integrity ..... 20

**3. BUILDINGS AND FACILITIES ..... 21**

3.1. Facility ..... 21
3.2. Security ..... 22
3.3. Disaster Recovery ..... 22
3.4. Environmental Monitoring ..... 22
3.5. Water Systems ..... 23
3.6. Housekeeping/Cleaning ..... 23
3.7. Insect & Rodent Control ..... 23
3.8. Emergency Power Supply ..... 23
3.9. Facility Changes ..... 24

**4. DOCUMENT CONTROL ..... 24**

4.1. Hierarchy of Internal Operating Procedures ..... 24
4.2. Document Approval, Issue, Control, and Maintenance ..... 25
4.3. Client-Supplied Methods and Documentation ..... 26
4.4. Laboratory Notebooks, Logbooks, and Forms ..... 26
4.5. Control of External Documents ..... 27

**5. SAMPLE HANDLING ..... 28**

5.1. Sample Collection ..... 28
5.2. Sample Receipt and Entry ..... 28
5.3. Sample Identification and Tracking ..... 29
5.4. Sample Storage ..... 30
5.5. Sample Return/Disposal ..... 30


Uncontrolled Copy



ED_004850_00001502-00299

5.6. LEGAL CHAIN OF CUSTODY ..... 30
5.7. REPRESENTATIVENESS OF SAMPLES ..... 31

**6. TECHNICAL REQUIREMENTS – TRACEABILITY OF MEASUREMENTS ..... 31**

6.1. REAGENTS AND SOLVENTS ..... 31
6.2. MEDIA ..... 32
6.3. CALIBRATION STANDARDS ..... 32
6.4. EQUIPMENT AND INSTRUMENTATION ..... 32
6.5. COMPUTERIZED SYSTEMS AND COMPUTER SOFTWARE ..... 35
6.6. CHANGE CONTROL ..... 37
6.7. LABWARE CLEANING ..... 37

**7. PURCHASING EQUIPMENT AND SUPPLIES ..... 38**

7.1. PROCUREMENT ..... 38
7.2. SUPPLIER EVALUATION ..... 38

**8. ANALYTICAL METHODS ..... 39**

8.1. SCOPE OF TESTING ..... 39
8.2. ANALYTICAL TEST METHODS ..... 40
8.3. CLIENT SUPPLIED METHODS ..... 41
8.4. METHOD VALIDATION ..... 41
8.5. PROCEDURAL DEVIATIONS ..... 42

**9. INTERNAL QUALITY CONTROL CHECKS ..... 42**

9.1. LABORATORY QUALITY CONTROL SAMPLES AND ACCEPTANCE CRITERIA ..... 42
9.2. QUALITY CONTROL SAMPLE FREQUENCY AND CORRECTIVE ACTION ..... 44
9.3. QUALITY CONTROL CHARTS ..... 45
9.4. MEASUREMENT UNCERTAINTY ..... 45

**10. ASSURING QUALITY OF TEST RESULTS ..... 46**

10.1. DATA MANAGEMENT ..... 46
10.2. DATA DOCUMENTATION ..... 48
10.3. DATA CALCULATIONS ..... 49
10.4. REPORTING LIMITS ..... 49
10.5. DATA REVIEW ..... 50
10.6. DATA QUALIFICATION ..... 50
10.7. DATA REPORTING ..... 50
10.8. DATA STORAGE, SECURITY, AND ARCHIVAL ..... 51

**11. AUDITS AND INSPECTIONS ..... 52**

11.1. INTERNAL QUALITY ASSURANCE AUDITS ..... 52
11.2. REVIEW OF THE QUALITY ASSURANCE PROGRAM ..... 52
11.3. GOOD LABORATORY PRACTICE CRITICAL PHASE INSPECTIONS ..... 53
11.4. CLIENT AUDITS ..... 53
11.5. AGENCY INSPECTIONS ..... 55
11.6. PROFICIENCY TESTING ..... 55

**12. CORRECTIVE AND PREVENTIVE ACTION ..... 56**

12.1. LABORATORY INVESTIGATIONS AND CORRECTIVE ACTION ..... 56
12.2. INVESTIGATION PROCESSES ..... 57
12.3. CLIENT FEEDBACK ..... 57
12.4. PREVENTIVE ACTIONS ..... 58

Uncontrolled Copy



ED_004850_00001502-00300

**13. SERVICE TO CLIENTS ..... 59**

13.1. SERVICE TO CLIENTS ..... 59
13.2. REVIEW OF WORK REQUESTS, TENDERS, AND CONTRACTS ..... 60
13.3. TIMELY DELIVERY ..... 60
13.4. SUBCONTRACTING ..... 61
13.5. USE OF NELAP AND A2LA LOGO ..... 61

Appendix A – Procedure Cross Reference List
Appendix B – Certifications, Accreditations, Registrations, and Contracts
Appendix C – Organizational Charts, Personnel to Sign Reports
Appendix D – Personnel Qualifications and Responsibilities
Appendix E – SOPs and Analytical Methods
Appendix F – Instrument and Equipment List
Appendix G – Preventive Maintenance Schedule
Appendix H – Calibration Schedules
Appendix I – NELAP Scope of Testing
Appendix J – Quality Control Types, Frequency, and Corrective Action
Appendix K – Microbiological Testing

Uncontrolled Copy

## Revision Log:

| Revision: 13 | Effective Date: This version | |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Throughout Document | Reflect re-identification of documents in EtQ | Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers |
| Title Page | Regulatory compliance | Added text for address, phone, reviewer/approver titles (previously listed on hardcopy covers and pre-EtQ versions) |
| Section 1 | Updated training requirements | Removed requirement for all employees to read the appendices, they are available as resources, required for dept 4052 only. |
| Section 1.2 | Regulatory compliance | Inserted additional ISO17025 text at opening and closing of Quality Policy Statement |
| Section 2.1.1 | New Section | Summarize processes to ensure business continuity and contingency plans |
| Section 2.2 | Reflect current structure | Moved summation of technical director and QA manager to this section; changed employee responsible for daily operation from COB to VP.<br>Throughout document, clarified management structure to include VP. |
| Section 2.6 | Added process | Added ability for management and/or QA to issue a stop work notice. |
| Section 2.16 | Regulatory compliance | Inserted additional ISO17025 text regarding ensuring impartiality, operation integrity, etc. |
| Section 3 | Added building | Added building D |
| Section 4.2 | Clarification | Noted that interim amendments to controlled procedures are not allowed. |
| Section 5.5 | Added information | Noted that minimum sample retention period is 2 weeks form reporting |
| Section 6.4 | Clarification | Standardized use or the terminology for equipment (supporting units) vs instruments (data producing units) |
| Section 6.5.1.9 | New section | Added to address passwords and audit trails for systems used to process electronic data |
| Section 6.5.2 | Clarification | Clarified SDLC processes |
| Section 8.1 | Added information | Added reference to laboratory website for all current accreditation records |
| Section 10.2 | Added information | Added information regarding electronic data, signatures, and audit trails |
| Section 10.4 | Regulatory compliance | Added DoD reporting requirements for DL, LOD, LOQ |
| Section 10.5 | Clarification | Clarified process and intent of data review |
| Section 10.7 | Updated process | Added process for identification of accreditation status<br>Noted use of LlabWeb for secure data transfer |
| Section 12.1 | Added process | Added ability for management and/or QA to issue a stop work notice. |
| Section 12.4 | Clarification, new process | Clarified processes that address preventive action; changed "PPI" to "Lean" |
| Section 13.2 | Clarification | Added detail on project evaluations |
| 13.4 | Added detail | Added information regarding the subcontractor warranty and the need to ensure subcontractor can meet accreditation requirements |
| Appendices A-J | Updated for current information | Updated to reflect current SOPs, personnel, methods, etc. |

Uncontrolled Copy

| Revision: 12 | Effective Date: Jul 29, 2013 | |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Throughout Document | Reflect re-identification of documents in EtQ | Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers |
| Section 1.1 | Not required | Deleted "Our Unique Promise of Value" statement |
| Section 2.1 | Reflect current organization | Added new company name and incorporation state |
| Section 2.3.1 | Detail | Added section to describe the responsibilities of the technical director. |
| Section 2.5 | Document Consolidation | Added language consistent with SOP-QC-024 so that procedure can be inactivated. |
| Section 4.2 | Document Consolidation | Added language from SOP-QC-024 regarding QA's signature so that procedure can be inactivated. |
| Sections 5.3 and 5.6 | Document Consolidation<br><br>Clarification | Added information from LOM-SOP-ES-212 so that procedure can be inactivated.<br><br>Added information to clarify the difference between and LSAR and a legal chain of custody. |
| Section 9 | Document Consolidation | Added information from LOM-SOP-ES-213 so that procedure can be inactivated. |
| Section 10.4 | Enhancement | Added definition and detail for LOD (Limit of Detection) |

Uncontrolled Copy

# INTRODUCTION

This *Quality Policy Manual* is based upon Eurofins Lancaster Laboratories Environmental LLC's (herein referred to as the laboratory) overall business and management philosophies, mission, and goals. This manual is written to present the policies employed by the laboratory as well as the support departments that serve the environmental laboratories and to comply with the requirements of the National Environmental Laboratory Accreditation Program, ISO 17025, and the Department of Defense (DoD). These policies define the "what" we do with emphasis on management's responsibilities and commitment to quality. Governing SOPs are in place within the organization, to ensure the proper execution of this policy document (refer to Appendix A). This manual is required reading for laboratory personnel. The appendices are available resources to all personnel but are not required reading for all employees. The most recent and up-to-date *Quality Policy Manual* and all referenced documents are available to all laboratory personnel who work in or support the laboratory. The laboratory actively strives for continuous improvement of its quality systems to better serve our clients.

## 1.1. Mission Statement

The laboratory offers analytical and consulting services in the chemical and biological sciences with comprehensive expertise in environmental laboratory applications. The company mission statement describes the corporate philosophy:

At Eurofins Lancaster Laboratories, Environmental LLC we are people working together to serve the health and environmental needs of society through science and technology. We strive to be the recognized leader in all that we do.

Our mission is to provide independent laboratory services in the chemical and biological sciences with excellent quality and service. As a corporate community, we:

- Deliver quality by fully understanding and always meeting the requirements of those we serve.
- Live our values by relating to our clients, coworkers, shareholders, suppliers, and community in a fair and ethical manner.
- Manage our growth and financial resources so we can serve our clients well, provide a satisfactory return to shareholders, and maintain our meaningful and enriching workplace.

## 1.2. Quality Policy

The Executive Management Group recognizes quality as a key element of the laboratory's standard of service. The group supports the laboratory's commitment to quality as defined by NELAP, ISO 17025, DoD, and other regulatory agencies (i.e. states) through the strict adherence to the Quality Policy Statement. The Quality Assurance Manager wrote the Quality Policy Statement, with final approval from the laboratory Vice-President. The policy can not be revised without their approval.

The Quality Policy Statement gives employees clear requirements for the production of analytical data. Employees are trained on the components of the Quality Policy Statement during their first day of orientation. Each employee signs the statement upon hire as agreement to implement the policy in all aspects of their work. Employee agreement to any subsequent revisions of the statement are obtained by documented reading and understanding of and agreement to follow the Quality Manual, which contains the current version of the statement. The statement is as follows:

Uncontrolled Copy

As an organization, all personnel are committed to high quality professional practice, testing and data, and service to our clients.

We strive to provide the highest quality data achievable by:

- Following all documentation requirements; describing clearly and accurately all activities performed; documenting "real time" as the task is carried out; understanding that it is never acceptable to "back date" entries and should additional information be required at a later date, the actual date and by whom the notation is made must be documented.
- Providing accountability and traceability for each sample analyzed through proper sample handling, labeling, preparation, instrument calibration/qualification, analysis, and reporting; establishing an audit trail that identifies date, time, analyst, instrument used, instrument conditions, quality control samples (where appropriate and/or required by the method), and associated standard material.
- Emphasizing a total quality management process and commitment to continuous improvement which provides accuracy, and strict compliance with agency regulations and client requirements, giving the highest degree of confidence; understanding that meeting the requirements of the next employee in the work flow process is just as important as meeting the needs of the external client.
- Providing thorough documentation and explanation to qualify reported data that may not meet all requirements and specifications, but is still of use to the client; understanding this occurs only after discussion with the client on the data limitations and acceptability of this approach.
- Responding immediately to indications of questionable data, out-of-specification occurrences, equipment malfunctions, and other types of laboratory problems, with investigation and applicable corrective action; documenting these activities completely, including the reasons for the decisions made.
- Providing a work environment that ensures accessibility to all levels of management and encourages questions and expression of concern on quality issues to management.

We each take personal responsibility to provide this quality product while meeting the company's high standards of integrity and ethics, understanding that improprieties, such as failure to conduct the required test, manipulation of test procedures or data, or inaccurate documentation will not be tolerated. Intentional misrepresentation of the activities performed is considered fraud and is grounds for termination.

I understand the expectations and commit to implementation of all applicable policies and procedures and to providing quality data.

## 1.3. Statement of Values

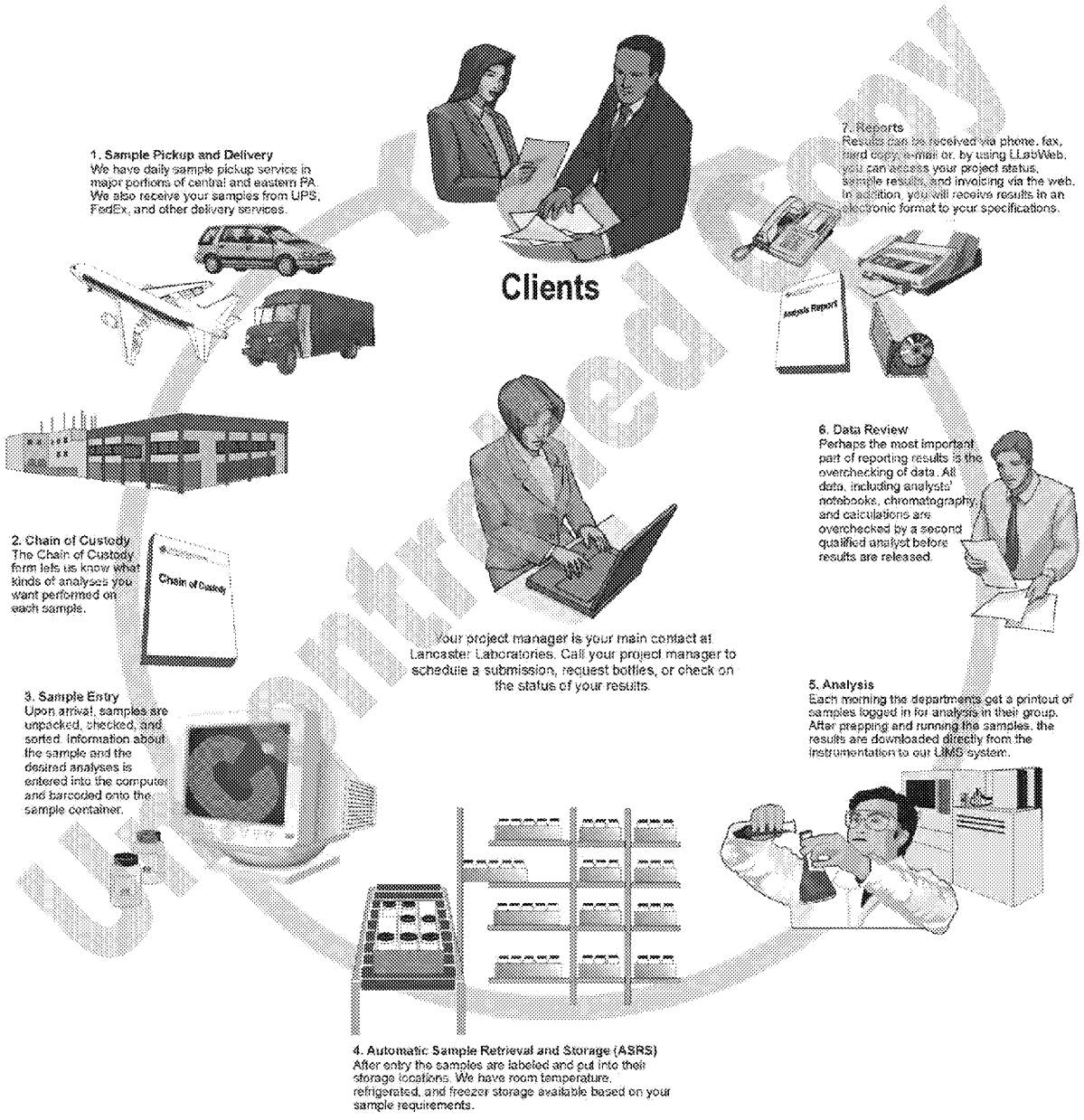
As a corporate community, we embrace our heritage of integrity and strive to live by the following principles:

- Fairness and honesty in all our relationships
- Mutual trust
- A respect for ourselves and others
- A sense of caring that leads us to act responsibly toward each other and society, now and in the future
- Loyalty to our clients and one another
- A spirit of open-mindedness as we deal with all

- Dedication to service
- Good stewardship of our resources
- A commitment to flexibility and continuous improvement

We each take personal responsibility to live these values in all of our dealings, knowing full well our pledge may involve difficult choices, hard work, and courage.

## 1.4. Sample Flow-Through Diagram




Uncontrolled Copy

### 1.5. Certifications, Accreditations, and Registrations

Accreditation/Certification is the process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications and/or standards. It is the one generally accepted method by which a laboratory such as ours can demonstrate its capability of generating acceptable, professional, quality test results in those areas in which it claims competence. To this end, we have actively sought accreditation by organizations offering it in those areas relevant to our technical expertise. We strive to ensure that the facilities, equipment, procedures, records, and methods used by the laboratory in the testing of environmental samples are in compliance with the requirements of these standards.

Although organizations offering accreditation differ somewhat in the details of their programs, they generally evaluate laboratories in four basic areas: personnel (adequate staffing, education, training, and experience), physical facilities, instrumentation/equipment, and quality assurance program. This evaluation is performed by one or more of the following procedures: periodic on-site inspections of the laboratory by assessors experienced in technical operations, quality systems, and management; periodic analysis of proficiency test samples; and periodic updating of the laboratory's file to reflect changes in personnel, equipment, or services offered. Some states offer reciprocity with other state programs.

Appendix B lists accreditations and registrations held by the laboratory in support of environmental work. Current copies of all scopes of accreditation are kept on file in the Quality Assurance Department.

## 2. ORGANIZATION AND PERSONNEL

### 2.1. Company Overview and History

The laboratory was founded in 1961 by Dr. Earl Hess in response to a need for high quality technical services by the agricultural and industrial communities in southeastern Pennsylvania. Nourished in a culture of quality and caring about all those associated with the business, the corporation became an industry leader known for innovative business practices and people-friendly policies. The company was independently owned until the retirement of Dr. Hess in 1995. At that time, the laboratory was acquired by a publicly held company, Thermo TerraTech, Inc., a Thermo Electron company. Ownership changed in September 2000, when the laboratory was acquired by Goldner, Hawn, Johnson, and Morrison, Inc. (GHJ&M), a private equity investment firm. In August 2005, the laboratory was acquired by Fisher Scientific under their BioPharma Division. On November 9, 2006, Thermo Electron and Fisher Scientific merged to form Thermo Fisher Scientific. In April 2011, Thermo Fisher Scientific sold the laboratory to Eurofins Scientific. Effective July 1, 2013, the Pharmaceutical and Environmental Divisions were split into separate business entities and the company name became Eurofins Lancaster Laboratories Environmental, LLC. The laboratory continues to operate as an independent laboratory and is incorporated by the State of Delaware.

The laboratory provides a wide array of laboratory services to clients working in environmental industries. We strive to offer high quality technical services in the chemical and biological sciences with personal attention to client needs. These services include chemical analyses, microbiological testing, and analytical method development. We are, therefore, a technical service company and do not manufacturer or distribute goods. Our "product" is accurate and timely technical information and our continued existence depends on the quality of the services we offer and efficiency with which we deliver them.

Uncontrolled Copy

2.1.1 Business Continuity and Contingency Plans

Various policies and practices are in place to address continuity of business and contingency plans to ensure continued operations or minimal disruption in operations should unplanned events (natural disasters, unexpected management changes, etc.) occur.

Section 2.2 of this document explains the identification of deputies for key management positions. Section 3.3 discusses the disaster recovery plan. Section 6.5 addresses the security and backup of our computer systems. Section 10.8 addresses handling of client records should the company have a change in ownership or go out of business.

## 2.2. Organizational Structure

The laboratory Vice-President/Technical Director, Duane Luckenbill, is responsible for the daily operations of the laboratory.

The Executive Management Group is defined as the Eurofins Environment Testing US Chairman of the Board and President and Eurofins Lancaster Laboratories Environmental, LLC Vice-President.

The management staff includes directors, managers and group leaders. Organizational charts are presented in Appendix C. A list of key personnel is also provided. The Vice-President and Quality Assurance (QA) Manager have identified deputies for all key management personnel.

2.2.1 Technical Director

The Technical Director ensures that the laboratory's policies and objectives for quality of testing services are documented in this quality manual. The Technical Director must assure that the manual is communicated to, understood, and implemented by all personnel concerned.

2.2.2. Quality Assurance Manager

The Quality Assurance Manager ensures that the quality system is followed at all times. The QA Manager reports directly to the Vice-President thus ensuring corrective actions to quality issues are taken promptly and are separate from business decisions. The QA Manager has no direct supervisory responsibility for the generation of technical data to avoid any conflict of interest in administrating the QA program. The QA Manager has the final authority to stop work that compromises our integrity or data quality. The situation must be investigated and appropriate corrective action must be put in place before the QA Manager will authorize the resumption of work. The specific duties of the QA Manager are communicated in job plan format.

Uncontrolled Copy

## 2.3. Management Responsibilities

Laboratory management duties are outlined for supervisory personnel using a job plan format, which details each individual's responsibilities along with expected results. Typically, management duties include, but are not limited to:

- Personnel hiring and training
- Supervision of personnel
- Providing resources to ensure a work environment free from commercial, financial, and other undue pressures that may adversely affect the quality of their work
- Providing resources to ensure a safe work environment
- Directing daily work operations, including scheduling of work
- Ensuring compliance with the TNI Standards, ISO 17025, Department of Defense quality Systems Manual, state agency programs, analytical methods, and client requirements.
- Assessing laboratory capacity and workload
- Resource allocation
- Ensuring quality of data produced
- Contributing to the continuous improvement of the laboratory operation
- Ensuring that corrective actions are carried out in an appropriate and agreed time-frame.
- Communicating problems and concerns to Senior and Executive Management to enlist a higher level of support for corrections and continuous improvements.
- Maintaining awareness of technical developments and regulatory requirements

## 2.4. Overview of the Quality Assurance Program

Quality Assurance (QA) is responsible for developing planned activities whose purpose is to provide assurance to all levels of management that a quality program is in place within the laboratory, and that it is functioning in an effective manner that is consistent with the requirements of NELAP, ISO 17025, DoD, and any other regulatory agencies (i.e. states) in which we hold accreditation. Although the laboratory is a wholly owned subsidiary of Eurofins Scientific, the Quality Assurance and Quality Systems operations described in this manual are specific to the Lancaster site.

The administration of the QA program is the responsibility of the QA Manager in cooperation with all levels of management.

The QA program, as directed by executive management, was established to:

- Ensure accountability, accuracy, and traceability of all analytical data generated.
- Ensure that current regulatory, agency, and client requirements are being met.
- Ensure that operating procedures are in place to minimize the possible loss, damage, and tampering with data, in addition to ensuring that raw data is stored in a secured area and is maintained by designated archivists and/or system administrators.
- Ensure that curriculum vitae (CVs) and training records are maintained to document that staff members have the necessary education, training, and experience to perform their job responsibilities and functions.
- Ensure that regulatory training is provided to applicable employees on a routine and ongoing basis.
- Ensure that all procedures are available, controlled, and current.

Uncontrolled Copy

- Ensure that documentation demonstrates that procedures are carried out in a compliant and effective manner.
- Ensure that all equipment and instrumentation is qualified, maintained, and calibrated, as appropriate, in accordance with written standard operating procedures.
- Ensure that all significant laboratory problems are investigated, evaluated for root cause and corrective action is put in place as documented
- Ensure that an internal audit program is in place to provide on-going monitoring and confirm that laboratory personnel are adhering to standard operating procedures and applicable regulations.
- Ensure that quality issues are brought to the attention of management in a timely manner.

## 2.5 Quality Assurance Responsibilities

The QA Manager assigns tasks with input from the company Vice President. The primary responsibilities of QA include, but are not limited to the following:

- Oversee the laboratories' internal audit program which consists of various audit types and applies to all laboratory activities (technical and administrative).
- Review and approve standard operating procedures and analytical methods.
- Review and approve validation documentation.
- Review non-conforming quality control data
- Perform tracking and trending of quality measurements and report the status and effectiveness of the quality system to management.
- Approve investigation and corrective action reports (ICARs) and audit responses to ensure that they are completed in a timely manner, evaluated for root cause, and corrective actions are implemented as needed. To monitor corrective action for effectiveness.
- Host client and regulatory agencies during facility audits and follow-up to any cited deficiencies.
- Provide regulatory guidance to the laboratory and support areas.
- Monitor Good Laboratory Practice (GLP) regulatory activities.
- Communicate quality issues to management in a timely manner
- Provide and/or coordinate on-going regulatory training (e.g., GLP).
- Participate in the vendor and supplier approval process, including subcontractors.
- Review analytical data for compliance with our procedures.
- Prepare and review QA project plans (QAPPs) as required by EPA and client projects.
- Maintain and update this *Quality Policy Manual*.
- Maintenance of the Laboratory's accreditations, including but not limited to, administration of the proficiency test sample programs, both single and double blinds.
- Communicate (within 30 days) to the relevant state authorities when there are management or facility changes that impact the laboratory. Changes in the technical director must be made within 20 days.

Uncontrolled Copy

## 2.6. Communication of Quality Issues to Management

The QA Department is responsible for preparing reports to Management to keep them apprised of outstanding quality issues. Reports to management foster communication, review, and refinement of QA activities to ensure that the QA program is adequate to meet regulatory and the laboratory's quality objectives. The following reports are used to communicate quality issues and include, but are not limited to:

- Internal, client, and agency audit reports and corrective action plans
- Proficiency test reports
- Investigation and corrective action reports
- Monthly and quarterly quality status reports
- Plans for corrective action

Upon review of quality issues, management and/or QA may issue a stop work notice if an issue indicates the potential for a problem on a broader scale with an analysis. The investigation would need to be completed and the issue resolved before work could continue. The information is tracked through our Investigation and Corrective Action Report (ICAR) process.

## 2.7. Personnel Qualifications and Responsibilities

Full resumes and responsibilities of key personnel are provided in Appendix D.

Due to the number of analysts on staff, entry level chemists, technicians, and support personnel are not included in the resume section. However, all employees have job plans that define their responsibilities. Duties for these personnel typically include:

- Sample storage
- Sample preparations
- Performance of tests
- Calibration, operation, and maintenance of instruments
- Data entry
- Standard and reagent preparation
- Glassware preparation
- Data deliverables preparation

## 2.8. Relationship of Functional Groups and the Quality Assurance Program

In addition to this *Quality Policy Manual*, aspects of the QA program are documented in a series of standard operating procedures that support the proper execution of this document. Technical operation procedures with required quality components are also in place. A list of the titles of relevant SOPs is provided in Appendix E. There are a variety of mechanisms used to communicate requirements and verify compliance with the QA program, including:

- Management requires that all employees read and be trained in the policies and SOPs that are pertinent to their jobs.
- Employee job plans define individual responsibilities. All job plans (PMDs) include QA aspects, and performance is reviewed annually.
- Laboratory audit findings are circulated to management and require a response and follow-up to items needing corrective action.

Uncontrolled Copy

- Cross-functional meetings, including representatives from QA, Client Services, Marketing, management, and technical operations are held regularly to review specific projects and quality issues.

## 2.9. Balancing Laboratory Capacity and Workload

Evaluating laboratory capacity to perform specific projects is the responsibility of the Vice-President, laboratory directors and managers, and the Client Services director and manager. These responsibilities are documented in the individual job plans for these positions.

The laboratory facilities and staff size are very large compared to other laboratories serving the environmental industry. Many analysts are cross-trained to perform a variety of tests, and there is redundant equipment available in case of malfunctions. This minimizes the need to evaluate small and medium size projects against capacity available to complete them. Large projects are reviewed against capacity estimates before bids are submitted to ensure that the client's analysis schedule is met.

Regularly scheduled meetings are held with upper management, laboratory middle management, Client Services and QA personnel to review progress with current projects, as well as special requirements of new work scheduled for the laboratory.

Laboratory capacity and backlog is tracked on a continuous basis using information from the Laboratory Sample Information System (LIMS) including turnaround time, and work in-house.

## 2.10. Identification of Approved Signatories

All data is reviewed and verified prior to release to the client. Based on complexity or regulatory needs, some projects are designated for secondary (technical and/or QA) review of the Analysis Reports and/or data deliverables. Approved signatories for these secondary reviews are defined in the SOP on Data Entry, Verification, and Reporting. Directors, managers, group leaders, and other designated employees (such as QA, project managers, and senior technical staff) are designated to approve/release Analysis Reports. Request for approval of an employee to approve/release reports must be made through the QA Department. These authorized personnel are designated with an asterisk in the personnel list provided in Appendix C.

## 2.11. Personnel Training

The experience and training received by personnel is of great importance to our clients and regulatory agencies. Curricula Vitae (CVs) and on-going training documentation are available to demonstrate how personnel have been prepared for the tasks they routinely perform. To ensure the highest quality of services at the laboratory, training programs and plans are developed to match skills with job functions. Accurate training documentation is the responsibility of both the employee and their supervisor. On a routine basis, the supervisor reviews and approves training documentation to verify that it is complete and current.

Training requirements can be met through education, prior job experience, internal and external training classes, on-the-job training, TRN training modules, procedure reading, or any combination thereof, to enable the person to perform assigned job functions and meet regulatory compliance.

Uncontrolled Copy

Each analyst training to perform a new analysis is required to perform an initial demonstration of capability and meet the requirements for accuracy and precision before working independently on the test method. Typically, this is accomplished by the successful analysis of four known samples. However, there are certain tests performed that are not required by the mandated test method or regulation to perform the above procedure (i.e., EPA 1010, 9095). In this case, the analyst's documentation of proficiency is satisfied by the sign-off of having read, understood, and agreed to follow the SOP as written and observation by a senior analyst.

Management personnel are responsible for planning ongoing professional growth and development activities for an employee through on-the–job training and/or internal and external training courses so an employee can maintain a current skill set to match job responsibilities.

An annual performance review based on job accountabilities, objective measures, and pre-defined standards is completed by management personnel for each employee. This assessment is documented and maintained. Input is obtained from other managerial personnel as needed.

2.11.1. New Hire Training

New employees are oriented as part of a year-long process that is designed to make the employee feel welcome and comfortable by defining our culture, traditions, philosophies, and work practices. During the orientation process an employee learns about personnel and safety policies and business strategies in addition to quality, ethics, and customer satisfaction expectations through a formal process administered by our Human Resources Department.

New employees are required to attend "core" technical orientation, as applicable, which can entail the participation in training module exercises, short session attendance, and/or other skill training specific to their assigned department or job function. Additional job-specific training required for an employee is based upon their assigned duties and is identified by their supervisor. Technical orientation occurs during the first few weeks of employment.

The orientation process is designed to enable employees to initiate and take responsibility for their personal and professional career growth at the laboratory. The orientation process is conducted without regard to employee race, color, creed, national origin, sex, age, or disability in accordance with the laboratory's Employee Equal Opportunity (EEO) policy.

2.11.2. Ongoing Training

Refresher and ongoing training occurs through various means, which include but are not limited to, training in or independently review new/updated standard operating procedures and TRN training procedures; on-going regulatory training; in-house or off-site classes or seminars. The goal of this training is to ensure that employees remain current with changes to laboratory systems and practices, as applicable to their job function. Retraining and re-qualification activities occur as directed by procedures or regulations. Employees are retrained if an issue or investigation warrants that retraining is a necessary corrective action. Management directs when employee re-training is required, and the extent of the re-training.



ED_004850_00001502-00313

## 2.12. Regulatory Training

The QA Department is responsible for coordinating and conducting initial and ongoing regulatory training (i.e., GLP) for all applicable laboratory and support personnel. It is the responsibility of management within each department to ensure that personnel attend the required training sessions.

The choice of training format and topics covered for ongoing regulatory training is left to the discretion of QA and the trainer. All training sessions reinforce the concepts in the regulations as they are relevant to the laboratory.

Whenever possible, after training is completed, a demonstration of proficiency of the training topic is given. The demonstration of proficiency is generally in the form of a quiz although other demonstrations of proficiency are acceptable depending on the scope and content of the training. If necessary, training is presented and/or repeated one-on-one with individuals who do not demonstrate proficiency in the training topic. This is performed by QA in conjunction with applicable laboratory management personnel.

## 2.13. Employee Safety

The laboratory, being mindful of its responsibilities as an employer and active corporate citizen, has established the following objectives of its safety program:

- Provide a safe environment for its employees, visitors, and the community surrounding its place of business.
- Provide ongoing safety training for employees.
- Provide all necessary facilities and equipment to ensure the safety of its employees and to minimize all chemical exposure during the normal performance of their required tasks, and to take all necessary precautions to safeguard the surrounding environment.
- Provide periodic health physicals for employees.
- Foster and encourage safe operations and a proper safety attitude on the part of our employees through general operations and systems, training, and the *Chemical Hygiene Plan* (CHP).

The CHP addresses various aspects of our safety program in greater detail.

A Safety Committee works to enhance our overall safety program. The committee meets on a routine and ongoing basis and its specific responsibilities are detailed below:

- Review accident and incident reports. Make recommendations for methods of prevention to eliminate further accidents.
- Promote safety awareness and distribute safety information by various means (e.g., posters, videotapes, pamphlets, and books). Use internal communication channels to promote safety awareness.
- Enhance and recommend safety-training programs for all employees, as necessary.
- Maintain up-to-date information on employee concerns that are safety related. Offer input and information to the Chemical Hygiene Officer and/or Safety Officer, as needed.

Uncontrolled Copy



ED_004850_00001502-00314

## 2.14. Client Services/Project Management Responsibilities

Members of the laboratory Client Services/Project Management Group are responsible for organizing and managing client projects. Clients are assigned a project manager (a.k.a. "CSR") who serves as their primary contact at the laboratory. It is the project manager's responsibility to act as the client advocate by communicating client requirements to laboratory personnel and ensuring that clients provide complete information needed by the laboratory to meet those requirements. All client verbal communications are documented by the project manager in a controlled notebook. In addition to information management, Project Management responsibilities include:

- Coordinating and preparing proposals in conjunction with technical staff.
- Confirming certification status.
- Hosting client visits and audits.
- Coordinating and communicating turnaround time (TAT) requirements for high priority samples/projects.
- Answering common technical questions, facilitating problem resolution.
- Providing clients with sample status report or results (partial reports) prior to receipt of the final Analysis Reports (e.g., fax, e-mail, phone).
- Scheduling sample submissions, sample containers, and sample pick-up via the laboratory courier service.
- Informing the client of deviation from their contract.

## 2.15. Confidentiality

Strict confidentiality is maintained in all of our dealings with clients. Confidentiality agreements, therefore, are willingly provided.

All employees are required to protect company technical data, including client names and test results from disclosure to any third party. This policy, as described in the *Eurofins Lancaster Laboratories Employee Handbook*, is provided and presented to employees during their orientation period.

Intellectual property associated with the testing that we perform under contract for a client is the property of the client.

In an attempt to ensure the confidentiality of our systems and procedures within our laboratory, it is our policy to restrict the distribution of our internal procedures to clients. Clients are permitted to review our procedures while on-site as part of an audit or visit. Based on this policy, we would request that any documents viewed would not be shared or made available to any third parties without the permission of the laboratory.

Uncontrolled Copy

## 2.16. Business Conduct

Our business conduct policy applies to all operations of the company. All employees must avoid involvement in any activities that would diminish confidence in their competence, impartiality, judgment, or operational integrity. All employees must further avoid any relationship with other individuals or organizations (including Eurofins Scientific sister companies) that might impair, or even appear to impair, the proper performance of their company-related responsibilities. Employees must avoid any situation that might affect their independence of judgment with respect to any business dealings between the company and any other organization or individual. Any employee who believes that they have such a conflict, whether actual or potential, or who is aware of any conflict involving any other employee must report all pertinent details to the Vice-President or President of the company. The company's management vigorously enforces this policy and takes prompt and appropriate action, including termination, against any employee found to be in violation.

## 2.17. Operational Integrity

All employees sign an Employee Ethics Statement on their first day of employment. Employees responsible for generating, handling, or reviewing laboratory data understand that the laboratory mission is to perform all work with the highest level of integrity. Under no circumstances are shortcuts or generating results to suit a client's purpose rather than good scientific practice considered acceptable. Any violation of the laboratory ethics policy results in a detailed investigation that could lead to termination.

All levels of management consider the following activities unacceptable:

- Knowingly recording inaccurate data.
- Fabrication of data without performing the work needed to generate the information. This includes creating any type of fictitious data or documentation.
- Time travel or adjusting clocks on computerized systems to make it appear that data was acquired at some time other than the actual time.
- Manipulation of data for the express purpose of passing system suitability or quality control criteria.
- Selective use of data generated, or not using data that was legitimately generated and has an impact on the outcome of the test.
- Executing significant deviations from approved test methods and procedures without prior approval from the laboratory management and/or the client.

If an issue does arise which could compromise data integrity, personnel are instructed to perform the following activities:

- Clearly document the situation and maintain all data generated. There is a big difference between poor judgment and fraud. Fraud usually involves intent to conceal an action taken. Therefore, the more documentation that is maintained, the less likely an action is considered fraudulent if further scrutinized.
- When out-of-specification results or quality type issues are detected, all supporting data and relative background information must be documented and presented for management review. Problem resolution and client contact, as applicable, must also be documented.
- Review any questionable situations and decisions with a supervisor.

Uncontrolled Copy



ED_004850_00001502-00316

- Bring a questionable or uncomfortable issue directly to the QA Manager or a member of the QA Department as part of our QA open door policy.
- Utilize the company's Ethics Committee. See Section 12.4 of this manual.

# 3. BUILDINGS AND FACILITIES

## 3.1. Facility

The laboratory is located at 2425 New Holland Pike, Lancaster PA. The facility consists of two campuses located on the North and South sides of Route 23. The two campuses are connected by a pedestrian bridge that spans route 23.

The North campus sits on a commercial plot measuring 5.2 acres. Several structures occupy this plot. The primary structure, Building A, is a 3-story building of concrete, brick, and wood construction. It is approximately 116,000 square feet and consists of approximately 62,000 square feet of laboratory space; 25,000 square feet of office space; and 29,000 square feet of storage, mechanical, and service space. Ancillary structures include a 1000 square foot chemical storage building (organic solvent, acid, and gas cylinder storage), a 10,000 square foot Butler building which houses stability chambers, and a 3,000 square foot storage warehouse which also houses a bottle packing area.

Property adjacent to Building A also includes two buildings that are leased. This space includes an 1800 square foot garage for recycling and for auto maintenance, and a 3500 square foot barn for shop and maintenance areas.

The South Campus sits on a plot measuring 14.48 acres on the south side of Route 23. Three primary laboratory and three ancillary storage buildings occupy this plot. Buildings B and C are 3-story buildings of steel and concrete construction. Building D is a 4-story building of steel and concrete construction. Each building is equipped with sprinkler protection. Building B is approximately 50,000 square feet and consists of approximately 20,000 square feet of laboratory space; 18,000 square feet of office space; and 12,000 square feet of storage, mechanical, and service space. Building C is approximately 45,000 square feet and consists of approximately 24,000 square feet of laboratory space, 9,000 square feet of office space, and 6,000 square feet of storage, service, and mechanical space. Building D is approximately 84,000 square feet and consists of approximately 35,000 square feet of laboratory space, 19,000 square feet of office space, and 24,000 square feet of storage, service, and mechanical space. Ancillary structures include a 400 square foot chemical storage building (organic solvent) and a 200 square foot medical waste storage building.

Property adjacent to Buildings B, C, and D also includes one building that is leased. This space includes approximately 8,000 square feet of warehouse space and 2000 square feet of Training laboratories, offices, and conference rooms.

There is an automatic fire alarm and security system hooked up at the facility. This system is monitored offsite by Choice Security. The entire campus and all exterior doors are monitored by video surveillance.

This facility is serviced by public sewer. Drinking water comes from a private well while the facility sprinkler system is fed by the public water supply. The closest surface water is the Conestoga Creek.

Uncontrolled Copy

## 3.2. Security

The laboratory is considered a secure facility. All outside doors except the main lobby entrance are locked during normal business hours to prevent unauthorized entry. An attendant monitors this entrance at all times.

During evenings, weekends, and holidays, all doors are locked and Security personnel are on site to prevent unauthorized entry into the building. Video cameras are utilized by Security personnel to monitor the facility grounds.

Every employee is issued a photo ID badge which also serves as a building access card. This badge must be worn at all times while on laboratory property so that employees are easily identified. Access to secured/designated areas within the building is limited to only applicable employees through the building security system. This system is administered by Security staff.

All visitors must register with the lobby attendant and are issued a visitor badge. A staff person must accompany visitors while in the facility. Additional visitor rules are outlined in the *Visitor Security and Safety Rules* pamphlet which is provided to all guests.

Building access cards are issued on a temporary basis to contractors or service technicians (e.g., electricians and plumbers) who need access to the building to work on a project. These cards provide the contractor with limited access during the normal workday and must be returned when the work is complete.

## 3.3. Disaster Recovery

A disaster recovery plan is in place to provide direction for situations where normal operations of the laboratory are not possible. In the event that the building would be severely challenged, a designated disaster recovery team, which includes Physical Services, Maintenance, Safety, Corporate Management, Public Relations, and other applicable personnel depending on the scope of the disaster, would assemble at a designated area to assess the situation and formulate a plan.

The plan addresses, in general terms, how to approach the following issues: electrical failures, heating/air conditioning failures, fire/building evacuation, computer failures, hazardous material spills, injury to employees, pandemic flu, disruption of phone service, and stability chamber failures.

## 3.4. Environmental Monitoring

The air handling system for the main laboratory is specially designed to protect sensitive instruments from harmful vapors to ensure that samples are not contaminated. The Physical Services/Maintenance Group is responsible for maintaining the HVAC and exhaust hood systems. This is particularly important in our instrumentation rooms and computer center where a controlled environment, positive pressure system is maintained.

Most refrigerators, freezers, incubators, and ovens used for analysis are monitored by a computerized system equipped with stationary thermometer temperature probes linked to a master panel that is accessed through a computer. If a unit is outside of a predefined temperature range for a specified period of time, the system alarms. Units not on the computerized system must be monitored manually by recording thermometer temperature readings twice daily.

Uncontrolled Copy

The laboratory is set up so that there is effective separation between neighboring areas in which there is potential for contamination. Laboratory storage blanks are also used to evaluate conditions under which samples for volatile analysis are stored to monitor for cross-contamination potential. QA provides oversight of the environmental monitoring system.

## 3.5. Water Systems

Well water and the public sewer system service the facility. The water system is monitored to meet the permit requirements of the Pennsylvania Department of Environmental Protection.

Reagent water is available to analysts for sample preparation (including dilution) and glassware cleaning. Two reverse-osmosis deionized water systems deliver highly purified water to a sealed fiberglass storage tank. From the storage tank the water is delivered to an ion-exchange-carbon filter system for further polishing. The water is also exposed to an in-line ultraviolet sterilization lamp before being circulated to taps throughout the laboratory.

Daily monitoring and preventive maintenance for the system is the responsibility of the Maintenance Department. Monthly and annual testing is performed as required by regulatory guidance. QA provides oversight of the water system monitoring. In addition, method blanks are tested with each batch (≤20) of samples.

## 3.6. Housekeeping/Cleaning

The laboratory is dedicated to providing a clean workplace. A third party professional cleaning service provides routine cleaning of "common areas" that include lavatories, drinking fountains, floors, and windows. Technical staff are responsible for the cleaning (or the contract of cleaning) of specific laboratory work areas.

Detergents used for cleaning contain no to very low levels of metals, pesticides/herbicides/ fungicides, or volatile solvents.

## 3.7. Insect & Rodent Control

Steps are taken to prevent, monitor, and control insect and rodent infestation. The coordination of this program is the responsibility of the Physical Services Department under the direction of QA. An outside service firm is contracted to perform routine and ongoing monitoring of the facility to ensure that preventive measures which are in place are effective and are working as intended.

No insect or rodent control chemical agents in a liquid or vapor form are applied or sprayed in any laboratory building, unless there is no other option, in which case department management must be contacted for approval.

## 3.8. Emergency Power Supply

The laboratory is located at the junction of two power grids that supply electrical service to the facility. If one of the power grids fails, we have the ability to work with the power company to have service switched to the other grid. Various types of diesel and natural gas generators are also available on a standby basis to supply power to selected areas of the laboratory in case of a power outage.

Uncontrolled Copy

To reduce spikes and spurious line voltage changes to laboratory instruments that can affect results or damage electronic equipment, "conditional power" is fed to these sensitive instruments. All essential computer systems are on uninterrupted power supply (UPS) which is a battery system that provides continuous conditional power for a limited time period in the event of a short power outage.

### 3.9. Facility Changes

Procedures are in place to manage change, ensure communication, and to minimize negative consequences through active participation of personnel involved in a facility change. The goal is to ensure that physical and environmental condition changes are adequately evaluated for impact and reduction of risk to quality, safety, health, employee, environment, property, analytical services, and business operations before and after the change is implemented.

## 4. DOCUMENT CONTROL

The administration of the document control system including tracking, filing, updating, and archiving of historical copies is the responsibility of the Office Services (OS) Department.

It is our policy to restrict the distribution of our internal procedures to clients and we discourage the distribution of company confidential documents outside of the facility. Clients are permitted to review our procedures while on-site as part of an audit or visit. Any documents that are distributed are only sent with the approval of QA.

The goals of the document control process are:

- Format documents according to consistent and defined standards
- Review and approve new documents
- Schedule review of existing documents
- Control of document versions and effective dates
- Review and approval of document changes
- Control document distribution and removal of obsolete documents
- Archive and protect obsolete documents

### 4.1. Hierarchy of Internal Operating Procedures

The hierarchy of controlled procedures at the laboratory is defined. These procedures and documentation are made available to promote consistency throughout the organization and to meet regulatory requirements. A list of relevant methods and procedures is located in Appendix E. The development of new procedures and the updating and reclassification of current procedures is an ongoing project.

#### 4.1.1. Level 1 – *Quality Policy Manual* and Company Policies

The intent of these documents is to define "what" we do with emphasis on Executive and Management's responsibility for quality.

The purpose of the *Quality Policy Manual* is to provide a framework to outline the quality systems at the laboratory. Organizational charts, list of SOPs, a list of equipment, instrumentation, and personnel resumes are included as attachments to this manual.



Uncontrolled Copy

- Executive Management is responsible for ensuring that adequate personnel, resources, and support are available to carry out the requirements of this *Quality Policy Manual.*
- Management is responsible for ensuring that SOPs or other appropriate documents are written and available to personnel to define the practices and systems which support these policies.
- All employees are responsible for conducting business in a manner which is compliant with quality and company policies and associated SOPs or other appropriate documents. Review of these policies and procedures must be documented.

Additional company policies are written to support and expand upon this *Quality Policy Manual.* These policies contain more detailed information about a subject with approval signatures executed at the Executive and/or Management level.

4.1.2. Level 2 – Standard Operating Procedures

The intent of these standard operating procedures is to define "who, what, where, and when." These procedures provide specific information for a process or topic so that the requirements outlined in this *Quality Policy Manual* and company policies can be achieved. The review and approval of these SOPs is performed at the director/manager/group leader level, including QA review and signoff, and the responsibility of these SOPs lies with the area or person directing the operation.

SOPs can apply to site-wide operations, the entire company, across multiple departments, or a specific operating area.

4.1.3. Level 3 – Work Instructions (at a departmental level)

The intent of these procedures or documents is to define in greater detail the specific "how to". The level of detail in these documents must be sufficient so any appropriately trained person can perform the task accurately. Examples include, but are not limited to standard operating procedures (SOPs); maintenance and calibration procedures; and the laboratory analytical methods. Departmental level procedures/documents are reviewed and approved at the manager or group leader level including QA review and signoff.

4.1.4. Level 4 – Quality Records

The intent of these documents is to provide documented evidence to support our quality systems and operations. Examples include but are not limited to, data notebooks/logbooks, and preformatted data recording forms.

## 4.2. Document Approval, Issue, Control, and Maintenance

The document control process ensures that documents are approved and adequate for use. It ensures that documents are readily available to personnel and at locations where essential operations are performed.

Procedures are available in electronic form on the company's intranet site through our document management system. The Document Control Group maintains this system in a current and accurate state. These procedures can be printed from this system for reference by employees as the corresponding task is being performed. Prior to using a printed document, the employee must ensure that it is the current version.

Each procedure is uniquely identified and includes effective date, revision identification, and page numbering (total number of pages). All documents are searchable and uniquely identified in the document management system.

Controlled policies, procedures, and work instructions are reviewed and approved by appropriate individuals and are formally issued and administered through the Office Services Group.

Word versions of each procedure can be accessed within the document management system by designated personnel within the Document Control group. A PDF copy is maintained on a separate limited access server as a back up to the system.

Procedures are reviewed to ensure that they are accurate, current, and compliant. The frequency of review is either annual or biennial, depending on the procedure. QA is the final signature on procedures which gives QA the authority to implement the procedure; the exception is the Quality Assurance procedures for which the Vice President or his designee is the final signature. Upon the effective date of new or updated documents, all copies of obsolete documents are removed from service. The original historical copy of each outdated/obsolete procedure is clearly identified as a historical version and maintained in a permanent archive file separate from any current versions. (Note: OH EPA is required to review all revised documents applicable to its certification prior to the document being made effective).

Interim amendments to procedures are not allowed. Any needed changes require a revision to the document.

## 4.3. Client-Supplied Methods and Documentation

Client documentation to support environmental testing at the laboratory is maintained in a centralized area. This information is organized by client/project in the Client Services/Project Management Group. Client documentation includes the following information depending on project size and scope:

- Client supplied analyte lists
- Client supplied project plans
- Client contract quality manuals with specified limits, QC criteria, etc.
- Communication/correspondence records which relate to testing requirements, interpretation of results, or reporting formats

## 4.4. Laboratory Notebooks, Logbooks, and Forms

Procedures are in place to ensure that all data is traceable, authentic, complete, and retrievable. The following general requirements outline our system for the issuing, control, and archival of laboratory notebook and logbooks.

- The administration of notebooks and logbooks is controlled by the Office Services Group. They maintain a master index to uniquely number and identify each book distributed.
- Notebooks and logbooks can contain blank or preformatted pages.
- Notebooks and logbooks are bound, uniquely identified and have sequentially pre-numbered pages.

Uncontrolled Copy

- If notebooks or logbooks contain preprinted laboratory form pages:
  - A unique identification number is assigned to each form
  - Forms are approved by appropriate management personnel before they are put into use
  - Forms are reviewed on a routine basis to ensure they are still accurate and current
- Completed notebooks are returned to an archivist. Incomplete books are returned to Document Control:
  - Two years from the issue date
  - for employee specific notebooks – when the employee leaves the company
  - for project specific notebooks – when the project for which it was used is complete
- In specific situations, records are bound to create books at the time of archival (e.g., temperature charts).
- At the time of archival any page(s) in the notebook or logbook that does not contain data documentation is crossed-out or a statement is written on the last page used to note that the book is complete to prevent data from being entered at a later date.
- Notebooks and logbooks identified as requiring permanent archival are assigned a designated qualifier.

## 4.5. Control of External Documents

Hard copy versions of external documents are controlled through the form system.

External documents such as copies of the 40 CFR and ASTM methods are stored exclusively in the QA Department. QA also keeps applicable agency documents on file, these include, but are not limited to, the TNI (The NELAC Institute) and ISO 17025 standards.

Environmental methods from the EPA or Standard Methods are available in the QA Department, but the technical areas also have copies that pertain to the tests that they perform. Any external document that is maintained in these areas must be inventoried and listed on a controlled form. Some methods are available on-line and are accessed through the Internet.

It is the laboratory's understanding that the need to control external documents is to ensure that the most current version of a method is referenced or appropriate manual is being used. Regulatory methods are used as references by the laboratory and testing is performed as per written SOPs that fall under our existing document control system and have scheduled reviews. The scheduled review of SOPs is used to ensure that the proper version of a method is referenced. While using the most current version of an analytical method is our typical practice, there are specific client needs and accreditation rules that require previous versions of a method to be used.

The technical areas are responsible for ensuring that all manufacturers' manuals are current and available to analysts. The vendor provides instrument manuals when new equipment is purchased or existing instruments are updated. These manuals are kept with the instruments to which they are associated.

Uncontrolled Copy



ED_004850_00001502-00323

# 5. SAMPLE HANDLING

## 5.1. Sample Collection

It is the responsibility of the client to send us representative and/or homogeneous and properly preserved samples of the system from which they are drawn. The laboratory assumes that all multiple sample containers with the same designator/description and bottle type contain a homogeneous, representative sample. We also assume that it is acceptable to deplete one container and move to the next, without implications unless otherwise indicated by the client.

The laboratory provides the appropriate sample containers, required preservative, chain-of-custody (COC) forms, shipping containers, labels, and custody seals. The laboratory also provides trip blanks and analyte-free water for field blanks. Preparation of methanol containers for field preservation of volatile soil samples is available.

Sample containers are purchased pre-cleaned by the supplier. For pre-preserved bottles, each lot of preservative is checked for contaminants before use and this testing is documented.

The laboratory provides instructions with all bottle orders that define how to sample, preserve, store, and ship the samples prior to their delivery at the laboratory. These instructions inform the client of the importance of proper sampling and advise them that non-compliant samples are rejected or reported with a qualifier.

If samples are collected by the laboratory personnel, applicable sampling methods are in place to perform the sampling operation.

As samples are analyzed at the laboratory, there are times when additional sample volume is necessary to complete testing or perform retesting. If this situation arises, “additional sample” is requested by the laboratory and/or submitted by a client to supplement current work being performed within our facility. Additional sample received is either assigned a new laboratory sample ID number and/or a comment noted on the final report to state that additional sample was received, depending on the situation. It is our goal to provide accurate traceability between sample submission and when testing is performed.

## 5.2. Sample Receipt and Entry

### 5.2.1. Sample Receipt

Samples can be received at the laboratory 24 hours a day, 7 days a week, 365 days of the year. Receipt can occur in one of three ways:

- The laboratory courier services (i.e., Transportation Department)
- Personal delivery
- Commercial courier

All samples received for testing are delivered to the Sample Administration Department immediately upon arrival. This group is responsible for the unpacking and organizing of the samples. This process includes checking custody seals if present, paperwork agreement, signing the chain of custody, recording cooler temperatures, documenting the condition of containers, accounting for all sample bottles, and observing any safety hazards, and reporting any problems to Client Services for communication to the client. This receipt process is documented in the LIMS.

Uncontrolled Copy

5.2.2. Sample Entry

As soon as practical after sample receipt, all samples are entered into our laboratory information management system (LIMS). Samples awaiting log-in are stored in temporary holding areas, at appropriate storage conditions to maintain sample integrity. Samples scheduled for Volatile analysis are stored separately. If there is doubt about the suitability of items received or if items do not conform to the description provided or the testing required is not clear or specified, the client is contacted and the conversation documented.

At the time of entry, the LIMS assigns a unique the laboratory' sample number to each sample. This number is sequentially assigned and a label is generated and is attached to the sample container.

Samples are tracked to the minute upon arrival. This allows the client to see exactly how long it took the samples to pass through receipt, unpacking, and entry.

A sample acknowledgement is generated from the LIMS per sample entry group. Upon request, a copy of the Acknowledgement may be sent to the client to confirm sample receipt and entry on the day following sample log-in. Internally, appropriate personnel audit all applicable sample entry and client paperwork.

5.2.3. Sample Preservation Check

Support personnel check and document preservation of non-volatile liquid samples after the samples have been entered into the LIMS and before they are placed into storage. Any checks of volatile samples are performed and documented at the time of analysis.

5.2.4. Sample Rejection Policy

Any time a sample is received in a condition that does not meet the method, regulatory, or client requirements, the condition of the sample is clearly documented on a sample administration documentation log or sample problem form. This information is forwarded to the CSR and the client is contacted to discuss the best course of action. The client is given the option to resample or have the sample analyzed and reported with a comment.

## 5.3. Sample Identification and Tracking

A sample label is generated for each sample and, in addition to the assigned unique sample number, the following information is displayed on the label: client name, sample identification assigned by the client, sample collection information, bottle code ID, analyses requested, and any applicable notes to laboratory personnel. The label includes a barcode that is used to trace the sample storage location.

To ensure accountability of results, the unique sample number assigned is used to identify the sample in all laboratory data documentation, including notebooks, instrument printouts, and final reports. The sample number is also used to identify additional containers of the sample that are created during sample preparation and analysis (e.g., subsamples, extracts, digests).

Routine sample tracking is documented using the Laboratory Sample Analysis Record (LSAR) which captures the date, time and analyst for each sample preparation and analysis. The information is compiled in the LIMS using electronic record tracking from the data upload and entry functions. This displays, per sample, on each Analysis Report.

Uncontrolled Copy

## 5.4. Sample Storage

After sample entry, samples are placed in an assigned and identified storage location until needed for analysis. Room temperature, refrigerated, and frozen storage are available and samples are stored in accordance with regulatory, method, or client direction. The LIMS is used to assign storage locations, which assists in the orderly storage of samples. Sample storage locations are secured and monitored for accurate temperature control.

The central locked storage facility contains 3430 square feet of refrigerated space, including 2740 square feet equipped for automated sample retrieval. Samples are stored in the laboratory's automated storage and retrieval system (ASRS) or other assigned storage locations (separate volatiles areas) within the laboratory until completion of all analytical work.

When a sample is scheduled for analysis, the analyst retrieves it from the storage area. To maintain the integrity and security of the sample(s), the amount needed for analysis is removed and the sample(s) returned to storage as soon as possible

## 5.5. Sample Return/Disposal

Samples remain in the storage area following analysis until the testing results have been verified and the analysis report has been generated. On a regular basis, a list is generated from the LIMS that summarizes samples that can be removed from the storage area. At a minimum, samples are held for 2 weeks after reporting before they would be eligible for disposal. Samples are either returned to the client or disposed of in accordance with local, state, and federal regulations.

Due to the variety of waste generated at the laboratory, several general categories of wastes and waste streams have been identified. Identification of waste occurs through information provided by the client, historical information, and/or analytical testing. The laboratory uses a sophisticated, computerized LIMS, which includes programming to assist in the identification of hazardous wastes at time of discard.

For reasons of environmental liability, client confidentiality, proprietary product formulation protection, etc., wastes generated by the laboratory are disposed of via incineration at EPA licensed facilities. The three exceptions include bulk neutralized acid waste, COD analysis waste, and lab pack waste containing mercury. None of these exceptions involve containers with client information.

## 5.6. Legal Chain of Custody

Samples being tested for litigation require locked storage and documentation of the time and personnel responsible when the sample was not in storage. This level of documentation is available upon client request and procedures to define these activities are in place and include the following:

- A chain-of-custody document is initiated for each bottle type submitted by the client.
- The chain of custody is signed each time the sample is stored, removed from storage, or changes hands.
- Clients requesting internal chain-of-custody documentation receive the completed forms after the analysis is complete.

### 5.7. Representativeness of Samples

Each analytical method provides specific procedures for ensuring that a representative aliquot of the sample is used for testing. These procedures include shaking water samples and mixing solid samples. Analysts are instructed in sampling techniques that prevent contamination of samples.

## 6. TECHNICAL REQUIREMENTS – TRACEABILITY OF MEASUREMENTS

### 6.1. Reagents and Solvents

The reliability of our analytical results can be directly affected by the quality of reagents used in the laboratory. Procedures are in place to address labeling, storage, and evaluation of these materials. Reagents and solvents include acids, bases, indicators, buffer solutions, colorimetric solutions (CS), test solutions (TS), and volumetric solutions (VS). The *Chemical Hygiene Plan* provides safety information in regard to the storage and handling of laboratory chemicals.

Each analytical method includes a list of reagents needed to perform the test. Reagents are fully described, including chemical name, purity, and description of preparation. Where applicable, shelf life and storage conditions are also listed. The laboratory is responsible for checking that new supplies meet the method requirements. These checks are documented and maintained.

Departmental management ensures that an adequate inventory of reagents needed to perform testing is maintained. Reagents received at the laboratory funnel through the Shipping and Receiving Department and deliveries are verified and labeled with the date of receipt. Large volume reagents (e.g., solvents, acids) are stored in a building outside of the laboratory until needed for use.

In addition to the name and concentration of the reagent, all reagents are labeled with the manufacturer/vendor, storage conditions, the date opened, and an expiration or re-evaluation date. Before using any reagent, the analyst must ensure that the material was properly stored and labeled. If a reagent has passed its expiration date or shows signs of deterioration, the material is not to be used in the laboratory and must be discarded or segregated as expired. In some method development or research work, expired reagents may be used. These must be labeled as such or stored in a designated location.

If a re-evaluation date is reached before a reagent is completely consumed, the reagent will be inspected by physical observation for signs of degradation. Physical signs include, but are not limited to, color changes, clumping or other texture changes for solids and formation of precipitate in solutions. This evaluation is performed by an experienced chemist or microbiologist.

Subsequent reagent solutions or mixtures prepared at the laboratory are fully documented in a logbook and labeled to include: unique name, concentration, date prepared, name of analyst who prepared the reagent, storage conditions or reference to the logbook containing these details, and expiration/re-evaluation date. The information recorded allows these solutions to be traced to the original stock solution. The reference to the logbook is intended for use on containers that are too small to clearly document all of the information.

All reagent certificates and MSDSs are retained by the laboratory.

## 6.2. Media

Within the microbiology laboratory, procedures are in place to address preparation, labeling, storage, expiration, documentation, and quality/sterility evaluation requirements for these materials. These procedures are described in Appendix K.

## 6.3. Calibration Standards

Written calibration procedures are required, where applicable, for all instruments and equipment used in the laboratory. The source and accuracy of standards used for calibration purposes are integral to obtaining quality data. Requirements for calibration are provided in each analytical method including specifications for the standards used. Where available and practicable, calibration measurements made by the laboratory must be traceable to national standards of measurement (e.g., NIST). C of As are maintained for each material, as applicable.

Standards are usually purchased from commercial supply houses either as neat compounds or as solutions with certified concentrations. The accuracy and quality of these purchased standards is documented on a C of A and these certificates are maintained on file in the laboratory. Upon receipt at the laboratory, material must be labeled with a date of receipt and stored appropriately.

Most solutions and all neat materials require subsequent dilution to an appropriate working range. Records of all standard preparations include the dilution(s) made and a reference to the original and any intermediate mixtures. Solutions are labeled according to laboratory procedures and assigned unique names or code numbers that provide traceability to the original components and stored appropriately. Each new preparation of standard is tested for integrity by comparison to standards from another source or previously prepared solutions. Standards are not used for sample analyses in the laboratory past their expiration date. In some method development or research work, expired standards may be used. These must be labeled as such or stored in a designated location.

## 6.4. Equipment and Instrumentation

The laboratory is equipped with all equipment and instrumentation required for testing the scope of work which it supports. All equipment and instrumentation is maintained in proper working order. A master list of our equipment and instruments is maintained by our accounting department and includes the date received and the condition at receipt (new v. used). Our major equipment and instrumentation capabilities are summarized in Appendix F. In addition, we have numerous other instruments including pH meters along with support equipment such as ovens, incubators, centrifuges, balances, etc.

### 6.4.1. General Requirements

- Equipment/instrumentation is assigned a unique designation. This unique number or system identification is used to track the equipment or instrument within data documentation.
- A maintenance logbook is established in conjunction with installation and is readily available to document all incidents that pertain to the equipment or instrument as they occur.
- All test, measuring, and inspection of laboratory systems, equipment, and instrumentation used at the laboratory is routinely calibrated and maintained in accordance with applicable standard operating procedures.



ED_004850_00001502-00328

- A member of the technical group, or designated individual, performs routinely scheduled maintenance and calibration of laboratory equipment and instruments as required by laboratory procedures. These activities are documented.
- If appropriate standards or expertise for calibration or maintenance are not available in-house, the operation is conducted by an outside service firm, with appropriate accreditation. Certificates or other data generated by the service firm are reviewed by applicable the laboratory personnel to verify acceptability. This information is maintained on file.
- All equipment or instruments taken out of service are tagged "DO NOT USE". The following minimum information is documented:
  - Date taken out of service
  - Employee who took the equipment/instrument out of service
  - Reason for tag-out
- The date that the equipment/instrument is returned to service, the corrective action taken, and performance checks performed is documented.

6.4.2. Standard Operating Procedures

Information regarding operation, maintenance, and calibration of equipment and instrumentation are found in respective SOPs. The procedures include a routine schedule for applicable preventive maintenance and calibration along with acceptance criteria and remedial action to be taken in the event of failure. These procedures are maintained in the document control system and reviewed on a regular basis to verify they remain current and accurate. Vendor supplied manuals are also available to provide additional information in regard to operation and maintenance.

6.4.3. Maintenance

- Instrument and equipment maintenance is performed as either a preventive or corrective operation.
- Preventive maintenance procedures and schedules are developed for each instrument or piece of equipment, where applicable. Preventive maintenance operations are performed by an analyst, equipment maintenance specialist, or contracted (manufacturer's representative or service firm personnel). Documentation is maintained in the associated maintenance log for the procedure(s) performed as part of the preventive maintenance operation. It is the responsibility of departmental management to ensure that a preventive maintenance schedule is addressed by a procedure where appropriate and is followed.
- Corrective maintenance is performed by an analyst, equipment maintenance specialist, or contracted (manufacturer's representative or service firm personnel) in response to indications of equipment or instrument malfunctions. The unit must be clearly tagged as out of service. All corrective actions taken to bring the unit back into service are documented in the associated maintenance log. After repair, further notation is made in the log regarding the functional status. Calibration activities are performed, as applicable, and documented in the log before the unit is placed back into service.

Uncontrolled Copy

- A supply of commonly needed replacement parts is maintained by the laboratory.
- A preventive maintenance schedule for major instruments is given in Appendix G. Maintenance of equipment used in microbiological testing is documented in Appendix K.

6.4.4. Calibration

- Calibration is the establishment of, under specified conditions, the relationship between the values/response indicated by a measuring instrument or system and the corresponding known/certified values associated with the standards used. Some types of calibrations are performed with a set frequency (e.g. daily) while others provide intermediate checks to ensure that the instrument response has not changed significantly.
- All measuring and testing instruments and equipment having an effect on the accuracy, precision, or validity of calibrations and tests are calibrated and/or verified on an on-going and routine basis. Methods for calibration of instruments and equipment vary widely with the nature of the device and the direction given by analytical procedures, departmental procedures, or manufacturer recommendations. Frequency of calibration can also depend on additional factors including ruggedness of the instrument or equipment and the frequency of use.
- Departmental management is responsible for developing or acquiring written calibration procedures for the types of instruments and equipment employed within their area, as applicable. Procedures address the following aspects: description of the calibration method, frequency/schedule for calibration, acceptance criteria, and corrective actions if failure occurs.
- Calibration information is recorded in a logbook that is associated with the instrument/equipment and/or a calibration certificate is maintained and/or data is generated and filed to document the activity.
- Calibration measurements are traceable to national standards of measurement (e.g., NIST) where available. Physical standards, such as NIST certified weights or thermometers are re-certified on a routine basis. Calibration certificates are maintained on file, where applicable, to indicate the traceability to national standards of measurement. These physical standards are used for no other purpose than calibration.
- Calibration failures are documented in the associated logbook and/or within the data generated from the instruments or equipment. Management personnel perform an evaluation and review of failures and assess any potential impact the failure might have on previously generated data. The laboratory utilizes “real-time” controls to ensure the accuracy of the data. These controls are used to assist in assessing the impact of the situation.
- After repair, adjustments, or relocation that could affect instrument response, calibration/verification activities are performed, as applicable, before the unit is returned to service.
- Analytical data is not reported from instrumentation or equipment that fails to meet calibration requirements.
- A summary of the calibrations for most major instruments and equipment is given in Appendix H.

Uncontrolled

- Procedures for calibration of equipment used in microbiological testing are documented in Appendix K.

## 6.5. Computerized Systems and Computer Software

### 6.5.1. Computer Usage

The laboratory provides computer equipment for employees to use as a tool in performing their work. Computer equipment is the property of the laboratory and used in accordance with defined terms and conditions. Our goal is to provide standard hardware and software that meets the needs of the user. The majority of desktop PCs in use are standardized using cloning software.

6.5.1.1. Physical security of computer systems – It is company policy to protect computer hardware, software and data documentation from misuse, theft, unauthorized access and environmental hazards. The corporate computer area and computer "Hot-Site" is locked and requires identification/building card access. All vendors, contractors, or other visitors must be escorted into this area. Controlled access of the laboratory buildings is outlined in Section 3.2.

6.5.1.2. Passwords – Passwords are important for the security of company data and resources. The laboratory's primary network operating system is Windows and each employee must have a user ID and password combination to access the system. Other computer systems also require a user ID password combination for access. The following procedures apply regardless of which system(s) is being utilized:

- Passwords must be kept confidential
- Users must log-out of a system when not in use to prevent unauthorized access. In addition, the network access will automatically timeout after a set period of inactivity, requiring a user to log-in to access the system.
- Forgotten passwords can only be reset by the Computer Systems Department or by an appropriate System Administrator.
- Network and LIMS passwords automatically expire every 90 days. The computer prompts a user to change the password when the expiration date nears.

6.5.1.3. Computer viruses – The laboratory centrally and continuously monitors the computer network for computer viruses. Employees are prohibited from using the company's computer equipment to propagate any virus. Anti-virus software is employed to detect viruses on the Windows network. A notification is sent when there is a particularly dangerous or virulent data destructive program that employees need to be aware of. However, employees are reminded to always be cautious and observant even if there are no current warnings. Employees must report any virus concerns to the anti-virus administrator or Computer Service Management as soon as possible. Employees who share files between their home computer and the laboratory should install anti-virus software on their home computer. If an employee does not have such software, the laboratory can suggest various no-cost anti-virus software products.

Uncontrolled Copy

6.5.1.4. Internet and e-mail system – The e-mail system is used primarily for the laboratory's business purposes. The *Eurofins Lancaster Laboratories' Employee Handbook* provides additional information in regard to system usage. Employee access to the internet is restricted to those employees who have a business need for it. All employees have access to e-mail. Access to the internet is configured through a user's Windows network account. All internet and e-mail activity is subject to monitoring. All messages created, sent or received over the internet are company property and can be regarded as public information. E-mail and website filtering software is utilized.

6.5.1.5. The laboratory's Intranet (LabLinks) – The Intranet is designed to be a useful tool for employees to acquire company information and to provide a company communication system. The *Eurofins Lancaster Laboratories' Employee Handbook* provides additional information in regard to usage.

6.5.1.6. Software policy

- Copyright laws protect software, and the laboratory's intent is to abide by all software agreements.
- Software purchases must be formally requested and approved by management and/or validation personnel, as necessary.
- All software is used in accordance with applicable license agreements.
- Employees are not to install any software on computer(s) unless authorized by the Computer Systems Department.
- Software upgrades must occur in accordance with applicable change control procedure
- Employees must not give software to outsiders (e.g., clients, contractors), unless approval is granted by management.
- Users must not make copies of any licensed software or related documentation without permission. Any user that illegally reproduces software is subject to civil and criminal penalties including fines and imprisonment.

6.5.1.7. Computer system backup, data restoration, and data archival – Mission critical data is stored on several computers throughout the laboratory. These computers are connected through the local area network. Selected files on these computers are backed up using an enterprise-level backup software program. The objective of this backup is to have the ability to restore data after a total loss (e.g., theft, fire, natural disaster). Procedures are in place to perform data backups and restores.

6.5.1.8. Remote access to computer systems – Employees are able to remotely connect to the laboratory computer systems through an encrypted (SSL) login. When logging in, users are authenticated with their Windows Active Directory account and password.

Uncontrolled Copy

6.5.1.9. Electronic data – Instrument software used for processing data must, when available, have password access and audit trails enabled. All data processed through the LIMS includes tracking features to document who and when data was entered and/or changed.

6.5.2. System and Software Verification – The laboratory LIMS is an in-house developed program. The design and updates to the system are written following typical Software Development Life Cycle (SDLC) processes for initial planning through testing and implementation. Before a new computer system/program or significant modification of an existing system/program is implemented in our laboratory, it is necessary to generate and Validation Project Plan which specifies the level of documentation required for the new or updated application. The following are the typical documents that are required for these updates:

- Requirements documents – Describe the required system functionality and specifications
- Design documents – System overview, screen design, report layout, data description, system configuration, file structure and module design
- Testing documentation for system development/verification – Structural testing of the internal mechanisms and user testing of the installation and system qualification
- Standard operating procedures and/or manuals

## 6.6. Change Control

Procedures are in place to define how to maintain processes, instrumentation, equipment, computerized systems, and computer software in a validated or controlled state through a plan of change control. Successful changes require a thorough evaluation and testing for potential consequences prior to implementation. Planning, authorizing, testing, and reviewing of proposed changes are documented throughout the change process. Changes are planned or could be made in response to an emergency situation. The following "general" elements apply to changes, as appropriate:

- Request to perform a change
- Evaluation of a change
- Authorization of a change request
- Preparation for an authorized change
- Execution and testing of the change
- Documentation of the change
- Approval of the change
- Change implementation and follow-up (Formal approval of the change is performed by designated responsible individuals and QA.)

## 6.7. Labware Cleaning

Dedicated washroom personnel support the laboratory operations in regard to labware preparation, washing, rinsing, and drying. Labware can include, but is not limited to glassware, plastic ware, utensils, and pipettes. Procedures are in place to outline the washing process for each type of labware. Most labware is cleaned using a Miele glass washing machine. Some labware is still washed by hand and either air-dried or dried in specifically designed ovens.

Uncontrolled Copy

Most of the labware used in the laboratory is "common or non-dedicated" labware (common to a department), but some of the labware used in the laboratory is identified as "dedicated" labware and exclusively used for certain analyses. Examples of dedicated labware include glassware used for MBAS and Ortho Phosphate analyses (acid washed) and "oils" glassware. This labware is isolated and cleaned only with "like" labware.

All glassware is class A and 100% visually inspected for breakage (e.g., cracks, chips), cleanliness, and dryness before being returned to the laboratory for use.

Generally, each test has controls in place to ensure that results are not adversely affected by unclean labware. These controls include blanks to detect positive interferences and recovery controls to detect negative interferences.

# 7. PURCHASING EQUIPMENT AND SUPPLIES

## 7.1. Procurement

It is the responsibility of management personnel within each department to ensure that the appropriate supplies are available and/or ordered with sufficient lead-time to perform analytical testing or to provide support to the testing areas. The individual technical departments have trained personnel who enter the supply order into the company's requisition software system. The selection of these products is based on technical input at the analyst level and authorized by technical departmental management. The Purchasing Department maintains an ordering system in which purchase requisitions are managed. Common laboratory items (e.g., beakers, flasks, reagents) are ordered directly through the Purchasing Department. Purchase orders over a specified dollar amount require verification from the appropriate member(s) of the Executive Management Group before an order can be placed.

Upon receipt of an order, the Purchasing Department checks the order to ensure that all items were received as specified. Products that have specific storage requirements are taken to the technical area upon receipt. It is the technical area's responsibility to ensure that the product is stored in the appropriate manner. Any checks on the quality of the materials received for use in a specific test are the responsibility of the laboratory using them. This is based upon the experience of the laboratory with the usability of the product. Generally, each test has controls in place to ensure that test results are not adversely affected by the materials.

Any problems encountered when using a material in the laboratory must be brought to the attention of the Purchasing Department and/or Quality Assurance as applicable, to ensure that follow-up and corrective action occur.

## 7.2. Supplier Evaluation

Procedures are in place to evaluate vendors who supply us with: new equipment, instrumentation, computerized systems and computer software; commercially purchased glassware, including sample bottleware, reagents, chemicals, solvents, gases, media, and standards; and contracted and subcontracted services.

The laboratory strives to ensure that our suppliers continually improve their quality systems and we reserve the right to purchase from suppliers of our choice in order to best fulfill the needs of our clients and our business. When directed by a client to purchase from a specific supplier, we will do so. In this instance it is the client's responsibility to "qualify" the specified supplier. We attempt to purchase from businesses that we have an established purchase history or have previously acquired information regarding the supplier's quality programs.



Uncontrolled Copy

The laboratory does not evaluate every supplier. Risk assessment is taken into consideration when making this decision. The risk assessment analysis includes system, material, services, and number of samples or operations the purchase may affect or support. Evaluations are not required for computer operating systems, utilities, toolsets, or systems software. They also are not required for any off-the-shelf configurable software package that has an extensive market performance history (e.g., Microsoft Word, Excel, Access).

Additional quality systems are also in place within the laboratory to further verify and support the materials used:

- C of A for every lot of purchased prepared microbiological media and for purchased chemicals, where available, are reviewed and maintained on file.
- For most chemical analyses a blank and a recovery check are routinely analyzed and serve as real time suitability testing of the reagent being used.
- Microbiological testing often employs positive and negative controls, which serve as real time control checks.

# 8. ANALYTICAL METHODS

## 8.1. Scope of Testing

Samples are analyzed in accordance with official published methods, standard methods, client-supplied methodology, or validated in-house methods. We recognize the importance of providing verifiable results and, therefore, use methods accepted and approved by a broad range of federal and state regulatory agencies. In order to meet the needs of our clients as well as regulatory agencies, the laboratory sometimes needs to support different versions of the same method (i.e. SW-846 8081A and 8081B). The laboratory can also assist in developing and validating analytical methods for specific products and matrices. All methods submitted for our review, as well as all analytical results, are considered confidential.

The laboratory performs a wide variety of environmental testing in support of the Safe Drinking Water Act (SDWA); Clean Water Act (CWA); Resource Conservation and Recovery Act (RCRA); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA/Superfund); and the Clean Air Act (CAA). Methods approved by ASTM are also used in testing. Potable water, wastewater, soil, sediment, sludge, oils, biota, tissue, soil gas, and air are among the matrices typically analyzed.

Uncontrolled Copy

Our areas of expertise include:

| Standard Services | Specialty Services |
|---|---|
| • Volatiles<br>• Semivolatiles<br>• Metals<br>• Pesticides/PCBs/Herbicides<br>• Petroleum Analysis<br>• Waste Characterization<br>• Water Quality<br>• Drinking Water<br>• Vapor & Air Analysis<br>• Sediment & Ecological<br>• Method Development<br>• Shale Oil & Gas Analysis<br>• Dioxins & Furans<br>• Explosives<br>• PCB Congeners | • Hydrazines/NDMA<br>• Perchlorate<br>• 1,4-Dioxane<br>• Pharmaceutical Manufacturing Industry (PMI)<br>• Method 25D<br>• Alkyl PAHs, Alkanes, Biomarkers<br>• PFC (PFOA)<br>• Organic Acids<br>• Aldehydes<br>• Low-Level Mercury |

A list of tests covered under the laboratory's NELAP accreditation can be found in Appendix I. All current certificates and scopes of accreditation are available on the laboratory's website at http://env.lancasterlabs.com/resources/certifications. A complete list of the tests routinely performed by the laboratory can be found in the *Schedule of Services*.

## 8.2. Analytical Test Methods

Each laboratory is required to establish and maintain analytical procedures for all the methods referenced in standard testing. The sources for these methods include the most recent versions of these compendia:

- Test Methods for Evaluating Solid Waste, SW-846
- Standard Methods for the Examination of Water and Waste
- Code of Federal Regulations, Chapter 40
- EPA 100 through 600 and 1600 series methods
- ASTM

Uncontrolled Copy

The test methods used are re-written into a laboratory standard format, which provides consistency in content and allows the analysts to locate the information they need quickly. Procedures are in place to define the format, required approvals, and the control system for these method documents. The format requirements include:

- Uniquely assigned method number, which is used extensively for scheduling and documentation purposes.
- Reference to the original source of the method (e.g. SW-846)
- Scope
- Basic Principles
- Apparatus and Reagents
- Personnel Training and Qualifications
- Safety and Waste Disposal
- Detailed procedure (including any method modifications)
- Calculations
- QA/Quality Control
- Revision Log
- Approval signatures from technical management and QA personnel

Analytical methods are maintained as controlled documents to ensure that analysts are always working with the most current version and are reviewed periodically for accuracy.

## 8.3. Client Supplied Methods

Most of the client-supplied method requirements presented to us involve achieving specific quality control criteria or limits of quantitation using standard EPA methods. These requirements are communicated to the appropriate technical groups prior to the project start up. Each technical group evaluates the scope of work and the requirements to ensure the criteria can be met using the standard EPA method. The data is monitored to ensure the criteria are met throughout the project. A client service representative notifies the client if there is a more appropriate method available or if the client's criteria cannot be achieved on a certain sample matrix (i.e., due to matrix or dilutions).

Occasionally, we are asked to transfer a non-standardized method from a client into our lab or to develop a new method, when one is not available. In the case of a method transfer, we set up the client's method and perform some initial evaluation. After the initial evaluation, we may make recommendations on how to improve method performance. If the method appears to be adequate, we determine linearity, specificity, precision, accuracy, LOD, and LOQ by performing calibrations, analyzing method blanks, and carrying out method detection limit and quad studies.

In the case of method development, we work with the client and/or data user to determine the level of validation required ensuring that the method meets its intended purpose. In addition to the elements above, we also determine standard and sample stability and robustness depending on the scope of the project. Typically, a standard operating procedure is written and submitted to the client with the results of the validation. These steps are completed prior to analysis of field samples. Data related to the set up of the method are archived.

## 8.4. Method Validation

Before new or revised analytical methods are authorized for routine use in the laboratory, validation data is required to demonstrate that the method as performed in our laboratory and analysts performing it are capable of meeting data quality objectives for precision and accuracy. A procedure is in place to outline this process.

Uncontrolled Copy

Many methods published by USEPA include instructions for performing an initial demonstration of capability, which typically consist of determining the method detection limit and analyzing fortified samples in quadruplicate. This demonstration is performed and compared to acceptance limits for precision, accuracy, and detection limits, when available.

Methods that do not include specific validation requirements are validated by analyzing fortified samples or standard reference materials in replicate. The results of these analyses are used to assess accuracy and precision. Results of validation studies are documented and subject to review and approval.

### 8.5. Procedural Deviations

Analysts are required to follow a documented method for all tests performed. Procedures are in place to ensure that deviations from analytical methods are documented, approved, and justified in an appropriate and consistent manner (Note: Deviation from the OH EPA approved SOPs is not permitted). We classify method deviations as either being a planned deviation or an unplanned deviation. In general, the following information is captured to document both types of situations:

- Description of the deviation
- Reason or justification for the deviation
- Impact the deviation had on the testing
- Signature/date of analyst performing the test
- Signature/date of Quality Assurance and Laboratory Management approving the deviation
- Signature/date of client approval, if necessary

Deviations to written procedures are documented in raw data records or through the ICAR (Investigation and Corrective Action Report) system. Both types of documentation require management and QA review and approval.

## 9. INTERNAL QUALITY CONTROL CHECKS

### 9.1. Laboratory Quality Control Samples and Acceptance Criteria

Quality control (QC) samples are analyzed with each batch of samples to demonstrate that all aspects of the analysis are in control within established limits of precision and accuracy. Management is responsible for ensuring that QC is analyzed as required in the procedure on written methods, each analytical method specifies (or cross-references another procedure) the type of QC sample, frequency of analysis, acceptance criteria for QC sample results, and corrective action to be taken if QC sample results fall outside of the acceptable range.

QA staff, at the direction of the technical department, must program the LIMS with the acceptance criteria for each QC type (other than blanks). The acceptance criteria are based on statistically generated limits from historical laboratory data, on method defined limits, government agency recommendations, or on client/project specific limits.

These limits are used to flag samples that are out-of specification.

The types of QC samples and the information each provides are discussed in the following paragraphs.

Quality control checks used for microbiological tests can be found in Appendix K.

Uncontrolled Copy

9.1.1. Blanks - A blank is a designated sample designed to monitor for sample contamination during the analysis process. A volume of reagent laboratory water is typically used to monitor water sample analysis, while solid sample analysis blanks consist of a purified solid matrix or just the reagents used in the test. The blank and field samples are treated with the same reagents, internal standards, and surrogate standards and carried through the entire analytical procedure. Ideally, blanks demonstrate that no artifacts were introduced during the analysis process. The specific acceptance criteria for each test are given in the analytical method and are usually based on the required reporting limit.

9.1.2. Surrogates - Surrogates are organic compounds, which are chemically similar to the analytes of interest but are not naturally occurring in environmental samples. When required by the analytical method, surrogates are spiked into all the field and QC samples to monitor analytical efficiency by measuring recovery on an individual sample basis. The percent recovery is determined and compared to the acceptance criteria. Acceptance criteria limits are set as required by the method or based on a statistical determination from laboratory data.

9.1.3. Matrix Spikes - A matrix spike sample is created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. Blanks are not used to for matrix spike QC. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. Matrix effects can cause results to be outside of the acceptance criteria. The acceptance criteria are given in the analytical method and limits are set as required by the method or based on a statistical determination from laboratory data.

9.1.4. Laboratory Control Samples - Laboratory control samples (LCS) are samples of known composition that are analyzed with each batch of samples to demonstrate laboratory accuracy. Laboratory fortified blank (LFB) is another term used to describe a LCS. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations. Percent recovery is calculated and compared to acceptance criteria, which are set as required by the method or based on a statistical determination from laboratory data.

9.1.5. Duplicates and Matrix Spike Duplicates and Laboratory Control Sample Duplicates - A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test. To compare the values for each compound, the relative percent difference (RPD) is calculated by dividing the difference between the numbers by their average. Precision for analytes that are not typically found in environmental samples (i.e., organic contaminants) is determined by analyzing a pair of matrix spike duplicates, defined as two spiked samples and comparing the RPD for the spiked compounds. The acceptance criteria are described as a maximum for the RPD value, which are set as required by the method or based on a statistical determination from laboratory data.

Uncontrolled Copy

9.1.6. Internal Standards - Internal standards are organic compounds, which are chemically similar to the analytes of interest but are not naturally occurring in environmental samples. When required by the method, internal standards are added to every field and QC sample after extraction but prior to analysis. Comparison of the peak areas of the internal standards is used for quantitation of target analytes. Internal standard peak area and retention time also provide a check for changes in the instrument response. The acceptance criteria are stipulated in the analytical method.

9.1.7. Serial Dilutions - A serial dilution is the dilution of a sample with sufficiently high concentration by a factor of five to check for the influence of interferents. This QC check is performed for inorganics analyzed by ICP or ICP-MS. When corrected by the dilution factor, the diluted sample result must agree with the original sample within specified limits.

9.1.8 Interelement Correction Standard – Analyzed to verify interelement and background correction factors. A solution containing both interfering and analyte elements of known concentration is analyzed at the beginning and end of each analytical run or a minimum of twice per 8 hours.

9.1.9. Second Source Check - A second source check is analyzed using either the LCS and/or an ICV (Initial Calibration Verification). The second source is a standard that is made from a solution or neat purchased from a different vendor than that used for the calibration standards. For some organic custom mixes, the same vendor but a different lot and preparation is used. This ensures that potential problems with a vendor supply would be evident in the analysis. Some areas of the lab use the continuing calibration verification standards as a second source from the initial calibration.

## 9.2. Quality Control Sample Frequency and Corrective Action

Each analytical method defines the frequency for the required QC samples and the corrective action required when a QC result fails to meet the acceptance criteria. A summary is provided in Appendix J.

The QC acceptance criteria are available to analysts in the laboratory. If the method reference requires the use of specific limits then the laboratory uses the published limits that are documented as part of the analytical method. Many methods require that each laboratory determine their own acceptance criteria based on statistical data obtained from performance of the method. In these cases, the limits are available to the analysts and are entered into the LIMS described below. Statistically determined acceptance criteria are subject to change as the laboratory recalculates its control limits. Due to their dynamic nature, acceptance criteria are not included in this manual.

The results of all quality control samples are entered into the computer in the same way as the results of client samples. The LIMS compares the individual values with the acceptance limits (statistically determined or method specified) and identifies quality control sample results that are out of specification. If the results are not within the acceptance criteria, corrective action suitable to the situation must be taken. This includes, but is not limited to, checking calculations, examining other quality control analyzed with the same batch of samples, qualifying results with a comment stating the observed deviation, and reanalysis of the samples in the batch.

Each month, a summary of all QC entries (except blanks and surrogates) is generated from the LIMS. This summary is reviewed by QA staff and evaluated for changes in data that may indicate that an analysis is trending towards an out-of-control situation. The technical department is notified if a trend is observed.

The laboratory allows for marginal exceedances based on the number of analytes in the LCS. The exceedances are carefully monitored so that any systemic problems would be identified and corrective action taken. If the LCS is being reported based on the marginal exceedance allowance, a comment is added to the analytical report. Note: The use of marginal exceedance is not allowed for OH VAP work.

## 9.3. Quality Control Charts

Quality control results entered into the computer are used to generate control charts that are plotted via computer and can be accessed at any time by all employees. The system charts results from blanks, surrogates, matrix spike/matrix spike duplicates, duplicates, and laboratory control samples/laboratory control samples duplicate. These charts provide a graphical method for monitoring precision and bias over time. They can be used to detect quality problems by observation of patterns. The computerized quality control system is used to report QC data to clients and to collect data for assessment of precision and accuracy statistical limits.

## 9.4. Measurement Uncertainty

(ISO 17025) "All uncertainty components which are of importance in a given situation shall be taken into account using appropriate methods of analysis" (5.4.6.3). This means the laboratory must determine the uncertainty contribution of all steps in the testing process such as equipment, calibration, standards, reagents, preparation, cleanups, etc. Since, in most methods, the laboratory control sample (LCS) goes through the entire process of preparation to analysis; all factors that would contribute to uncertainty is evident through the LCS results. LCSs are performed with every batch of samples where appropriate for the method.

Measurement uncertainty is calculated as two times the standard deviation of the LCS recoveries for the group and date range of data points selected for all applicable methods. This is reported as a percentage.

Tests that do not have LCSs (e.g. TCLP and paint filter test), are evaluated on a case-by-case basis by taking into account the uncertainty of each of the steps taken to perform the test.

Reports for uncertainty are generated and submitted to QA on an annual basis. It is not necessary to apply or report the uncertainty determination with sample results. When a client requests the measurement uncertainty it is applied by multiplying the determined analyte concentration by the uncertainty percentage.

Uncontrolled Copy



ED_004850_00001502-00341

# 10. ASSURING QUALITY OF TEST RESULTS

## 10.1. Data Management

At a minimum, data management is initiated when the laboratory receives the samples from the client. More often the process begins with client communication of their needs and requirements for a specific project and/or testing. The CSRs are responsible for entering the information in the sample set up function of the LIMS. Upon receipt of the samples the unique tracking number is generated based on this information. At this point, computer technology becomes an integral part of tracking the samples through laboratory operations. The flow of data from the time samples enter the laboratory until the data is reported is summarized in the following table:

Uncontrolled Copy

## Sample and Data Flow

| Action | Personnel Involved |
|---|---|
| Sample received at Lancaster Labs<br>• Unpacked and reconciled against the client paper work or COC<br>• SA Documentation log completed | Sample Administration |
| Sample is entered into the LIMS<br>• Lab ID number assigned<br>• Analyses entered<br>• Chain of custody started<br>• Storage location assigned<br>• Electronic record of sample number<br>• Labels generated<br>• Acknowledgement printed (record of samples received and analysis entered) | Sample Administration |
| Sample stored in assigned location (refrigerator, freezer, etc.)<br>• Electronic record of sample #, bottle code, and location | Sample Support |
| Acknowledgment sent to client (when requested) | Sample Administration |
| Sample removed from storage for analysis<br>• Electronic requisition of sample number by bottle code<br>• Necessary aliquot taken<br>• Sample returned to storage | Technical Personnel |
| Analysis is performed according to selected analytical method<br>• Raw data recorded<br>• Reviewed<br>• Transferred to computer by analyst* (This is tracked by the unique sample number and batch number.) | Technical Personnel |
| Computer performs calculations as programmed according to methods | Data Processing |
| Second analyst or supervisor verifies raw data | Technical Personnel |
| Generation/release of reports (automated through LIMS) | Billing and Reporting Group |
| Data package deliverables are assembled | Data Package Group |
| Electronic Data Deliverables (EDDs) are generated | EDD Group |
| Data packages are reviewed prior to sending to client | QA, Data Package Personnel, and Laboratory Management |
| Data packages are scanned<br>Hard copy of batch raw data is archived<br>Electronic files are backed up and archived | Data Package Personnel, Office Services, Computer Services |

*Analyses requiring the analyst's interpretation may involve manual data reduction before entry into the computer.

Uncontrolled Copy

## 10.2. Data Documentation

Analytical data generated in the laboratory is collected from the instruments or associated data system or is manually documented in bound notebooks. Analysts review data as it is generated to determine that the instruments/systems are performing within specifications. If any problems are observed during an analytical run or the testing process, corrective action is taken and documented.

Procedures are in place to ensure that all data is traceable, authentic, and complete. Electronic data records are maintained and tracked through the LIMS, requiring authorized, password protected user access. The following general requirements outline our system for notebook, logbook, and documentation recording:

- Observations, data, and calculations are recorded at the time they are made and are identifiable to the specific task.
- Entries must be legible, signed, and dated. The signature may be a wet or electronic signature.
- Errors are corrected in a manner that does not obliterate the original entry, initialed and dated, and coded with an explanatory identifier. Changes to electronic data are tracked through audit trail functions.
- Blank pages or substantial portions of pages which are left blank are crossed-out to eliminate the possibility of data entry at a later date.
- Notebook pages and instrument printouts are signed/dated to indicate second party data review; this may be a wet or electronic signature.
- At periodic intervals a supervisor or data reviewer checks equipment/instrument logbook entries and temperature recordings for completeness, legibility, and conformance to procedures.
- At a minimum, the following information is recorded as part of data documentation:
    - Date of analysis/operation
    - Signature/date of analyst performing test/operation
    - Identification of client sample(s) and material(s) analyzed
    - Materials, reagents, standards used to perform the testing/operation
    - Method used to perform testing/operation (including version number and/or effective date)
    - Equipment/instrumentation used to perform testing/operation
    - Calculations and how they were derived
    - Departures, planned or unplanned, from the analytical method
    - Signature/date of person reviewing data documentation
- For computer generated data, the following information is recorded:
    - Sample(s) analyzed/operations performed
    - Date of analysis/operation
    - Unique instrument identification
    - Name/date of person operating the instrument
    - Name/date of person reviewing data
    - Any manual notations or interpretations made on instrument printouts are signed, dated, and reviewed

Uncontrolled Copy

## 10.3. Data Calculations

Most instruments either include or are connected to a data system programmed to perform calculations to reduce the raw data to a reportable form. All calculations are maintained in the instrument manuals and/or as part of the analytical method.

In many cases, the data from the local instrument system are uploaded directly to the LIMS for review and reporting. This direct upload eliminates the need to retype data and an associated source of transcription errors from the analytical scheme.

Some instruments report data that require application of additional factors before the data is in final form. For example, an extract concentration may be reported by the instrumental data system, but additional dilution and preparation factors may be needed before the result represents the concentration of analyte in the sample. Analysts input these additional factors into the LIMS, where final calculations are performed.

Analysts manually enter collected data, such as titration data, into the LIMS, which is programmed to perform calculations for final reporting. Documentation of the programming for each calculation performed by the LIMS is maintained.

## 10.4. Reporting Limits

It is important to ascertain the limit of quantitation (LOQ) that can be achieved by a given method, particularly when the method is commonly used to determine trace levels of analyte. The Environmental Protection Agency has set forth one method for determining method detection limits (MDLs) from which LOQs can be extrapolated which is summarized in a laboratory procedure.

MDLs are verified or determined annually on each instrument and are the basis for the LOQ used in the default reporting format. Because MDLs change each time they are re-evaluated, they are not included in this manual, but are available in each laboratory and available to clients upon request.

The reporting limit used to determine whether a result is significant and reported as detectable is dependent upon agency and client requirements. A variety of formats are available and include use of the MDL, LOQ, method specified limits, and project specific limits. The MDL and LOQ for each analyte are programmed into LIMS for reporting purposes.

Under the DoD program, the laboratory must establish a Detection Limit (DL) and Limit of Detection (LOD). As defined by the DoD program, the DL is the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. The laboratory determines the DL using the calculated value from the MDL Study. The DL can be derived from pooled MDL values obtained across instruments. The LOD is the smallest amount of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. It is established by spiking a quality system matrix at a concentration of 2-4 times the DL. The LOD must be verified on a quarterly basis or with each batch of samples.

Uncontrolled Copy

## 10.5. Data Review

Final review and verification of the data are performed by designated employees using the sample results, quality control information, method criteria and Project Notes entered into the LIMS. Data are initially evaluated by the analyst and then a second designated employee knowledgeable in the test, other than the employee responsible for performing the test, reviews the data. The reviews include checks for correct transcription, calculations, passing calibrations, compliant quality control results, holding time compliance, and project specific requirements. Any issues or errors identified during this stage are addressed, corrected, and reviewed with the responsible person.

After determining that all necessary requirements for valid data and for the project are met, the reviewer electronically approves the data by changing the LIMS status of the data from "complete" to "verified". The computer is programmed with a list of approved reviewers for each test, and the system is password protected to ensure that only qualified individuals verify the data.

## 10.6. Data Qualification

Data qualifiers are used to provide additional information about the results reported. The most typical use for data qualifiers is for results that fall below the quantitation limit, in the region where it becomes more difficult to distinguish a positive result from the background instrument signal. The data systems used to generate and report results are programmed to flag values in this range as estimates.

Other qualifiers are applied to advise data users of any validation issues associated with the data. The laboratory makes every effort to meet all of the requirements for generation of data. Occasionally, generation of data that does not meet all the method requirements occurs due to sample matrix or other analytical problems. If the test can not be repeated or reanalysis would not yield better quality data, qualified data is reported. Qualifiers can be in the form of comments on the analytical report or flags applied to the results.

## 10.7. Data Reporting

When all analyses are completed, reviewed and verified, a report is generated. The client receives a copy of the report containing the results of the analysis, associated QC data, and where necessary, explanatory comments to address non-conformances. To avoid ambiguity in interpreting results, a summary page that contains an explanation of all symbols and units used in reporting data is included with the Analysis Report submitted to clients. Some regulatory agencies also require the laboratory accreditation identification on the Analysis Reports. Where required, this information is added. The current list of agencies can be accessed in the LIMS. Copies of reports and associated supporting raw data are retained in our archives. The report contains the signature of the assigned client service representative who is the key contact for any questions concerning the results. Personnel authorized to review, sign, and release Analysis Reports are noted in the key personnel list provided in Appendix C.

The laboratory offers a variety of data levels and formats, from a basic report of sample and QC results only, to a comprehensive data package of QC/calibration information and raw data. The client and any agency involved direct the selection of report type. A summary of report formats and data packages types is provided in the laboratory *Schedule of Services*. Various electronic formats are also available formatted to client-specified file structure and sent via e-mail, direct upload, web-site access (LLabWeb), or common courier. LLabWeb is used for clients that require secure transfer of electronic data.



ED_004850_00001502-00346

Client confidentiality of LLabWeb data is ensured by the use of a secured firewall internet environment coupled with the use of a user ID and password to gain login access to the system. User accounts are configured to only allow access to specific data associated with the user's business account number.

Amendments to a final report after issue are in the form of an additional document or data transfer and include a reference to the original report. When a completely new final report is required, it is uniquely identified and includes a reference to the original report it replaces.

10.7.1. Reporting the Results

Analytical reports are generated with a cover page that summarizes all samples in that group. This page lists the laboratory assigned sample number and the corresponding client description. The cover page identifies the laboratory contact person's name and phone number if there is a question about the report. Within this package, each page is uniquely identified and paginated. Analytical test results for methods listed on the laboratories' accreditation scope meet all requirements of NELAP accreditation and ISO 17025 unless noted otherwise. Ohio EPA VAP requires that a signed, notarized affidavit accompany each analytical report.

## 10.8. Data Storage, Security, and Archival

The laboratory has documented procedures and instructions for the identification, collection, access, indexing, filing, storage, maintenance, and disposition of data records. Records are in the form of paper records, electronic data files, magnetic tape, and CD-ROMs.

All data records are maintained in a confidential manner in an environment to minimize deterioration or damage and to prevent loss. Some records are stored in off-site facilities, in such a way that they are readily retrievable. Retention time for records is in accordance with specific procedures or instructions. Prior to the destruction of data/records, and if requested by a client or agency, the laboratory will notify the client/agency that their data is scheduled for destruction so arrangements can be made to have the original data sent to the client.

If specified in client contract(s), archived records are transferred according to their instructions in the event of a change in laboratory ownership or if the laboratory goes out of business. If not specified by the client, the sale agreement must require that archived records be maintained as scheduled by the new owners. In the case of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed.

The laboratory maintains all documentation which is necessary for historical reconstruction of data:

- Analysis reports
- Data notebooks
- Data logbooks
- Instrument output
- Correspondence and client files
- Instrument and equipment logbooks
- QA records
- Corporate documents
- Electronic records

Uncontrolled Copy

# 11. AUDITS AND INSPECTIONS

## 11.1. Internal Quality Assurance Audits

The QA Department, which is independent of laboratory activities, performs routine and on-going system, traceability, and observation audits to objectively review current systems, operations, and procedures as well as automated data integrity audits of electronic data records. The goal of the audits is to ensure that the quality system activities are effective and in compliance with regulatory programs, including NELAP. ISO 17025, DoD, and state agencies, as well as internal policies and procedures. Audits are documented and tracked in a QA database.

Audits are scheduled and conducted following a predefined schedule, based on criticality of operation and prior audit results, with the goal of evaluating systems and technologies across the operation. If warranted, additional audits are performed to follow up on promised corrective action or areas of concern.

Results of an audit are documented in a report format and distributed to applicable management personnel responsible for the area(s) under audit. Management is responsible to address all non-conformances found during an audit.

Audit reports and responses are circulated to Management to communicate the outcome of the audit and the proposed plan(s) for corrective action, if warranted. If any of the audit findings cast doubt on the validity of the results, the clients must be notified within three business days of the investigation.

All records maintained as part of an audit are kept on file for three years.

On an annual basis, an audit of the QA Department is performed as directed by the company Executive Management. The auditors assigned to carry out this operation are qualified staff members independent of the QA Department.

The specific content and findings of internal audits are not shared with clients.

## 11.2. Review of the Quality Assurance Program

All levels of management are continually updated on the status of quality and compliance by circulation of pertinent documents. Management review is documented by signatures on the route list, along with any comments or request for additional follow-up. The types of documents circulated real-time include:

- Internal, client, and agency audit reports and responses
- Proficiency test results
- Investigation and corrective action reports
- Monthly and quarterly QA status reports

Uncontrolled Copy

Executive management reviews the elements of the total QA program on an annual basis to ensure its continuing suitability and effectiveness in meeting the stated objectives outlined in Section 2.4 of this manual. The evaluation entails review of reports to management, all audit findings, client complaints, laboratory investigations, staff adequacy and training, and projected growth in workload. Patterns or trends in any of these areas are reviewed as a means to continually improve the quality system. This review also includes an evaluation of any audit findings resulting from the audit of the QA Department. At the conclusion of this quality system review, executive management determines the need to introduce changes or improvements into the quality systems at the laboratory. The minutes from the meeting and any recommendations for improvement are documented and a copy is forwarded to the QA staff for review and follow-up.

## 11.3. Good Laboratory Practice Critical Phase Inspections

Any project that is subject to Good Laboratory Practice (GLP) regulations is audited by the QA Department at intervals adequate to ensure the integrity of the study, as required by the regulations. Inspections of a GLP project include direct observation of analysts as they perform various phases of the study. Data documentation is reviewed as part of the inspection. The purpose of this type of audit is to ensure that there are no deviations from written methods, procedures, or study protocols.

Results of inspections are documented in a report format and distributed to applicable management personnel responsible for the area(s) under audit. Management is responsible to address all non-conformances found during an inspection. Inspection reports and responses are circulated to applicable laboratory management and an off-site study director, as applicable, to communicate the outcome of the inspection and the proposed plan(s) for corrective action, if warranted.

All records maintained as part of an inspection are kept on file.

## 11.4. Client Audits

Because clients place great importance on compliance with applicable regulations, data quality, and project requirements, they may audit our facility as assurance that their objectives are being met. QA, management staff, CSRs, and the analytical laboratories play a key role in these audits. Visits by clients can range anywhere from a tour (to verify laboratory facilities and instrumentation) to an intensive inspection of technical operations, procedures, regulatory compliance, and/or review of specific project(s).

- Audits are scheduled directly with the CSR or QA. The request to audit is communicated to all applicable laboratory departments.
- In accordance with our policy on client confidentiality, a client is permitted to review only data and results that apply to their work, or which have been approved by laboratory management.
- An escort (designated laboratory employee) remains with an auditor at all times.

Responsibilities are assigned to the following groups in regard to client audits:

Uncontrolled Copy



ED_004850_00001502-00349

11.4.1. QA Department

- Research previous audit reports and laboratory responses to past deficiencies.
- Follow-up with the applicable analytical laboratory areas to ensure action items were completed from the last audit, as necessary.
- Work with client to set audit agenda.
- Function as an escort during the audit
- Answer questions the auditor has in regard to laboratory and quality systems.
- Take notes of areas where corrective action or suggestions are recommended during the audit.
- Communicate audit issues to management at the completion of the audit.
- Respond to client audit reports.
- Ensure follow-up to cited items are performed in a timely manner.

11.4.2. CSRs

- Gather and organize relevant information (e.g., client correspondence, analysis/project requests, copies of analytical data from archives).
- Be knowledgeable about client-specific project requirements and issues.
- Function as an escort during the audit.
- Communicate issues/problems to appropriate personnel.

11.4.3. Laboratories

- Gather and organize laboratory data and documentation in preparation for client review.
- Assure corrective action was implemented from past audit findings, if necessary.
- Be prepared to discuss project data/testing results during the audit.
- Be familiar with client-specific project requirements and be prepared to answer client questions.
- Be familiar with the location of routine laboratory information and equipment (e.g., SOPs, data notebooks, calibration data, etc.).
- Be prepared to answer specific technical questions in regards to laboratory procedures and instrumentation within the area.
- Functions as an audit escort within the department during the audit.
- Laboratory managers may function as an escort during the audit

Uncontrolled Copy

## 11.5. Agency Inspections

It is laboratory policy to cooperate to the fullest extent and maintain cordial relations with all government agencies. The QA Department is assigned the responsibility of hosting and working with agency representatives. Their role includes, escorting the investigator(s); ensuring all questions are answered promptly and accurately; making note of all unresolved issues; informing management of the audit status and outcome; responding to the audit report and ensuring that appropriate corrective action is completed.

Inspections can be performed by investigators or auditors from the EPA, states, third-party accreditation bodies (i.e. A2LA, United States Department of Agriculture (USDA), or other regulatory agencies.

Government agencies have the right to investigate and inspect the laboratory during normal business hours and permission to inspect is granted by Executive Management.

Designated members of the QA Department are primary contacts for announced inspections. The QA Manager is the primary contact for all unannounced agency inspections. If the QA Manager is unavailable, Executive Management is notified, in addition to a member of the QA Department. The QA Manager, or their designee, must obtain evidence of the investigator's authority either in the form of a letter or examination/explanation of credentials.

Inspections include the examination of records or the inspection of facilities. Investigators are usually concerned only with the records relating to their responsibilities. As a general rule, they are given copies of records and documents, if requested. All copied records taken by an investigator must be stamped as being confidential material. The laboratory must have a record of all items taken by an investigator.

Investigators must be escorted through the laboratory. The laboratory is not obligated to show an investigator the following types of information: sales, financial or pricing information, or any personnel data other than training or qualification documentation. On a case-by-case basis, internal QA audit reports and investigation reports are made available for agency review. Any questions or concerns about a request made by an investigator in regard to recording devices or photographs must be reviewed with legal counsel.

The laboratory personnel are not permitted to sign affidavits. If an affidavit is presented during an inspection, all personnel are directed not to sign it, read it, nor listen to it being read. The only document that is acceptable to sign is an acknowledgement that an inspection report has been received. If there is any doubt as to what should be signed, legal counsel must be consulted.

## 11.6. Proficiency Testing

Many of the organizations that certify our laboratory to perform various analyses require proof of our competency. Laboratory performance is checked regularly by participation in a variety of proficiency testing programs. When available, blind samples are obtained from vendors that are accredited to provide PT samples for NELAP for all test and matrices routinely tested at the laboratory. In addition, some individual certification programs require analysis of specific sets of proficiency samples, and the laboratory also chooses to participate in a double blind program.

Uncontrolled Copy

Generally, the proficiency test programs consist of samples or ampulated spiking solutions used to fortify laboratory samples. The laboratories analyze the samples in the same manner as a client sample and the data is sent to the agency or vendor for evaluation. After the study results are returned to the laboratory, any data falling outside the acceptance criteria is investigated and corrective action is implemented, if needed. Results are circulated to management and communicated to the analyst. No proficiency testing samples or portion of a proficiency test sample are sent to another laboratory for analysis.

Double blind samples are submitted to the laboratories by the Client Services Department using a fictitious client name so that the analysts are not aware that the samples are proficiency tests. The samples are submitted quarterly and include a cross-section of organic and inorganic tests. The acceptance criteria for these double blind samples are developed statistically using data from participating laboratories, providing a source of inter-laboratory comparison. Results are reviewed, investigated as needed, and circulated to management.

If a trend in PT failures is identified, additional blind samples are ordered for that specific test as corrective action.

Clients routinely submit blind and double blind samples to evaluate the laboratory's performance. If a report is issued to the laboratory, it is handled in the same manner as a scheduled PT study evaluation and follow-up.

# 12. CORRECTIVE AND PREVENTIVE ACTION

## 12.1. Laboratory Investigations and Corrective Action

Due to the technical nature of laboratory work and the encompassing nature of our QA program, a wide variety of laboratory issues can require investigations, documentation, and corrective action. Prompt investigation and implementation of corrective action ensure that only data of known quality are reported and prevent the reoccurrence of errors. The following list provides "examples" of the type of issues that warrant investigation:

- Out-of-specification QC results
- Failed performance evaluation samples
- Reporting incorrect results
- Contamination issues
- Client technical complaints
- Procedural errors
- Missed holding times
- Systematic problems that compromise the accuracy or compliance of the data generated
- Problems with instrumentation and equipment which could compromise the data generated

These investigations must include the following:

- Identification of the problem
- Steps taken to investigate the problem
- Explanation of probable root cause(s) of the problem
- Steps taken to prevent future occurrence
- Determination of samples or systems affected by the problem

Uncontrolled Copy

Management is informed of problem situations and the QA Department tracks documentation and the status of the investigation activities. Technical management and/or QA may issue a stop work notice if issues indicate the potential for problems on a broad scale. The goal is to identify root cause, have the corrective action implemented promptly, and to the degree appropriate for the magnitude and risk of the problem. Corrective action issues are subject to follow up by the QA Department. Tracking and trending of laboratory issues is performed by the QA Department and reported to management on a monthly and quarterly basis.

## 12.2. Investigation Processes

All results from quality control (QC) samples are logged into the computerized quality control system, which is programmed to alert analysts to unacceptable results. Analysts are required to review the results and determine the source of the problem. The source of the problem and proposed corrective action must be documented. Corrective action may include, but is not limited to, re-analysis, re-extraction or re-digestion, instrument maintenance, or re-calibration. If these actions do not yield compliant data within the required hold time, a Nonconformance Form is initiated to document actions and communication with the client. The original form is archived with the associated raw data. Nonconformance Forms are reviewed by the technical department's management, or designee. A copy of the form is reviewed by QA.

Missed holding times are investigated and documented according to a procedure specific to this issue. A standard form is used for documenting this type of incident and signed by a representative of all areas involved, in addition to management and QA. Clients are informed of any problems involving holding time.

Other types of problems having the potential for impact on the quality of data are investigated and documented using a form titled Investigation and Corrective Action Report (ICAR). This process was developed to ensure that laboratory problems are investigated, evaluated for root cause, documented, and corrective action is put into place to prevent reoccurrence. Any employee can initiate an ICAR to document a laboratory problem. Once initiated, the QA Department is notified to assign a unique tracking number and the due date for the investigation. The QA Department reviews and approves the completed ICAR then monitors the corrective action.

If a laboratory error is identified from the outcome of the investigation that impacts client data, the client must be immediately notified in writing of the situation. If the root cause of the problem has affected any other client sample results, all affected clients are notified immediately of the problem.

## 12.3. Client Feedback

The laboratory is in the business of providing high quality analytical testing services. The data that we supply to our clients must be technically complete, accurate, and compliant with applicable regulations. Complaints can be received via letter, phone call, e-mail, or face-to-face meeting.

When a complaint is received, it is our responsibility to determine, to the best of our ability, the extent of the issue and what data is in question. The person receiving the complaint documents this information and promptly forwards it to the appropriate management personnel where the work in question was performed. If a transcription or calculation error is discovered, the final report and/or data must be regenerated with the correct value(s).



ED_004850_00001502-00353

The Client Service Representative is responsible for entering client concerns into the LIMS and an automated summary report is sent to QA on a weekly basis for review. In some cases, an investigation is initiated to address and document the situation.

On an annual basis, the Client Services and Business Development Groups send a client satisfaction survey to all clients. The results of these surveys are compiled and used to identify areas of improvement for the laboratory.

## 12.4. Preventive Actions

All employees are empowered and encouraged to use the concept of Preventive Action to avoid a problematic situation. The company supports, embraces and drives the process for continuous quality improvement by several means, such as: Ethics Committee and the Suggestion Box (accessible to all employees on the company's Intranet 'LabLinks'), and training classes that include "Making Quality a Science" and Ethics. If an employee identifies a potential problem or an area of concern or it should be brought to the attention of his/her supervisor, Human Resources or the Ethics Officer. Employees are also encouraged to communicate to their supervisor any area(s) or operation(s) that they believe could be streamlined, make their job easier, would provide a quality improvement, or could provide a cost savings to the company.

Various training courses are provided to all employees to assist with building quality and efficiency into their daily jobs. They stress a proactive approach/environment to problem solving and to review quality systems and operational efficiencies.

- "Making Quality a Science" is an introductory total quality management (TQM) course required for all employees to teach why quality is important and to explain the laboratory's quality philosophy and processes, and how to apply quality thinking and techniques on the job. Topics discussed include: communication, teamwork, serving the client, measurement, quality tools, and continuous process improvement. To foster continuous improvements of laboratory systems, process improvement teams are formed, as needed, if an employee needs help in solving a problem or addressing an issue. The goal of these groups is to have representation from various areas of the laboratory work together to look at a problem, evaluate the need for a temporary fix, brainstorm root causes, plan process improvement, implement the process improvement, evaluate and follow-up to the corrective action.

- "Putting our Values to Work" is a seminar required for all employees to teach the laboratory's Statement of Values by examining how it translates to our everyday jobs and ethical decision making. Topics discussed include: Statement of Values, ethical paradigms, and ethical decision making. Mandatory ethics training refresher seminars are offered on an annual basis.

- The laboratory has an Ethics Committee that meets on a regular basis to discuss and handle ethical issues or situations that cause concern or make employees feel uncomfortable. The mission of this group is to promote sharing of concerns on ethical issues; encourage and maintain commitment among employees to our core ethical values; and to maintain an environment that ensures open access to committee members and all levels of management and the confidential handling of ethical issues.

Uncontrolled Draft

- The laboratory also utilizes a formal program to encourage preventive action through development of lean processes. The goal of this program is to optimize processes to ensure efficiency and operational improvements while maintaining compliance. The efficiency gains are inherently coupled with minimizing errors and rework. Teams of employees learn the tools and techniques to evaluate a process, identify potential sources of errors, delays or problems in an operation, determine system changes that will minimize these and work to implement the improvements. Each project includes thorough documentation of the evaluation, measurement, and implementation phases. The process is continually monitored to ensure that the anticipated results are sustained.

- The Quality Assurance Group prepares monthly and quarterly program status reports for management. The reports include a variety of metrics and graphs which are used to evaluate trends in laboratory performance across all quality and compliance areas. Management responds to any negative trends by developing a corrective action plan.

# 13. SERVICE TO CLIENTS

## 13.1. Service to Clients

We value our client relationships and support these partnerships through the following principles:

- Honesty and Fairness – Our corporate culture is founded on the principles of professionalism and high ethical standards in dealing with our clients. This may mean declining to provide the service requested (if we are convinced that to do so would be meaningless) or it may mean referring clients outside of our Lab if we believe that another company can better meet their needs.

- Complete Service – We will give our clients full value on every service provided. We will provide detailed information on our methods, procedures, and QA programs if requested, and take a personal interest and initiative in helping solve our client's problems within the area of our professional expertise.

- Trustworthiness – All data and information developed for a client will be held confidential and not disclosed to a third party except on written request of the client. If information is subpoenaed, we must, by law, release it, but the client will be informed of the release.

- Commitment to Quality – We constantly strive to improve our service in quality, flexibility, and dependability, to keep our competitive edge. We will achieve this through: meeting the requirements of those we serve, staying apprised of regulatory and industry expectations, and providing prompt responses to client concerns.

- Basics of Superlative Service – Our focus is on our client's success. Through proactive collaborative communication, our leadership ensures we understand our client's expectations and strives to exceed them. We foster a service culture in our training, reward and recognition, and performance management process so each employee takes ownership to deliver superlative service to our clients. Feedback from clients, whether positive or negative, is an important part of our continuous improvement system. Ways in which feedback is gathered can include, but is not limited to, customer satisfaction surveys, client audits, and the customer complaint system, which is described within section 12.3.

We also view our fellow employees as our clients since they frequently receive the results of our labor. Meeting the requirements of the next employee in the workflow process is just as important as meeting the needs of an external client.

Uncontrolled Copy

## 13.2. Review of Work Requests, Tenders, and Contracts

The laboratory places great importance on understanding client requirements for a project. We ensure, to the best of our ability, that client/project requirements are identified. Project evaluation can be achieved in various ways, including the review of analytical methods, protocols, business contracts, and quality agreements. Project kick-off meetings can also be arranged through the Business Development and/or the Environmental Project Management Group. These meetings allow the client and key technical personnel to discuss project issues and requirements prior to project initiation. The project review encompasses our Project Cycle process and individual topics to be evaluated for a project include, but are not limited to: scope of testing; required accreditations (i.e. individual state agencies, NELAP, DoD, and ISO17025) held by the laboratory; appropriate and current testing methods; ability to meet project required reporting limits and QC (if applicable); inconsistencies clarified; and nonstandard work requests. Any differences between laboratory processes and the project requirements are discussed and addressed with the client and the laboratory staff before the project is accepted and samples arrive. Testing that cannot be performed at the laboratory may be subcontracted to another laboratory (see 13.4).

A key client contact, the CSR is assigned to oversee the project. Communication between the client and laboratory staff is available and is coordinated through the CSR.

As a project continues, the CSRs provide continuous communication and status reports (if requested) about the project to the client. The CSR relays any project changes or modifications to the technical groups. If the client submits revised project documents (QAPPs, etc.) then the Project Cycle review process is repeated. The CSR also communicates any issues encountered by the technical laboratories back to the client and vice-versa.

## 13.3. Timely Delivery

Evaluating laboratory capacity and ability to perform specific projects is a joint responsibility between the Technical Director, Business Development, and the laboratory managers. We recognize that one of the most important aspects of the service we offer is turnaround time.

Many analysts are cross-trained to perform a variety of tests, and there is redundant equipment available in the laboratory area creating operation flexibility for routine work. Larger projects are reviewed against capacity estimates before bids are submitted to ensure that the client's schedule is met. Turnaround time is continually measured.

Regularly scheduled meetings are held with technical and support management, and project management personnel to review progress with current projects, as well as special requirements of new work scheduled for the laboratory.

Management receives a daily report of the status of all samples in the lab, including those with priority status or those that have exceeded a preset turnaround time. This is of inestimable value in planning and organizing the workload through efficient scheduling.



ED_004850_00001502-00356

Any changes to the established timeline by the client or the laboratory must be communicated to the client or laboratory as soon as possible. Upon communication of changes, a new timeline is established and agreed upon by both parties. If a client requires a change in the scope of the project (e.g., number of samples submitted, change in analyses, revised protocol) the laboratory must be informed in writing and a new timeline and cost estimate is be provided.

## 13.4. Subcontracting

The laboratory may subcontract tests to other laboratories if the requested testing is not routinely performed in our laboratory. To a lesser extent, samples may need to be subcontracted to an overflow laboratory to ensure hold times and/or turn-around-times (TAT) are met.

Testing is only subcontracted with the client's knowledge and approval. The CSR must notify the client in writing when any of their requested analyses will be subcontracted to another lab. Client approval must be obtained in writing before samples are shipped.

Subcontract laboratories are selected based on their qualifications and accreditations. The subcontractor is requested to sign a statement that they warrant all testing procedures they perform and that they are solely liable and responsible for the accuracy of tests performed. If projects require a specific agency certification (i.e. individual state agencies, National Environmental Laboratory Accreditation Program (NELAP), Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP), and ISO17025), only an appropriately accredited laboratory is used. The client may also have a list of laboratories to be used for subcontracting. In these cases, the evaluation of the subcontract laboratory is made by the client.

Data obtained from subcontract laboratories is clearly marked as such when reported by the laboratory. The data are submitted to the client in the format obtained from the subcontractor.

## 13.5. Use of NELAP and A2LA logo

It is not laboratory policy to use these logos on any company letterhead, including analytical reports.

Uncontrolled Copy

Uncontrolled Copy

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-GDL-9015378 | **Revision** | 3 |
| **Effective Date** | Aug 8, 2014 | **Status** | Effective |
| **Historical/Local Document Number** | DOD - Environmental Quality Policy Manual Appendix A | | |
| **Local Document Level** | Level 1 | | |
| **Local Document Type** | POL - Policy | | |
| **Local Document Category** | ES - Environmental Sciences | | |

| | |
|---|---|
| **Prepared by** | Christiane Sweigart and Kathryn Brungard |
| **Reviewed and Approved by** | Duane Luckenbill;Review;Tuesday, July 29, 2014 11:15:02 AM EDT<br>Robert Strocko;Review;Wednesday, July 30, 2014 1:19:46 PM EDT<br>Dorothy Love;Approval;Wednesday, July 30, 2014 2:05:44 PM EDT |

Uncontrolled Copy

## Procedure Cross Reference List

**NOTE**: SOPs and Forms are indicated in the table with the unique Document Control Database number starting with "90…". The topic of the document is given in parentheses.

| Section # | Title | Procedure(s) |
|---|---|---|
| 1 | Introduction | |
| 1.1. | Mission Statement | Employee Handbook |
| 1.2. | Quality Policy | 9007879 (Statement form)<br>Employee Handbook |
| 1.3. | Statement of Values | Employee Handbook |
| 1.5. | Certifications, Accreditations, and Registrations | 9007852 (Cert Summary form) |
| 2 | Organization and Personnel | |
| 2.1.1 | Business Continuity and Contingency Plans | 9017347 (Incident Response Plan)<br>9017681 (Preparedness …Policy 0010)<br>9017358 (Archiving SOP)<br>9021762 (Deputies form) |
| 2.2. | Organizational Structure | Organization Charts |
| 2.3. | Management Responsibilities | PQDs (job descriptions)<br>PMDs (individual job plans) |
| 2.4. | Overview of the Quality Assurance Program | Dept 4052 SOP Series |
| 2.5. | Quality Assurance Responsibilities | Dept 4052 SOP Series |
| 2.6. | Communication of Quality Issues to Management | 9020717 (QA Reports) |
| 2.7. | Personnel Qualifications and Responsibilities | 9017379 (Employee Training)<br>PQDs (job descriptions)<br>PMDs (individual job plans)<br>Task Specific Training |
| 2.8. | Relationship of Functional Groups and the Quality Assurance Program | Quality Orientation<br>TQM Training<br>PMDs (individual job plans)<br>Dept 4052 SOP Series<br>9017338 (Project Cycle) |
| 2.9. | Balancing Laboratory Capacity and Workload | PMDs (individual job plans)<br>LIMS reports for mgt |
| 2.10. | Identification of Approved Signatories | 9017322 (Date Entry, Verification and Reporting) |
| 2.11. | Personnel Training | 9017379 (Employee Training)<br>9015390 (DOCs)<br>PQDs (job descriptions)<br>PMDs (individual job plans)<br>Task Specific Training |
| 2.12. | Regulatory Training | 9022322 (GLP) |

Uncontrolled Copy

| Section # | Title | Procedure(s) |
|---|---|---|
| 2.13. | Employee Safety | Analytical Methods<br>Chemical Hygiene Plan<br>9017681 (Preparedness ...Policy 0010)<br>Dept 6098 SOP Series<br>PMDs (individual job plans) |
| 2.14. | Client Services/Project Management Responsibilities | Dept 4039 SOP Series<br>9017338 (Project Cycle) |
| 2.15. | Confidentiality | Employee Handbook<br>9017360 (E-mail System)<br>9022134 (Client and Agency Audits) |
| 2.16. | Business Conduct | Employee Handbook |
| 2.17. | Operational Integrity | 9017675 (Manual Integration Policy 0001)<br>9017333 (Chromatographic Integration)<br>9017679 (Ethics Policy 0007)<br>9007879 (Quality Statement form) |
| 3 | Buildings and Facilities | |
| 3.1. | Facility | Floor Plans |
| 3.2. | Security | 9017366 (Building Security) |
| 3.3. | Disaster Recovery | 9017347 (Incident Response Plan) |
| 3.4. | Environmental Monitoring | 9017311 (VOA Storage)<br>9021509 (ETM) |
| 3.5. | Water Systems | 9017368 (Reagent Water) |
| 3.6. | Housekeeping/Cleaning | 9017373 (Housekeeping) |
| 3.7. | Insect & Rodent Control | 9017367 (Insect & Rodent Control) |
| 3.8. | Emergency Power Supply | 9017347 (Incident Response Plan) |
| 3.9. | Facility Changes | 9017364 (Facility Change Control)<br>9028515 (Change Control) |
| 4 | Document Control | |
| 4.1. | Hierarchy of Internal Operating Procedures | 9017356 (Writing SOPs) |
| 4.2. | Document Approval, Issue, Control, and Maintenance | 9017357 (Document Control)<br>9017329 (Method Validation) |
| 4.3. | Client-Supplied Methods and Documentation | 9021833 Analytical Decision Making)<br>9022599 (QA review of QAPPs)<br>9017338 (Project Cycle)<br>9015436 Auditing Paperwork) |
| 4.4. | Laboratory Notebooks, Logbooks, and Forms | 9017357 (Document Control)<br>9021767 (Notebooks) |

Uncontrolled Copy

| Section # | Title | Procedure(s) |
|---|---|---|
| 4.5. | Control of External Documents | 9017357 (Document Control)<br>Departmental "Controlled Documents" forms |
| 5 | Sample Handling | |
| 5.1. | Sample Collection | Dept 4031 SOP Series |
| 5.2. | Sample Receipt and Entry | Dept 6042 SOP Series |
| 5.3. | Sample Identification and Tracking | Dept 6042 SOP Series<br>9017318 (LSAR) |
| 5.4. | Sample Storage | Dept 6055 SOP Series |
| 5.5. | Sample Return/Disposal | 9015512 (Sample Discard)<br>9017352 (Hazardous Wastes - Lab)<br>9017756 (Hazardous Wastes – Storage) |
| 5.6. | Legal Chain of Custody | 9017335 (Legal COC) |
| 5.7. | Representativeness of Samples | Analytical Methods<br>9017334 (Representative Solid Samples) |
| 6 | Technical Requirements - Traceability of Measurements | |
| 6.1. | Reagents and Solvents | 9017328 (Reagents and Standards)<br>Analytical Methods |
| 6.3. | Calibration Standards | 9017328 (Reagents and Standards)<br>Analytical Methods |
| 6.4. | Equipment and Instrumentation | 9017325 (Inst. & Equip M&C)<br>9015389 (Balance, Syringe, Pipette Verification)<br>Departmental Technical Procedures |
| 6.5. | Computerized Systems and Computer Software | 9028515 (Change Control)<br>9017361 (Network Accounts)<br>9017360 (E-mail System)<br>9017710 (Computer Backup)<br>Employee Handbook<br>9017712 (Computer Viruses) |
| 6.6. | Change Control | 9028515 (Change Control) |
| 6.7. | Labware Cleaning | Departmental Procedures |
| 7 | Purchasing Equipment and Supplies | |
| 7.1 | Procurement | 9021705 (Procurement)<br>9018236 (Receipt of Lab Supplies) |
| 7.2 | Supplier Evaluation | 9021705 (Procurement)<br>9017310 (Subcontracting)<br>9017328 (Reagents and Standards)<br>9015516 Preservative Checks) |

Uncontrolled Copy

| Section # | Title | Procedure(s) |
|---|---|---|
| 8 | Analytical Methods | |
| 8.1. | Scope of Testing | Schedule of Services |
| 8.2. | Analytical Test Methods | 9017329 (Method Validation)<br>9023483 Writing Procedure Guidance form) |
| 8.3. | Client Supplied Methods | 9017329 (Method Validation) |
| 8.4. | Method Validation | 9017329 (Method Validation) |
| 8.5. | Procedural Deviations | 9017331 (ICARs) |
| 9 | Internal Quality Control Checks | |
| 9.1. | Laboratory Quality Control Samples and Acceptance Criteria | 9017313 (QC Limits)<br>Analytical Methods |
| 9.2. | Quality Control Sample Frequency and Corrective Action | 9017315 (Noncompliant Data)<br>Analytical Methods |
| 9.3. | Quality Control Charts | 9018253 (End of Month QC Reports) |
| 9.4. | Measurement Uncertainty | 9017313 (QC Limits) |
| 10 | Assuring Quality of Test Results | |
| 10.1. | Data Management | 9021767 (Notebooks) |
| 10.2. | Data Documentation | 9021767 (Notebooks)<br>9017322 (Date Entry, Verification and Reporting)<br>9007879 (Statement form) |
| 10.3. | Data Calculations | 9017322 (Date Entry, Verification and Reporting)<br>Analytical Methods |
| 10.4. | Reporting Limits | 9017309 (MDLs & LOQs) |
| 10.5. | Data Review | 9021767 (Notebooks)<br>9017322 (Date Entry, Verification and Reporting) |
| 10.6. | Data Qualification | 9017315 (Noncompliant Data) |
| 10.7. | Data Reporting | 9017322 (Date Entry, Verification and Reporting)<br>9017330 (MCL Exceedance) |
| 10.8. | Data Storage, Security, and Archival | 9017358 (Data Archiving)<br>9017710 (Computer Backup) |
| 11 | Audits and Inspections | |
| 11.1. | Internal Quality Assurance Audits | 9020535 (Internal Audits)<br>9022322 (GLP)<br>9008821 IInternal Audit Checklist form) |
| 11.2. | Review of the Quality Assurance Program | 9020535 (Internal Audits)<br>9020717 (QA Reports) |
| 11.3. | Good Laboratory Practice Critical Phase Inspections | 9022322 (GLP) |
| 11.4. | Client Audits | Employee Handbook<br>9022134 (Client and Agency Audits) |

Uncontrolled Copy

| Section # | Title | Procedure(s) |
|---|---|---|
| 11.5. | Agency Inspections | Employee Handbook<br>9022134 (Client and Agency Audits) |
| 11.6. | Proficiency Testing | 9017321 (PT Program)<br>9018237 (PT Entry) |
| 12 | Corrective and Preventive Action | |
| 12.1. | Laboratory Investigations and Corrective Action | 9017315 (Noncompliant Data)<br>9017331 (ICARs)<br>9017332 (Client Complaints) |
| 12.2. | Investigation Processes | 9017326 Missed Hold Procedure)<br>9007810 (Missed Hold form)<br>9017331 (ICARs) |
| 12.3. | Client Feedback | 9017332 (Client Complaints)<br>Annual Client Survey |
| 12.4. | Preventive Actions | Corporate Training<br>Lean Projects<br>9017338 (Project Cycle)<br>9028515 (Change Control)<br>9020535 (Internal Audits) |
| 13 | Service to Clients | |
| 13.1. | Service to Clients | Employee Handbook<br>Ethics Statement<br>9007879 (Statement form)<br>TQM Training |
| 13.2. | Review of Work Requests, Tenders, and Contracts | 9015436 (Client Paperwork)<br>9017338 (Project Cycle)<br>9018254 (QAPP Review) |
| 13.3. | Timely Delivery | 9015434 (Tracking Rush Samples)<br>9015437 (Scheduling Rush Samples)<br>Departmental LIMS reports |
| 13.4. | Subcontracting | 9017310 Subcontracting)<br>9017338 (Project Cycle)<br>9018248 (QA Approval of Subcontractors) |

Uncontrolled Copy

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-GDL-9015379 | **Revision** | 3 |
| **Effective Date** | Aug 8, 2014 | **Status** | Effective |
| **Historical/Local Document Number** | DOD - Environmental Quality Policy Manual Appendix B | | |
| **Local Document Level** | Level 1 | | |
| **Local Document Type** | POL - Policy | | |
| **Local Document Category** | ES - Environmental Sciences | | |

| | |
|---|---|
| **Prepared by** | Christiane Sweigart |
| **Reviewed and Approved by** | Duane Luckenbill;Review;Tuesday, July 29, 2014 10:47:11 AM EDT<br>Robert Strocko;Review;Wednesday, July 30, 2014 1:31:56 PM EDT<br>Dorothy Love;Approval;Wednesday, July 30, 2014 2:07:59 PM EDT |

Uncontrolled Copy

| Agency | Parameter | Applicable Matrices | Lab ID No. Certificate No |
|---|---|---|---|
| Federal Programs: | | | |
| American Association for Laboratory Accreditation (A2LA) | Organics, inorganics, dioxin per ISO 17025 and DoD QSM 4.2 | Nonpotable water, solid and hazardous waste, air, tissue and tobacco | 0001.01 |
| USDA Quarantine Soil Permit | All | All | P330-13-00350 |
| State Programs: | | | |
| State of Alaska, Department of Environmental Conservation | Organics, inorganics, UST analysis | Nonpotable water, solid and hazardous waste | UST-061 |
| State of Arizona, Department of Health Services | Dioxins | Potable water, nonpotable water, solid and hazardous waste | AZ0780 |
| State of Arkansas, Department of Environmental Quality | Organics, inorganics, dioxin | Nonpotable water, solid and hazardous waste | 88-0680 |
| State of California, Department of Health ELAP | Organics, inorganics | Potable water, nonpotable water, solid and hazardous waste | 2792 |
| State of California, Department of Health NELAC | Dioxin and NDMA | Potable water, nonpotable water, hazardous waste | 10276CA |
| State of Colorado, Department of Public Health and Environment | Organics, inorganics, dioxin | Potable water | None |
| State of Connecticut, Department of Public Health | Organics, inorganics, dioxin, micro | Potable water, nonpotable water, solid and hazardous waste | PH-0746 |
| State of Delaware, Health and Social Services | Organics, inorganics, dioxin, micro | Potable water | None |
| *State of Florida, Department of Health | Organics, inorganics, dioxin, micro | Air and emissions, potable water, nonpotable water, solid and chemical materials | E87997 |
| *State of Illinois, Environmental Protection Agency | Organics, inorganics, dioxin | Nonpotable water, solid and chemical materials | 200027 003345 |
| State of Iowa, Department of Natural Resources | Organics, inorganics, UST analysis | Nonpotable water, solid and hazardous waste | 361 |
| *State of Kansas, Department of Health and Environment | Organics, inorganics, dioxin | Potable water, nonpotable water, solid and chemical materials | E-10151 |
| Commonwealth of Kentucky, Department of Environmental Protection, Division of Water | Organics, inorganics, dioxin | Potable water | 90088 |
| *Commonwealth of Kentucky, Department for Environmental Protection – UST Branch | Metals only | Nonpotable water, solids | 89 |
| *** State of Louisiana, Department of Environmental Quality | Organics, inorganics, dioxin | Air emissions, nonpotable water, solid chemical materials, biological tissue | Lab ID:02055 AI No. 30729 |
| State of Maryland, Department of the Environment | Organics, inorganics, dioxin, micro | Potable water | 100 |
| Commonwealth of Massachusetts, Department of Environmental Protection | Organics, inorganics | Nonpotable water | M-PA009 |

Unofficial Copy





ED_004850_00001502-00366

| Agency | Parameter | Applicable Matrices | Lab ID No. Certificate No. |
|---|---|---|---|
| State of Michigan, Department of Environmental Quality | Organics, inorganics, dioxin | Potable water | 9930 |
| State of Missouri, Department of Natural Resources | Organics | Potable water | 450 |
| State of Montana, Department of Public Health and Human Services | Organics, inorganics, dioxin | Potable water | CERT0098 |
| *State of Nevada, Division of Environmental Protection | Organics, inorganics, dioxin | Nonpotable water, solid and chemical materials | PA00009 |
| *State of New Hampshire, Department of Environmental Services | Organics, inorganics, micro | Potable water, nonpotable water, solid and chemical materials | 2730 |
| *State of New Jersey, Department of Environmental Protection (NJDEP) | Organics, inorganics, dioxin, micro | Air and emissions (direct accreditation), potable water, nonpotable water, solid and chemical materials, | PA011 |
| *State of New York, Department of Health | Organics, inorganics, dioxin | Air, nonpotable water, potable water, solid and chemical materials | 10670 |
| State of North Carolina, Department of the Environment and Natural Resources | Organics, inorganics | Nonpotable water | 521 |
| State of North Carolina, Department of Health and Human Services | Organics, micro | Potable water | 42705 |
| State of North Dakota, Department of Health | Inorganics | Nonpotable water | R-205 |
| State of Ohio, Environmental Protection Agency (Voluntary Action Program) | Organics, inorganics | Nonpotable water, solid and hazardous waste | CL0070 |
| State of Oklahoma, Department of Environmental Quality | Organics, inorganics, dioxin | Nonpotable water, solid and hazardous waste | 9804 |
| *State of Oregon, Public Health Laboratory | Organics, inorganics, dioxin | Air, nonpotable water, solid and chemical materials | PA200001 |
| *Commonwealth of Pennsylvania, Department of Environmental Protection (Bureau of Laboratories) | Organics, inorganics, dioxin, micro | Potable water, nonpotable water, solid and chemical materials | 36-00037 013 |
| State of Rhode Island, Department of Health | Organics, inorganics | Potable water, nonpotable water | LAO00338 |
| State of South Carolina, Department of Health and Environmental Control | Organics, inorganics, dioxin | Potable water, nonpotable water, solid and hazardous waste | 89002 89002002 |
| State of Tennessee, Department of Environment & Conservation | Organics, inorganics, dioxin | Potable water | TN02838 |
| *State of Texas, Commission on Environmental Quality | Organics, inorganics, dioxin | Air and emissions, potable water nonpotable water, solid and chemical materials, biological tissue (direct accreditation) | T104704184-14-13 |
| *State of Utah, Department of Health | Organics, inorganics, dioxin | Potable water, nonpotable water, solid and hazardous material | PA00009 |

Uncontrolled Copy





ED_004850_00001502-00367

| eurofins Lancaster Laboratories Environmental | Document Title: Certifications, Accreditations, Registrations and Contracts | | |
|---|---|---|---|
| | Eurofins Document Reference: 1-P-QM-FOR-9007852 | Revision: 22 | Historical Reference: Form 2528 |
| | Effective date: Jun 23, 2014 | Status: Effective | |

| Agency | Parameter | Applicable Matrices | Lab ID No. Certificate No. |
|---|---|---|---|
| State of Vermont, Department of Health Laboratory | Organics, inorganics, dioxin, micro | Potable water | VT 36037 |
| Commonwealth of Virginia, Department of General Services | Organics, inorganics, micro | Potable water | 00187<br>2417 |
| [5] Commonwealth of Virginia, VELAP | Organics, inorganics, dioxin, micro | Air, Potable water, nonpotable water, solid and chemical materials | 460182<br>2754 |
| State of Washington, Department of Ecology | Organics, inorganics, dioxin | Air, Potable water, Nonpotable water, solid and chemical materials | C457 |
| State of West Virginia, Department of Health and Human Resources | Organics, inorganics | Potable water | 9906C |
| State of West Virginia, Department of Environmental Protection | Organics, inorganics, dioxin, micro | Nonpotable water, solid and chemical materials, hazardous waste | 055 |
| State of Wisconsin, Department of Natural Resources | Organics, inorganics, dioxin | Nonpotable water, solid and hazardous waste | 998035060 |
| State of Wyoming and all Tribal Public Water Systems in Region 8 | Organics, inorganics, dioxin, micro | Potable water | 8TMS-L |

[1]NELAP Primary AB: Air and Emissions
[2]NELAP Primary AB: Potable Water, Nonpotable water, solid and chemical materials
[3]NELAP Secondary AB
[4]Approval for UST work by A2LA
[6] NELAP Primary AB: Biological Tissue

**NOTE:** This list accurately reflects the certifications, accreditations, registrations, and contracts held at the time of publication and is subject to change. Check with your account manager on the status of any certification needed for a specific project.

Uncontrolled Copy



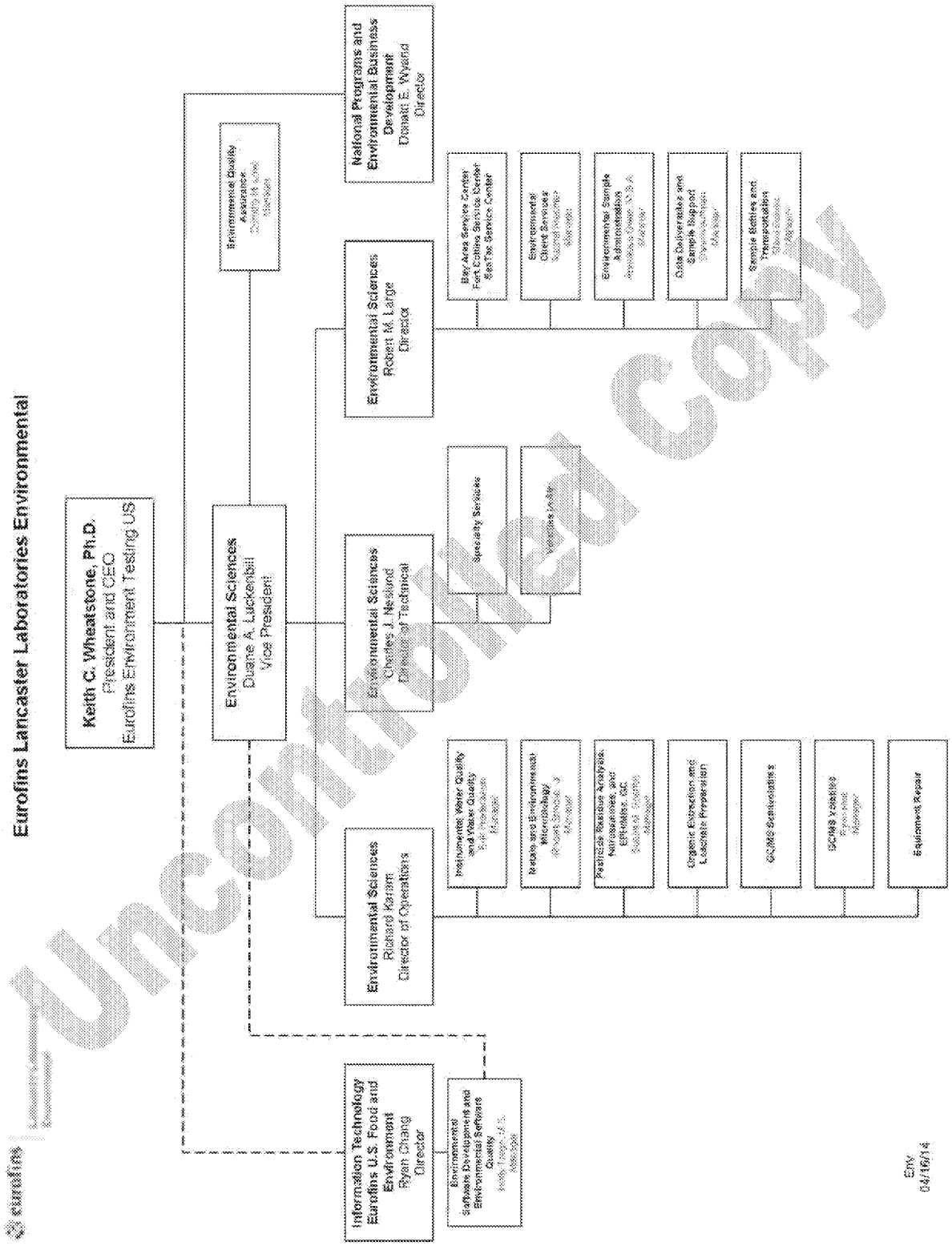


ED_004850_00001502-00368

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-GDL-9015380 | **Revision** | 3 |
| **Effective Date** | Aug 8, 2014 | **Status** | Effective |
| **Historical/Local Document Number** | DOD - Environmental Quality Policy Manual Appendix C | | |
| **Local Document Level** | Level 1 | | |
| **Local Document Type** | POL - Policy | | |
| **Local Document Category** | ES - Environmental Sciences | | |

| | |
|---|---|
| **Prepared by** | Christiane Sweigart |
| **Reviewed and Approved by** | Duane Luckenbill;Review;Tuesday, July 29, 2014 10:52:10 AM EDT<br>Robert Strocko;Review;Wednesday, July 30, 2014 1:03:25 PM EDT<br>Dorothy Love;Approval;Wednesday, July 30, 2014 2:19:54 PM EDT |

Uncontrolled Copy




Uncontrolled Copy

| Name | Degree | Title |
|---|---|---|
| **Quality Assurance** | | |
| Dorothy Love* | B.S. | Manager |
| Barbara Reedy* | B.S. | Senior Specialist |
| Christiane Sweigart | B.S. | Senior Specialist |
| Kathryn Brungard* | | Senior Specialist |
| **Environmental Sciences** | | |
| Duane Luckenbill | B.S. | Vice President |
| Donald Wyand | B.S. | Director |
| Robert Large | B.S. | Director |
| Richard Karam* | B.S. | Director |
| Charles Neslund* | B.S. | Director |
| **Environmental Client Services and Inside Business Development** | | |
| Rachel Kreamer | B.S. | Manager |
| Lynn Frederiksen* | B.S. | Principal Specialist GL |
| Nicole Maljovec* | M.S. | Principal Specialist GL |
| Wendy Kozma* | B.S. | Principal Specialist GL |
| Angela Miller* | B.S. | Specialist |
| Barbara Weyandt* | M.S. | Specialist |
| Irene Dodd* | M.S. | Principal Specialist |
| Kaitlin Plasterer* | B.S. | Senior Specialist |
| Katherine Klinefelter* | M.S. | Principal Specialist |
| Loran Carter* | B.S. | Specialist |
| Luz Garcia* | | Specialist |
| Lyssa Longenecker* | B.S. | Senior Specialist |
| Marianne Bragg* | B.S. | Principal Specialist |
| Megan Moeller* | B.S. | Senior Specialist |
| Melissa McDermott* | B.A. | Principal Specialist |
| Nancy Bornholm* | B.S. | Principal Specialist |
| Natalie Luciano* | B.A. | Senior Specialist |
| Tara Spaide* | | Senior Specialist |
| Teresa Cunningham* | B.S. | Principal Specialist |
| Additional support personnel in this group: 1 | | |
| **Data Deliverables** | | |
| Dana Kauffman* | | Manager |
| F. Bradley Ayars | | Principal Chemist Group Leader |
| Grace Salm | | Specialist Group Leader |
| Luz Torres | | Senior Specialist Group Leader |
| Audrey McClune | | Specialist |
| Betty Umble | | Specialist |
| Jessica Baron | | Specialist |
| Judi Brown | | Specialist |
| Kathy Fair | | Specialist |
| Lydia Steinke | B.S. | Specialist |
| M Susan Kreider | | Senior Specialist |

Uncontrolled Copy

| Name | Degree | Title |
|---|---|---|
| Patricia Madrigal-Kauffman | A.S. | Specialist |
| Tina McNeil | | Specialist |
| Tracy Pang-Ward | | Specialist |
| Additional support personnel in this group: 5 | | |
| **Service Centers** | | |
| Rachel Kreamer | B.S. | Manager |
| Kay Hower* | B.A. | Principal Specialist Group Leader |
| Larry Starkey | | Specialist |
| Vincent Yu | B.S. | Specialist |
| Cassandre Pelto* | B.S. | Project Manager |
| Additional support personnel in this group: 1 | | |
| **Environmental Microbiology** | | |
| Robert Strocko* | B.S. | Manager |
| Hannah Cottman | B.S. | Microbiologist |
| **Extractable Petroleum Hydrocarbons (EPH)/Miscellaneous GC** | | |
| Susan Goshert* | B.S. | Manager |
| Michele Hamilton* | B.S. | Senior Chemist Group Leader |
| Christine Dolman | B.S. | Chemist |
| Elizabeth Marin | B.S. | Chemist |
| Glorines Suarez-Rivera | | Chemist |
| Heather Williams | B.S. | Senior Chemist |
| Nicholas Rossi | B.S. | Senior Chemist |
| Tracy Cole* | | Senior Specialist |
| Tyler Griffin | B.S. | Chemist |
| **Field Sampling** | | |
| Samuel Huber* | B.S. | Manager |
| Jeffrey Allen | | Specialist Group Leader |
| Timothy Hauck | | Specialist |
| **GC/MS Semivolatiles** | | |
| Richard Karam* | B.S. | Director |
| Rachel Cochis* | B.A. | Senior Specialist Group Leader |
| Beth Rubino | B.S. | Senior Specialist |
| Brian Graham | B.A. | Senior Chemist |
| Catherine Bachman | B.S. | Chemist |
| Chad Moline* | B.S. | Senior Chemist |
| Holly Berry | B.S. | Senior Chemist |
| Joseph Gambler | B.S. | Senior Chemist |
| Linda Hartenstine | B.A. | Senior Chemist |
| Mark Clark | B.S. | Principal Chemist |
| Mark Ratcliff* | B.A. | Senior Specialist |
| Matthew Barton* | B.S. | Senior Specialist |
| **GC/MS Volatiles** | | |
| Ryan Nolt | B.S. | Manager |
| Kenneth Boley* | B.S. | Senior Chemist Group Leader |

Uncontrolled Copy

| Name | Degree | Title |
|---|---|---|
| Roy Mellott | B.S. | Senior Chemist Group Leader |
| Kathrine Muramatsu | B.S. | Senior Chemist Group Leader |
| Amanda Richards | | Chemist |
| Andrea Lando | B.S. | Chemist |
| Angela Sneeringer | B.S. | Chemist |
| Anita Dale | | Chemist |
| Brett Kenyon | B.S. | Chemist |
| Chelsea Stong | B.S. | Senior Chemist |
| Christine Dulaney* | B.S. | Senior Specialist |
| Christopher Torres | B.S. | Chemist |
| Daniel Heller | B.S.E. | Senior Chemist |
| Jason Long | B.S. | Senior Chemist |
| Kelly Keller | | Chemist |
| Kerri Legerlotz | B.S. | Senior Chemist |
| Kevin Sposito | B.S. | Chemist |
| Laura Krieger | B.S. | Chemist |
| Lawrence Taylor* | B.S. | Senior Specialist |
| Linda Pape | B.A. | Senior Chemist |
| Marie Beamenderfer | B.S. | Senior Chemist |
| Marla Brewer* | B.S. | Senior Specialist |
| Miranda Tillinghast | B.S. | Chemist |
| Robin Runkle* | B.S. | Senior Specialist |
| Sara Johnson | B.S. | Senior Chemist |
| Sarah Guill | B.S. | Chemist |
| Stephanie Selis | B.S. | Senior Chemist |
| Additional support personnel in this group: 3 | | |
| **Instrumental Water Quality** | | |
| Erik Frederiksen* | B.A. | Manager |
| Nicole Veety | | Senior Chemist Group Leader |
| Clinton Wilson | B.A. | Chemist |
| James Mathiot | | Chemist |
| Joseph McKenzie | | Chemist |
| Sandra Miller | | Chemist |
| William Hamaker | | Chemist |
| Additional support personnel in this group: 2 | | |
| **Metals** | | |
| Robert Strocko* | B.S. | Manager |
| Nina Haller* | | Senior Specialist Group Leader |
| Debra Bryan | | Specialist Group Leader |
| Choon Tian | B.A. | Chemist |
| Damary Valentin | | Chemist |
| Deborah Krady | B.S. | Specialist |
| Eric Eby | B.S. | Senior Chemist |
| Jennifer Moyer | B.S. | Senior Specialist |

Uncontrolled Copy

| Name | Degree | Title |
|---|---|---|
| John Hook | B.S. | Senior Chemist |
| Katlin Cataldi | B.S. | Chemist |
| Maria Orrs | M.S. | Chemist |
| Micaela Dishong | B.S. | Chemist |
| Parker Lindstrom* | B.S. | Senior Chemist |
| Tara Snyder | B.S. | Chemist |
| Additional support personnel in this group: 7 | | |
| **Organic Extraction** | | |
| Richard Karam* | B.S. | Director |
| Wanda Oswald | | Chemist Group Leader |
| Joseph Feister | | Chemist Group Leader |
| Anna Stager | B.A. | Chemist |
| Darin Wagner | B.A. | Chemist |
| David Hershey | | Chemist |
| Edwin Ortiz | | Chemist |
| Heidi Roberts* | B.S. | Senior Chemist |
| Kelli Barto | B.S. | Chemist |
| Kerrie Freeburn | B.S. | Chemist |
| Maria Davenport | | Chemist |
| Robert Vincent | B.S. | Principal Chemist |
| Seth Farrier | B.S. | Chemist |
| William Saadeh | B.S. | Chemist |
| Additional support personnel in this group: 19 | | |
| **Pesticide Residue Analysis** | | |
| Susan Goshert* | B.S. | Manager |
| James Place | B.S. | Senior Chemist |
| Jamie Brillhart | B.S. | Senior Chemist |
| Jessica Miller | B.S. | Senior Chemist |
| Lisa Reinert | B.S. | Chemist |
| Matthew Listner | B.S. | Chemist |
| Monica Souders | B.S. | Chemist |
| Richard Shober | B.S. | Principal Chemist |
| Valerie Tomayko* | B.S. | Principal Specialist |
| **Specialty Services Group** | | |
| Charles Neslund* | B.S. | Director |
| Brett Weidman | B.S. | Chemist |
| Deborah Zimmerman | | Chemist |
| Ginelle McQuaid | | Chemist |
| Joseph Anderson | B.S. | Senior Chemist |
| Meng Yu | M.S. | Principal Chemist |
| Michael Ziegler | B.S. | Senior Chemist |
| Michele Smith* | B.S. | Senior Specialist |
| Paul Cormier | B.A. | Principal Specialist |
| Robert Brown | | Principal Chemist |

Uncontrolled Copy

| Name | Degree | Title |
|---|---|---|
| Timothy Trees | A.S. | Principal Chemist |
| Additional support personnel in this group: 1 | | |
| **Volatiles in Air** | | |
| Charles Neslund* | B.S. | Director |
| Chin Ly | B.S. | Chemist |
| Christine Ratcliff | B.S. | Principal Specialist |
| Florida Cimino | B.S. | Senior Chemist |
| Jeffrey Smith | B.A. | Senior Chemist Group Leader |
| **Water Quality** | | |
| Erik Frederiksen* | B.A. | Manager |
| Kenneth Bell* | B.S. | Principal Chemist Group Leader |
| Hannah Royer | B.A. | Chemist |
| Michele Graham | B.S. | Chemist |
| Michelle Lalli | | Chemist |
| Robert Heisey* | B.A. | Senior Specialist |
| Susan Engle | | Chemist |
| Susan Hibner | B.S. | Chemist |
| Yolunder Bunch | | Chemist |
| Additional support personnel in this group: 1 | | |
| **Environmental Software Development** | | |
| Sooyun Chang | | IT Director |
| Holly Trego | B.S. | Manager |
| John Riggs | B.S. | Senior Specialist Group Leader |
| Andrew Strebel | | Principal Chemist |
| Bret Winey | B.S. | Senior Specialist |
| Catherine Holt | B.S. | Principal Specialist |
| Chadwick Hershey | B.S. | Senior Specialist |
| Christopher Stauffer | B.S. | Specialist |
| Diana Holmes | M.S. | Senior Specialist |
| Ryan Pettit | B.S. | Specialist |
| Susan Shorter | B.S. | Principal Specialist |
| Tiffany Betz | B.S. | Principal Specialist |
| Timothy Weaver | B.A. | Senior Specialist |
| **Environmental Sample Administration** | | |
| Anneliese Owen | M.B.A. | Manager |
| Carolyn Cyms | B.S. | Senior Specialist Group Leader |
| Tamara Helsel | | Senior Specialist Group Leader |
| Christine Knoedler | B.A. | Specialist |
| Deborah Neslund | | Senior Specialist |
| Katherine Metzger | B.A. | Specialist |
| Katie Hartlove | | Specialist |
| Kristin Zeigler | B.S. | Specialist |
| Additional support personnel in this group: 4 | | |

Uncontrolled Copy

| Name | Degree | Title |
|---|---|---|
| **Equipment Maintenance & Repair** | | |
| Robert Allison | | Specialist |
| Additional support personnel in this group: 3 | | |
| **Training** | | |
| Beth DiPaolo | M.A. | Vice President of PSS & Recruiting/Organizational Development |
| Kimberly Davies | M.B.A. | Director |
| Harry Ward | PHD | Principal Specialist GL |
| Barbara Weaver | M.S. | Principal Specialist |
| Dennis Urban | M.S. | Principal Specialist |
| Lindsay Deibler-Wallace | M.S. | Senior Specialist |
| **Sample Bottles** | | |
| Steven Davies | B.S. | Manager |
| Jeffrey Moyer | B.S. | Senior Specialist Group Leader |
| Karen Guito | | Specialist |
| Samantha DeFalcis | | Specialist |
| Sandra Muckle | | Specialist |
| Additional support personnel in this group: 3 | | |
| **Sample Support** | | |
| Dana Kauffman* | | Manager |
| Chad Wettig | | Chemist Group Leader |
| Lisa Cooke | | Chemist |
| Stephanie Sanchez | | Chemist |
| Additional support personnel in this group: 7 | | |
| **Transportation** | | |
| Steven Davies | B.S. | Manager |
| Christopher Winters | | Specialist |
| L Kenneth Miller | | Specialist |
| Leon Wolf | | Specialist On-Call |
| Timothy Miller | | Specialist |
| Tony Luque | | Specialist |
| Additional support personnel in this group: 19 | | |
| **Safety** | | |
| Matthew Gehman | B.S. | Principal Specialist Group Leader |
| Beth Rich | | Senior Specialist |
| William Gambler | B.S. | Senior Specialist |

*Denotes those employees who are authorized to release Analysis Reports.

Uncontrolled Copy

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-GDL-9015381 | **Revision** | 3 |
| **Effective Date** | Aug 8, 2014 | **Status** | Effective |
| **Historical/Local Document Number** | DOD - Environmental Quality Policy Manual Appendix D | | |
| **Local Document Level** | Level 1 | | |
| **Local Document Type** | POL - Policy | | |
| **Local Document Category** | ES - Environmental Sciences | | |

| | |
|---|---|
| **Prepared by** | Christiane Sweigart |
| **Reviewed and Approved by** | Duane Luckenbill;Review;Tuesday, July 29, 2014 11:12:48 AM EDT<br>Robert Strocko;Review;Wednesday, July 30, 2014 1:27:29 PM EDT<br>Dorothy Love;Approval;Wednesday, July 30, 2014 2:11:21 PM EDT |

Uncontrolled Copy

**Joseph D. Anderson, B.S., Senior Chemist, Specialty Services Group**

Education:

B.S. General Science, Pennsylvania State University (2004)

Professional Experience:

ALSI, GC GC/MS Analyst (2004-2010)

Responsibilities included preparing, running, and reviewing samples according to client and industry methods using various instrumentations including GC and GC/MS; performing analysis for various departments as determined by work volume and staffing needs; reviewing and reporting data within client specified criteria

With Lancaster Laboratories since 2010

Senior Chemist, Flexible Staffing (2010)

Responsibilities included preparing, running, and reviewing samples according to client, compendia, and industry methods using various wet chemistry techniques and instrumentation, which may include but is not limited to, gas chromatography, liquid chromatography, IC, and TOC instrumentation; performing analysis for various departments as determined by work volume and staffing needs

Senior Chemist, Specialty Services Group (2012)

Responsibilities include maintaining instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; diagnosing complex problems and offering solutions with a high degree of independence; suggesting and implementing improvements to maximize quality and productivity; acting as technical resource for internal problems and projects; assisting in "brainstorming" client problems and projects; training new employees in all aspects of instrumentation; researching new and emerging technologies

**F. Bradley Ayars, Principal Specialist Group Leader, Data Deliverables**

Continuing Education:

Environmental Law & Policy, Franklin & Marshall College (1991)

Professional Experience:

With Eurofins Lancaster Laboratories since 1988

Client Services Specialist (1992)

Environmental Project Management (1994)

Senior Specialist Coordinator, Electronic Data Deliverables (1997)

Responsibilities included supervising EDD staff; developing and maintaining EDD formats; overchecking lab data for EDDs; primary contact for EDD issues

Senior Specialist Group Leader, Electronic Data Deliverables (2005)

Responsibilities included supervising EDD staff; developing and maintaining EDD formats; overchecking lab data for EDDs; primary contact for EDD issues

Principal Specialist Group Leader, Electronic Data Deliverables (2014)

Responsibilities include supervising EDD staff; developing and maintaining EDD formats; overchecking lab data for EDDs; primary contact for EDD issues

**Matthew Rusty E. Barton, B.S., Senior Specialist, GC/MS Semivolatiles**

Education:

B.S. Biochemistry, East Stroudsburg University (1991)

Professional Experience:

With Lancaster Laboratories since 1991

Senior Chemist (1998)

Senior Chemist/Coordinator (1999)

Responsibilities included: supervise personnel; schedule lab work; perform purge and trap gas chromatography testing; operate O.I. 4560/4551, Tekmar 3000, Archon 5100, and HP5890 Series II OC instruments; review and approve data; and developing and evaluating new methods.

Senior Chemist, Nitrosamines (2003)

Responsibilities included: Analysis of nitrites in tobacco samples

Senior Chemist, EPH/Misc. GC (2004)

Responsibilities include: Analysis of environmental samples for diesel range organics via gas chromatography

Senior Specialist, GC/MS Semivolatiles (2008)

Responsibilities include: audit and upload of departmental data

Uncontrolled Copy

## Marie D. Beamenderfer, B.S., Senior Chemist, GC Volatiles

Education:

B.S. Biology, The Pennsylvania State University (2006)

Professional Experience:

With Eurofins Lancaster Laboratories since 2006

Chemist, GC Volatiles (2006)

Responsibilities included maintaining GC instrumentation; calibrating instruments as needed; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; suggesting and implementing the necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; performing all duties with minimal supervision; training new employees; tracking inventory of instrument parts and standards and entering them into the standards database as received; verifying data on an as needed basis

Senior Chemist, GC Volatiles (2012)

Responsibilities include maintaining GC instrumentation; calibrating instruments as needed analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; suggesting and implementing the necessary corrective action to ensure the above can be performed in alignment with client an/or regulatory requirements; performing all duties with minimal supervision; training new employees; tracking inventory of instrument parts and standards and entering them into the standards database as received; working on special assignments; diagnosing complex problems and offering solutions with a high degree of independence; assisting in "brainstorming" client problems and projects; completing assigned projects on time; verifying data on an as needed basis

## Kenneth A. Bell, B.S., Principal Chemist Group Leader, Water Quality

Education:

B.S. Chemistry, Millersville University (1997)

Professional Experience:

Johnsons Chemical, Laboratory Assistant (1989-1992)

Responsibilities included collecting samples and performing testing on raw material

With Eurofins Lancaster Laboratories since 1994

Senior Laboratory Technician, Water Quality (1994)

Responsibilities included routinely performing analytical testing using wet chemistry methods

Chemist/Coordinator, Water Quality (1994)

Responsibilities included performing wet chemistry analyses, sample verification, and coordinating workflow

Senior Chemist/Coordinator, Water Quality (1994)

Responsibilities included coordinating workflow, performing sample verification, back-up report signing, training new employees, revising standard operating procedures, writing annual job plans and reviews

Senior Chemist Group Leader, Water Quality (2005)

Responsibilities included coordinating workflow, performing sample verification, back-up report signing, training new employees, revising standard operating procedures, writing annual job plans and reviews

Principal Chemist Group Leader, Water Quality (2014)

Responsibilities include coordinating workflow, performing sample verification, back-up report signing, training new employees, revising standard operating procedures, writing annual job plans and reviews

## Holly Berry, B.S., Senior Chemist, GC/MS Semivolatiles

Education:

B.S. Forensic Chemistry, Buffalo State College (SUNY) (2006)

Professional Experience:

New York State Police, Toxicology Intern (2005-2006)

Responsibilities included performing analysis of alternative medicines using FPIA, SPE, GC/NPD, and GC/MS

With Lancaster Laboratories since 2006

Chemist, GC/MS Volatiles (2006)

Responsibilities included analyzing soils and waters for VOAs using purge and trap and GC/MS instrumentation

Senior Chemist, GC/MS Volatiles (2010)

Responsibilities included analyzing performing GC/MS analysis of water and soil samples along with other matrices by various analytical methods such as EPA 8260B and CLP; evaluating analytical data generated; calibrating and troubleshooting GC/MS instrumentation; assisting other employees with any questions that may arise and helping to train new employees

Uncontrolled Copy

Senior Chemist, GC/MS Semivolatiles (2011)

Responsibilities include maintaining GC/MS instrumentation; tuning and calibrating instruments daily; analyzing quality control and client samples; reviewing and assembling this data in an efficient manner with a high degree of quality to meet client requirements; working on special assignments; running 8270C, 625, THPA, and TEL methods

## Memberships and Appointments:

Emergency Response Team (Hazmat technician) – LLI (2006-2011)

### Tiffany D. Betz, B.S., Principal Specialist, Environmental Software Development

## Education:

B.S. Computer Science, Millersville University (2001)

## Continuing Education:

Oracle Exam #1Z0-007, Introduction to Oracle 9i: SQL (May 17, 2004)

Oracle Exam #1Z0-147, Oracle 9i: Program with PL/SQL (August 4, 2004)

## Professional Experience:

With Eurofins Lancaster Laboratories since 2000

Specialist, Computer Applications Development (2000)

Responsibilities included performing computer applications development and maintenance.

Senior Specialist, Computer Applications Development (2006)

Responsibilities included performing computer applications development and maintenance.

Principal Specialist, Environmental Software Development (2012)

Responsibilities include analyzing, designing, developing, documenting, validating, and deploying custom software in a regulated environment; conforming to FDA guidelines and CFR Part 11 in all duties; strictly adhering to Lancaster Laboratories Software Development Lifecycle (SDLC) policies and procedures; preparing and executing software test plans for custom developed Laboratory Information Management System (LIMS) and other software in accordance with internal procedures; spending a large portion of time writing documentation in support of various software development stages and in accordance with SDLC procedures; spending some portion of time supporting and assisting users with new software applications; at times, conducting formal training sessions with a small group of users to familiarize them with a new computer system

### Kenneth L. Boley, Jr., B.S., Senior Chemist Group Leader, GC/MS Volatiles

## Education:

B.S. Chemistry, Messiah College (1995)

## Professional Experience:

Heritage Custom Kitchens, Inc., Face Frame Assembler (1997–2001)

Responsibilities included reading and interpreting job orders; overseeing daily production of department; performing various manufacturing duties daily; member of the safety committee, first aid team, and security team

With Lancaster Laboratories since 2001

Chemist, GC/MS Volatiles (2001)

Responsibilities included analyzing samples and QC by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers; following methods and SOPs

Senior Chemist, GC/MS Volatiles (2005)

Responsibilities included performing routine and non-routine analyses; diagnosing and solving technical problems; maintaining and troubleshooting instrumentation; writing and revising SOPs; training new analysts; auditing and uploading data as work load deems necessary

Senior Chemist Group Leader, GC/MS Volatiles (2009)

Responsibilities include maintaining GC/MS instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; suggesting and implementing corrective action and system improvements when necessary; performing all duties with minimal supervision; working on special assignments; diagnosing complex problems and offering solutions with a high degree of independence; assisting in "brainstorming" client problems and projects; completing assigned projects on time; researching new and emerging technologies; producing written and oral reports on research activities; performing both technical and personnel aspects of group operations; performing work within the department or other areas as required; acting as a technical resource, trainer, and troubleshooter to specific department; making recommendations for operational and/or technical improvements; communicating effectively within the group; coaching and developing direct reports; planning and monitoring workflow

Uncontrolled Copy

**Nancy J. Bornholm, B.S., Principal Specialist, Environmental Client Services**

Education:

B.S. Chemistry (magna cum laude), Muhlenberg College (1981)

Continuing Education:

Instrumental Analysis of Paints and Polymers, FBI Academy (1984)
Analytical Chemistry of Contaminants in Surface and Groundwater, ACS Short Course (1986)

Professional Experience:

University of Connecticut Health Center, Laboratory Technician (1977-1980)
Institute for Cancer Research, Research Technician (1981)
Baltimore City Crime Laboratory, Mobile Crime Unit Trainee (1981-1982)
Maryland State Police Crime Laboratory, Forensic Chemist III (1982-1985)
With Lancaster Laboratories since 1985
Senior Specialist, Environmental Client Services (1987)
Responsibilities included project management; audit sample entries; answer client questions; communicate client requirements to lab areas; and schedule sample submissions and provide sampling containers
Principal Specialist, Environmental Client Services (2004)
Responsibilities include performing project management for large clients/projects; auditing sample entries for accuracy; providing price quotes; answering client questions; understanding and communicating client requirements to lab personnel; scheduling sample submissions; ordering sampling containers and providing pre-printed COCs; serving as a technical resource to both internal and external clients and notifying management of any client issues

Awards, Citations, Honorary Societies, and Publications:

Quarterly Impact Award (2008)
Superlative Service President's Award (2008)

**Marianne L. Bragg, B.S., Principal Specialist, Environmental Business Development**

Education:

B.S. Biology, Millersville University (1987)

Professional Experience:

With Lancaster Laboratories since 1985
Coordinator
Group Leader (1990)
Principal Specialist (1994)
Responsibilities included: advise clients on testing; provide price quotes and proposals; answer client questions; schedule sample submissions and provide sampling containers; communicate client requirements to lab areas; and assist with client visits to the lab.
Principal Specialist/Coordinator, Environmental Business Development (2002)
In addition to the responsibilities listed above, manage workload and workflow among business development staff.
Principal Specialist/Group Leader, Environmental Business Development (2005)
In addition to the responsibilities listed above, manage workload and workflow among business development staff.
Principal Specialist, Environmental Business Development (2007)
Responsibilities include: advise clients on testing; provide price quotes and proposals; answer client questions; schedule sample submissions and provide sampling containers; communicate client requirements to lab areas; and assist with client visits to the lab.

**Marla S. Brewer, B.S., Senior Specialist, GC/MS Volatiles**

Education:

B.S. Industrial Hygiene, Purdue University (2000)

Continuing Education:

OSHA 8-Hour (2000)
Comprehensive GC/MS Seminar, Restek (2002)
Practical Process Improvement Facilitator Training (2010)

Professional Experience:

ALCOA, Industrial Hygiene Intern (1999)
Responsibilities included performing air sampling for a variety of substances; conducting noise survey including area and personal sampling; testing plant environment for heat stress and evaluated reports; assisting in formulation of written program
BP-Amoco Refinery/Orr Professional Services, Industrial Hygiene Technician (2000)
Responsibilities included performing air sampling to reevaluate Benzene Exposure Surveillance Program; conducting noise surveys including area and personal monitoring to reevaluate Hearing Conservation Program

Uncontrolled Copy

With Eurofins Lancaster Laboratories since 2000
- Senior Technician, Volatiles by GC (2000)
  - Responsibilities included performing prescreen analysis, sample prep, GC maintenance, and data review
- Chemist, GC/MS Volatiles (2001)
  - Responsibilities included analyzing samples and QC by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers
- Senior Specialist, GC/MS Volatiles (2006)
  - Responsibilities include performing GC/MS volatile data interpretation; reviewing and approving data; signing reports; analyzing samples; generating raw data; sample verification; SOP revisions and updates

## Jamie L. Brillhart, B.S., Senior Chemist, Pesticide Residue Analysis

### Education:

B.S. Physical Science, York College of Pennsylvania (2003)

### Professional Experience:

B-H Laboratories Inc./Analytical Laboratory Services Inc., Inorganic Laboratory Technician/Inorganic Chemist (2003-2005)
- Responsibilities included performing wet chemistry testing on drinking waters and waste water; being responsible for analyses included fluoride, cyanide, phosphorus, nitrate/nitrite, cadmium reduction, and grease and oil testing when needed; prepping and analyzing for mercury on a mercury analyzer; analyzing for various metals on a graphite furnace; prepping leachates; prepping standards as needed

Hercon Laboratories, Inc., QC Analyst I (2005-2007)
- Responsibilities included performing Quality Control Testing on Transdermal Systems; performing assays, dissolutions, degradation, residual solvents, and raw material testing; prepping necessary standards and performing instrument maintenance as needed

With Lancaster Laboratories since 2007
- Chemist, Pesticide Residue Analysis (2007)
  - Responsibilities included analyzing soils for PPL Pesticides using 5890 and 6890 GCs with ECD detectors; performing instrument maintenance; prepping standards; auditing calibrations as necessary; being able to analyze for OPPAs, ACMOs, EDBs, PCBs, and Herbicides as needed
- Senior Chemist, Pesticide Residue Analysis (2011)
  - Responsibilities include analyzing soils for PPL Pesticides using 5890 and 6890 GCs with ECD detectors; performing instrument maintenance; prepping standards; auditing calibrations as necessary; being able to analyze for OPPAs, ACMOs, EDBs, PCBs, and Herbicides as needed

## Robert Brown, Principal Chemist, Specialty Services Group

### Education:

Attended 2.5 years at Pennsylvania State University towards B.S. in Microbiology (1988)
Completed 20 credits towards B.S. in Environmental Biology, Millersville University (1993)

### Professional Experience:

With Lancaster Laboratories since 1988
- Chemist (1993)
- Senior Chemist (1997)
  - Responsibilities included performing extractable petroleum testing; operating multiple Hewlett-Packard gas chromatograph (GC) instruments; data interpretation and entry; developing and evaluating new methods
- Principal Chemist (2004)
  - Responsibilities included performing extractable petroleum testing; operating multiple Hewlett-Packard gas chromatograph (GC) instruments; data interpretation and entry; developing and evaluating new methods; serving as primary technical contact for client service representatives and their clients
- Principal Chemist Group Leader, EPH/Misc. GC (2005)
  - Responsibilities included performing extractable petroleum testing; operating multiple Hewlett-Packard gas chromatograph (GC) instruments; data interpretation and entry; developing and evaluating new methods; serving as primary technical contact for client service representatives and their clients
- Principal Chemist, Specialty Services Group (2011)
  - Responsibilities include: acting as technical resource within the environmental division; developing and validating analytical protocols; troubleshooting and solving analytical chemistry problems; optimizing instrument configuration and performance; evaluating and interpreting analytical results; writing SOPs; assisting in responding to and eliminating ICARs, assisting in optimizing procedures in prep lab; communicating effectively within department; performing routine work as required

Uncontrolled Copy

**Kathryn A. Brungard, Senior Specialist, Environmental Quality Assurance**

Continuing Education:

Clinical Laboratory Science, Temple University (1984-1988)

Professional Experience:

Environmental Partners, Inc., Environmental Technician/Health and Safety Coordinator (2003-2005)

Responsibilities included determining personnel health and safety risks on each work site and determining appropriate measures to be taken for personal protection; maintaining and servicing sampling equipment; calibrating meters and analytical equipment; collecting and processing representative samples at each monitoring site following state mandated procedures; routinely measuring field water and soil quality parameters; performing product recovery as part of site remedial measures; evaluating and reporting upon trends and/or results that were out-of-range

Maxwell House Coffee/Kraft Foods, Quality Assurance Technician (2004-2005)

Responsibilities included conducting hourly audits on operating production lines which included weight of product, oxygen content, density, caffeine level by HPLC, moisture content, inspection for foreign or incidental materials, and packaging compliance; performing weekly water testing for level of chlorine and microbial contamination; producing result spreadsheets and accurate logs; notifying upper management of all results in a timely manner

Columbia Analytical Services, Inc, Quality Assurance Program Manager (2005-2009)

Responsibilities included being responsible for the overall coordination of the NELAP certified environmental laboratory program; monitoring laboratory quality systems through audits; identifying potential problem areas, recommending corrective actions, and providing technical assistance and training as necessary; informing management of potential problems and recommending remedial measures in a timely basis both orally and by written communication; maintaining performance evaluation records; maintaining accreditations for regulatory agencies and client programs; providing audit responses and initiating changes in procedures; maintaining the calibration of all weights, balances, and thermometers

With Eurofins Lancaster Laboratories since 2010

Senior Specialist, Environmental Quality Assurance (2010)

Responsibilities include ensuring quality of data being produced in the laboratories by performing data review, auditing laboratories, and reviewing written procedures; ensuring laboratory adherence to government regulations and client requirements; reviewing client and government documents for requirements outside our usual laboratory practices; setting up and testing new analysis in the laboratory sample management system as required by the departments

Memberships and Appointments:

Florida Society of Environmental Analysts (2005-2009)

**Florida A. Cimino, B.S., Senior Chemist, Volatiles in Air**

Education:

B.S. Chemistry, Shippensburg University (2004)

Professional Experience:

With Lancaster Laboratories since 2005

Chemist, Flexible Staffing (2005)

Responsibilities included preparing, running, and reviewing samples according to client, compendia, and industry methods using various wet chemistry techniques and instrumentation including, but not limited to, gas chromatography, liquid chromatography, IC and TOC instrumentation; performing analysis for various departments as determined by work volume and staffing needs

Senior Chemist, Flexible Staffing (2008)

Responsibilities included preparing, running, and reviewing samples according to client, compendia, and industry methods using various wet chemistry techniques and instrumentation including, but not limited to, gas chromatography, liquid chromatography, IC and TOC instrumentation; performing analysis for various departments as determined by work volume and staffing needs

Senior Chemist, Volatiles in Air (2010)

Responsibilities include maintaining instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; diagnosing complex problems and offering solutions with a high degree of independence; suggesting and implementing improvements to maximize quality and productivity; acting as technical resource for internal problems and projects; assisting in "brainstorming" client problems and projects; training new employees in all aspects of instrumentation; researching new and emerging technologies

Awards, Citations, Honorary Societies, and Publications:

Girl Scout Gold Award (2000)

Who's Who Among College Students (2001-2004)

**Mark A. Clark, B.S., Principal Chemist, GC/MS Semivolatiles**

Education:

B.S. Biochemistry, Millersville University (1986)

Professional Experience:

With Eurofins Lancaster Laboratories since 1985

Associate Chemist, Water Quality (1985)

Responsibilities included performing wet chemistry analyses; operated departmental instrumentation including TOC,TOX, Technicon, IC

Chemist, Water Quality (1987)

Responsibilities included coordinating, performing, and verifying 24/48 hour hold time analyses; performing wet chemistry analyses

Senior Chemist, Expresslab (1989)

Responsibilities included performing rush analyses operating AA, GC, IR; analyses included BTEX, Petroleum Hydrocarbons by IR, Metals by AA

Senior Chemist, Food Chemistry (1993)

Responsibilities included operating department instrumentation including Fatty Acid Profile by GC, assorted analyses by HPLC including Artificial Sweeteners, Vitamins D, E, etc.

Principal Chemist, GC/MS Semivolatiles (2001)

Responsibilities included performing PAH by HPLC analysis and assisting with GC/MS operations on third shift

Principal Chemist, GC/MS Semivolatiles (2012)

Responsibilities include performing GC/MS semivolatiles testing; operating GC/MS instruments; performing data Interpretation and entry; calibrating and repairing instruments

**Rachel R. Cochis, B.A., Principal Specialist Group Leader, GC/MS Semivolatiles**

Education:

B.A. Science, Pennsylvania State University (1992)

Continuing Education:

Introduction to Mass Spec Interpretation, Hewlett-Packard (1995)

Gas Chromatography Principles & Practices (1994)

Professional Experience:

With Eurofins Lancaster Laboratories since 1993

Chemist (1994), GC/MS Semivolatiles (1993)

Responsibilities included performing semvolatiles analysis on water and soil samples

Senior Chemist Coordinator, GC/MS Semivolatiles (1996)

Responsibilities included scheduling lab work; performing data interpretation and entry; reviewing and approving data; revising and updating SOPs and analytical methods; monitoring turnaround time; communicating client requirements to lab areas

Senior Specialist Group Leader, GC/MS Semivolatiles (2005)

Responsibilities included scheduling lab work; performing data interpretation and entry; reviewing and approving data; revising and updating SOPs and analytical methods; monitoring turnaround time; communicating client requirements to lab areas

Principal Specialist Group Leader, GC/MS Semivolatiles (2013)

Responsibilities include scheduling lab work; performing data interpretation and entry; reviewing and approving data; revising and updating SOPs and analytical methods; monitoring turnaround time; communicating client requirements to lab areas

**Tracy A. Cole, Senior Specialist, EPH/Miscellaneous GC**

Continuing Education:

Gas Chromatography: Principles and Practice, LLU (1997)

Professional Experience:

With Lancaster Laboratories since 1991

Laboratory Technician, Volatiles in Air (1991)

Responsibilities included preparing samples and standards; washing glassware; loading samples on instruments

Senior Technician, Volatiles in Air and EPH/Miscellaneous GC (1994)

Responsibilities included analyzing routine samples and QC by Gas Chromatography for DRO and miscellaneous organic compounds; preparing direct injection samples for analysis; preparing standards; reviewing chromatography data and uploading to the LIMS

Chemist, EPH/Miscellaneous GC (1999)

Responsibilities included analyzing routine and nonroutine samples and QC by Gas Chromatography for various organic analyses including DRO, TPH, and other petroleum related methods and miscellaneous organic compounds by direct injection; reviewing chromatography data and uploading to the LIMS; performing instrument maintenance; calibrating instruments for various methods

Uncontrolled Copy

Senior Specialist, EPH/Miscellaneous GC (2008)
Responsibilities include reviewing/verifying data for technical correctness including raw chromatography data, initial calibrations, and analytical reports; ensuring that method and project requirements were followed and entry into the LIMS is correct; acting as a technical resource for the department; assisting in reviewing/writing SOPs and other technical documents

**Paul R. Cormier, B.A., Principal Specialist, Specialty Services Group**

Education:
B.S. Microbiology, Virginia Tech (1984)
B.A. Chemistry, Virginia Tech (1984)

Continuing Education:
Hewlett-Packard GC/MS Advance Operations/System Manager Course (1990)
Mass Spectral Interpretation, Finnigan MAT Institute (1991)
Technical Training, OI Analytical (1995)

Professional Experiences:
Environmental Testing & Certification (1985-1989)
Analytikem, Inc. (1989-1990)
With Lancaster Laboratories since 1990
Senior Chemist (1990)
Responsibilities included: operate GC/MS instruments; data interpretation; review and approve data; repairing instruments; and train other analysts.
Senior Specialist (2005)
Responsibilities included: operate GC/MS instruments; data interpretation; review and approve data; repairing instruments; and train other analysts.
Principal Specialist, GC/MS Volatiles (2006)
Responsibilities include: operate GC/MS instruments; data interpretation; review and approve data; repairing instruments; and train other analysts.
Principal Specialist, Specialty Services Group (2010)
Responsibilities include acting as technical resource within the environmental division; developing and validating analytical protocols; troubleshooting and solving analytical chemistry problems; optimizing instrument configuration and performance; evaluating and interpreting analytical results; writing SOPs; assisting in responding to and eliminating ICARs, assisting in optimizing procedures in prep lab; communicating effectively within department; performing routine work as required

Memberships & Appointments:
American Chemical Society

**Teresa L. Cunningham, B.S., Principal Specialist, Environmental Client Services and Inside Business Development**

Education:
B.S. Biology, St. Joseph's University (1999)

Continuing Education:
Chemical Monitoring Assistance Program, Pennsylvania Rural Water Association (2000)
How to Deliver Exceptional Customer Service, Fred Pryor Seminars (2000)
Organizational Behavior, Penn State University (2005)

Professional Experience:
With Eurofins Lancaster Laboratories since 1999
Specialist, Environmental Client Services (1999-2000)
Senior Specialist, Environmental Client Services (2001)
Senior Specialist Coordinator, Environmental Client Services (2001)
Responsibilities included serving as project manager for clients with petroleum-related testing accounts; coordinating client requests with laboratory groups to ensure that the client's needs are met; scheduling bottle shipments and sample pickups; preparing quotations; coordinating staff
Senior Specialist Group Leader, Environmental Client Services (2005)
Responsibilities included serving as project manager for clients with petroleum-related testing accounts; coordinating client requests with laboratory groups to ensure that the client's needs are met; scheduling bottle shipments and sample pickups; preparing quotations; coordinating staff
Manager, Environmental Client Services (2006)
Responsibilities included overseeing implementation of new projects; coordinating client requests with laboratory groups to ensure that the client's needs are met; coordinating staff
Principal Specialist, Environmental Client Services and Inside Business Development (2008)
Responsibilities include performing project management; training new client service representatives; auditing sample entry; answering client questions; communicating client requirements to lab areas

Uncontrolled Copy

**Carolyn M. Cyms, B.S., Senior Specialist Group Leader, Environmental Sample Administration**

Education:

B.S. Secondary Education/Chemistry, Bloomsburg University of Pennsylvania (1993)
Post Baccalaureate Certificate, Biology and MS Math, Millersville University (2002)

Continuing Education:

Accounting I, HACC (1996)
Introduction to the Internet, PC Focus (1996)
Self-Discipline & Emotional Control, Franklin-Covey (1997)
Child Growth & Development, HACC (1998)
Cell Biology, Millersville University (2000)
Botany; Genetics; Zoology; Biochemistry; Ecology, and Ecology Lab, Millersville University (2001)
Immunology; Animal Behavior; Teaching Biological Issues; Entomology, Millersville University (2002)
Introduction to Computer Programming, Millersville University (2003)

Professional Experience:

Lancaster Theological Seminary, Field Education Assistant-Special Project Coordinator (1996-1999)
Responsibilities included assisting with mailings, organization of the field education program; creating and preparing a student field education manual for the ministerial studies program; acting as liaison between Field Ed Professor, Field Ed sites, and students; preparing all written correspondences for the field ed office; organizing and preparing materials for meetings; tracking student progress through the program; assisting with other special projects requiring computer skills of PageMaker, WordPerfect, Quattro Pro, and Envoy

Self-Employed, Tutor (1994-2005)
Responsibilities included tutoring HACC students in Introduction to Chemistry, Chemistry, Biology, and Algebra

Millersville University – Biology Department, Assistant (2003)
Responsibilities included preparing Power Point presentations for a stream restoration monitoring program; photographing various stages of the project

With Lancaster Laboratories since 1994

Administrator III, Environmental Sample Administration (1994)
Responsibilities included receiving samples, entering samples, auditing, filing, noting discrepancies, and unpacking samples

Administrator III/Coordinator, Environmental Sample Administration (1995)
Responsibilities included relaying technical/client information when it became available; answering questions from clients/technical areas when CSR was unavailable; coordinating/prioritizing entry; supervising and evaluating work of 2nd Shift Environmental Entry Staff; training new personnel in the entry/interpretation process; preparing Job Plans on an as-needed basis

Specialist I, Environmental Sample Administration (1996)
Responsibilities included receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis

Senior Specialist, Environmental Sample Administration (2000)
Responsibilities included receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis; training; preparing resource materials; working on special projects as needed

Senior Specialist Coordinator, Environmental Sample Administration (2004)
Responsibilities included receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis; training; preparing resource materials; working on special projects as needed

Senior Specialist Group Leader, Environmental Sample Administration (2005)
Responsibilities include receiving samples; entering samples; auditing; filing; noting discrepancies; unpacking samples; acting as project coordinator on an as-needed basis; training; preparing resource materials; working on special projects as needed

Awards, Citations, Honorary Societies & Publications:

Residential Life Award of Merit (1990)
Bloomsburg University Dean's List 6 of 8 semesters, graduated cum laude (1990-1993)
Kappa Delta Phi (National Co-Ed Honor Society) (1994)
Spirit of LLI (2001)

Memberships & Appointments:

Elizabethtown Fire Company (1993-present)
Safety Committee (1994-1998)
Alpha Phi Omega (National Co-Ed Service Fraternity) (1991-1993)
NSTA (2000-2008)
Kappa Delta Phi (1994, 2001-2003)

Uncontrolled Copy

## Kimberly A. Davies, M.B.A., Director, Divisional Support Services

Education:

B.S. Biology, Shippensburg University of Pennsylvania (1991)
M.B.A., Pennsylvania State University (1999)

Professional Experience:

Polybac Corporation, Technical Services (1991-1992)
Upper Saucon Township Wastewater Treatment Plant, Technician (1992-1993)
With Eurofins Lancaster Laboratories since 1993
- Client Services Senior Specialist (1996)
- Senior Specialist/Coordinator, Pharmaceutical Project Management (1998)
- Principal Specialist/Coordinator, Pharmaceutical Project Management (2000)
- Group Leader, Pharmaceutical Project Management and Data Support (2001)
  - Responsibilities included managing pharmaceutical project management and data support staff; facilitating group meetings to communicate with staff; supporting company and division policies and provide information to department; supporting employee development and acknowledge innovative ideas; promoting group and department teamwork and collaboration
- Manager (previously titled Group Leader), Pharmaceutical Project Management (2003)
  - Responsibilities included managing pharmaceutical project management staff; facilitating group meetings to communicate with staff; supporting company and division policies and provide information to department; supporting employee development and acknowledge innovative ideas; promoting group and department teamwork and collaboration
- Manager, Flexible Staffing (2005)
  - Responsibilities included managing labor resources across departments and divisions, coordinating continuous improvement activities including Management Operating System (MOS) audits, new management MOS training, and MOS tool maintenance
- Manager, Flexible Staffing and Technical Training (2006)
  - Responsibilities included managing labor resources across departments and divisions, coordinating continuous improvement activities including Management Operating System (MOS) audits, new management MOS training, and MOS tool maintenance; managing the technical training staff responsible for designing and facilitating technical training
- Manager, PPI Process and Flexible Staffing (2008)
  - Responsibilities included managing labor resources across departments and divisions, coordinating continuous improvement activities including Management Operating System (MOS) audits, new management MOS training, and MOS tool maintenance, managing the technical training staff responsible for designing and facilitating technical training; qualified Practical Process Improvement process manager responsible for facilitating PPI project team training and PPI efforts within LLI
- Director, Divisional Support Services (2012)
  - Responsibilities include managing Billing and Reporting, Office Services, Shipping & Receiving, Purchasing and Flexible Staffing; moving labor resources across departments and divisions, coordinating continuous improvement activities through Practical Process Improvement and the Management Operating System; managing the technical training staff responsible for designing and facilitating technical training; qualified Practical Process Improvement process manager and PPI Master Facilitator

## Steven C. Davies, B.S., Manager, Transportation and Sample Bottles

Education:

B.S. Elementary Education, Lancaster Bible College (1987)

Professional Experience:

With Lancaster Laboratories since 1990
- Transportation Coordinator (1991)
- Transportation Group Leader (1994)
- Transportation and Sample Bottles Group Leader (1998)
  - Responsibilities included supervise personnel; schedule lab work; manage financial resources; answer client questions; communicate client requirements to lab areas; and schedule sample submissions and provide sampling containers.
- Transportation and Sample Bottles Manager (2005)
  - Responsibilities include supervise personnel; schedule lab work; manage financial resources; answer client questions; communicate client requirements to lab areas; and schedule sample submissions and provide sampling containers.

**Beth E. DiPaolo, M.A., SPHR, Vice President of PSS & Recruiting/Organizational Development**

Education:

B.S. Business Management, Human Resources, State University of New York, Empire State College (2007)
M.A. Human and Organizational Systems, Fielding Graduate University (2010)
Certified as Senior Professional in Human Resources, SHRM, HRCI
Certifications for Leader Instructor/Consulting in: Working with Emotional Intelligence, Seven Habits of Highly Effective People, Social Styles Facilitation, Contributing Team Member, Signature Service Client Service Training, Targeted Selection Interviewing, Achieve Global Leadership Series, and Speed of Trust

Professional Experience:

People Unlimited (1985-1987)
Responsibilities included recruitment, supervision, sales, and client service for temporary and permanent placement service
With Lancaster Laboratories Human Resources Department since 1987
Recruiting Specialist (1987)
Senior Recruiting Specialist (1990)
Senior Recruiting Coordinator (1991)
Recruiting & Training Group Leader (1992)
Manager of Recruiting, Training, Organizational Development (2001)
Director of Recruiting, Training, and Organizational Development (2005)
Director, Professional Scientific Staffing, Recruiting, and Organizational Development (2005)
Managing Director, Professional Scientific Staffing, Recruiting, and Organizational Development (2007)
Responsibilities included managing operations including client service, business development, recruiting, and training of PSS internationally; providing strategic senior leadership in accordance with vision, values, and strategic goals of company for PSS, recruiting, and organizational development
Vice President of PSS & Recruiting/Organizational Development (2012)
Responsibilities include managing operations including client service, business development, recruiting, and training of PSS internationally; providing strategic senior leadership in accordance with vision, values, and strategic goals of company for PSS, recruiting, and organizational development

Awards, Citations, Honorary Societies, and Publications:

Society for Human Resource Management, Pennsylvania Chapter
Past President of LCAHRM, SHRM Lancaster Chapter
Outstanding Member of the Year (1996)
Two Superior Merit Awards during Presidency

Memberships and Appointments:

American Society for Training and Development
Society for Human Resource Management

**Irene Lynn Dodd, M.B.A., Principal Specialist, Environmental Business Development**

Education:

B.A. Chemistry, Washington & Jefferson College (1988)
M.B.A. Pennsylvania State University (1993)

Continuing Education:

Mass Spectral Interpretation Course (1991)
High Impact Communication Skills (1992)
GC Troubleshooting Course (1993)
Selected courses at Millersville University (1996)
Effective Technical Communication (2000)
Business Writing for Results (2002)
Signature Service (2002)
The Counselor Salesperson (2004)
Pennsylvania Chamber Annual Environmental Laws and Regulations Conference (2004, 2005, 2006, 2007)
Conceptual Selling (2009)
Intermediate II and Advanced Excel (2011)

Professional Experience:

Stauffer Chemical Company, Food Chemist (1987-1988)
With Lancaster Laboratories since 1988
Chemist (1991)
Senior Chemist (1995)
Senior Specialist (1997)
Principal Specialist, Environmental Business Development (2003)
Responsibilities include: project management; review and approve data; consult with clients regarding testing needs; work with external auditors; assist with client visits to the lab, advise clients on testing; provide price quotes; monitoring turnaround time; audit sample entry; answer client questions; communicate client requirements to lab areas; provide status reports, including results, to clients; provide sampling containers; schedule sample submissions

Uncontrolled Copy

Memberships and Appointments:

American Chemical Society
National Society of Collegiate Journalists
American Business Women's Association
President (1998-1999); Vice President (1994-1995, 1997-1998); Secretary (2000-2001); Newsletter Chair (1993-1994, 2001-2003); Business Associate Night Chair (2000); Woman of the Year (1999, 2004); Thelma Farley Memorial Award (1995); Hospitality Chair (2003-2004) with Wheatland Conestoga Chapter
Vice President of Communications (2006-2007, 2007-2008) and Formation committee (2006-2007); Woman of the Year (2007) for Lancaster Area Express Network; Regional and National Newsletter Award Winner (2008)
Girl Scouts in the Heart of Pennsylvania
Leader (2008-Present); Outstanding Leader of the Year 2012

**Christine M. Dulaney, B.A., Senior Specialist, GC/MS Volatiles**

Education:

B.A. Biology, Meredith College (1984)

Continuing Education:

Waters Fundamentals of HPLC, Compuchem Laboratories (1989)

Professional Experience:

Compuchem Laboratories (1984-1998)
Extraction Technician (1984-1986)
Responsibilities included performing extraction of various environmental matrices for pesticide GC analysis and semivolatile GC/MS analysis; extracting quarterly PE samples
GC Technician (1986-1989)
Responsibilities included performing analysis of environmental extracts for pesticides, PAHs, and volatile organic compounds using GC, HPLC, and purge and trap, respectively; performing routine instrument maintenance
Senior Chemist, Pesticide Review (1990-1995, 1996-1998)
Responsibilities included performing qualitative and quantitative review of pesticide, PAH, and volatile organic data; reviewing instrument maintenance and standard logbooks
With Eurofins Lancaster Laboratories since 1998
Chemist, Pesticide Residue (1998)
Responsibilities included reviewing GC pesticide residue data packages; responding to client inquiries and ICARs
Project Management Specialist, Pharmaceutical Client Services (2003)
Responsibilities included managing details of various pharmaceutical client accounts using the laboratory information management system; acting as liaison between the client and internal laboratory personnel
Senior Specialist, GC/MS Volatiles (2005)
Responsibilities include auditing data for various GC and GC/MS volatile analyses; verifying data within the laboratory information management system, communicating and following up on outstanding data issues

**Eric L. Eby, B.S., Senior Chemist, Metals**

Education:

B.S. Biology, Millersville University (1988)

Continuing Education:

OSHA 40-hour Hazardous Waste Management, Phoenix Safety Associates (1991)
DX500 Maintenance and Troubleshooting, Dionex (1996)
The Chemistry Behind the Techniques, EAS, Inc. (1996)
Cleaning Validation Strategies, Applied Analytical Industries, Inc. (1997)
Gas Chromatography Practical Theory and Applications, Lancaster Laboratories (1998)

Professional Experience:

With Lancaster Laboratories since 1988
Associate Chemist (1993)
Responsibilities included environmental wet chemistry testing and field sampling.
Chemist (1997)
Senior Chemist, Pharmaceutical Raw Materials (1998)
Responsibilities included IC, TOC analysis, IC maintenance, USP purified water testing, raw materials testing, USP <661> container closure testing.
Senior Chemist, Pharmaceutical Product Testing (2000)
Responsibilities included pharmaceutical product testing per client specific methods, IC and HPLC maintenance.
Senior Chemist, Metals (2005)
Responsibilities include ICP analysis for environmental testing and ICP instrument maintenance.

Original Copy

**Erik J. Frederiksen, B.A., Manager, Water Quality and Instrumental Water Quality**

Education:

B.A. Chemistry, University of Virginia (1990)

Continuing Education:

Infrared Spectral Interpretation (1993)

Professional Experience:

With Lancaster Laboratories since 1990

Chemist/Coordinator (1993)

Group Leader (1994)

Responsibilities included supervising personnel; managing laboratory operations; project management; managing financial resources; reviewing and approving data

Manager, Water Quality and Instrument Water Quality (2005)

Responsibilities include supervising personnel; managing laboratory operations; project management; managing financial resources; reviewing and approving data

**Lynn Frederiksen, B.S., Principal Specialist Group Leader, Environmental Client Services**

Education:

B.S. Conservation and Resource Development, University of Maryland (1981)

Professional Experience:

University of Missouri, Senior Research Lab Technician (1982 – 1984)

GPU Nuclear Corporation, Data Analyst (1985 – 1989)

With Lancaster Laboratories since 1989

Senior Specialist (1989)/Team Leader, Environmental Client Services (2006)

Responsibilities included: consult with clients regarding testing needs; revise and update SOPs; provide price quotes; audit sample entry; answer client questions, communicate client requirements to lab areas; provide status reports, including results, to clients; schedule sample submissions and provide sampling containers; assist Group Leader with training of new employees and delegating new projects.

Senior Specialist Group Leader, Environmental Client Services (2007)

Responsibilities included: managing a team of client service representatives, training of new employees, setting up and delegating new projects, serving as primary project manager for several large petroleum clients and consultants.

Principal Specialist Group Leader, Environmental Client Services (2011)

Responsibilities include serving as the primary contact or back-up with the laboratory for a number of assigned clients requiring specialized testing or complex projects; understanding and communicating technical information and client requirements to laboratory personnel, helping to ensure that requirements are met; leading broad-based complex projects to a satisfactory conclusion according to client technical and schedule requirements, developing strong relationships with major accounts resulting in additional sales; advising and training other members of the department; serving as a technical resource both internally and externally; proactively assisting Outside Business Development with client visits, presentations, and internal audits for assigned clients; participating on PPI teams

**Joseph M. Gambler, B.S., Senior Chemist, GC/MS Semivolatiles**

Education:

B.S. Chemistry, Millersville University (1996)

Professional Experience:

Wyeth, Biological Manufacturing Technician (1996)

With Lancaster Laboratories since 1996

Senior Chemist, GC/MS Semivolatiles (1996)

Responsibilities include training new hires; maintaining GC/MS systems; preparing standards/stocks/spikes; maintaining Helium supply system; performing data interpretation; ordering supplies; auditing; cross trained in Pesticides Department

Uncontrolled Copy

**William E. Gambler, B.S., Senior Specialist, Safety**

Education:

B.S. Occupational Safety and Environmental Health, Millersville University (2011)

Continuing Education:

Principles and Practices of Bio Safety, American Biological Safety Association (2012)
Radiation Safety Officer, Dade Moeller Training Academy (2012)
Certified Safety Committee Training, High Safety Consulting Services (2013)
Hazardous Material Technician Training, High Safety Consulting Services (2013)
Visible Emissions Evaluation Program, Penn State University (2013)
First Aid, CPR, and AED, Respond First Aid Systems (2013)
Basic IATA/49CFR Dangerous Goods Training, Dangerous Goods International Training Center (2013)

Professional Experience:

With Eurofins Lancaster Laboratories since 2011
- Specialist, Environmental Health and Safety, Human Resources (2011)
  - Responsibilities included managing employee health programs; maintaining current and developing new safety programs; managing environmental compliance program
- Senior Specialist, Safety (2013)
  - Responsibilities include managing employee health programs; maintaining current and developing new safety programs; managing environmental compliance program

Memberships and Appointments:

Lancaster County Industrial Safety Council (2011-present)
Board of Certified Safety Professionals (GSP designation) (2011-present)

**Matthew R. Gehman, B.S., Principal Specialist Group Leader, Environmental Health and Safety Officer, Human Resources**

Education:

B.S. Occupational Safety and Environmental Health, Millersville University (2002)

Continuing Education:

24-Hour Emergency Response (HAZWOPER), Lancaster Laboratories (2004)
8-Hour Emergency Response Refresher, High Safety Consulting (2013)
IATA/DOT 49 CFR, DGI Training Center (2013)
American Heart Association First Aid, CPR, AED certified, Respond First Aid (2013)
Advanced RCRA, Environmental Resource Center (2004)
In-depth Environmental Compliance, PA Chamber (2005)
In-depth Environmental Compliance, PA Chamber (2006)
National Incident Command System, Command School, Inc. (2006)
Life Safety Code, NFPA (2006)
International Conference on Biocontainment Facilities, Tradeline (2006)
In-depth Environmental Compliance, PA Chamber (2007)
Principals of Biosafety, ABSA (2010)
Potent Compound Boot Camp, SafeBridge Consulting (2012)

Professional Experience:

With Eurofins Lancaster Laboratories since 2004
- Senior EHS Specialist, Environmental Health and Safety, Human Resources (2004-2007)
  - Responsibilities included employee health program administration; maintaining current and developing new safety programs; managing environmental compliance program
- Senior Specialist, Environmental Health and Safety Officer, Human Resources (2007)
  - Responsibilities included managing employee health programs; maintaining current and developing new safety programs; managing environmental compliance program
- Principal Specialist Group Leader, Environmental Health and Safety Officer, Human Resources (2011)
  - Responsibilities include managing employee health programs; maintaining current and developing new safety programs; managing environmental compliance program

Memberships and Appointments:

Central PA section of American Industrial Hygiene Association (AIHA)
  Member (2004-present)
VFW, Post 7362
  Member (2004-present)
American Biological Safety Association (ABSA)
  Member (2007-present)

Uncontrolled Copy

**Susan M. Goshert, B.S., Manager, EPH/Miscellaneous GC, Pesticide Residue Analysis, Nitrosamines**

Education:

B.S. Chemistry, Juniata College (1988)

Continuing Education:

Advanced Aquarius Report Training, Hewlett-Packard (1989)
How to Handle People with Tact and Skill, Harrisburg Area Community College (1992)
Positive Attitude and Peak Performance, Harrisburg Area Community College (1992)

Professional Experience:

With Lancaster Laboratories since 1988
- Chemist (1990)
- Senior Chemist Coordinator (1997)
  - Responsibilities included supervising personnel; reviewing and approving data; monitoring turnaround time
- Senior Specialist Group Leader, EPH/Misc. GC (2005)
  - Responsibilities included supervising personnel; reviewing and approving data; monitoring turnaround time
- Principal Specialist Group Leader, GC/MS Volatiles (2008)
  - Responsibilities included supervising personnel; reviewing and approving data; monitoring turnaround time
- Manager, EPH/Miscellaneous GC, Pesticide Residue Analysis, Nitrosamines (2012)
  - Responsibilities include supervising personnel; managing laboratory operations and financial resources; project management; reviewing and approving data; consulting with clients regarding testing needs

**Brian K. Graham, B.A., Senior Chemist, GC/MS Semivolatiles**

Education:

B.A. Mathematics, Millersville University (1996)

Professional Experience:

With Lancaster Laboratories since 1989
- Chemist, GC/MS Semivolatiles (1989-2006)
- Senior Chemist, GC/MS Semivolatiles (2006)
  - Responsibilities include maintaining GC/MS Instrumentation; tuning and calibrating GC/MS; analyzing samples by GC/MS; reviewing and assembling all supporting GC/MS data; preparing standards for calibrations; training new analysts

**Nina C. Haller, Senior Specialist Group Leader, Metals**

Continuing Education:

State Dairy Lab Cert., State of PA (1993)
Butterfat Testing License, State of PA (1995)
Seminar ICP/ICPMS, Fisons Instruments (1995)
Three-day ICP Trace Training Course, Thermo Jarrell Ash, MA (1996)

Professional Experience:

Hazelton Research Products, Lab Technician (1981-1984)
- Responsibilities included rabbit production facility, removal of ovaries, care, and maintenance

With Lancaster Laboratories since 1987
- Technical Associate, Foods (1987)
  - Responsibilities included coordinating Listeria Testing Program; performing data entry and verification
- Chemist, Metals (1993)
  - Responsibilities included performing daily tracking of rushes; operating and maintaining ICP instrumentation; reviewing and verifying of ICP data, data package review
- Specialist Group Leader, Metals (2003)
  - Responsibilities included overseeing the ICP/ICPMS personnel and instrumentation workflow; verifying ICP/ICPMS/GFAA/Hg data
- Senior Specialist Group Leader, Metals (2006)
  - Responsibilities included overseeing the ICP/ICPMS personnel and instrumentation workflow; verifying ICP/ICPMS/GFAA/Hg data
- Senior Specialist Group Leader, Metals (2007)
  - Responsibilities include overseeing metals instrument and verification personnel and instrumentation workflow; verifying metals data

Uncontrolled Copy

**Michele D. Hamilton, B.S., Senior Chemist Group Leader, EPH/Misc. GC**

Education:

B.S. Chemistry, Temple University (1990)

Continuing Education:

Gas Chromatography: Practical Theory and Applications for LL (1993)
Practice of Modern HPLC, LC Resources (1996)

Professional Experience:

With Eurofins Lancaster Laboratories since 1991
- Senior Chemist (1997)
- Senior Chemist Coordinator (2000)
  - Responsibilities included supervising personnel; coaching and developing new employees; sample tracking; reviewing rush request; communicating client requirements; operating GC and HPLC instruments; data interpretation and entry; calibrating; repairing instruments and verifying data
- Senior Chemist Group Leader, Pesticide Residue Analysis (2005)
  - Responsibilities included supervising personnel; coaching and developing new employees; sample tracking; reviewing rush request; communicating client requirements; operating GC and HPLC instruments; data interpretation and entry; calibrating; repairing instruments and verifying data
- Senior Chemist Group Leader, EPH Misc. GC (2011)
  - Responsibilities include supervising personnel; coaching and developing new employees; sample tracking; reviewing rush request; communicating client requirements; operating GC instruments; data interpretation and entry; calibrating; repairing instruments and verifying data

**Linda M. Hartenstine, B.A., Senior Chemist, GC/MS Semivolatiles**

Education:

B.A. Chemistry, Millersville University (1994)

Professional Experience:

With Lancaster Laboratories since 1994
- Associate Chemist (1994)
- Chemist (1997)
- Senior Chemist, GC/MS Semivolatiles (1998)
  - Responsibilities include performing GC/MS semivolatiles testing; operating GC/MS instruments; data interpretation; developing and evaluating new methods; calibrating and repairing instruments; preparing standards; revising and updating SOPs and analytical methods; training other analysts

**Robert G. Heisey, Jr., B.A., Senior Specialist, Water Quality**

Education:

B.A. Chemistry, Millersville State College (1972)

Professional Experience:

RCA Corp., Engineering Technician (1972-1987)
With Lancaster Laboratories since 1988
- Chemist Coordinator (1989)
- Senior Chemist Coordinator (1997)
  - Responsibilities included: supervise personnel; schedule lab work; review and approve data; develop and evaluate new methods; prepare test standards.
- Senior Chemist Group Leader (2005)
  - Responsibilities included: supervise personnel; schedule lab work; review and approve data; develop and evaluate new methods; prepare test standards.
- Senior Specialist, Water Quality (2006)
  - Responsibilities include: review and approve data; develop and evaluate new methods; prepare test standards; order laboratory supplies; maintain department's chemical inventory.

Uncontrolled Copy

**Daniel H. Heller, B.A., Senior Chemist, GC/MS Volatiles**

Education:

A.S.T. Machine Technology, Stevens State College (1998)
B.A. Secondary Education Biology, Millersville University (2003)

Professional Experience:

Tyco Electronics, Machinist B (1998-2004)
Responsibilities included machining various materials using various machines
Columbia Junior/Senior High School, Teacher (2005)
Responsibilities included teaching 9th and 10th grade biology
Penn State Cooperative Extension, Biologist (2005-2006)
Responsibilities included treating and surveying mosquito populations
With Lancaster Laboratories since 2006
Chemist, GC/MS Volatiles (2006)
Responsibilities included evaluating water samples for volatiles using GC/MS instrumentation
Senior Chemist, GC/MS Volatiles (2012)
Responsibilities include evaluating water samples for volatiles using GC/MS instrumentation

**Tamara J. Helsel, Senior Specialist Group Leader, Environmental Sample Administration**

Professional Experience:

Willow Valley Retirement Communities, Certified Nursing Assistant (2000-2001)
Responsibilities included assisting nursing home residents with their daily activities and personal hygiene
Bayada Nurses, Certified Nursing Assistant (2000-2001)
Responsibilities included assisting people with disabilities in their homes with their personal hygiene and daily activities
With Eurofins Lancaster Laboratories since 2001
Senior Administrator, Environmental Sample Administration (2001)
Responsibilities included performing sample receipt, interpretation, and entry
Specialist, Environmental Sample Administration (2001)
Responsibilities included performing sample receipt, interpretation, and entry
Senior Specialist, Environmental Sample Administration (2007)
Responsibilities included performing sample receipt, interpretation, and entry
Senior Specialist Group Leader, Environmental Sample Administration (2013)
Responsibilities include performing sample receipt, interpretation, and entry

Memberships and Appointments:

Lancaster Laboratories Safety Committee (2003-2007)

**Chadwick J. Hershey, B.S., Senior Specialist, Environmental Software Development**

Education:

B.A. Economics, Millersville University (2001)
B.S. Computer Science, Millersville University (2001)

Continuing Education:

Mastering Microsoft Visual Basic 6 Development, IntelliMark (2001)
Oracle Exam #120-007, Introduction to Oracle 9i: SQL (2004)

Professional Experience:

With Eurofins Lancaster Laboratories since 1999
Intern, Computer Applications Development (1999-2001)
Responsibilities included maintaining and developing departmental computer systems
Specialist, Computer Applications Development (2001)
Responsibilities included maintaining and developing departmental computer systems
Senior Specialist, Environmental Software Development (2006)
Responsibilities include maintaining and developing departmental computer systems

Uncontrolled Copy

**Diana G. Holmes, M.S., Senior Specialist, Environmental Software Development**

Education:

B.A. Physics, Cornell University (1983)
M.S. Computer Science, Rensselaer Polytechnic Institute (1985)

Professional Experience:

AT&T Bell Laboratories, Technical Staff Member (1985-1986)
Responsibilities included developing software for testing software
Prime Computer, Software Engineer II (1986-1988)
Responsibilities included designing, implementing, and testing software for PRIMOS and mini-supercomputers
Banyan Systems, Principal Software Engineer (1988-1999)
Responsibilities included developing, enhancing, and maintaining suite of services for VINES mail service; worked with 3rd party developers; third line customer support
Progressive Systems/Cobalt Networks, Senior Software Engineer (1999-2000)
Responsibilities included managing and leading software releases; designed and implemented software features; third line customer support
Sun Microsystems, Project Manager (2000-2005)
Responsibilities included project manager for Linux Operation System releases
Innovative Emergency Management, Inc., Applications Systems Engineer (2005-2006)
Responsibilities included providing system administration support, development of software tools for deployment
Pennington Biomedical Research Center, IT Applications Developer III (2006-2013)
Responsibilities included analyzing, designing, developing, executing, documenting, and supporting software applications for the Basic Science labs
With Eurofins Lancaster Laboratories since 2013
Senior Specialist, Environmental Software Development (2013)
Responsibilities include providing technical support for maintenance of installed software applications and assistance with development, installation, and maintenance of new applications for general use; assistance in development, implementation, and maintenance of software intended to improve quality and efficiency of work performed

**Catherine M. Holt, B.S., Principal Specialist, Environmental Software Development**

Education:

B.A. Mathematics, Franklin & Marshall College (1984)
B.S. Computer Science, Millersville University (1987)

Continuing Education:

Novell Network Seminar, Novell (1989)
Clarion Database Management Seminar, Clarion Software (1991)
Operations Process Optimization, Penn State University (1992)
Fast Track to Powerbuilder Seminar, Actium (1997)
Mastering Visual Basic 6 Development, Microsoft Corporation (1999)
Introduction to Oracle9I: SQL, Online Testing (2004)
Programming with the Microsoft .NET framework using Microsoft Visual Studio 2005 (2008)
Windows Forms 3.5 Programming for Experienced VB .NET Programmers (2010)

Professional Experience:

R.R. Donnelley & Sons Company, Technician (1985-1987)
Responsibilities included scanning and developing photographs for use in catalogs
Shared Medical Systems, Programmer (1987-1989)
Responsibilities included customizing and installing software at hospitals
With Eurofins Lancaster Laboratories since 1989
Principal Specialist, Computer Applications Development (1989)
Responsibilities included developing and maintaining computer systems/programs for laboratory use
Principal Specialist/Coordinator, Computer Applications Development (1995)
Responsibilities included supervising personnel; developing and maintaining computer systems/programs for lab use; communicating with clients about disk requirements
Principal Specialist, Environmental Software Development (1997)
Responsibilities include developing and maintaining computer systems in VB6 and VB.net for use within Parallax shell

Uncontrolled Copy

**John P. Hook, B.S., Senior Chemist, Metals**

Education:

B.S. General Science, Pennsylvania State University (2002)

Continuing Education:

ICP/ICP-MS Seminar, Perkin-Elmer (2003)
ICP-MS Seminar, Agilent (2004)
ICP-MS training, Perkin-Elmer (2005)
PPI Team Training, Lancaster Laboratories (2008)
Facilitator Training, ThermoFisher Scientific (2009)

Professional Experience:

Sony Technology Corporation, Manufacturing Staff (2002-2003)
Responsibilities included assembly, final inspection, and packaging of television sets
ALCOA Primary Metals, Laboratory Technician (2003)
Responsibilities included observation and maintenance of aluminum production pilot test operation; analysis of product
With Lancaster Laboratories since 2003
Chemist, Metals (2003)
Senior Chemist, Metals (2006)
Responsibilities include performing setup, analysis, and review of ICP, ICP-MS runs; maintenance and troubleshooting of ICP, ICP-MS instruments; yearly, quarterly and start-up ICP instrument qualifications including IECs, IDLs, MDLs, and LDRs; maintaining adequate laboratory supply inventory; disposing of acid waste; writing SOPs

**Kay G. Hower, B.S., Principal Specialist Group Leader, Bay Area Service Center**

Education:

B.S. Animal Science, University of Delaware (1988)

Professional Experience:

U.S. Fish and Wildlife Service, Research Assistant (1990-1991)
RMC Environmental Services, Biological Technician (1992-1994)
Lancaster Laboratories
Senior Specialist, Project Manager, Environmental Client Services (1994-2001)
Responsibilities included managing client projects; auditing sample entry; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions and providing sampling containers.
Principal Specialist, Environmental Business Development (2001-2007)
Responsibilities included providing price quotes and proposals; advising clients on testing; assisting on client visits/audits; answering client questions; communicating client requirements to lab areas
Principal Specialist, Pharmaceutical Client Services (2007-2008)
Responsibilities included acting as the pharmaceutical client liaison within the laboratory by communicating client's requirements to the technical staff by maintaining project-related documentation, communicating desired turnaround times, and managing information flow; other duties include facilitating and organizing client audits, visits, and conference calls; monitoring ongoing projects and providing status updates as needed; auditing client sample paperwork and resolving discrepancies; overseeing the general administration of pharmaceutical projects (issuing quotations, answering billing and reporting questions, and scheduling sample pickups)
Urological Associates of Lancaster, Surgical Coordinator (2010-2012)
Responsibilities included coordinating surgical procedures for seven urologists at four facilities; meeting with patients to explain procedure details including pre-hospital testing, day-of timeline and post-op appointments and testing; obtaining insurance authorizations
With Lancaster Laboratories since 2012
Principal Specialist Group Leader, Bay Area Service Center (2012)
Responsibilities include serving as the primary contact with the laboratory for a number of assigned clients; communicating technical information and conveying client requirements to laboratory personnel, ensuring that those requirements are met; managing large/complex projects according to client technical and schedule requirements; developing strong relationships with major accounts resulting in additional sales; performing both technical and personnel aspects of group operations; performing work within the department or other areas as required; acting as a technical resource, trainer, and troubleshooter to specific department; making recommendations for operational and/or technical improvements; communicating effectively within the group; coaching and developing direct reports; planning and monitoring workflow

Uncontrolled Copy

**Samuel A. Huber, B.S., Manager, Physical Services/Equipment Maintenance & Repair**

Education:

B.S. Biology, Lebanon Valley College (1988)
Certificate of Business Administration, Penn State University (1995)

Continuing Education:

24-hour HAZWOPER (spill response) (1995-2004)
40-hour HAZWOPER (2005-present)
DOT/IATA training (2004-2010)
Incident Command System IS-00100 (2006)
National Incident Management System IS-00700 (2006)
Total Productive Maintenance (2007)
Basic Electricity for the Non-Electrician (2009)
Air Conditioning and Refrigeration (2010)
OSHA Asbestos 2- Hour Awareness Training (2012)
Applied Structural Drying (4-Hours) (2012)
Siemens APOGEE Workstation Operations (2012)
NFMT (National Facilities Management & Technology) – annual conference attendance (2008-present)
I2SL (International Institute for Sustainable Laboratories) – annual conference attendance (2012)

Professional Experience:

With Eurofins Lancaster Laboratories since 1988
- Environmental department responsibilities (1988-2007)
  - Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations and financial resources; project management; supervising method development
- Manager, Physical Services/Equipment Maintenance & Repair (2007- present)
  - Responsibilities include overseeing facilities staff and operation of physical plant and grounds; growth planning; overseeing security functions

Awards, Citations, Honorary Societies & Publications:

Dawson-Grundmann Innovation Award, Lancaster Laboratories (1999)
- Design and oversee installation of bulk solvent delivery system for organic extractions; annual savings in waste reduction and labor costs of greater than $12,000

Organizing the Laboratory to Efficiently and Accurately Process Soil Samples, Pittcon poster session (2006)
NFPA Industrial Fire Protection Section Member (2009-present)
NFMT (National Facilities Management & Technology) Member (2010-present)
I2SL (International Institute for Sustainable Laboratories) Member (2012-present)
AFE (Association for Facilities Engineering) Member (2012-present)
LCISC (Lancaster County Industrial Safety Council) Member (2009-present)

**Sara E. Johnson, B.S., Senior Chemist, GC/MS Volatiles**

Education:

B.S. Chemistry, Biochemistry option, Millersville University (2006)

Professional Experience:

With Lancaster Laboratories since 2006
- Chemist, Flexible Staffing (2006)
  - Responsibilities included flexing to various departments as needed and performing analysis ranging from GC/MS to SDS-PAGE Electrophoresis with colloidal blue or silver staining
- Chemist, GC/MS Volatiles (2008)
  - Responsibilities included performing GC/MS analysis of water and soil samples along with other matrices by various analytical methods such as EPA 624, 8260B, and CLP; evaluating analytical data generated; calibrating and troubleshooting GC/MS instrumentation
- Senior Chemist, GC/MS Volatiles (2010)
  - Responsibilities include performing GC/MS analysis of water and soil samples along with other matrices by various analytical methods such as EPA 624, 8260B, and CLP; evaluating analytical data generated; calibrating and troubleshooting GC/MS instrumentation; assisting other employees with any questions that may arise and helping to train new employees

Uncontrolled Copy

**Richard H. Karam, B.A., Director of Operations, Eurofins Lancaster Laboratories Environmental**

Education:

B.A. Environmental Studies, Green Mountain College (2000)

Professional Experience:

Severn Trent Laboratories

Analytical Chemist (2000-2005)

Responsibilities included analyzing environmental samples for various general chemistry parameters, metals by ICP/ICPMS, pesticides/PCBs/herbicides by GC, and semivolatiles by GC/MS

Project Manager (2005-2006)

Responsibilities included managing environmental projects; writing case narratives; project set up

With Eurofins Lancaster Laboratories since 2006

Group Leader, GC/MS Semivolatiles (2006)

Responsibilities included coordinating production in GC/MS Semivolatiles; reviewing and signing reports

Manager, GC/MS Semivolatiles (2007)

Responsibilities included ensuring the accuracy and acceptability of all data generated by the GC/MS Semivolatiles group; coordinating daily prioritization of workload and monitoring the holding time and turnaround time status of samples; responding to client questions regarding GC/MS Semivolatiles data and methods and communicating technical issues or concerns about samples to project managers for clarification or resolution with the client

Manager, Organic Extraction/Leachate Preparation/GC/MS Volatiles/GC/MS Semivolatiles (2008)

Responsibilities included ensuring the accuracy and acceptability of all data generated by the groups; coordinating daily prioritization of workload and monitoring the holding time and turnaround time status of samples; responding to client questions regarding data and methods and communicating technical issues or concerns about samples to project managers for clarification or resolution with the client

Director, Eurofins Lancaster Laboratories Environmental (2014)

Responsibilities include leading departments in accordance with vision, values, and strategic goals of company; overseeing and facilitating efficient operations and systems, sound business practices, consistent client service, and motivated staff

**Dana M. Kauffman, Manager, Sample Support and Data Deliverables**

Continuing Education:

Introduction to Electronics, Lancaster County Career & Technology Center, Brownstown (1994)
AC/DC Electronics, Lancaster County Career & Technology Center (1995)
Entry Level Management (1997)
Gas Chromatography: Principles and Practices, Lancaster Labs University (2003)
Practical Process Improvement Facilitator Training (2009)
Practical Process Improvement Process Manager Training (2011)

Professional Experience:

With Lancaster Laboratories since 1994

Lab Technician (1995)

Senior Technician (1996)

Sample Support Coordinator (1997)

Group Leader, Sample Support (1999); Group Leader, Volatiles by GC (2002)

Responsibilities included supervising personnel; managing laboratory operations; project management; sample preparation; developing and evaluating new methods; reagent preparation; revising and updating SOPs; ordering supplies; training other analysts; running the automated storage and retrieval system; lab cleaning and maintenance; monitoring laboratory activities; performing internal audits; enforcing regulatory compliance requirements; maintaining required certifications; communicating client requirements to lab areas

Manager, Sample Support and Data Deliverables (2005)

Responsibilities include overseeing all upfront sample handling requirements including storage, preservation, homogenization, moisture determination, volatile prescreen, and volatile soil prep; supervising group leader personnel; project management; revising and updating SOPs; performing internal audits; enforcing regulatory compliance requirements; maintaining required certifications; communicating client requirements to lab areas; data package and EDD TAT monitoring; overseeing all data package processes including data assembly, review, and processing; Practical Process Improvement (PPI) process manager responsible for facilitating PPI project team training and PPI efforts within LLI

Uncontrolled Copy

**Katherine A. Klinefelter, M.S., Principal Specialist, Environmental Client Services**

Education:

B.S. Chemistry, Rutgers University (1983)
M.S. Physiology, Rutgers University (1985)

Continuing Education:

Additional graduate work in Physiology, Rutgers University (1985-1989)
Practical Process Improvement (Team Member Training), Lancaster Labs University (2009)

Professional Experience:

Rutgers University, Research and Teaching Assistant (1984-1989)
M. S. Hershey Medical Center of Penn State University, Senior Research Technician (1990-1993)
With Lancaster Laboratories since 1993
- Environmental Project Management
- Senior Specialist, Environmental Client Services (1993)
- Senior Specialist/Coordinator, Environmental Client Services (1996)
- Senior Specialist, Environmental Client Services (2000)
- Principal Specialist, Environmental Client Services (2007)
  - Responsibilities include project management; training new client service representatives; auditing sample entry; answering client questions; communicating client requirements to lab areas

Awards, Citations, Honorary Societies & Publications:

Dean's Graduate Student Dissertation Research Award, Rutgers University
Dean's Graduate Student Travel Award, Rutgers University
Steinetz Memorial Fund Award, Department of Biological Sciences, Rutgers University
10 abstracts and 3 scientific papers on membrane transport physiology
4 presentations on membrane transport physiology
Quarterly Impact Award for Practical Process Improvement (2009)

**Wendy A. Kozma, B.S., Principal Specialist Group Leader, Environmental Client Services**

Education:

B.S. Environmental Science, Allegheny College (1991)

Professional Experience:

Roy F. Weston, Inc. (1992-1993)
With Lancaster Laboratories since 1993
- Senior Specialist, Environmental Client Services (1996)
  - Responsibilities included performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers
- Principal Specialist, Environmental Client Services (2004)
  - Responsibilities included performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers
- Principal Specialist Group Leader, Environmental Client Services (2006)
  - Responsibilities include performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers

**Rachel L. Kreamer, B.S., Manager, Environmental Client Services**

Education:

B.S. Biology, Eastern Mennonite College (1980)

Continuing Education:

Financial Accounting, Penn State (2005)
Behavioral Science in Business, Penn State (2006)
Price and Markets, Penn State (2006)

Professional Experience:

With Lancaster Laboratories since 1987
- Client Services Specialist, Environmental Client Services (1990)
- Environmental Project Manager, Environmental Client Services (1994)
- Coordinator, Environmental Client Services (1996)
- Group Leader, Environmental Client Services (1996)
  - Responsibilities included supervising personnel; training; revising and updating SOPs; monitoring turnaround time

Uncontrolled Copy

Manager, Environmental Client Services (2005)
Responsibilities included supervising personnel; training; revising and updating SOPs; monitoring turnaround time
Manager, Pharmaceutical Client Services (2005)
Responsibilities included supervising personnel; revising and updating SOPs; training
Director, Professional Scientific Staffing – VA (2007)
Responsibilities included managing all aspects of the PSS group in VA
Director, Bay Area Service Center (2008)
Responsibilities included managing all aspects of the Bay Area Service Center
Manager, Environmental Client Services and Bay Area Service Center (2009)
Responsibilities include managing all aspects of the environmental client services group and Bay Area Service Center

Awards, Citations, Honorary Societies & Publications:
Senior Leadership Group Achievement Award (1996)

**M. Susan Kreider, Senior Specialist, Data Deliverables**

Continuing Education:
Chemistry and Psychology courses, F&M College

Professional Experience:
General Cigar Co., R&D Center, Laboratory Technician (1963-1966)
Responsibilities included testing tobacco products; smoke analysis; nicotine and tar analysis; preparing samples for gas chromatography
Company F. Weaver, Inc., Laboratory Technician (1966-1967)
Responsibilities included performing microbiological testing of food products, both raw materials and finished products; training factory employees in sterile food handling
Microbiological Associates, Inc., Stock Line/Sterile Technician (1968-1969)
Responsibilities included performing cancer research; dissection of animal and human tissue for cell line production; freezing of live cells; all phases of sterile lab work
Warner Lambert Co., Assistant Microbiologist/Organic Chemistry Technician (1970-1975)
Responsibilities included performing microbiological and chemical testing of raw material and finished products
Julia Winifred & Co. (Jacks III), Sales Clerk (1982-1983)
Responsibilities included retail sales; preparing windows and displays in store
With Lancaster Laboratories since 1983
Laboratory Technician, ExpressLAB (1983)
Responsibilities included performing sample prep and analyses
Senior Technician, ExpressLAB (1986)
Responsibilities included performing sample prep and analyses
Chemist, ExpressLAB (1988)
Responsibilities included performing sample prep and analyses
Specialist, Pesticide Residue Analysis (1998)
Responsibilities included performing sample prep and analyses
Specialist, EPH/Misc. GC (2003)
Responsibilities included performing sample prep and analyses
Specialist, Data Deliverables (2005)
Responsibilities included validating and sending data deliverables
Senior Specialist, Data Deliverables (2006)
Responsibilities include validating and sending data deliverables

**Robert M. Large, B.S., Director, Environmental Client Services/Inside Business Development/Sample Administration/Data Deliverables/Sample Support/Bay Area Service Center**

Education:
B.S. Zoology, Pennsylvania State University (1973)

Continuing Education:
Chromatography/Mass Spectral Interpretation, Finnigan MAT Institute (1981)
Foundations of Management, Gilbert Associates (1982)
M.B.A. Program, St. Joseph's University (1984-1987)
How to Market Professional Services, ACIL (1990)

Uncontrolled Copy

Professional Experience:

Gilbert Associates, Inc., Program Manager (1977-1984)
Spotts, Stevens, & McCoy, Director of Client Services (1984-1990)
With Lancaster Laboratories since 1990
Marketing Specialist, Environmental Client Services (1990)
Group Leader, Environmental Client Services (1994)
Manager, Environmental Client Services (1995)
Responsibilities included: supervise personnel; project management; various office tasks; interpret QC implications to data quality; and advise clients on testing. Set up and managed the Bay Area Service Center in Richmond, CA (2001). Manage Environmental Sample Administration (2002). Manage Inside Business Development (2003).
Director, Environmental Client Services/Business Development/Sample Administration/Bay Area Service Center (2005)
Responsibilities include: supervise personnel; project management; various office tasks; interpret QC implications to data quality; and advise clients on testing. Set up and managed the Bay Area Service Center in Richmond, CA (2001). Manage Environmental Sample Administration (2002). Manage Inside Business Development (2003). Assisted setting up Professional Scientific Staffing (PSS) for a major biotech client (2004). Manage Data Deliverables and Sample Support (2010).

**Kerri E. Legerlotz, Senior Chemist, GC/MS Volatiles**

Education:

B.S. Chemistry, Houghton College (2005)

Professional Experience:

Pfizer, Chemist (2005-2006)
Responsibilities included performing raw material, finished product, and stability testing; wet chemistry, pH, viscosity, IR, Karl Fischer, specific gravity
With Lancaster Laboratories since 2006
Chemist, GC/MS Volatiles (2006)
Responsibilities included testing for volatile compounds using GC/MS by purge and trap; preparing working standards from neat compounds
Senior Chemist, GC/MS Volatiles (2013)
Responsibilities include analyzing water and soil samples by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers; troubleshooting problems on GC/MS, purge and traps, and autosamplers; formulating and diluting analytical reference materials

**Parker D. Lindstrom, B.S., Senior Chemist, Metals**

Education:

B.S. Chemical Oceanography, Millersville University (2002)

Continuing Education:

Comprehensive Gas Chromatography Seminar, RESTEK (2002)
Comprehensive GC/MS Seminar, RESTEK (2002)
Statistics at Lancaster Laboratories, LLU (2005)
24-hour HAZWOPER, LLU (2006)

Professional Experience:

Fred Fiorentino, Assistant Laborer (1997-2002
Responsibilities included roofing, painting, general construction, clean-up, installation of windows, doors, stairs, decking
Dr. Kerper, Office Assistant (2000-2002)
Responsibilities included filing, cataloging children's books
Millersville University IMC/IMS, Media/Education Assistant (2000-2002)
Responsibilities included assisting teachers in creating media for the classroom, editing video and audio projects
With Lancaster Laboratories since 2002
Associate Chemist/Senior Chemist, GC/MS Volatiles (2002)
Responsibilities included running purge and trap and GC/MS to analyze samples and QC for VOCs; performing purge and trap and GC/MS maintenance
Senior Chemist, Metals (2006)
Responsibilities included running ICP/MS; verifying samples; performing maintenance; prepping samples; general troubleshooting for metals department; installation, maintenance and operation of CVAF low level Mercury; providing general computer help to Computer Services department
Senior Chemist Metrology, Metals (2009)
Responsibilities include helping the instrument (Metrology) group maintain and qualify HPLCs, GCs, and other pharmaceutical instruments; helping with other qualifications as needed (hoods, storage units, etc); for a short time in 2009 verifying data in Water Quality department

Memberships and Appointments:

Emergency Response Team (Spill Team), Lancaster Laboratories (2006)

Uncontrolled Copy

**Jason M. Long, B.S., Senior Chemist, GC/MS Volatiles**

Education:

B.S. Chemistry, Shippensburg University (2004)

Professional Experience:

EA Engineering Science & Technology, Lab Tech (2004)

Responsibilities included setting up and running tests in toxicology lab; cleaning glassware used in performing tests; titrating for alkalinity and pH of water samples

With Lancaster Laboratories since 2004

Chemist, GC/MS Volatiles (2004)

Responsibilities included analyzing water and soil samples by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers

Senior Chemist, GC/MS Volatiles (2007)

Responsibilities include analyzing water and soil samples by purge and trap GC/MS; generating and reviewing raw data; performing maintenance on GC/MS, purge and traps, and various autosamplers; troubleshooting problems on GC/MS, purge and traps, and autosamplers

**Lyssa M. Longenecker, B.S., Senior Specialist, Environmental Client Services**

Education:

B.S. Biology, Millersville University of PA (2010)

Professional Experience:

With Eurofins Lancaster Laboratories since 2011

Specialist, Environmental Client Services (2011)

Responsibilities included serving as the primary laboratory contact to clients; communicating technical information to the client in a comprehensible manner; deciphering the clients' testing needs; conveying the clients' requirements to the laboratory; ensuring clients' requirements and needs are met

Senior Specialist, Environmental Client Services (2014)

Responsibilities include serving as the primary laboratory contact to clients; communicating technical information to the client in a comprehensible manner; deciphering the clients' testing needs; conveying the clients' requirements to the laboratory; ensuring clients' requirements and needs are met

**Dorothy M. Love, B.S., Manager, Environmental Quality Assurance**

Education:

B.S. Environmental Health, Indiana University of Pennsylvania (1981)

Professional Experience:

Sun Transport, Inc., Safety Assistant (1980-1981)
Texas A & M University, Research Assistant (1982-1984)
Texas Water Commission, Chemist (1984-1986)
GHR Analytical, Chemist (1986-1987)
Clean Harbors, Inc., Senior Chemist (1987-1989)
With Eurofins Lancaster Laboratories since 1989

Senior Specialist (1989)
Senior QA Specialist (1998) Coordinator (2000)
Principal Specialist/Coordinator, Quality Assurance (2003)

Responsibilities included supervising personnel; training other QA staff; revised and updated analytical methods; monitored laboratory activities and corrective action for quality issues; performed internal audits; worked with external auditors; reviewed lab data and procedures; enforced regulatory compliance requirements; reviewed/wrote client/lab Quality Assurance Project Plans (QAPP)

Principal Specialist Group Leader, Quality Assurance (2005)

Responsibilities included supervising personnel; training other QA staff; revised and updated analytical methods; monitored laboratory activities and corrective action for quality issues; performed internal audits; worked with external auditors; reviewed lab data and procedures; enforced regulatory compliance requirements; reviewed/wrote client/lab Quality Assurance Project Plans (QAPP)

Manager, Environmental Quality Assurance (2013)

Responsibilities include supervising the Environmental QA department; monitoring regulatory activities; reviewing procedures and data; interacting with clients and agencies; performing regulatory and client document review; enforcing regulatory compliance; quality improvement; staff training; QA policy development and maintenance

Memberships and Appointments:

Society of Women Environmental Professionals (SWEP (2007-present)
TNI Quality Systems Committee (2009-present)
NJ Environmental Laboratory Advisory Committee (2012-present)

Uncontrolled Copy

**Natalie R. Luciano, B.A., Senior Specialist, Environmental Client Services**

Education:

B.A. Biology, Bridgewater College (2006)

Continuing Education:

Safe Drinking Water Regulations Revisions, PaAAEL & PA DEP (2010)
PA Regulatory Update Bureau of Safe Drinking Water, PaAAEL (2013)
PA DEP Regulatory Update, PA DEP (2013)

Professional Experience:

With Eurofins Lancaster Laboratories since 2007
- Specialist, Environmental Client Services (2007)
  - Responsibilities included performing project management; serving as the primary contact for external clients; communicating client requirements to laboratory areas; auditing entries and reviewing sample data
- Senior Specialist, Environmental Client Services (2013)
  - Responsibilities include performing project management; serving as the primary contact for external clients; communicating client requirements to laboratory areas; auditing entries and reviewing sample data

**Duane A. Luckenbill, B.S., Vice President, Eurofins Lancaster Laboratories Environmental**

Education:

B.S. Chemistry, Clarion University of PA (1989)

Continuing Education:

Introduction to Mass Spectral Interpretation, Hewlett-Packard (1995)
Technical Training, OI Analytical (1995)

Professional Experience:

ATEC Associates, Inc., GC/MS Analyst (1989)
With Eurofins Lancaster Laboratories since 1989
- Chemist (1991)
- Chemist/Coordinator (1993)
- Group Leader (1997)
- Manager (2001)
  - Responsibilities included client satisfaction, safety and quality systems administration, and all aspects of financial, personnel, and operations management of the GC/MS Volatiles and GC/MS Semivolatiles groups
- Director, Environmental Sciences (2005)
  - Responsibilities included client satisfaction, safety and quality systems administration, and all aspects of financial, personnel, and operations management of the GC/MS Volatiles, GC/MS Semivolatiles, Volatiles in Air, Organic Extraction, Leachate Preparation, Field Sampling, Pesticide Residue Analysis, Volatiles by GC, and EPH/Miscellaneous GC groups
- Vice President, Eurofins Lancaster Laboratories Environmental (2013)
  - Responsibilities include all aspects of financial, personnel, and operations management of all Technical areas, Environmental Quality and Compliance, Computer Application/Development, and Environmental Support Services while continually focusing on client satisfaction, safety, and quality systems administration; collaborating with other Eurofins US environmental companies to expand national testing capabilities and grow market share in the US

Awards, Citations, Honorary Societies & Publications:

Undergraduate Award in Analytical Chemistry, American Chemical Society (1988)
Department of Chemistry Competitive Award, Clarion University (1988-1989)
Outstanding Senior Chemistry Award, American Institute of Chemists Foundation (1989)
Senior College Award for Chemistry, Society for Analytical Chemists of Pittsburgh (1989)
One publication on mass spectrometry

**Nicole L. Maljovec, M.S., Principal Specialist Group Leader, Environmental Client Services**

Education:

B.S. Chemistry, St. Bonaventure University (2004)
M.S. Adolescence Education, D'Youville College (2005)

Professional Experience:

CYTEC Industries, Industrial Hygiene Internship (2003-2004)
- Responsibilities included performing air monitoring and sampling; complying with OSHA standards; assisting R/D lab with the identification of unknown chemicals and wastes

Niagara Wheatfield, Environmental Science Teacher (2005-2006)
- Responsibilities included teaching chemistry, chemistry lab, and environmental science; developing special education plans to assist students with learning disabilities

Uncontrolled Copy

With Lancaster Laboratories since 2006
- Specialist, Environmental Client Services (2006)
  - Responsibilities included performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers
- Senior Specialist Group Leader, Environmental Client Services (2007)
  - Responsibilities included performing project management; advising clients on testing; providing price quotes; monitoring turnaround time; auditing sample entries; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions; ordering sampling containers; managing a team of client service representatives and administrative assistants, training of new employees, setting up and delegating new projects, serving as primary project manager for several large clients and consultants
- Principal Specialist Group Leader, Environmental Client Services (2012)
  - Responsibilities include serving as the primary contact or back-up with the laboratory for a number of assigned clients requiring specialized testing or complex projects; understanding and communicating technical information and client requirements to laboratory personnel, helping to ensure that requirements are met; leading broad-based complex projects to a satisfactory conclusion according to client technical and schedule requirements; developing strong relationships with major accounts resulting in additional sales; advising and training other members of the department; serving as a technical resource both internally and externally; proactively assisting Outside Business Development with client visits, presentations, and internal audits for assigned clients; participating on PPI teams

## Melissa McDermott, B.A., Principal Specialist, Environmental Business Development

### Education:

- B.A. Biology, Millersville University (1992)
- Elementary Education Certification, PA (May 2009)
- Middle School Science Certification, PA (July 2009)

### Continuing Education:

- Gas Chromatography Principles and Practices (1995)
- Conflict Resolution and Confrontation Skills Seminar (1996)
- Coaching Skills for Supervisors Seminar (1996)
- Waste Testing and Quality Assurance Symposium (1996)
- Entry Level Management (1997)
- How to Deliver Exceptional Customer Service Seminar (1997)
- Statistics at Lancaster Laboratories (2006)

### Professional Experience:

With Eurofins Lancaster Laboratories since 1992
- Chemist, EPH/Misc. GC (1993)
  - Responsibilities included performing analysis of environmental samples for metals by AA flame and cold vapor generation; assembling client data packages
- Chemist Coordinator, EPH/Misc. GC (1996)
  - Responsibilities included coordinating rush work; communicating with client service representatives regarding sample status; answering client questions; generating employee job plans; conducting employee evaluations
- Senior Chemist, EPH/Misc. GC (1997)
  - Responsibilities included performing analysis of environmental samples for DRO and interpretive TPH analyses; verifying analyses performed by other analysts; preparing standards; revising departmental SOPs; method development; reviewing data packages
- Senior Specialist, Environmental Client Services (1997)
  - Responsibilities included auditing sample entry; answering client questions; communicating client requirements to lab areas; providing status reports, including results, to clients; scheduling sample submissions and providing sampling containers
- Senior Chemist, EPH/Misc. GC (2002)
  - Responsibilities included reviewing and approving data; writing departmental methods; reviewing and approving data packages; acting as technical resource within department; answering client questions; monitoring and performing QA metrics
- Senior Specialist, Environmental Client Services (2007)
  - Responsibilities included acting as technical resource between client services and laboratories; scheduling sample submissions and providing sampling containers; communicating client requirements to lab areas
- Senior Chemist, EPH/Misc. GC (2009)
  - Responsibilities included reviewing and approving data; writing departmental methods; reviewing and approving data packages; acting as technical resource within department; answering client questions; monitoring and performing QA metrics

Uncontrolled Copy

Senior Chemist Group Leader, Pesticides (2011)

Responsibilities included performing routine and non routine instrumental analyses of QC and clients' samples for pesticides, PCBs, herbicides, and other related compounds in accordance with departmental methods and standard operating procedures (SOPs); assisting in implementing special client requests; identifying and offering solutions to correct instrument problems and causes of QC problems; reviewing data for accuracy and completeness (for both routine and non routine analyses, reports, or data packages); serving as a technical resource for the department; performing both technical and personnel aspects of group operations; performing work within the department or other areas as required; acting as a technical resource, trainer, and troubleshooter to specific department; making recommendations for operational and/or technical improvements; communicating effectively within the group; coaching and developing direct reports; planning and monitoring workflow

Principal Specialist, Environmental Business Development (2014)

Responsibilities include using company literature, verbal discussions, formal written quotes, proposals, tours, and audits to independently secure new business consistent with operational capabilities and business plan goals; collaborating efforts and activities with those of Outside Sales account managers as needed; focusing on proposal writing for major national accounts; attending face-to-face sales meetings with selected national accounts as needed and maintaining responsibility for their maintenance and growth

## Roy R. Mellott Jr., B.S., Senior Chemist Group Leader, GC/MS Volatiles

### Education:

B.S. Biology, Millersville University (1993)

### Continuing Education:

Hazardous Waste Disposal, LLU (1996)
GC: Principles & Practices, LLU (1997)
GC/MS: Applications/Troubleshooting Seminar, ECS/MDL Systems, Inc. (1999)
Introduction to Interpretation of Mass Spectra, LLU (2005)
Interpretation of Mass Spectra, Intermediate, LLU (2005)
Role of the Leader 1 – Giving Recognition, LLU (2007)
Role of the Leader 2 – Clarifying Performance Expectations, LLU (2007)
Role of the Leader 3 – Developing Others, LLU (2007)
Role of the Leader 4 – Providing Constructive Feedback, LLU (2007)
PPI Team Training, LLU (2010)
PPI Facilitator Workshop, LLU (2010)
Targeted Selection, LLU (2010)
Role of the Leader Building Team Pride and Purpose, LLU (2011)
Role of the Leader Resolving Conflicts with Your Peers, LLU (2011)

### Professional Experience:

With Eurofins Lancaster Laboratories since 1995

Senior Lab Tech I, GC/MS Volatiles (1995)

Responsibilities included requisitioning samples; performing sample storage, prescreening, discard, hazardous waste disposal; tracking down missing samples by various means

Chemist/Auditor, GC/MS Volatiles (1996)

Responsibilities included performing analysis of waters, soils, and other matrices for VOCs via various analytical methods; evaluation of analytical data; calibrating and trouble shooting various GC/MS equipment; evaluation/review of analyst-generated data; corresponding with analysts about possible trends (whether analyst- or system-related) in generated data; evaluation/review of corrections of problems with generated data

Senior Chemist, GC/MS Volatiles (2002)

Responsibilities included performing analysis of waters, soils, and other matrices for VOCs via various analytical methods; evaluation of analytical data; setting up, calibrating, and trouble shooting various GC/MS equipment; evaluation/review of analyst-generated data; corresponding with analysts about possible trends (whether analyst- or system-related) in generated data; evaluation/review of corrections of problems with generated data; updating/correcting SOPs and laboratory and analytical procedures; preparation, tracking and documentation of analytical standards used in the laboratory; training of new employees to the department

Senior Chemist Group Leader, GC/MS Volatiles (2005)

Responsibilities include performing analysis of waters, soils, and other matrices for VOCs via various analytical methods; evaluation of analytical data; setting up, calibrating, and trouble shooting various GC/MS equipment; evaluation/review of analyst-generated data; corresponding with analysts about possible trends (whether analyst- or system-related) in generated data; evaluation/review of corrections of problems with generated data; updating/correcting SOPs and laboratory and analytical procedures; preparation, tracking and documentation of analytical standards used in the laboratory; training of new employees to the department

Uncontrolled Copy

Memberships & Appointments:
- Nature Conservancy (1998-present)
- Eurofins Lancaster Laboratories
  - Ethics Committee (1999-2003)
- Lancaster Herpetological Society
  - Treasurer (2005-present)
- HabitatMT (2011-present)

**Jessica L. Miller, B.S., Senior Chemist, Pesticide Residue Analysis**

Education:
- B.S. Chemistry, Cedar Crest College (2011)

Continuing Education:

Gas Chromatography Principles and Practice (2011)

Professional Experience:
- With Eurofins Lancaster Laboratories since 2011
  - Chemist, Pesticide Residue Analysis (2011)
    - Responsibilities included performing pesticide residue analysis; prescreening samples; calibrating, reviewing, and uploading data
  - Senior Chemist, Pesticide Residue Analysis (2014)
    - Responsibilities include performing pesticide residue analysis; prescreening samples; calibrating, reviewing, and uploading data

Memberships and Appointments:
- Psi Chi
  - Member (2009)
- Gamma Sigma Epsilon
  - Member (2011)

**Megan A. Moeller, B.S., Senior Specialist, Environmental Client Services**

Education:
- B.S. Environmental Science, University of Delaware (1999)

Professional Experience:
- With Lancaster Laboratories since 1999
  - Sample Administration/Client Service Specialist, Environmental Client Services (2003)
    - Responsibilities included Interpretation and entry of incoming samples. Route samples to the correct locations. Assist Client Service representatives with auditing, reviewing reports, and reviewing invoices.
  - Specialist, Environmental Client Services (2004-2006)
    - Responsibilities included managing projects, prepare quotations, audit sample entries, answer client questions, communicate client requirements to lab areas, schedule sample submissions, and provide sample containers.
  - Senior Specialist, Environmental Client Services (2006)
    - Responsibilities include managing projects, prepare quotations, audit sample entries, answer client questions, communicate client requirements to lab areas, schedule sample submissions, and provide sample containers.

**Chad A. Moline, B.S., Senior Chemist, GC/MS Semivolatiles**

Education:
- B.S. Environmental Studies, Slippery Rock University (1998)
- Teaching Certification, Secondary Education, Millersville University (2003)

Professional Experience:
- Centre Analytical Laboratories, Lab Technician (1999-2000)
  - Responsibilities included running various wet chemistry analyses
- Lancaster Laboratories, Chemist/Senior Chemist (2000-2005)
  - Responsibilities included maintaining GC/MS instrumentation
- Warwick School District, Science Teacher (2005-2006)
  - Responsibilities included teaching chemistry and physics to 8th grade students
- Conestoga Valley School District, Science Teacher (2006-2007)
  - Responsibilities included teaching chemistry and earth science to 8th grade students
- With Eurofins Lancaster Laboratories since 2007
  - Senior Chemist Group Leader, GC/MS Semivolatiles (2007)
    - Responsibilities included monitoring workflow; meeting client turnaround times
  - Senior Chemist (2012)
    - Responsibilities include maintaining and operating GC/MS instrumentation

Uncontrolled Copy

**Jeffrey S. Moyer, B.S., Senior Specialist Group Leader, Sample Bottles**

Education:

B.S. Environmental Resource Management, Penn State University (1977)

Professional Experience:

Joseph A. Kodak, Carpenter's Helper (1977-1978)
Responsibilities included performing construction

BP Oil, Inc., Operations Supervisor (1978-1979)
Responsibilities included working on special projects in the regional operations office

Koch Hydrocarbon Company, Terminal Manager (1979-1997)
Responsibilities included managing the operation of a 24 hr/day, 365 day/year propane storage facility; coordinating inventory storage, product quality control, maintenance, safety, and personnel staffing and training; additional responsibilities included facility upgrades and expansion projects

With Lancaster Laboratories since 1997

Specialist, Environmental Sample Administration (1997)
Responsibilities included entering environmental samples for analysis; coordinating projects with client services; updating standard forms; filing client bottle orders; tracking change forms and forwarding updated info to SA department; tracking short hold/rush list; processing gold forms

Specialist, Environmental Client Services (1999)
Responsibilities included acting as technical resource for clients and SA entry; preparing quotes for clients; preparing bottle orders; scheduling sample pickups; auditing acknowledgements and client paperwork; troubleshooting client problems; updating standard forms; processing bottle orders, lab reports, acknowledgements, and COCs; handling reprint requests; preparing SDG reports

Senior Specialist Group Leader, Sample Bottles (2004)
Responsibilities include managing bottles department; coordinating projects with client services; updating bottle code and preservation sheets; updating SOPs; working with purchasing to ensure inventory levels are adequate; backing up transportation coordination

**Jennifer L. Moyer, B.S., Senior Specialist, Metals**

Education:

B.S. Chemistry, Lock Haven University (2000)

Professional Experience:

Lock Haven University, Lab Tech (1996-1998)
Responsibilities included setting up labs; stocking and setting up stock rooms; helping professors with projects

Croda Inc., Process Development Chemist (1998-2000)
Responsibilities included developing and improving procedures on existing products

With Lancaster Laboratories since 2000

Chemist, Metals (2000)
Responsibilities included running and maintaining ICP instruments

Chemist, Metals (2002)
Responsibilities included running and maintaining Graphite Furnace Atomic Absorption instruments

Group Leader/Specialist, Metals (2003)
Responsibilities included overseeing Graphite Furnace Atomic Absorption and Mercury analysts

Senior Specialist, Metals (2007)
Responsibilities include verifying ICP, GFAA, Mercury, and ICP-MS

**Kathrine K. Muramatsu, B.S., Senior Chemist Group Leader, GC/MS Volatiles**

Education:

B.S. Chemistry, University of Colorado (2005)

Continuing Education:

Forensic Science and DNA Testing Certification (2006)
24-Hour Emergency Response (HAZWOPER), Lancaster Laboratories (2009)
American Heart Association (AHA)/American Red Cross certified, Lancaster Laboratories (2009)

Professional Experience:

With Eurofins Lancaster Laboratories since 2007

Chemist, Analytical Chemistry, Professional Scientific Staffing – CO (2007)
Responsibilities included ensuring compliance with cGMPs; performing analysis of system water, clean in place (CIP) samples, clean out of place (COP) samples, and other sample types; methods used were total organic carbon (TOC), pH, conductivity, Limulus Amebocyte Lysate (LAL), and UV spectroscopy

Chemist, GC/MS Volatiles (2007)
Responsibilities included analyzing environmental samples of various sample matrices using purge and trap GC/MS; generating and reviewing raw data; performing instrument maintenance as needed

Uncontrolled Copy

Chemist Group Leader, GC/MS Volatiles (2009)
Responsibilities included supervising and mentoring personnel; coordinating daily workload through prioritizing and scheduling; processing monthly metrics for the department; verifying sample data; analyzing environmental samples of various sample matrices using purge and trap GC/MS; generating and reviewing raw data; performing instrument maintenance as needed
Senior Chemist Group Leader, GC/MS Volatiles (2014)
Responsibilities include supervising and mentoring personnel; coordinating daily workload through prioritizing and scheduling; processing monthly metrics for the department; verifying sample data; analyzing environmental samples of various sample matrices using purge and trap GC/MS; generating and reviewing raw data; performing instrument maintenance as needed

## Awards, Citations, Honorary Societies, and Publications

Dean's List (2002)
Colorado Scholars (2002-2005)
Superlative Service Award (2010)
Two publications in the Journal of Organic Chemistry

## Memberships and Appointments:

American Chemical Society

**Charles J. Neslund, B.S., Technical Director, Volatiles in Air and Specialty Services Group, Eurofins Lancaster Laboratories Environmental**

## Education:

B.S. Chemistry, University of Pittsburgh (1982)

## Continuing Education:

Graduate studies in organic chemistry, University of Pittsburgh (1983)

## Professional Experience:

Lancaster Laboratories (1984-1996)
Chemist (1986)
Group Leader (1987)
Chemist (1991)
OI Analytical, Sales Representative (1996)
With Eurofins Lancaster Laboratories since 1997
Group Leader, GC/MS Semivolatiles (1997)
Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations and financial resources; project management; data interpretation; reviewing and approving data; developing and evaluating new methods; consulting with clients regarding testing needs; revising and updating SOPs and analytical methods
Manager, GC/MS Semivolatiles and Volatiles in Air (2005)
Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations and financial resources; project management; data interpretation; reviewing and approving data; developing and evaluating new methods; consulting with clients regarding testing needs; revising and updating SOPs and analytical methods
Manager, Volatiles in Air and Specialty Services Group (2007)
Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations and financial resources; project management; data interpretation; reviewing and approving data; developing and evaluating new methods; consulting with clients regarding testing needs; revising and updating SOPs and analytical methods; marketing specialty services capabilities; conducting technical presentations
Technical Director, Volatiles in Air and Specialty Services Group, Eurofins Lancaster Laboratories Environmental (2014)
Responsibilities include leading departments in accordance with vision, values, and strategic goals of company; overseeing and facilitating efficient operations and systems, sound business practices, consistent client service, and motivated staff

## Awards, Citations, Honorary Societies & Publications:

Dawson-Grundmann Innovation Award (1995)

## Memberships & Appointments:

American Chemical Society (ACS)
Chromatography Forum of the Delaware Valley (CFDV)
Past member of Executive Committee of the Chromatography Forum of the Delaware Valley
Air & Waste Management Association (A&WMA)
Society of Environmental Toxicology and Chemistry (SETAC)
Sediment Management Workgroup (SMWG)

Uncontrolled Copy

**Deborah A. Neslund, Senior Specialist, Environmental Sample Administration**

Professional Experience:

- Lancaster General Hospital, Phlebotomist (1976-1977)
- Fairfax Hospital, LPN (1978)
- Lancaster General Hospital, Phlebotomist/EKG Technician (1980-1986)
- With Eurofins Lancaster Laboratories since 1986
  - Senior Specialist Coordinator, Environmental Sample Administration (1986)
    - Responsibilities included supervising personnel; directed flow of samples to include prioritization to meet hold times and standards set for rush and other samples; developed and improved systems for efficiency within SA; represented SA in communications with Technical Groups, Client Services, and other support areas; logged-in samples
  - Senior Specialist Group Leader, Environmental Sample Administration (2005)
    - Responsibilities included supervising personnel; directed flow of samples to include prioritization to meet hold times and standards set for rush and other samples; developed and improved systems for efficiency within SA; represented SA in communications with Technical Groups, Client Services, and other support areas; logged-in samples
  - Senior Specialist (2013)
    - Responsibilities include directing flow of samples to include prioritization to meet hold times and standards set for rush and other samples; developing and improving systems for efficiency within SA; representing SA in communications with Technical Groups, Client Services, and other support areas; logging-in samples

**Ryan V. Nolt, B.S., Manager, GC/MS Volatiles**

Education:

- B.S. Chemistry, Millersville University (1997)

Professional Experience:

- With Eurofins Lancaster Laboratories since 1996
  - Clerk II, Sample Support (1996)
    - Responsibilities included performing ASRS operations, preserving incoming samples, homogenizing samples, packing bottle orders, and performing sample discard
  - Senior Technician, ExpressLAB (1997)
    - Responsibilities included performing sample dilutions, preparing standards, prepping samples, and setting up new instruments
  - Chemist, GC/MS Volatiles (1998)
    - Responsibilities included performing purge and trap and GC/MS maintenance; tuning and calibrating GC/MS system; analyzing samples, reviewing, working up, and assembling all supporting data; and preparing new standards
  - Senior Chemist Coordinator, GC/MS Volatiles (2000)
    - Responsibilities included performing routine and non-routine laboratory analysis; diagnosing and solving technical problems; implementing improvements to maximize quality; maintaining and troubleshooting instruments; writing and revising SOPs; validating new methods and equipment; assigning new work to instrument groups and monitoring productivity; training new analysts
  - Principal Chemist Group Leader, GC/MS Volatiles (2005)
    - Responsibilities included performing routine and non-routine laboratory analysis; diagnosing and solving technical problems; implementing improvements to maximize quality; maintaining and troubleshooting instruments; writing and revising SOPs; validating new methods and equipment; assigning new work to instrument groups and monitoring productivity; training new analysts
  - Manager, GC/MS Volatiles (2014)
    - Responsibilities include performing a variety of technical and administrative tasks to develop, evaluate, and supervise staff; planning and monitoring work flow; designing, implementing, and utilizing departmental operations systems; promoting safety; remaining current on technical developments in the area of GC/MS volatiles; communicating with clients; maintaining a strong commitment to quality

Uncontrolled Copy

## Anneliese H. Owen, M.B.A., Manager, Environmental Sample Administration

### Education:

B.S. Molecular and Cell Biology, Pennsylvania State University (1986)
M.B.A. Pennsylvania State University (1993)

### Professional Experience:

With Lancaster Laboratories since 1986
- Coordinator (1987)
- Client Services Specialist (1988)
- Business Development Specialist (1990)
- Group Leader, Environmental Sample Administration (1992)
  - Responsibilities included: supervise personnel; manage laboratory operations and financial resources; sample interpretation and entry; and monitor corrective action for quality issues.
- Manager, Environmental Sample Administration (2005)
  - Responsibilities include: supervise personnel; manage laboratory operations and financial resources; sample interpretation and entry; and monitor corrective action for quality issues.

## Linda C. Pape, B.A., Senior Chemist, GC/MS Volatiles

### Education:

B.A. Business Administration, Milsaps College (1985)

### Professional Experience:

Rite Aid Pharmacy, Store Manager (1985-1989)
- Responsibilities included being responsible for overall maintenance and security of merchandise, store, and property; ordering and display of all merchandise; auditing daily cash and inventory reports; scheduling employees; payroll accounting; training of new and prospective personnel

With Lancaster Laboratories since 1993
- Chemist, Volatiles by GC (1993)
  - Responsibilities included analyzing client-submitted samples and their associated quality control samples by purge-and-trap gas chromatography; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality
- Chemist, Water Quality (2000)
  - In addition to responsibilities listed above performed CN distillation, $PO_4$ digestion, and phenol distillation during a 3-month time frame
- Senior Chemist, Volatiles by GC (2007)
  - Responsibilities included analyzing client-submitted samples and their associated quality control samples by purge-and-trap gas chromatography; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; performing final review (verification) of data for clients (adding appropriate comments as necessary); evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality; training new employees in Volatiles by GC soils
- Senior Chemist, Volatiles by GC/MS (2008)
  - Responsibilities included analyzing client-submitted samples and their associated quality control samples by purge-and-trap gas chromatography/mass spectrometry; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; performing final review (verification) of data for clients (adding appropriate comments as necessary); evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality; training new employees
- Senior Chemist, GC/MS Volatiles (2009)
  - Responsibilities include analyzing client-submitted samples and their associated quality control samples; reviewing and uploading the corresponding data in an efficient manner with a high degree of accuracy and quality; performing final review (verification) of data for clients (adding appropriate comments as necessary); evaluating current organizational and analytical systems; suggesting and implementing necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; initiating and leading technical projects to a timely, accurate, and efficient conclusion while meeting client and/or regulatory requirements with a high degree of quality; training new employees

Uncontrolled Copy

**Cassandre L. Pelto, B.S., Project Manager, Fort Collins Service Center**

Education:

B.S. Biology, University of Central Florida (2008)

Professional Experience:

Environmental Research and Design, Laboratory Technician (2005-2008)

Responsibilities included performing following tests: Color, pH, Alkalinity, Spec. Conductivity, Turbidity, Metals Digestion, TN/TP Digestion, Chloride, Fluoride and Hardness

Environmental Research and Design, Microbiologist/Assistant Laboratory Manager (2008-2010)

Responsibilities included performing tests and QC on Fecal Coliform, E. Coli, and Total Coliform by MF and MTF (MPN); assisted Lab Manager with data entry, QC checks and inspections

Environmental Research and Design, Laboratory Manager (2010-2014)

Responsibilities included personnel Training, Liaison for Inspections, QC Review, Data Entry, Sample receiving, Client Project Management, Inorganic Analysis: Metals, Nutrients, Oil and Grease, Hardness, etc.

With Eurofins Lancaster Laboratories since 2014

Project Manager, Fort Collins Service Center (2014)

Responsibilities include serving as the primary contact for a number of assigned clients; understanding technical information and communicating client requirements to laboratory personnel, helping to ensure that requirements are met; managing large/complex projects according to client technical and schedule requirements; developing strong relationships with major accounts resulting in additional sales; training subordinates; delegating routine tasks; resolving issues when problems arise; participating in departmental process improvement

Memberships and Appointments:

Florida Society of Environmental Analysts

Member (2010-2014)

**James H. Place, B.S., Senior Chemist, Pesticide Residue Analysis**

Education:

B.S. Physical Science, York College of Pennsylvania (1997)

Professional Experience:

AMZ Corporation, Laboratory Technician (1998-2000)

Responsibilities included performing analysis and maintenance of chemical compositions pertaining to electroplating baths

Nichia America Co., Laboratory Technician (2000-2001)

Responsibilities included performing analysis of phosphorus for composition of pigments; performing sample screening and AA analysis

AMZ Corporation, Laboratory Technician (2001-2003)

Responsibilities included performing analysis and maintenance of chemical compositions pertaining to electroplating baths; conducting inventory and ordering chemicals

With Lancaster Laboratories since 2003

Chemist, Pesticide Residue Analysis (2003)

Responsibilities include performing routine and non-routine instrumental analyses of QC and clients' samples for pesticides, PCBs, herbicides, and other related compounds in accordance with departmental methods and SOPs; achieving quality results within the time-frame expected by our clients with minimal daily supervision; maintaining the GCs or HPLCs used for routine analyses; identifying and correcting common instrument or QC problems

Senior Chemist, Pesticide Residue Analysis (2008)

Responsibilities include performing routine and non-routine instrumental analyses of QC and clients' samples for pesticides, PCBs, herbicides, and other related compounds in accordance with departmental methods and SOPs; assisting in implementing special client requests; identifying and offering solutions to correct instrument problems and causes of QC problems; reviewing data for accuracy and completeness (for both routine and non-routine analyses, reports, or data packages); serving as a technical resource for the department

Uncontrolled Copy

**Christine M. Ratcliff, B.S., Principal Specialist, Volatiles in Air**

Education:

B.S. Chemistry, Shippensburg University (1988)

Continuing Education:

Mass Spectral Interpretation, Finnigan MAT Institute (1990)

Professional Experience:

With Lancaster Laboratories since 1988

Chemist (1991)

Coordinator (1994)

Group Leader (1996)

Senior Chemist/Coordinator (1997)

Senior Chemist (2002)

Responsibilities included reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data

Senior Specialist, GC/MS Semivolatiles (2005)

Responsibilities included reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data

Principal Specialist, GC/MS Semivolatiles (2009)

Responsibilities included reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data; performing technical audit of GC/MS semivolatiles data in a timely manner

Principal Specialist, Volatiles in Air (2009)

Responsibilities include reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data; performing technical audit of Volatiles in Air, GC/MS semivolatiles, and GC/MS volatiles data in a timely manner

Principal Specialist, Volatiles in Air (2009)

Responsibilities include reviewing and approving data; revising and updating SOPs and analytical methods; reviewing lab data; performing technical audit of Volatiles in Air, GC/MS semivolatiles, GC/MS volatiles, and dioxans and furans data in a timely manner

**Mark A. Ratcliff, B.A., Senior Specialist, GC/MS Semivolatiles**

Education:

B.A. Physics, Franklin & Marshall College (1988)

Continuing Education:

Finnegan Mass Spectral Interpretation Course (1991)

Professional Experience:

With Lancaster Laboratories since 1989

Chemist (1992)

Senior Chemist (1996)

Responsibilities included: perform GC/MS semivolatiles testing; operate GC/MS instruments; data interpretation; calibrating and repairing instruments; prepare standards; revise and update SOPs; and train other analysts.

Senior Specialist, GC/MS Semivolatiles (2005)

Responsibilities include: perform GC/MS semivolatiles testing; operate GC/MS instruments; data interpretation; calibrating and repairing instruments; prepare standards; revise and update SOPs; and train other analysts.

**Barbara F. Reedy, B.S., Senior Specialist, Environmental Quality Assurance**

Education:

B.S. Environmental Biology, Millersville University (1993)

Continuing Education:

Environmental GC Analysis Seminar, Restek (2001)

The Internet Audit A Quality Tool, PaAAEL (2001)

Advanced Gas Chromatography Mass Spectroscopy Seminar, PaAAEL (2002)

LC/MS/MS System Seminar, Applied Biosystems (2006)

Introduction to Root Cause Analysis, Patton Professional (2007)

When to Initiate Corrective Action, Patton Professional (2007)

Practical Process Improvement Training in the role of Team Member (2008)

GC Pesticide/PCB's Analysis Training Seminar (2008)

NY/PAAAEL Annual Meeting - Internal & Electronic Audits: Satisfying Regulatory Requirements, Corrective and Preventive Actions, Ethics and Data Integrity Training (2009)

Environmental Laboratory Assessment Basic Assessor Training – TNI Standard 2009 (2012)

Uncontrolled Copy

Professional Experience:

Department of Environmental Resources, Division of Rivers and Wetlands, Scientific Intern (1993)

Responsibilities included reviewing wetland permits applications; inspecting and photographing wetland mitigation sites; determining hydrology, soil type, and the consistency of the mitigation with the approved project plans; researching records of the sites

With Eurofins Lancaster Laboratories since 1993

Associate Chemist/Chemist, Volatiles by GC (1993)

Responsibilities included calibrating Capillary, VOA, BTEX, and FID instruments; performing routine maintenance; interpreting, reviewing, and uploading data

Senior Chemist, Volatiles by GC (1999)

Responsibilities included being primary verifier for the majority of data for Volatiles by GC for the ELCD/PID and FID for both waters and soils; signing of analytical reports; generating statistically determined QC windows; training new analysts to review and upload data into the LIMS

Senior Specialist, Environmental Quality Assurance (2001)

Responsibilities include ensuring quality of data being produced in the laboratories by performing data review, auditing laboratories, and reviewing written procedures; ensuring laboratory adherence to government regulations and client requirements; reviewing client and government documents for requirements outside our usual laboratory practices; setup and testing new analysis in the laboratory sample management system as required by the departments; maintaining documentation of agency certifications

Memberships & Appointments:

Pennsylvania Association of Accredited Laboratories (2013-present)

**Beth A. Rich, Senior Specialist, Safety**

Professional Experience:

With Eurofins Lancaster Laboratories since 1998

Senior Administrator, Human Resources (1998)

Responsibilities included entering and maintaining employee information in system; photocopying, filing, maintaining personnel files; tracking mid-year and annual job plan completion; following up on exit interviews and other HR admin and support

Specialist, Human Resources (2005)

Responsibilities included maintaining a high level of human resource generalist knowledge to support all personnel in the HR department and to serve all employees

Senior Specialist, Human Resources (2010)

Responsibilities included maintaining a high level of human resource generalist knowledge to support all personnel in the HR department and to serve all employees

Senior Specialist, Safety (2013)

Responsibilities include managing worker's compensation and return to work programs; coordinating annual health screenings, flu shots, and blood bank donations; setting up new site worker's compensation systems as needed; filing incident reports and tracking recordable incidents; coordinating special medical programs as needed

**John R. Riggs, Jr., B.S., Senior Specialist Group Leader, Environmental Software Development**

Education:

B.S. Professional Studies (Computer Science/Mathematic), Misericordia University (1994)

Continuing Education:

Masters Business Administration, Elizabethtown College (Expected graduation date: 2015)

Professional Experience:

Nissin Foods, Inc., Distribution Supervisor/IT Engineer (1994-1998)

Responsibilities included acting as a liaison between local and corporate management teams; supervised the activities of multiple teams of material handlers engaged in receiving, storing, and shipping finished goods; ensured the accuracy of orders and inventory to meet customer demand; maintained documentation and prepared reports which reflected the effectiveness and efficiency of department activities; Implemented warehouse safety procedures and hold regular safety meetings; established and recommended changes to policies to improve the organization; supported and maintained Novell servers and backups; administered user accounts and email; configured new desktop machines and maintained existing work stations

AVAR, Project Manager/Lead Developer (1998-2014)

Responsibilities included directing the planning, design, production and management of applications and data centers; lead a development team in creating software applications to provide business solutions; acted as a point of contact for vendors, business units, and Information Technology partners during integration of projects, administering schedules and communicating risks; conducted meetings, helping to facilitate communication and maximize productivity; coordinated the work of multiple teams to support applications for data management systems; oversaw creation and maintenance of all unit and system testing plans; supervised the generation of documentation and technical guides for end users; prepared and deliver end-user training

Uncontrolled Copy

With Eurofins Lancaster Laboratories since 2014
Senior Specialist Group Leader, Environmental Software Development (2014)
Responsibilities include providing technical support for maintenance of installed software applications and assisting with the development, installation, and maintenance of new applications for general use; assisting in development, implementation, and maintenance of software intended to improve the quality and efficiency of work performed

## Heidi L. Roberts, B.S., Senior Chemist, Organic Extraction

### Education:

B.S. Environmental Science/Biology, Kutztown University (1996)

### Continuing Education:

P.E. Spectroscopy Seminar, Perkin Elmer (1998)
Statistics, LLU (1999)
Pharm. Calc. Class, LLU (1999)
LLI Leadership Training (2000)
Practical Process Improvement Team Member Training (2008)
Practical Process Improvement Facilitator Training (2010)

### Professional Experience:

M.J. Reider Associates, Lab Technician (1996-1997)
Responsibilities included organics prep/method development for HEM/various wet chemistry analyses.
With Lancaster Laboratories since 1997
Chemist, Metals (1998)
Responsibilities included performing metals analyses, maintenance of instruments, verification of analyses, analyzed GMP samples, administered quad studies, MDL studies, IDL studies.
Coordinator, Metals (1999)
Responsibilities included coordination of GFAA/FAA/Hg group, verification of analyses, instrument maintenance and operation, updating of SOPs, training records, quad studies, MDLs, and IDLs, performed GMP analyses.
Coordinator/Specialist, Environmental Client Services (2001)
Responsibilities included supervising Commercial Account Team and administrators, handle miscellaneous and homeowner calls, prepare bottle orders, audit sample paperwork, monitor sample progress, and handle client concerns.
Group Leader/Senior Specialist, Environmental Client Services (2005)
Responsibilities included supervising Account Management Team and administrator, work with team members on continual process improvement, manage several large client accounts, prepare bottle orders, audit sample paperwork, monitor sample progress, and handle client concerns.
Senior Chemist, Organic Extraction (2007)
Responsibilities include performing non-routine extractions, scheduling prep work, verification of prepped batches, processing MOS reports, managing projects for tobacco analyses, point person for project rollouts.

### Awards, Citations, Honorary Societies, and Publications:

Senior Leadership Group Award, Lancaster Laboratories (2001, 2005, 2007)
Superlative Service Award, Lancaster Laboratories (2004, 2010)

### Memberships and Appointments:

Ethics Committee, Lancaster Laboratories (1998)
MOS Process Improvement Team, Lancaster Laboratories (2005)

## Nicholas R. Rossi, M.S., Senior Chemist, EPH/Misc. GC

### Education:

B.S. Biology, Messiah College (2005)
M.S. Environmental Pollution Control, Penn State Harrisburg (2011)

### Professional Experience:

Vermont Agency of Agriculture, Laboratory Technician/Sample Collector (2004-2005)
Responsibilities included collecting water samples from agricultural sites and extracting samples in the lab
With Eurofins Lancaster Laboratories since 2005
Chemist, GC/MS Volatiles (2005)
Responsibilities included organizing batches of samples, sample preparation, analyzing soil and water samples for volatile organic compounds using purge and trap GC-MS, instrument maintenance, and performing a level II audit on data prior to verification; processing plan improvement (PPI) team to reduce the amount of errors in the prescreen department; evaluating the process, implementing changes, and tracking results

Uncontrolled Copy

Chemist, EPH/Misc. GC (2011)
Responsibilities included analyzing routine and non-routine samples and their associated quality control samples by gas chromatography; reviewing and reporting the corresponding data; maintaining, optimizing, and calibrating equipment (functions are to be performed in an efficient manner with a high degree of accuracy and quality); assisting in organization of related departmental work and in sample preparation (as required) to consistently meet client turnaround time requirements
Senior Chemist, EPH/Misc. GC (2013)
Responsibilities include performing routine and non-routine instrumental analyses of QC and clients' samples for total petroleum hydrocarbons, diesel range organics, and other miscellaneous organic compounds in accordance with departmental methods and SOPs; assisting in implementing special client requests; identifying and offering solutions to correct instrument problems and causes for QC problems; reviewing data for accuracy and completeness for routine and non-routine analyses, reports, or data packages; serving as a technical resource for the department

Memberships and Appointments:
American Chemical Society (2010)
Pennsylvania Department of Environmental Professionals (2011)

**Robin C. Runkle, B.S., Senior Specialist, GC/MS Volatiles**

Education:
B.S. Chemistry, State University of New York at Oneonta (1988)

Continuing Education:
Introduction to Mass Spectral Interpretation, Finnigan Mat (1991)
Gas Chromatography: Practical Theory and Applications for LL (1993)
HP5890 GC Troubleshooting and Maintenance, Hewlett-Packard (1993)
Technical Training, OI Analytical (1995)

Professional Experience:
With Lancaster Laboratories since 1989
Senior Chemist (1993)
Responsibilities included: sample preparation; perform GC/MS volatile testing; operate GC/MS instruments; data interpretation; review and approve data; developing and evaluating new methods; calibrating and repairing instruments; prepare standards; reagent preparation; revise and update SOPs and analytical methods; order supplies; train other analysts; and prepare and test trip blank water.
Senior Specialist, GC/MS Volatiles (2005)
Responsibilities include: data review and verification, review and sign reports, respond to and work on client inquiries and ATF requests.

**Stephanie A. Selis, B.S.E., Senior Chemist, GC/MS Volatiles**

Education:
B.S.E. Biology, Chemistry Minor, Millersville University (1996)

Professional Experience:
Access I, Access II, PC Focus (1997)
Emergency Evacuation Coordinator (1998)
Gas Chromatography Principles and Practices, Lancaster Laboratories University (1998)
GC/MS Theories and Applications, MDL Systems (1999)
Statistics, Lancaster Laboratories University (2000)
Enlightened Leadership: Getting to the Heart of Change, Lancaster Laboratories University (2000)
Building Relationship Versatility: Social Styles at Work, Lancaster Laboratories University (2000)
Leadership at Lancaster Laboratories, Lancaster Laboratories University (2000)
Introduction to Interpretation of Mass Spectra, Lancaster Laboratories University (2005)

Professional Experience:
With Lancaster Laboratories since 1996
Chemist (1996)
Senior Chemist, Volatiles by GC (2000)
Responsibilities included performing sample analysis, troubleshooting, and maintenance; calibrating the system; establishing QC windows for soil analysis; writing SOPs; performing data entry; preparing standards; performing sample verification; training analysts
Senior Chemist, GC/MS Volatiles (2005)
Responsibilities include performing sample analysis; auditing maintenance notebooks; performing troubleshooting, maintenance, and system calibration; preparing standards; performing sample verification; training analysts

Controlled Copy

**Richard A. Shober, B.S., Principal Chemist, Pesticide Residue Analysis**

Education:

B.S. Chemistry, Muhlenberg College (1984)

Continuing Education:

Inductively Coupled Plasma Spectroscopy, Allied Analytical (1985)
ACS Short Course, Analytical Chemistry of Contaminants in Surface and Groundwater (1986)
Gas Chromatography: Practical Theory & Application, Lancaster Laboratories (1994)
Mass Spectral Interpretation, Hewlett-Packard (1995)
Comprehensive HPLC, RESTEK (2010)

Professional Experience:

With Lancaster Laboratories since 1984
Principal Chemist, Pesticide Residue Analysis (1999)
Responsibilities include performing pesticide residue testing; operating gas chromatography instruments; interpreting data; repairing instruments; developing new methods for and operating LC/MS/MS; developing and maintaining computer systems/programs for lab use

Awards, Citations, Honorary Societies & Publications:

Poster paper on computer applications for analytical chemistry
Poster paper on tobacco specific nitrosamine analysis

Biographical Listings:

*Who's Who in Environmental Science*

**Susan B. Shorter, B.S. CTFL, Principal Specialist, Environmental Software Development**

Education:

B.S. Chemistry and Mathematics, Cedar Crest College (1986)
ISTQB Software Testing – Foundations Certification, Certificate #05-CTFL-00172-USA (2005)

Continuing Education:

Introduction to DOS, HACC-Lancaster Campus (09/18/1992)
How to Handle People with Tact and Skill, HACC (06/14/1993)
Challenges Facing Drinking Water Laboratories: ICR, Methods, Quality, and Certification, EPA and Western Michigan University (08/30-31/1994)
How to Evaluate Data from a QA/QC Perspective, EPA (07/07/1997)
Systematic Software Testing, Software Quality Engineering (June 2004)
Software Testing Foundations, Software Quality Engineering (May 2005)

Professional Experience:

With Eurofins Lancaster Laboratories since 1988
Associate Chemist (1988)
Responsibilities included setting up ICP, maintaining ICP, reviewing data from the instrument, reviewing daily oos sheets
Chemist I, Coordinator added 10/1991 (1990)
Responsibilities included setting up ICP, maintaining ICP, reviewing data from the instrument, reviewing daily oos sheets, plus verifying sample analyses, training new employees, maintaining instrumental SOPs
Specialist, Quality Assurance (1991)
Responsibilities included QA coordination for various environmental analytical departments, reviewing data packages, submitting blind and PT samples to ESD, maintaining state certifications, GLP, working with state, agency, and client auditors, technical resource for SDWA
Senior Specialist (previously known as Specialist II), Quality Assurance (1993)
Responsibilities included QA coordination for various environmental analytical departments, reviewing data packages, submitting blind and PT samples to ESD, maintaining state certifications, GLP, working with state, agency, and client auditors, technical resource for SDWA, document review, QAPP generation
Senior Chemist, GC/MS Volatiles (1999)
Responsibilities included auditing GC/MS volatile data, performing QA tasks (filing SOPs, maintaining training records, etc.), auditing MDLs and Quad studies
Senior Specialist, Computer Applications Development (2002)
Responsibilities included writing and executing Test Plans for software quality support; completing documentation as required by policies and procedures for software validation
Senior Specialist, Computer Systems (2007)
Responsibilities included writing and executing Test Plans for software quality support; completing documentation as required by policies and procedures for software validation
Principal Specialist, Environmental Software Development (2013)
Responsibilities include writing and executing Test Plans for software quality support; completing documentation as required by policies and procedures for software validation

Uncontrolled Copy

Memberships & Appointments:

Society of Applied Spectroscopy (1990-1993)
Pennsylvania Association Accredited Environmental Laboratories (PA AAEL) (1992-2004)
Director (1998-2003)
Secretary/Treasurer (1998-2003)

**Jeffrey B. Smith, B.A., Senior Chemist Group Leader, Volatiles in Air**

Education:

B.A. Biology, University of Delaware (1991)

Professional Experience:

Roy F. Weston, Inc., Chemist (1991-1997)
Merck, Chemist (1997-2000)
With Lancaster Laboratories since 2001
Senior Chemist, GC/MS Semivolatiles (2001)
Responsibilities included performing GC/MS analysis of semivolatile organics
Senior Chemist Group Leader, Volatiles in Air (2005)
Responsibilities include tracking of all incoming work and scheduling analysts; tracking all incoming summa orders and assigning to analyst; main CSR contact for group; instrument troubleshooting and maintenance; auditing and certifying data as needed

**Michele J. Smith, B.S., Senior Specialist, Specialty Services Group**

Education:

B.S. Chemistry, St. Mary's College, Notre Dame, Indiana (1998)
22 credits master's study with Penn State University (2000-2002)

Continuing Education:

Gas Chromatography Principles and Practices, Lancaster Laboratories University (1999)
Statistics, Lancaster Laboratories University (2000)

Professional Experience:

St. Mary's College, Laboratory Teaching Assistant (1996-1998)
Responsibilities included: assisted professor in the laboratory—responsible for experiment demonstrations, answered student's questions, and graded lab reports.
With Lancaster Laboratories since 1998
Chemist (1998)
Responsibilities included: maintain GC/MS instrumentation, tune and calibrate GC/MS, analyze samples by GC/MS, review and assemble all supporting GC/MS data, review daily QC outliers.
Senior Chemist (2001)
Responsibilities included: maintain GC/MS instrumentation, tune and calibrate GC/MS, analyze samples by GC/MS, review and assemble all supporting GC/MS data, perform technical audit of GC/MS and HPLC, sign analysis reports, track samples to meet turn around time.
Senior Chemist Coordinator (2004)
Responsibilities included: maintain GC/MS instrumentation, tune and calibrate GC/MS, analyze samples by GC/MS, review and assemble all supporting GC/MS data, perform technical audit of GC/MS and HPLC, sign analysis reports, track samples to meet turn around time.
Senior Specialist Group Leader, GC/MS Semivolatiles (2005)
Responsibilities included: review and assemble GC/MS data, perform technical audit of GC/MS and HPLC, sign analysis reports, schedule and track samples to meet turn around time.
Senior Specialist, Environmental Client Services (2008)
Responsibilities included auditing sample paperwork; setting up standard forms; generating bottle orders; preparing quotes
Senior Specialist, Specialty Services Group (2011)
Responsibilities include maintaining instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; diagnosing complex problems and offering solutions with a high degree of independence; suggesting and implementing improvements to maximize quality and productivity; acting as technical resource for internal problems and projects; assisting in "brainstorming" client problems and projects; training new employees in all aspects of instrumentation; researching new and emerging technologies

Memberships and Appointments:

American Chemical Society (1998-2002)

Uncontrolled Copy

**Tara M. Spaide, Senior Specialist, Environmental Client Services**

Continuing Education:

Algebra and Analytical Geometry, Pennsylvania State University (1993)
Chemistry, Pennsylvania State University (1993)

Professional Experience:

With Lancaster Laboratories since 1986
- Senior Specialist Coordinator, Organic Extraction (1997)
  - Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations; reviewing and approving data; and revising and updating analytical methods
- Senior Chemist Coordinator, Organic Extraction (2003)
  - Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations; reviewing and approving data; and revising and updating analytical methods
- Senior Chemist Group Leader, Organic Extraction (2005)
  - Responsibilities included supervising personnel; scheduling lab work; managing laboratory operations; reviewing and approving data; and revising and updating analytical methods
- Senior Specialist, Environmental Client Services (2007)
  - Responsibilities include auditing sample paperwork; setting up standard forms; generating bottle orders; preparing quotes

**Chelsea B. Stong, B.S., Senior Chemist, GC/MS Volatiles**

Education:

B.S. Biology, Eastern University (2007)

Professional Experience:

With Lancaster Laboratories since 2006
- Laboratory Technician, GC/MS Volatiles (2006)
  - Responsibilities included scanning samples into LIMS; prepping samples for analysis
- Chemist, GC/MS Volatiles (2007)
  - Responsibilities included analyzing water and soil samples using a GC/MS; prepping samples for analysis; working up raw data
- Senior Chemist, GC/MS Volatiles (2012)
  - Responsibilities include maintaining GC/MS instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; suggesting and implementing the necessary corrective action to ensure the above can be performed in alignment with client an/or regulatory requirements; performing all duties with minimal supervision; working on special assignments; diagnosing complex problems and offering solutions with a high degree of independence; assisting in "brainstorming" client problems and projects; completing assigned projects on time; researching new and emerging technologies; producing written and oral reports on research activities

**Andrew J. Strebel, Principal Chemist, GC/MS Semivolatiles**

Continuing Education:

Advanced Aquarius Programmers Course, Hewlett-Packard (1989)
Environmental Applications of GC/MS, Indiana University (1989)
Environmental GC-MS (DOS) Operation, Hewlett-Packard (1995)
Unix Module 1, Albright College (1995)
Unix Module 2, Albright College (1995)
Unix Shell Scripts, Albright College (1995)
Unix AWK Programming, Albright College (1995)
Target Training, Thru-Put Systems, Inc. (1995)
Report Writer Training, Thru-Put Systems, Inc. (1998)
HP-UX System Administration for HP 9000s, Hewlett Packard (1998)
HP-UX Troubleshooting for HP 9000s, Hewlett Packard (1998)
GC/MS Training Course, MDL Systems (1999)
LC/MS/MS 101 Training Course, Basic Mass Spec Solutions, Inc. (2001)

Professional Experience:

With Lancaster Laboratories since 1986
- Technical Specialist (1991)
- Chemist (1994)
- Senior Chemist (1997)
- Principal Chemist, GC/MS Semivolatiles (2001)
  - Responsibilities include: perform routine semivolatile testing; operate GC/MS semivolatile instruments; data interpretation; review and approve data; developing and evaluating new methods; calibrating and repairing instruments; prepare standards; revise and update SOPs and analytical methods; train other analysts; develop and maintain computer systems/programs for lab use; and computer validation testing.

Controlled Copy

**Robert Strocko, Jr., B.S., Manager, Metals and Microbiology**

Education:

B.S. Biology, York College of Pennsylvania (1988)

Continuing Education:

Thermo Jarrel l ASA ICP Course, Thermo Jarrell ASA (1993)

Professional Experience:

Springettsbury Waste Water Treatment Facility, Chemistry Technician (1986-1988)

Responsibilities included running NPDES tests on wastewater, % solids, NH4, pH, BOD, suspended solids, coliform, dissolved solids, temperature, and Hexa-Chrome testing

Penn Dairies, Laboratory Technician (1988-1989)

Responsibilities included testing raw milk for coliform bacteria for acceptance; performing milk-fat percent solids on milk products; calculating sugar content in sweetened milk

Pennsylvania Department of Environmental Resources, Chemistry Technician (1989-1992)

Responsibilities included receiving samples; logging data for analysis to computer; handling field sampling questions; operating flame AA; shipping cooler to field samples

With Eurofins Lancaster Laboratories since 1992

Chemist, Metals (1992)

Responsibilities included setting up, pouring, and running samples on ICP; reviewing and verifying ICP data; performing instrument maintenance; calculating IDLs, MDLs, and linear ranges; writing SOPs

Chemist/Coordinator, Metals (1996)

Responsibilities included overseeing prep room personnel and work flow; scheduling work flow through prep room; writing job plans and job reviews; ordering standards and reagents; overchecking notebooks

Manager, Metals (1998)

Responsibilities include overseeing technical areas in ICP, low-level mercury, ICP-MS, and mercury; writing SOPs, ICARs, etc.; writing job plans and job reviews; handling technical questions for clients/client services; verifying ICP/ICP-MS/Hg data

Manager, Metals Analysis and Microbiology (2013)

Responsibilities included overseeing technical areas in ICP, low-level mercury, ICP-MS, and mercury; writing SOPs, ICARs, etc.; writing job plans and job reviews; handling technical questions for clients/client services; verifying ICP/ICP-MS/Hg data

Manager, Metals Analysis and Microbiology (2014)

Responsibilities include included overseeing technical areas in ICP, low-level mercury, ICP-MS, and mercury; writing SOPs, ICARs, etc.; writing job plans and job reviews; handling technical questions for clients/client services; verifying ICP/ICP-MS/Hg data; overseeing technical area in Microbiology; tests include Colilert (presence/absence), Colilert (Q-tray), Heterotrophic Plate Count (HPC), Fecal Coliform by Membrane Filtration, Yeast and Mold, Hydrocarbon degraders; overseeing writing of SOPs, responding to ICARs; writing job plans and job reviews; handling technical questions for clients/client services; verifying data

**Christiane S. Sweigart, B.S., Senior Specialist, Environmental Quality Assurance**

Education:

B.S. Science, Elizabethtown College (1985)

Medical/Technology Degree, St. Joseph School of Medical Technology (1985)

Continuing Education:

The Principals of Gas Chromatography (1993)

Statistics Course (1993)

Creative Training Techniques Conference (1997)

SEDD/ADR Implementation Workshop (2008)

ERPTOOLSX (Environmental Resources Planning Tools) (2010)

PPI (Practical Process Improvement) - Facilitator Training (2011)

Professional Experience:

With Eurofins Lancaster Laboratories since 1985

Chemist, GC/MS (1985)

Responsibilities included GC/MS operation targeting VOA and BNA compounds, instrument maintenance, sample handling, and data handling (interpretation and documentation)

Chemist, GC/VOA (1986)

Responsibilities included GC operation targeting both aromatic and halogenated compounds, FID operation, instrument maintenance, sample handling, and data handling (interpretation and documentation); training others on FID methods, development of training/reference manual for FID, development of internal Operating Manual, standard documentation, definition and maintenance of statistically defined windows, and temporary coordinator in Department 4025

Chemist Coordinator, GC/VOA (1993)

Responsibilities included coordination of sample analysis and data management; job plans and feedback for several personnel; communication both internal and external, and data handling (interpretation and documentation; and combination of existing department with another (personnel, instrumentation, and sample volume)

Controlled Copy

Senior Specialist, Human Resources (1997)
Responsibilities included recruiting, training, and professional development
Senior Specialist, Electronic Data Deliverables (2001)
Responsibilities included EDD generation, EDD content review, and communication (internal and external)
Senior Specialist, Environmental Quality Assurance (2013)
Responsibilities include ensuring quality of operations and data being produced in the laboratories; ensuring laboratory adherence to government regulations and client requirements; independently performing complex work and special projects in addition to routine and non-routine duties

Awards, Citations, Honorary Societies & Publications:
Recognition for the implementation of a revamped New Hire Orientation (1999)
Recognition for the development and presentation of the Ethic's Refresher (2001)

Memberships & Appointments:
LCAHRM (1997-2001)

**Lawrence M. Taylor, B.S., Senior Specialist, GC/MS Volatiles**

Education:
B.S. Chemistry, Shippensburg University (1989)

Continuing Education:
QA Report Operator Training Course, Finnigan Mat Institute (1990)
Technical Training, OI Analytical (1995)
Mass Spectral Interpretation Course, Hewlett-Packard (1995)
Archon Training Course, PTS (1997)

Professional Experience:
With Lancaster Laboratories since 1989
Senior Chemist (1992)
Responsibilities included GC/MS volatile data interpretation; review and approve data; verify sample results, and sign reports.
Senior Specialist, GC/MS Volatiles (2005)
Responsibilities include GC/MS volatile data interpretation; review and approve data; verify sample results, and sign reports.

**Valerie L. Tomayko, B.S., Principal Specialist, Pesticide Residue Analysis**

Education:
A.S. Chemical Engineering Technology, Pennsylvania State University (1977)
B.S. Human Resource Management, Geneva College (1993)

Professional Experience:
Hercules Inc., Laboratory Technician (1977-1983)
Antech Ltd., Associate Chemist, (1985-1989)
Quanterra (formerly Wadsworth/Alert), Chemist, (1989-1997)
UEC (United States Steel Engineering Consultants), Chemist (1997)
With Lancaster Laboratories since 1997
Senior Chemist, Pesticide Residue Analysis (1997)
Responsibilities included: data interpretation; review and approve data; review data packages; and generate statistical QC limits for Pesticide Residue Analysis and Extractable Petroleum Hydrocarbons/MBC GC and Nitrosamines departments.
Senior Chemist Coordinator, Pesticide Residue Analysis (2001)
Responsibilities included: Monitor turnaround time and status of samples and packages; coordinate work flow; track employees' progress; assist in implementing procedures/protocols for meeting QA requirements, data package requirements, and special client or project-specific requests. In addition to data interpretation; review and approve data; review data packages; and generate statistical QC limits for Pesticide Residue Analysis and Extractable Petroleum Hydrocarbons/MBC GC and Nitrosamines departments.
Senior Specialist Group Leader, Pesticide Residue Analysis (2005)
Responsibilities included: Monitor turnaround time and status of samples and packages; coordinate work flow; track employees' progress; assist in implementing procedures/protocols for meeting QA requirements, data package requirements, and special client or project-specific requests. In addition to data interpretation; review and approve data; review data packages; and generate statistical QC limits for Pesticide Residue Analysis and Extractable Petroleum Hydrocarbons/MBC GC and Nitrosamines departments.
Senior Specialist Group Leader, Volatiles by GC (2006)
Responsibilities included: Monitor turnaround time and status of samples; coordinate work flow; track employees' progress; assist in implementing procedures/protocols for meeting QA requirements, data package requirements, and special client or project-specific requests. In addition to data interpretation; review and approve data; review data packages; and generate statistical QC limits for GC Volatile analysis.

Uncontrolled Copy

Principal Specialist, Pesticide Residue Analysis (2011)

Responsibilities include reviewing laboratory data for technical compliance to methods, SOPs, client protocols, and regulatory agency requirements; overchecking and verifying data from the analysts performing instrumental analyses, including QC and clients' samples for pesticides, PCBs, herbicides, and other related compounds; reviewing data for accuracy and completeness (for routine and non-routine analyses, analytical reports, and/or data packages); assisting in implementing special client requests that impact data processing and reporting; identifying and offering solutions to correct problems related to data processing and reporting; serving as a technical resource for the department with regard to QA/QC procedures and issues

## Luz C. Torres, B.S., Senior Specialist Group Leader, Data Deliverables

### Education:

B.S. Secretarial Sciences, Catholic University of Puerto Rico (1982)

### Continuing Education:

English as a Second Language, Spanish American Civic Association (1988)
Computer Literacy, Spanish American Civic Association (1989)

### Professional Experience:

Dr. Jose Moro, Pediatrician, Administrative Secretary (1976-1986)

Responsibilities included customer service, answering phone, collecting payment, billing medical insurance, dictation, transcription, writing letters, filing, archiving, account receivables, ordering supplies.

With Lancaster Laboratories since 1988

Laboratory Assistant, Water Quality (1988)

Responsibilities included washing glassware, assisting technical staff by performing Odor and TDS analyses.

Clerk II, Data Deliverables (1991)

Responsibilities included data package assembly, tracking/preparing/sending QC summary reports, processing and sending data packages, generating and sending Lotus Text file disks, and DP content review.

Administrator I, II, III, Data Deliverables (1992)

Responsibilities included DP assembly, DP content review, review of analytical data, DP processing and sending, training new hires and current staff learning new tasks, DP corrections follow up.

Specialist Coordinator, Data Deliverables (1996)

Responsibilities included technical data review, package correction and problems investigation, Package TAT monitoring, oversee data package assembly, content review, and data package processing, documentation of departmental procedures, maintenance of database, interviewing, supervision of personnel

Senior Specialist Coordinator, Data Deliverables (2003)

Responsibilities included QA review, interviewing, supervision of personnel including writing job plan and performance evaluation, package correction and problems investigation, package TAT monitoring, documentation of departmental procedures, training new hires and cross-training employee from other areas, maintenance of method summary database, oversee data package assembly, content review, and data package processing.

Senior Specialist Group Leader, Data Deliverables (2005)

Responsibilities include QA review, interviewing, supervision of personnel including writing job plan and performance evaluation, package correction and problems investigation, package TAT monitoring, documentation of departmental procedures, training new hires and cross-training employee from other areas, maintenance of method summary database, oversee data package review and data package processing.

## Timothy J. Trees, A.A.S., Principal Chemist, Specialty Services Group

### Education:

Certificate, N.Y.S. Water/Wastewater Treatment Operations, Columbia Greene Community College (1985)
A.A.S. Environmental Control of Hazardous Waste/Water Quality, Ulster County Community College (1988)

### Continuing Education:

Water Treatment Operations, NYS License Board (1984)
Wastewater Treatment Operations, NYS License Board (1986)
Varian AA Course (1992)
Service Operations Process Optimization, Pennsylvania State University (1992)
Hitachi GFAA Workshop, Hitachi, CT (1994)
24-hour HAZWOPER (spill response) (1995)
Atomic Spectroscopy Workshop, Perkin-Elmer (1997)

Uncontrolled Copy

## Professional Experience:

York Wastewater Management (1985-1986)
Rider Engineering (1986-1988)
With Eurofins Lancaster Laboratories since 1988

Senior Technician, Metals (1988)

Responsibilities included: operation, maintenance, and sample preparation of mercury cold vapor and hydride generation instrumentation for the determination of mercury, arsenic, and selenium; data entry; troubleshooting instruments; repair of instrumentations' electronic system.

Chemist I, Metals (1990)

Responsibilities included: operation and maintenance of graphite furnace instrumentation; verification of mercury cold vapor and hydride generation data; coaching and training of personnel in the operation of mercury and hydride instrumentation; troubleshooting and repair of instrumentations' mechanical and electronic system.

Chemist I/Coordinator, Metals (1992)

Responsibilities included: operation and maintenance of graphite furnace instrumentation; ICP operation; verification of mercury cold vapor and hydride generation data; coaching and training of personnel in the operation of mercury, hydride, and graphite furnace instrumentation; troubleshooting and repair of instrumentations' mechanical and electronic system; systems operation optimization to increase production; scheduling of personnel for department operation; job plan and review with employees.

Chemist II/Coordinator, Metals (1993)

Responsibilities included: coaching and training of personnel in the operation of mercury, hydride, and graphite furnace instrumentation; assist clients with data interpretation and process improvement; ICP operation; verification of graphite furnace, mercury cold vapor, and hydride generation data; data package review; troubleshooting and repair of instrumentations' mechanical and electronic systems; system operations optimization to increase production; scheduling of personnel for department operation; job plan and review with employees.

Senior Chemist/Coordinator, Metals (1994)

Responsibilities included: operation, maintenance, repair, and troubleshooting of department graphite furnaces; flame atomic absorption, mercury cold vapor, hydride generation, and Inductively Coupled Plasma Instrumentation as well as computer systems used in the operation with these instruments; data qualification, interpretation, and verification of department workload; assist clients with interpretation of data, cause and effect; coaching and training of department personnel in areas of sample preparation, instrument setup, maintenance, and analysis using these instruments; job plan, review, and evaluation with employees; ordering of supplies; maintained operation of Metals Atomic Absorption for the department; method development for both environmental and pharmaceutical divisions for graphite furnace and ICP work; Set up and maintain, all SOPs and documentation for computer systems and instrumentation to comply with GMP regulations; data package review for metals analysis; review and verification of ICP data as needed.

Principal Chemist/Coordinator, Metals (1996)

Responsibilities included: operation, maintenance, repair, and troubleshooting of department graphite furnaces; flame atomic absorption, mercury cold vapor, hydride generation, and Inductively Coupled Plasma Instrumentation as well as computer systems used in the operation with these instruments; data qualification, interpretation, and verification of department workload; assist clients with interpretation of data, cause and effect; coaching and training of department personnel in areas of sample preparation, instrument setup, maintenance, and analysis using these instruments; job plan, review, and evaluation with employees; ordering of supplies; maintained operation of Metals Atomic Absorption for the department; method development for both environmental and pharmaceutical divisions for graphite furnace and ICP work; Set up and maintain, all SOPs and documentation for computer systems and instrumentation to comply with GMP regulations; data package review for metals analysis; review and verification of ICP data as needed.

Senior Chemist, GC/MS Semivolatiles (1998)

Responsibilities included: operation, maintenance, and troubleshooting of GC/MS instrumentation; HP5890, 6890 GC, 5971, 5972, 5973 Mass Spec; review and data interpretation of various analyses including but not limited to, 8270C, Appendix IX, 625, CLP 3/90, and 2/88; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures.

Principal Chemist, GC/MS Semivolatiles (2001)

Responsibilities included: operation, maintenance, and troubleshooting of GC/MS instrumentation; HP5890, 6890 GC, 5971,5972, 5973 Mass Spec; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including but not limited to 8270C, Appendix IX, 625, CLP 3/90 and 2/88; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; analysis and troubleshooting of HPLC and analysis of PAHs; coaching and training of analysts to assist with troubleshooting; working in Pharmaceutical Method Development and Validation, operating LC/MS, LC/MS/MS, and GC/MS instrumentation, and performing instrument qualifications since June 2003

Principal Chemist, Flexible Staffing (2006)

Responsibilities included working in GC/MS Volatiles in Air department; operation, maintenance, and troubleshooting GC/MS instrumentation; HP5890, 6890 GC, 5971, 5972, 5973 Mass Spec; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including but not limited to TO-15 and TO-14; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; ability to operate a variety of instrumentation and data systems

Principal Chemist, GC/MS Semivolatiles (2007)

Responsibilities included operating, performing maintenance on, and troubleshooting GC/MS instrumentation; HP5890, 6890 GC, 5971,5972, 5973, 5975 Mass Spec; setting up and performing method development of Thermo Fisher TRACE GC and DSQ II MS; performing method development using both EI and CI mode of analysis; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including, but not limited to, 8270C, Appendix IX, 625, CLP 3/90 and 2/88; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; analysis and troubleshooting of HPLC and analysis of PAHs; coaching and training of analysts to assist with troubleshooting; Including working in GC/MS Volatiles in Air department; operation, maintenance, and troubleshooting GC/MS instrumentation; HP5890, 6890 GC, 5971, 5972, 5973 Mass Spec; method development, research, and development of GC/MS procedures; review and data interpretation of various analyses including but not limited to TO-15 and TO-14; standards preparation for various methods; data interpretation and data package assembly of batch data; evaluation and review of system procedures; ability to operate a variety of instrumentation and data systems

Principal Chemist, Specialty Services Group (2011)

Responsibilities include acting as technical resource within the environmental division; developing and validating analytical protocols; troubleshooting and solving analytical chemistry problems; optimizing instrument configuration and performance; evaluating and interpreting analytical results; writing SOPs; assisting in responding to and eliminating ICARs, assisting in optimizing procedures in prep lab; communicating effectively within department; performing routine work as required. Maintain and operation of Thermo Fisher Scientific TSQ Quantum XLS MS/MS as well as TSQ8000 MS/MS with a Trace 1310 GC; developing methods utilizing GC triple Quad technology in a variety of matrices; utilizing various extraction technologies such as QuEChERS (Quick, Easy, Cheap, Effective, Rugged, and Safe) to effectively extract and cleanup sample matrices

## Holly L. Trego, M.S., Manager, Computer Applications Development

### Education:

B.S. Computer Science, Millersville University (1998)

M.S. Computer Science, Pennsylvania State University (2004)

### Professional Experience:

Millersville University (1994-1998)

Computer Programmer

Responsibilities included organizing meetings with staff of Academic Advising and students; maintained statistics on students grades in the Undeclared program using SAS; created reports in Cobol to report on the statistics; organized summer orientation for the Undeclared program.

Internet Programmer

Responsibilities included creating and maintaining various interactive web pages to allow students to view information; developed web site for students to vote on what classes departments should offer.

With Lancaster Laboratories since 1996

Senior Specialist, Computer Applications Development (1996)

Responsibilities included write Visual Basic code to general client reports; design Powerbuilder System with customized macros which processes analytical data; develop data acquisition software with SQL*Loader.

Senior Specialist/Group Leader, Computer Applications Development (2005)

Responsibilities included managing environmental application development projects, maintenance of existing applications.

Manager, Computer Applications Development (2007)

Responsibilities include managing environmental application development projects, maintenance of existing applications.

**Dennis Urban, M.S., Principal Specialist, Training**

Education:

B.A. Chemistry, Millersville University (1972)
M.S. Chemistry, St. Joseph's University (1976)
M.S. Applied Statistics, Villanova University (1998)

Continuing Education:

Waters HPLC Training Course, Techniques, Instrument Maintenance, and Service, Waters Associates (1979)
Technicon Autoanalyzer Techniques, Technicon (1982)
Fundamentals of Gas Chromatography, Perkin-Elmer Corporation
FTIR Spectrometry, Theory, Techniques, and Application, Analect Instruments (1983)
FTIR Spectrometry, Pittsburgh Conference (1985)
Infrared Spectroscopy II: Instrumentation, Polymer Spectra, Sample Handling, and Computer Assisted Spectroscopy, Bowdoin College (1985)
Infrared Spectroscopy I: Interpretation of Spectra, Bowdoin College (1986)
Theoretical and Applied Statistics, RCA (1987)
Purge and Trap Training Course: Theory, Operation, and Maintenance, Tekmar Company (1990)
Chemometrics for Chemists, Spectros Associates (1993)
Statistically Sound Procedures for Calculating MDLs and PQLs from Calibration Data, Pittsburgh Conference (1995)
Design and Analysis of Experiments, Institute for Professional Education (1996)
Experimental Design for Productivity & Quality in R & D, ACS Shore Course (1996)

Professional Experience:

RCA, Chemistry and Physics Laboratory, Associate Engineering Technician (1972-1977)
Wyeth Labs, Analytical Quality Control Laboratory, Control Analyst (1977-1979)
Responsibilities included performing the necessary chemical and physical testing of all raw materials used in the manufacturing facility; techniques used were GC, IR, UV/VIS, AA, and wet chemical methods
Wyeth Labs, Drug in Feed Group, Chemist (1979-1980)
Responsibilities included developing and validating HPLC methods for analyzing the drug content in various animal feed matrices used in toxicology studies; conducted stability studies of drug in feed mixtures
RCA, Member, Technical Staff (1980-1987)
Responsibilities included method development and analytical support and troubleshooting to the manufacturing particle size analysis, and classical wet chemical methods
With Eurofins Lancaster Laboratories since 1987
Principal Chemist (1997)
Responsibilities included methods development and validation; instrument maintenance, troubleshooting and repair; and analyst training
Principal Specialist, Training (2000)
Responsibilities include developing, designing, and presenting in-house technical training programs, consulting with laboratory personnel and management on the proper use of appropriate statistical procedures and in the interpretation of statistical results

Memberships & Appointments:

American Chemical Society
American Statistical Association

**Nicole M. Veety, B.S., Senior Chemist Group Leader, Instrumental Water Quality**

Education:

AA Psychology, Harrisburg Area Community College (1997)
B.S. Psychobiology, Lebanon Valley College (2000)

Professional Experience:

With Eurofins Lancaster Laboratories since 2000
Senior Technician, Instrumental Water Quality (2000)
Responsibilities included various prep analyses, data entry, TOC and TOX analyses.
Chemist, Instrumental Water Quality (2003)
Responsibilities included performing various analyses, verification, and review and revise SOPs.
Senior Chemist, Instrumental Water Quality (2006)
Responsibilities include performing various analyses, method development, verification, and review and revise SOPs.
Senior Chemist Group Leader, Instrumental Water Quality (2009)
Responsibilities include performing various analyses, method development, verification, and review and revise SOPs; acting as a technical resource, trainer, and troubleshooter; making recommendations for operational and/or technical improvements; coaching and developing direct reports; planning and monitoring workflow.

Awards, Citations, Honorary Societies, and Publications:

Phi Theta Kappa National Honor Society (Alpha Nu Omega) (1996-2000)

Uncontrolled Copy

**Robert Todd Vincent, B.S., Principal Chemist, Organic Extraction**

Education:

B.S. Chemistry, West Virginia Wesleyan College (2001)

Professional Experience:

With Lancaster Laboratories since 2001

Chemist, EPH/Misc. GC (2001)

Responsibilities included analyzing samples; performing equipment repair; GC method development

Chemist, Organic Extraction (2005)

Responsibilities included performing method development; equipment repair

Senior Chemist, Organic Extraction (2007)

Responsibilities included performing method development; equipment repair; vendor relations; technology evaluation

Principal Chemist, Organic Extraction (2011)

Responsibilities include performing high level, difficult preps (with minimal supervision or guidance) following standard operating procedures (SOPs); self train in new techniques; entering information into computer; training new or existing employees in extraction techniques or use of equipment; using knowledge to actively improve current processes; developing, enhancing, and validating new extraction methods; keeping work area clean and organized; preparing spikes; repairing equipment; updating departmental SOPs and training manual; disposing of wastes in approved manner; assisting in incident prevention and remediation when necessary

**Harry D. Ward, Ph.D., Principal Specialist Group Leader, Training**

Education:

B.S. Chemistry, Muhlenberg College (1980)

Ph.D. Organic Chemistry, University of Delaware (1985)

Professional Experience:

Armstrong World Industries, Inc., Research Scientist (1985-2003)

Responsibilities included performing research and development related to flooring

With Eurofins Lancaster Laboratories since 2003

Senior Chemist, Pharmaceutical Product Testing (2003)

Responsibilities included performing pharmaceutical product testing

Senior Chemist, Method Development & Validation (2005)

Responsibilities included performing pharmaceutical method development and validation

Senior Training Specialist, Human Resources (2006)

Responsibilities included design and delivery of core and elective technical training

Principal Training Specialist, Human Resources (2008)

Responsibilities included design and delivery of core and elective technical training

Principal Specialist Group Leader, Training (2011)

Responsibilities include managing the resources of the technical training group; designing and delivering core and elective technical training

**Barbara J. Weaver, M.S., CIH, Principal Specialist, Training and Development, Human Resources**

Education:

B.S. Chemistry, Elizabethtown College (1971)

M.S. Analytical Chemistry, Illinois Institute of Technology (2001)

Certifications:

CIH - American Board of Industrial Hygiene - Certified in the comprehensive practice of industrial hygiene (1983), Certification #2719

Uncontrolled Copy

## Continuing Education:

Business Law, Elizabethtown College (1979)
NIOSH Course #553 "Industrial Hygiene Sampling, Decision Making, Monitoring and Record Keeping, Sampling Strategies" (1979)
Industrial Toxicology, 5-Day Workshop, Thomas Jefferson University (1980)
Special Topics: Environmental Analytical Chemistry, Graduate Work, Villanova University (1981)
"Comprehensive Industrial Hygiene Review", University of Cincinnati, NIOSH Education Resource Center (1983)
Environmental Health, Graduate Work, West Chester University (1985)
Chemical Hygiene - The OSHA Laboratory Standard, NEAIHA PDC (1990)
Health and Safety Management for Hazardous Waste Professionals, AIHA PDC #11 (1990)
Financial Accounting, Penn State (1990)
NIOSH Course #582 "Sample and Analysis of Airborne Asbestos Dust", NIOSH Education Resource Center, Cincinnati (1992)
Survey of Management, Penn State University (1993)
Laboratory Safety and Health, American Chemical Society (1994)
24-hour HAZWOPER (spill response) and Refreshers (1995-present)
Health, Safety, and Environmental Auditing, Johns Hopkins (1995)
Managing Ionizing Radiation Programs for Industrial Hygienists, AIHA (1996)
Radiation Safety Officer Training, Radiation Safety Associates, MA (1997)
Presenting Data and Information, Edward R. Tufte, Graphic Press LLC (2005)
IATA/FIATA Dangerous Goods, IATA (2007)
GC/MS Training Seminar, Restek (2008)
IATA Dangerous Goods Refresher Training, DGI (2009)
Exposure Assessment Strategies and Statistics, 4.6 CEUs, AIHA (2009)
Practical Process Improvement, Training in the Role of Facilitator (2010)
DOT (49CFR) Shipper Course, DGI (2011)
8-hr HAZWOPER refresher (2011)
IATA Acceptance Training, all inclusive (2011)

## Professional Experience:

Warner Lambert, Inc., Quality Control Chemist (1970-1973)
Responsibilities included performing USP/NF and client-specific raw materials and product testing; conducting specific project assignments such as documentation of product-specific alcohol denaturing at supplier's site; pre-market new product quality control testing; serving on panels for testing fragrance and color

Hershey Medical Center, Junior Research Technician (1973-1974)
Responsibilities included developing rubidium-crystal FID-GC (nitrogen sensitive) methods for the low level detection of barbiturates in solution and in blood extracts; performing analysis of blood and spiked blood from rat and monkey; performing analysis of a specific liver enzyme; using preparative fix-angle ultracentrifuge in sample preparation; developing electron microscopy photographs for liver cell mitochondria study

Elizabethtown College, Laboratory Instructor (1977-1978)
Responsibilities included preparing materials for freshman chemistry laboratories; providing basic laboratory instruction for freshmen; conducting research on the separation of linoleic and linolenic acids (omega-3 and omega-6 fatty acids in olive oil) using spinning band distillation; testing flame-retardant cellulose insulation to determine the flame-retardant formulation for industrial client

With Lancaster Laboratories since 1978

Chemist, Air Quality/Industrial Hygiene (1978)
Responsibilities included performing air and miscellaneous chemical analysis using gas chromatography, colorimetric analysis, UV-Vis, spectrophotometry, fiber-counting using phase contrast microscopy, and infrared analysis

Program Manager, Air Quality/Industrial Hygiene (1978)
Responsibilities for the Air Quality and Miscellaneous Chemistry Group included conducting NIOSH, OSHA, and EPA air sampling and analysis; industrial hygiene (air quality and employee exposure in the workplace) consulting services; responsibilities for laboratory work included method development for analysis of pharmaceutical active compounds in air; method development for the FID-GC analysis of cholesterol and fatty acid profiles; infra-red and gas chromatography methods; forensic sample analysis and expert witness testimony; USP/NF testing, some ASTM testing, analytical microscopy using phase contrast, fluorescence and light microscopy; preparing and/or submitting PAT and QA test samples and blanks for analysis; business development, technical writing, proposal, pricing and quote development, and client services for QA/IH; managing the industrial hygiene field sampling/consultation and industrial hygiene/miscellaneous chemistry (client special projects) lab group; maintaining DEA registration; serving as laboratory director for the AIHA analytical laboratory certification for more than 10 years

Marketing and Technical Services Specialist, Business Development (1987)
Responsibilities included inside and external business development including client visits and trade shows; serving as client services/account representative for air quality, foods, and pharmaceutical sciences; creating and tracking quotes and responses to requests for bids and proposals; continued to serve as laboratory director for the AIHA analytical laboratory certification

Uncontrolled Copy

Principal Specialist reporting to Vice President, Environmental and Pharmaceutical Sciences (1987)
Responsibilities included technical writing, special projects, and performing Graphite Furnace Atomic Absorption for Pb and Cu in water; pesticides data entry verification; coordinating, developing, and providing technical and EHS training; providing technical support to the EHS staff; serving as interim EHS officer and the EHS liaison with our parent company; serving as Lancaster Radiation Safety Officer during the period in which Lancaster held a site NRC license; serving as a permanent member of the safety committee representing EHS training
Principal Specialist, Training & Development, Human Resources (1991)
Responsibilities include coordinating, developing, and providing technical training and environmental health and safety (EHS) training; soliciting and managing grants for training programs; providing coordination for the external and continuing education programs; providing technical support for the EHS staff and continuing to represent EHS training on the safety committee

## Awards, Citations, Honorary Societies & Publications:

1 publication on microscopy
1 publication on NMR and Copper-histidine
Book Review - Review of *Guidelines for Laboratory Design: Health and Safety Aspect*, ***The Synergist*** March 2002
Acknowledged in two EPA publications: Pb-Based Paint Laboratory Operations Guidelines: Analysis of Pb in Paint, Dust and Soil (EPA 747-R-92-006 May 1993) and Environmental Management Guide for Small Laboratories (EPA 233-B-98-001 July 1998)
Biographical Listings: *Who's Who in the East*, under Barbara J. Felty; *Who's Who in the Safety Profession*

## Memberships and Appointments:

American Board of Industrial Hygiene (1984-present)
American Industrial Hygiene Association (AIHA) (1980-present)
Sampling and Laboratory Analysis Committee (2001-present)
Communication and Training Methods Committee (2006-present)
AIHA - Central Pennsylvania Section, Charter Member (1981-present)
Treasurer (1981-1984, 2008-present), President-elect (1985-1986, 2002-2005), President (1986-1987, 2005-2006), Secretary (2007-2008), Membership Director (1988-1993), Director (2000-2002)
American Chemical Society (1985-present)
Chemical Health and Safety Section, Membership Committee (1992-1993)
Lancaster County Industrial Safety Council (Director 1988-1990)
Leadership Lancaster (1995)
Mentor (1999-2002), Marketing Committee (1999-2000)
Johns Hopkins NIOSH Education Resource Center Continuing Education Advisory Committee (1996-2006)
Penn State University–Lancaster Center Advisory Committee (2002–2006)
Chromatography Forum, Delaware Valley (2002-present/lifetime member)

### Timothy S. Weaver, B.A., Senior Specialist, Environmental Software Development

## Education:

B.A. Mathematics, Franklin & Marshall College (1996)

## Professional Experience:

With Eurofins Lancaster Laboratories since 1996
Computer Specialist, Volatiles by GC (1996)
Responsibilities included programming, maintenance, and updates
Computer Specialist, Environmental Sciences (1997)
Responsibilities included disk format programming initially, followed by pesticides system and database maintenance and programming
Specialist, Computer Applications Development (2002)
Responsibilities included pesticides system and database maintenance and programming; invoice print server maintenance; LLENS program administration
Senior Specialist, Environmental Software Development (2008)
Responsibilities include pesticides system and database maintenance and programming; invoice print server maintenance; LLENS program administration

Uncontrolled Copy

**Heather E. Williams, B.S., Senior Chemist, EPH/Miscellaneous GC**

Education:

B.S. Forensic and Investigative Science, West Virginia University (2004)

Continuing Education:

Principles of Gas Chromatography, LLU (2007)

Professional Experience:

With Lancaster Laboratories since 2006

Chemist, EPH/Miscellaneous GC (2006)

Responsibilities included analyzing routine samples and their associated QC by gas chromatography for extractable petroleum products such as DRO, TPH, and other related materials; reviewing, calculating, and reporting the corresponding data and results; maintaining, optimizing, and calibrating Gas Chromatographs in an efficient and accurate manner; assisting in organization of department work, track samples, and prepare samples and standards to consistently meet turn around time requirements

Senior Chemist, EPH/Miscellaneous GC (2008)

Responsibilities include analyzing routine samples and their associated QC by gas chromatography for extractable petroleum products such as DRO, TPH and other related materials; reviewing, interpreting, calculating, and reporting the corresponding data and results; maintaining, optimizing, and calibrating Gas Chromatographs in an efficient and accurate manner; assisting in organization of department work, tracking samples; preparing samples and standards to consistently meet turn around time requirements; verifying sample data; corresponding with client service representatives regarding client inquiries and providing answers and solutions when problems arise; SOP writing and revising as new methods are developed; assisting with new instrument installation and set-up; participating in practical process improvements as a member of a team

**Bret M. Winey, B.S., Senior Specialist, Environmental Software Development**

Education:

B.S. Computer Science, Millersville University (2005)

Professional Experience:

Penn State University, College of Medicine, Programmer/Analyst (2009-2011)

Responsibilities included developing systems responsible for collecting and analyzing medical research data

Weidenhammer Systems Corp., Programmer/Analyst (2011-2012)

Responsibilities included maintaining and implementing functionality on clients' websites, using specification gathered directly from the respective client

Donegal Mutual Insurance Company, Inc., Programmer (2012-2013)

Responsibilities included maintaining existing web presentation and provide aid during transition to new website design

With Eurofins Lancaster Laboratories since 2013

Senior Specialist, Environmental Software Development (2013)

Responsibilities include providing technical support for maintenance of installed software applications and assisting with the development, installation, and maintenance of new applications for general use; assisting in development, implementation, and maintenance of software intended to improve the quality and efficiency of work performed

**Donald E. Wyand, B.S., Director, Environmental Business Development/Sales**

Education:

B.S. Chemistry, Lebanon Valley College (1989)

Continuing Education:

Graduate Chemistry, Villanova University

Professional Experience:

With Lancaster Laboratories since 1989

Client Services Specialist (1990)

Business Development Specialist (1993)

Principal Specialist/Account Manager (1995)

Principal Specialist/Sales (1998) Principal Specialist/Coordinator/Sales, Environmental Sciences (2001)

Responsibilities included: National Account Manager; project management; evaluating new methods; consult with clients regarding testing needs; develop long-term, mutually beneficial relationships with new and existing clients by maximizing our clients' efficiency and effectiveness in managing analytical projects; present relevant market information to senior management and technical operations staff to develop new services for our clients; organize and manage National Account teams; prepare, organize, and manage project planning for target accounts; present Lancaster Labs' capabilities through formal presentations, personal account visits, and marketing campaigns; develop and maintain marketing programs within assigned geographic territory; maintain and communicate knowledge of regulatory issues, analytical methodology, and industry requirements to new and existing clients; prepare proposals and quotations; advise clients on testing; communicate client requirements to lab areas; perform technical presentation to inform our clients of new environmental regulations; and lead client teams to offer analytical solutions to client problems.

Principal Specialist/Group Leader/Sales (2005)

Responsibilities included: National Account Manager; project management; evaluating new methods; consult with clients regarding testing needs; develop long-term, mutually beneficial relationships with new and existing clients by maximizing our clients' efficiency and effectiveness in managing analytical projects; present relevant market information to senior management and technical operations staff to develop new services for our clients; organize and manage National Account teams; prepare, organize, and manage project planning for target accounts; present Lancaster Labs' capabilities through formal presentations, personal account visits, and marketing campaigns; develop and maintain marketing programs within assigned geographic territory; maintain and communicate knowledge of regulatory issues, analytical methodology, and industry requirements to new and existing clients; prepare proposals and quotations; advise clients on testing; communicate client requirements to lab areas; perform technical presentation to inform our clients of new environmental regulations; and lead client teams to offer analytical solutions to client problems.

Director, Environmental Business Development/Sales (2006)

Responsibilities include: National Account Manager; project management; evaluating new methods; consult with clients regarding testing needs; develop long-term, mutually beneficial relationships with new and existing clients by maximizing our clients' efficiency and effectiveness in managing analytical projects; present relevant market information to senior management and technical operations staff to develop new services for our clients; organize and manage National Account teams; prepare, organize, and manage project planning for target accounts; present Lancaster Labs' capabilities through formal presentations, personal account visits, and marketing campaigns; develop and maintain marketing programs within assigned geographic territory; maintain and communicate knowledge of regulatory issues, analytical methodology, and industry requirements to new and existing clients; prepare proposals and quotations; advise clients on testing; communicate client requirements to lab areas; perform technical presentation to inform our clients of new environmental regulations; and lead client teams to offer analytical solutions to client problems.

## Memberships & Appointments:

American Chemical Society
Society of American Military Engineers
Society of Environmental Toxicology and Chemistry

## Meng Yu, M.S., Principal Chemist, Specialty Services Group

## Education:

B.S. Chemical Engineering, Zhejiang University of Technology (1986)
Post Graduate, Biogeography and Environmental Assessment, University of Saarland (1995)
M.S. Chemistry, Catholic University of Leuven (1999)

## Professional Experience:

Setsco Service Ltd. Executive Chemist (1999-2002)

Responsibilities performing EPA and USDA method development and validation for water, soil, food, and pharmaceutical materials using USP, BP, and AOAC methods; performing pesticide residue analysis using all kinds of GC

Cantest Ltd. Research Chemist (2002-2008)

Responsibilities included performing bioanalytical and food safety method development and validation; performing pesticide and drug residue method validation as per USDA, EPA, CFIA methods; UPLCMSMS, LCMSMS, LCMS and GCMS operation and maintenance

Pharmanet Inc. HSP Laboratory, Research Scientist (2008-2010)

Responsibilities included performing bioanalytical method development and validation for plasma, urine, tissue, etc.; performing LCMSMS operation, tuning, and maintenance

With Lancaster Laboratories since 2010

Principal Chemist, Specialty Services Group (2010)

Responsibilities include developing and validating new testing methods; operating and maintaining LCMSMS instruments; performing sample analyses

## Memberships and Appointments:

ASMS (2010)

**Michael A. Ziegler, B.S., Senior Chemist, Volatiles in Air**

Education:

B.S. Molecular Biology, Clarion University of PA (2002)

Professional Experience:

With Eurofins Lancaster Laboratories since 2006

Chemist, GC/MS Volatiles (2006)

Responsibilities included maintaining GC/MS instrumentation; tuning and calibrating instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality; evaluating current organizational and analytical systems; suggesting and implementing the necessary corrective action to ensure the above can be performed in alignment with client and/or regulatory requirements; performing all duties with minimal supervision

Chemist, Volatiles in Air (2010)

Responsibilities included maintaining GC and/or GC/MS instrumentation and calibrating GC and/or GC/MS instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality to meet client requirements; performing various Airlab duties associated with sample prep and sample flow (these include, but are not limited to, sample retrieval and entry, Nitrogen tank replacement, summa can cleaning, summa/FC requests, and sample pressurization/prescreen)

Senior Chemist, Volatiles in Air (2014)

Responsibilities include maintaining GC and/or GC/MS instrumentation and calibrating GC and/or GC/MS instrument daily; analyzing quality control and client samples; reviewing and assembling data in an efficient manner with a high degree of quality to meet client requirements; performing various Airlab duties associated with sample prep and sample flow (these include, but are not limited to, sample retrieval and entry, Nitrogen tank replacement, summa can cleaning, summa/FC requests, and sample pressurization/prescreen)

Uncontrolled Copy

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-GDL-9015382 | **Revision** | 4 |
| **Effective Date** | Aug 8, 2014 | **Status** | Effective |
| **Historical/Local Document Number** | DOD - Environmental Quality Policy Manual Appendix E | | |
| **Local Document Level** | Level 1 | | |
| **Local Document Type** | POL - Policy | | |
| **Local Document Category** | ES - Environmental Sciences | | |

| | |
|---|---|
| **Prepared by** | Kathryn Brungard |
| **Reviewed and Approved by** | Duane Luckenbill;Review;Tuesday, July 29, 2014 11:10:44 AM EDT<br>Robert Strocko;Review;Wednesday, July 30, 2014 1:00:17 PM EDT<br>Dorothy Love;Approval;Wednesday, July 30, 2014 2:21:13 PM EDT |

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Document Owner |
|---|---|---|---|
| **Level 1** | | | |
| Organizational Charts Personnel to Sign Reports | 1-P-QM-GDL-9015380 | DOD - Environmental Quality Policy Manual Appendix C | 4052 - Environmental Quality Assurance |
| Personnel Qualifications and Responsibilities | 1-P-QM-GDL-9015381 | DOD - Environmental Quality Policy Manual Appendix D | 4052 - Environmental Quality Assurance |
| SOPs and Analytical Methods | 1-P-QM-GDL-9015382 | DOD - Environmental Quality Policy Manual Appendix E | 4052 - Environmental Quality Assurance |
| Instrument and Equipment List | 1-P-QM-GDL-9015383 | DOD - Environmental Quality Policy Manual Appendix F | 4052 - Environmental Quality Assurance |
| Preventative Maintenance Schedules | 1-P-QM-GDL-9015384 | DOD - Environmental Quality Policy Manual Appendix G | 4052 - Environmental Quality Assurance |
| Calibration Schedules | 1-P-QM-GDL-9015385 | DOD - Environmental Quality Policy Manual Appendix H | 4052 - Environmental Quality Assurance |
| NELAP Scope of Testing | 1-P-QM-GDL-9015386 | DOD - Environmental Quality Policy Manual Appendix I | 4052 - Environmental Quality Assurance |
| Quality Control Types, Frequency, and Corrective Action | 1-P-QM-GDL-9015387 | DOD - Environmental Quality Policy Manual Appendix J | 4052 - Environmental Quality Assurance |
| Microbiological Testing | 1-P-QM-GDL-9015388 | DOD - Environmental Quality Policy Manual Appendix K | 4052 - Environmental Quality Assurance |
| Manual Integration | 1-P-QM-GDL-9017675 | Policy 0001 | 4052 - Environmental Quality Assurance |
| Laboratory Ethics and Data Integrity Policy | 1-P-QM-GDL-9017679 | Policy 0007 | 4052 - Environmental Quality Assurance |
| Chemical Hygiene Plan | 1-P-QM-GDL-9015198 | Chemical Hygiene Plan | 6098 - Safety |
| Preparedness, Prevention, and Contingency Plan | 1-P-QM-GDL-9017681 | Policy 0010 | 6098 - Safety |
| Exposure Control Plan for Bloodborne Pathogens | 1-P-QM-GDL-9017682 | Policy 0011 | 6098 - Safety |
| **Level 2** | | | |
| Balance, Syringe, Pipette Verification | 1-P-QM-QMA-9015389 | DOD - LOM-SOP-ES-235 | 4052 - Environmental Quality Assurance |
| Bay Area Service Center Dangerous Goods Shipping Procedure | 1-P-QM-QMA-9017337 | LOM-SOP-ES-237 | 50 - Bay Area Service Center |
| Change Control Procedures for ELLE | 1-P-QM-QMA-9028515 | N/A | 4052 - Environmental Quality Assurance |
| Chromatography Integration and Documentation | 1-P-QM-QMA-9017333 | LOM-SOP-ES-232 | 4052 - Environmental Quality Assurance |
| Chromatography Integration and Documentation for OH VAP | 1-P-QM-QMA-9022815 | LOM-SOP-ES-232 (OH VAP) | 4052 - Environmental Quality Assurance |
| Communicating Maximum Contaminant Level (MCL) Exceedances | 1-P-QM-QMA-9017330 | LOM-SOP-ES-227 | 4039 - Environmental Client Services and Inside Business Development |
| Compliance with Environmental GLP Regulations | 1-P-QM-QMA-9022322 | LOM-SOP-LAB-204 and LOM-SOP-LAB-224 | 4052 - Environmental Quality Assurance |
| Data Entry, Verification and Reporting | 1-P-QM-QMA-9017322 | LOM-SOP-ES-218 | 4052 - Environmental Quality Assurance |

| Document Title | Document ID | Historical Document ID | Document Owner |
|---|---|---|---|
| **Level 2 (continued)** | | | |
| Demonstrations of Capability | 1-P-QM-QMA-9015390 | DOD - LOM-SOP-ES-238 | 4052 - Environmental Quality Assurance |
| Determining Method Detection Limits and Limits of Quantitation | 1-P-QM-QMA-9017309 | LOM-SOP-ES-203 | 4052 - Environmental Quality Assurance |
| Documentation for the Parallax Analysis Definition Function | 1-P-QM-QMA-9017323 | LOM-SOP-ES-219 | 4052 - Environmental Quality Assurance |
| Environmental Project Cycle | 1-P-QM-QMA-9017338 | LOM-SOP-ES-239 | 4052 - Environmental Quality Assurance |
| Establishing Control Limits | 1-P-QM-QMA-9017313 | LOM-SOP-ES-207 | 4052 - Environmental Quality Assurance |
| Forensic Laboratory Services | 1-P-QM-QMA-9017307 | LOM-SOP-ES-201 | 4052 - Environmental Quality Assurance |
| Guidelines for Analytical Decision Making in Environmental Testing | 1-P-QM-QMA-9021833 | LOM-SOP-LAB-226 | 4052 - Environmental Quality Assurance |
| Guidelines for Writing Technical Reports | 1-P-QM-QMA-9017308 | LOM-SOP-ES-202 | 4052 - Environmental Quality Assurance |
| Handling of Client Technical Complaints (Investigations and Response) | 1-P-QM-QMA-9017332 | LOM-SOP-ES-231 | 4052 - Environmental Quality Assurance |
| HP-UX Target 3.5 Data System Accounts and Electronic Signature Security | 1-P-QM-QMA-9017336 | LOM-SOP-ES-236 | 4052 - Environmental Quality Assurance |
| Instrument and Equipment Maintenance and Calibration | 1-P-QM-QMA-9017325 | LOM-SOP-ES-222 | 4052 - Environmental Quality Assurance |
| Investigation and Corrective Action of Noncompliant Data | 1-P-QM-QMA-9017315 | LOM-SOP-ES-209 | 4052 - Environmental Quality Assurance |
| Investigation and Corrective Action Reporting for Laboratory Problems | 1-P-QM-QMA-9017331 | LOM-SOP-ES-230 | 4052 - Environmental Quality Assurance |
| Laboratory Notebooks, Logbooks, and Documentation for Environmental Testing | 1-P-QM-QMA-9021767 | LOM-SOP-LAB-220 | 4052 - Environmental Quality Assurance |
| Laboratory Sample Analysis Record (LSAR) Documentation | 1-P-QM-QMA-9017318 | LOM-SOP-ES-212 | 4052 - Environmental Quality Assurance |
| Legal Chain-of-Custody Documentation | 1-P-QM-QMA-9017335 | LOM-SOP-ES-234 | 4052 - Environmental Quality Assurance |
| Missed Holding Time Reports | 1-P-QM-QMA-9017326 | LOM-SOP-ES-223 | 4052 - Environmental Quality Assurance |
| Monitoring of the Volatile Organics Analysis (VOA) Storage Areas for Contamination | 1-P-QM-QMA-9017311 | LOM-SOP-ES-205 | 4052 - Environmental Quality Assurance |
| Monitoring Temperatures in Refrigerators, Freezers, Incubators, and Ovens Using the Andover System | 1-P-QM-QMA-9017316 | LOM-SOP-ES-210 | 4052 - Environmental Quality Assurance |
| Monitoring Temperatures in Refrigerators, Freezers, Incubators, and Ovens Using the ETM | 1-P-QM-QMA-9021509 | N/A | 4052 - Environmental Quality Assurance |
| Obtaining a Representative Environmental Solid Sample Aliquot | 1-P-QM-QMA-9017334 | LOM-SOP-ES-233 | 4052 - Environmental Quality Assurance |
| Procurement of Environmental Laboratory Supplies | 1-P-QM-QMA-9021705 | LOM-SOP-LAB-218 | 4052 - Environmental Quality Assurance |
| Proficiency Test Samples | 1-P-QM-QMA-9017321 | LOM-SOP-ES-216 | 4052 - Environmental Quality Assurance |
| Quarantine Soils Procedures | 1-P-QM-QMA-9017317 | LOM-SOP-ES-211 | 4052 - Environmental Quality Assurance |
| Reagents and Standards | 1-P-QM-QMA-9017328 | LOM-SOP-ES-225 | 4052 - Environmental Quality Assurance |

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 2 (continued)** | | | |
| Sample Requisition | 1-P-QM-QMA-9017312 | LOM-SOP-ES-206 | 4052 - Environmental Quality Assurance |
| Subcontracting Analytical Testing | 1-P-QM-QMA-9017310 | LOM-SOP-ES-204 | 4052 - Environmental Quality Assurance |
| Thermometer Use and Calibration | 1-P-QM-QMA-9017314 | LOM-SOP-ES-208 | 4052 - Environmental Quality Assurance |
| Validation and Authorization of Analytical Methods | 1-P-QM-QMA-9017329 | LOM-SOP-ES-226 | 4052 - Environmental Quality Assurance |
| Automated External Defibrillator (AED) Program | 1-P-QM-QMA-9017350 | LOM-SOP-HS-215 | 6098 - Safety |
| Biosafety Manual | 1-P-QM-QMA-9024252 | N/A | 6098 - Safety |
| Disposal of Regulated Medical Waste | 1-P-QM-QMA-9017349 | LOM-SOP-HS-214 | 6098 - Safety |
| Emergency Evacuation Plan | 1-P-QM-QMA-9017343 | LOM-SOP-HS-208 | 6098 - Safety |
| Environmental Hazardous Sample Communication Procedure | 1-P-QM-QMA-9017346 | LOM-SOP-HS-211 | 6098 - Safety |
| Environmental, Health, and Safety (EHS) Assessments | 1-P-QM-QMA-9017344 | LOM-SOP-HS-209 | 6098 - Safety |
| Fall Protection Plan | 1-P-QM-QMA-9017354 | LOM-SOP-HS-221 | 6098 - Safety |
| Fleet Safety Plan | 1-P-QM-QMA-9021826 | N/A | 6098 - Safety |
| Hot Work Permit Program | 1-P-QM-QMA-9017345 | LOM-SOP-HS-210 | 6098 - Safety |
| Incident Response Plan | 1-P-QM-QMA-9017347 | LOM-SOP-HS-212 | 6098 - Safety |
| Inspection of Facility Emergency Equipment | 1-P-QM-QMA-9017353 | LOM-SOP-HS-220 | 6098 - Safety |
| Lockout/Tagout | 1-P-QM-QMA-9017342 | LOM-SOP-HS-207 | 6098 - Safety |
| Management of Hazardous Wastes in the Laboratory | 1-P-QM-QMA-9017352 | LOM-SOP-HS-219 | 6098 - Safety |
| Pharmaceutical Sample Handling | 1-P-QM-QMA-9017351 | LOM-SOP-HS-218 | 6098 - Safety |
| Radiation Safety Program | 1-P-QM-QMA-9017348 | LOM-SOP-HS-213 | 6098 - Safety |
| Reporting Work Related Incidents | 1-P-QM-QMA-9017340 | LOM-SOP-HS-203 | 6098 - Safety |
| Respiratory Protection Program | 1-P-QM-QMA-9017341 | LOM-SOP-HS-204 | 6098 - Safety |
| Safety Glasses | 1-P-QM-QMA-9017339 | LOM-SOP-HS-202 | 6098 - Safety |
| Spill Prevention, Control, and Countermeasure Plan | 1-P-QM-QMA-9017355 | LOM-SOP-HS-222 | 6098 - Safety |
| Building Security | 1-P-QM-QMA-9017366 | LOM-SOP-LAB-212 | 6043 - Physical Services |
| Data and Record Storage, Security, Retention, Archival, and Disposal | 1-P-QM-QMA-9017358 | LOM-SOP-LAB-203 | 6047 - Office Services |
| Document Control | 1-P-QM-QMA-9017357 | LOM-SOP-LAB-202 | 6047 - Office Services |

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 2 (continued)** | | | |
| E-Mail System | 1-P-QM-QMA-9017360 | LOM-SOP-LAB-205 | 9013 - Information Technology |
| Employee Training Program | 1-P-QM-QMA-9017379 | LOM-SOP-LAB-231 | 6047 - Office Services |
| Environmental Health and Safety Training | 1-P-QM-QMA-9017378 | LOM-SOP-LAB-230 | 6054 - Training |
| EtQ System User Account Maintenance | 1-P-QM-QMA-9017380 | LOM-SOP-LAB-232 | 6047 - Office Services |
| Eurofins North America E-Mail and Archiving | 1-P-QM-QMA-9020074 | NA | 9013 - Information Technology |
| Facilities Operation Manual | 1-P-QM-QMA-9017374 | LOM-SOP-LAB-223 | 6043 - Physical Services |
| Facility Change Control Procedure | 1-P-QM-QMA-9017364 | LOM-SOP-LAB-209 | 6043 - Physical Services |
| Insect and Rodent Control | 1-P-QM-QMA-9017367 | LOM-SOP-LAB-213 | 6043 - Physical Services |
| Laboratory Housekeeping and Cleaning | 1-P-QM-QMA-9017373 | LOM-SOP-LAB-221 | 6043 - Physical Services |
| Position Qualification Descriptions (PQDs) and Essential Job Functions (EJFs) | 1-P-QM-QMA-9017376 | LOM-SOP-LAB-225 | 6056 - Recruiting |
| Review of Legal Matters | 1-P-QM-QMA-9017371 | LOM-SOP-LAB-219 | 20 - Bio/Pharmaceutical Sciences |
| Review of Legal Matters | 1-P-QM-QMA-9017371 | LOM-SOP-LAB-219 | 40 - Environmental Sciences |
| Use and Maintenance of Reagent Water Supply | 1-P-QM-QMA-9017368 | LOM-SOP-LAB-214 | 4052 - Environmental Quality Assurance |
| Utilizing the Services and Support of the Computer Systems Group | 1-P-QM-QMA-9017362 | LOM-SOP-LAB-207 | 9013 - Information Technology |
| Windows Network and Computer Accounts | 1-P-QM-QMA-9017361 | LOM-SOP-LAB-206 | 9013 - Information Technology |
| Writing and Reviewing Lancaster Laboratories Policies and Operating Procedures | 1-P-QM-QMA-9017356 | LOM-SOP-LAB-201 | 6047 - Office Services |
| **Level 3 – Environmental Microbiology** | | | |
| Quanti-Tray X Sealer | 1-P-QM-PRO-9017534 | OMC-PM-078 | 3002 - Environmental Microbiology |
| Quality Control/Quality Assurance Procedure for Environmental Microbiology | 1-P-QM-PRO-9018209 | SOP-PM-041 | 3002 - Environmental Microbiology |
| 2% Brilliant Green Bile Broth (for Coliform Test Dept. 02) | 1-P-QM-WI -9018027 | SOP-PM-001, Media 400 | 3002 - Environmental Microbiology |
| EC Medium – for Dept. 02 | 1-P-QM-WI -9018028 | SOP-PM-001, Media 401 | 3002 - Environmental Microbiology |
| Free Chlorine Residual Data Records (Optional Total Chlorine Reading) | 1-P-QM-WI -9011681 | Analysis 0308 | 3002 - Environmental Microbiology |
| Heterotrophic Plate Count Testing for Environmental Solid and Liquid Samples Pour Plate Method SM 9215B-1994 | 1-P-QM-WI -9011658 | Analysis 0307, 4196, 12833 | 3002 - Environmental Microbiology |
| Hydrocarbon Degrading Plate Count Study Waters and Solids | 1-P-QM-WI -9013997 | Analysis 6157, 6158 | 3002 - Environmental Microbiology |
| Lauryl Sulfate Tryptose Broth (1x LST) Single Strength – for Dept. 02 | 1-P-QM-WI -9018025 | SOP-PM-001, Media 398 | 3002 - Environmental Microbiology |
| Lauryl Sulfate Tryptose Double Strength (2x LST) – for Dept. 02 | 1-P-QM-WI -9018026 | SOP-PM-001, Media 399 | 3002 - Environmental Microbiology |



Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 3 – Environmental Microbiology (continued)** | | | |
| M-FC (for Dept. 02) | 1-P-QM-WI -9018024 | SOP-PM-001, Media 397 | 3002 - Environmental Microbiology |
| Modification DPD Free Chlorine Residual In Water (Presence/Absence) | 1-P-QM-WI -9011686 | Analysis 0416 | 3002 - Environmental Microbiology |
| Modification Fecal Coliform by Membrane Filtration | 1-P-QM-WI -9011598 | Analysis 0199, 11028 | 3002 - Environmental Microbiology |
| MS/Agar Noble Base (for HC degrading PC study) | 1-P-QM-WI -9018021 | SOP-PM-001, Media 390 | 3002 - Environmental Microbiology |
| MS/Agar Noble Medium (for HC degrading PC study for Dept. 02) | 1-P-QM-WI -9018022 | SOP-PM-001, Media 391 | 3002 - Environmental Microbiology |
| Total Coliform and E. coli Analysis Potable Water (Presence/Absence), 6477 Swimming Pool Samples, 6479 Potable Water (Quantitative), 8161 | 1-P-QM-WI -9014018 | Analysis 6477, 6479, 8161 | 3002 - Environmental Microbiology |
| Tryptic Soy Broth (TSB) for Dept. 02 Sterility Checks | 1-P-QM-WI -9018035 | SOP-PM-001, Media 409 | 3002 - Environmental Microbiology |
| Tryptic Soy Broth (TSB)—for Dept. 02 | 1-P-QM-WI -9018023 | SOP-PM-001, Media 396 | 3002 - Environmental Microbiology |
| **Level 3 – Environmental Sciences** | | | |
| Glassware Cleaning | 1-P-QM-PRO-9015465 | DOD - SOP-MS-001 | 4021 - GC/MS Volatiles |
| Preparation and Testing of Trip Blanks for GC/MS Volatile Analyses | 1-P-QM-PRO-9015466 | DOD - SOP-MS-002 | 4021 - GC/MS Volatiles |
| GC/MS Instrumentation Maintenance | 1-P-QM-PRO-9015467 | DOD - SOP-MS-004 | 4021 - GC/MS Volatiles |
| Preservation and Residual Chloride Checks of Samples for GC/MS Volatile Water Analysis | 1-P-QM-PRO-9015468 | DOD - SOP-MS-005 | 4021 - GC/MS Volatiles |
| GC/MS Volatile Standards Traceability | 1-P-QM-PRO-9015469 | DOD - SOP-MS-006 | 4021 - GC/MS Volatiles |
| Preparation and Analysis of Cleaning Blanks for GC and GC/MS Volatiles | 1-P-QM-PRO-9015470 | DOD - SOP-MS-007 | 4021 - GC/MS Volatiles |
| GC/MS Volatiles Audit Process | 1-P-QM-PRO-9015471 | DOD - SOP-MS-012 | 4021 - GC/MS Volatiles |
| Preparation and Testing of Storage Blanks for GC/MS Volatile Analysis | 1-P-QM-PRO-9015473 | DOD - SOP-MS-015 | 4021 - GC/MS Volatiles |
| Use of 40-mL Vials for Volatile Organic Analyses | 1-P-QM-PRO-9015474 | DOD - SOP-MS-016 | 4021 - GC/MS Volatiles |
| Level II Review of GS/MS Volatiles | 1-P-QM-PRO-9017810 | SOP-MS-017 | 4021 - GC/MS Volatiles |
| Volatile Compounds in Aqueous and Solid Samples by SW-846 8260B for OH VAP | 1-P-QM-WI -9012739 | Analysis 10237, 10335 OH VAP | 4021 - GC/MS Volatiles |
| Volatile Organics Tentatively Identified Compound Method (Interpretive) | 1-P-QM-WI -9012746 | Analysis 0882, 0884, 12027 | 4021 - GC/MS Volatiles |
| Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by GC/MS in Soils and Solids by Method 8260B | 1-P-QM-WI -9012764 | Analysis 10237, 10607, 10949, 10950, 10951 | 4021 - GC/MS Volatiles |
| The Determination of 1,2,3- Trichloropropane by Gas Chromatography/ Mass Spectrometry (GC/MS) using Isotope Dilution and Selective Ion Monitoring (SIM) | 1-P-QM-WI -9012867 | Analysis 11017 | 4021 - GC/MS Volatiles |
| Targeted Library Search by GC/MS | 1-P-QM-WI -9013053 | Analysis 11660 | 4021 - GC/MS Volatiles |
| Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by GC/MS in Soils and Solids by Method 8260C | 1-P-QM-WI -9013077 | Analysis 11995 | 4021 - GC/MS Volatiles |
| Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Waters and Wastewaters by Method 8260C | 1-P-QM-WI -9013078 | Analysis 11996, 11997, 13130 | 4021 - GC/MS Volatiles |

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 3 – Environmental Sciences (continued)** | | | |
| The Determination of Vinyl Chloride, Trichloroethene and Tetrachloroethene by Gas Chromatography /Mass Spectrometry (GC/MS) using Selective Ion Monitoring (SIM) | 1-P-QM-WI -9013082 | Analysis 12030 | 4021 - GC/MS Volatiles |
| The Determination of Vinyl Chloride and Carbon Disulfide by Gas Chromatography/Mass Spectrometry (GC/MS) using Selective Ion Monitoring (SIM) | 1-P-QM-WI -9013992 | Analysis 6008 | 4021 - GC/MS Volatiles |
| The Determination of Ethylene Oxide and Crotonaldehyde by Gas Chromatography/Mass Spectrometry (GC/MS) in Water and Soil by SW-846 Method 8260B | 1-P-QM-WI -9014003 | Analysis 6372, 6377 | 4021 - GC/MS Volatiles |
| Preparation of Oil Samples | 1-P-QM-WI -9015068 | Analysis DOD - 0373 | 4021 - GC/MS Volatiles |
| The Determination of 1,4-Dioxane by Gas Chromatography/Mass Spectrometry (GC/MS) using Isotope Dilution and Selective Ion Monitoring (SIM) | 1-P-QM-WI -9015075 | Analysis DOD - 0527, 10326 | 4021 - GC/MS Volatiles |
| Volatile Organics Tentatively Identified Compound Method | 1-P-QM-WI -9015084 | Analysis DOD - 0890, 0880, 12028 | 4021 - GC/MS Volatiles |
| Waters for Volatile Organic Compounds by Purge and Trap Gas Chromatography/Mass Spectrometry using EPA Method 624 | 1-P-QM-WI -9015097 | Analysis DOD - 10371 | 4021 - GC/MS Volatiles |
| Determination of Volatile Target Compounds by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Waters and Wastewaters by Method 6200B | 1-P-QM-WI -9015099 | Analysis 10460 | 4021 - GC/MS Volatiles |
| The Determination of Volatile Organic Compounds in Wastewater by Isotope Dilution and Gas Chromatography/Mass Spectrometry (GC/MS) | 1-P-QM-WI -9015136 | Analysis 2394, 2417 | 4021 - GC/MS Volatiles |
| Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Waters and Wastewaters by Method 8260B | 1-P-QM-WI -9015141 | Analysis DOD - 2898, 10335, 10903, 10904, 10905, 10943, 10945 | 4021 - GC/MS Volatiles |
| Toxicity Characteristic Leachate Procedure (TCLP); Analysis of Zero Headspace Extractions (ZHE) of Solid Waste, Soils, and other Matrices for Volatile Target Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique | 1-P-QM-WI -9015142 | Analysis DOD - 3636 | 4021 - GC/MS Volatiles |
| Waters for Purgeable Organic Compounds by Capillary Column Gas Chromatography Mass Spectrometry | 1-P-QM-WI -9015143 | Analysis DOD - 3648 | 4021 - GC/MS Volatiles |
| Low Concentration Waters for Volatile Organic Analysis | 1-P-QM-WI -9015153 | Analysis DOD - 4914 | 4021 - GC/MS Volatiles |
| Fixed-Volume Hand-Held | 1-P-QM-PRO-9015403 | DOD - MC-IO-003 | 4022 - Metals |
| Bottletop Dispensers | 1-P-QM-PRO-9015404 | DOD - MC-IO-019 | 4022 - Metals |
| Glassware Cleaning | 1-P-QM-PRO-9015463 | DOD - SOP-IO-013 | 4022 - Metals |
| Metals Use of the LLENS System | 1-P-QM-PRO-9015464 | DOD - SOP-IO-036 | 4022 - Metals |
| Mercury in Aqueous and Solid Samples by SW-846 Method 7470A (Aqueous) and 7471A (Solid) for OH VAP | 1-P-QM-WI -9011649 | Analysis 0259, 0159 OH VAP | 4022 - Metals |
| Maintenance and Calibration of HACH Model 2100N Laboratory Turbidimeter | 1-P-QM-PRO-9017427 | MC-IO-017 | 4022 - Metals |
| Mercury in Aqueous and Solid Samples by SW-846 Method 7470A (Aqueous) and 7471A (Solid) for OH VAP | 1-P-QM-WI -9011649 | Analysis 0259, 0159 OH VAP | 4022 - Metals |

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 3 – Environmental Sciences (continued)** | | | |
| Sample Preparation of Soil, Sediment, and Sludge for Total Mercury Analysis by Atomic Absorption Cold Vapor Technique | 1-P-QM-WI -9012710 | Analysis 0494 | 4022 - Metals |
| Langelier Index in Water | 1-P-QM-WI -9012744 | Analysis 0576 | 4022 - Metals |
| Mercury by Cold Vapor Atomic Fluorescence Spectrometry using EPA Method 1631 Revision E | 1-P-QM-WI -9013144 | Analysis 1573, 1574 | 4022 - Metals |
| Preparation of Soil, Sediment, and Sludge for Analysis of Metals by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES) | 1-P-QM-WI -9013404 | Analysis 1849 | 4022 - Metals |
| Client Specific - 3030 C. Treatment for Acid-Extractable Metals for North Carolina Groundwater Samples | 1-P-QM-WI -9013465 | Analysis 2812, 10651, 11988, 11989 | 4022 - Metals |
| Dilute/Run and AVS/SEM Sample Handling for Metals | 1-P-QM-WI -9013476 | Analysis 4792 | 4022 - Metals |
| Digestion of Non-Aqueous Samples by SW-846 Method 3050B for OH VAP | 1-P-QM-WI -9013983 | Analysis 5708, 10637, 11026, 11027 OH VAP | 4022 - Metals |
| Sample Preparation of Sediments, Sludges, and Soils for Analysis of Metals by Inductively Coupled Plasma Atomic Emission Spectrometry (5708) | 1-P-QM-WI -9013984 | Analysis 5708II | 4022 - Metals |
| Digestion of Solid Samples by SW-846 Method 7471A - OH VAP | 1-P-QM-WI -9013985 | Analysis 5711 OH VAP | 4022 - Metals |
| Digestion of Aqueous Samples by SW-846 Method 7470A for OH VAP | 1-P-QM-WI -9013986 | Analysis 5713 OH VAP | 4022 - Metals |
| Sample Preparation of Potable Water, Groundwater, Surface Water, and Wastewater for Analysis of Total Recoverable Metals by ICP (5716) | 1-P-QM-WI -9013987 | Analysis 5716 | 4022 - Metals |
| Undigested Sample Preparation of Potable Water for Analysis of Total Recoverable Metals by Inductively Coupled Plasma Mass Spectrometry [ICP-MS] | 1-P-QM-WI -9013994 | Analysis 6051, 5281 | 4022 - Metals |
| Sample Preparation of Wastewater for Analysis of Total Recoverable Metals by Inductively Coupled Mass Spectrometer (ICP-MS) | 1-P-QM-WI -9013995 | Analysis 6052 | 4022 - Metals |
| Sample Preparation of Potable Water, Groundwater, Surface Water, and Wastewater for Analysis of Total Recoverable Metals by ICPMS (7050) | 1-P-QM-WI -9014042 | Analysis 7050 | 4022 - Metals |
| Mercury in Aqueous, Solid and Tissue Samples by Cold Vapor AA | 1-P-QM-WI -9015067 | Analysis DOD - 0259, 0159 | 4022 - Metals |
| Digestion of Aqueous Samples by SW-846 Method 7470A, EPA 254.1, CLP2.1, CLP4.0 and CLP 5.2. | 1-P-QM-WI -9015082 | Analysis DOD - 0821, 5713, 5714 | 4022 - Metals |
| Sample Preparation of Oils for Analysis of Metals by Inductively Coupled Plasma Spectroscopy | 1-P-QM-WI -9015091 | Analysis DOD - 1015, 11355 | 4022 - Metals |
| Sample Preparation of Waters for Analysis of Total Recoverable Metals by Inductively Coupled Plasma Optical Emission Spectrometry | 1-P-QM-WI -9015133 | Analysis DOD - 1848, 5720, 10635 | 4022 - Metals |
| Sample Preparation of Wastewater and Leachates for Analysis of Total Metals by Inductively Coupled Plasma Atomic Emission Spectrometry | 1-P-QM-WI -9015159 | Analysis DOD - 5705, 10636 | 4022 - Metals |
| Sample Prep of Sediments, Sludges, Soils, and Fish Tissue for Analysis of Metals by ICP and ICP-MS | 1-P-QM-WI -9015160 | Analysis DOD - 5708, 10637 | 4022 - Metals |

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 3 – Environmental Sciences (continued)** | | | |
| Sample Preparation of Soil, Sediment, Sludge, Oils, and Fish Tissue for Total Mercury Analysis by Atomic Absorption Cold Vapor Technique | 1-P-QM-WI -9015161 | Analysis DOD - 5711, 10638 | 4022 - Metals |
| Sample Preparation of Leachates and Other Wastewater for Analysis of Total Metals by Inductively Coupled Plasma-Mass Spectrometer (ICP-MS) | 1-P-QM-WI -9015165 | Analysis DOD - 6050, 10639 | 4022 - Metals |
| Metals by Inductively Coupled Plasma Atomic Emissions Spectroscopy for SW-846 Methods 6010A/B/C (aqueous, solid, tissue), CLP 2.1(water/solid/tissue), CLP 4.0(water/solid/tissue), CLP 5.2 (water/solid/tissue) and EPA 200.7(aqueous) | 1-P-QM-WI -9018442 | Analysis 6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961,10145, 6955, 6944, 6936, 6969, 7968 | 4022 - Metals |
| Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A (aqueous, solid, tissue), CLP 5.2 (aqueous, solid, tissue) and EPA 200.8 (aqueous) | 1-P-QM-WI -9018443 | Analysis 6142, 6123, 6125, 10801, 6126, 6127, 6129, 6128, 6132, 6131, 6133, 6134, 6140, 6136, 6137, 6138, 6143, 6139, 6135, 6124, 6141, 6146, 6144, 6147, 6145, ... | 4022 - Metals |
| Trace Metals in Aqueous and Non-Aqueous Samples by Method SW-846 6020 for OH VAP | 1-P-QM-WI -9022820 | 6127, 6027, 6131, 6031, 6137, 6037, 6139, 6039, 6133, 6033, 6125, 6142, 6042, 6128, 6028, 6124, 6024, 6126, 6026, 6145, 6045, 6135, 6035 OH VAP | 4022 - Metals |
| Digestion of Aqueous Samples by SW846 Method 3020A/3010A Modified for Analysis by ICP/MS for OH VAP | 1-P-QM-WI -9022821 | 6050 OH VAP | 4022 - Metals |
| Trace Metals in Aqueous and Non-Aqueous Samples by Method SW-846 6010B for OH VAP | 1-P-QM-WI -9022822 | 7066, 6966, 1743, 1643, 7035, 6935, 7046, 6946, 7047, 6947, 1750, 1650, 7049, 6949, 7052, 6952, 7051, 6951, 7053, 6953, 1754, 1654, 1762, 1662, 7058, 6958, 1767, 1667, 7061, 6961, 7055, 6955, 7044, 6944, 7036, 6936, 7022, 6925, 7071, 6971, 7072,... OH VAP | 4022 - Metals |
| Digestion of Aqueous Samples by SW-846 3005A for ICP Analysis – OH VAP | 1-P-QM-WI -9024237 | Analysis 1848 OH VAP | 4022 - Metals |
| Digestion of Aqueous Samples by SW-846 3010A for ICP Analysis – OH VAP | 1-P-QM-WI -9024239 | Analysis 5705 OH VAP | 4022 - Metals |
| Pesticide Extract Cleanup Using Gel Permeation Chromatography | 1-P-QM-PRO-9015407 | DOD - MC-OE-004 | 4024 - Pesticide Residue Analysis |
| QC Data Acceptability and Corrective Action | 1-P-QM-PRO-9015493 | DOD - SOP-PP-002 | 4024 - Pesticide Residue Analysis |
| Interpretation of Chromatographic Data | 1-P-QM-PRO-9015494 | DOD - SOP-PP-011 | 4024 - Pesticide Residue Analysis |
| Preventative and Corrective GC Maintenance | 1-P-QM-PRO-9015495 | DOD - SOP-PP-013 | 4024 - Pesticide Residue Analysis |
| Monitoring QC Data Acceptance Limits | 1-P-QM-PRO-9015496 | DOD - SOP-PP-025 | 4024 - Pesticide Residue Analysis |
| Preventative and Corrective HPLC Maintenance for the Pesticide Residue Analysis Department | 1-P-QM-PRO-9015497 | DOD - SOP-PP-029 | 4024 - Pesticide Residue Analysis |
| Setting Up Single Component Initial Calibrations | 1-P-QM-PRO-9015498 | DOD - SOP-PP-031 | 4024 - Pesticide Residue Analysis |
| Using "Datalog" Software for Data Acquisition of Multicomponent Pesticides/PCBs | 1-P-QM-PRO-9015499 | DOD - SOP-PP-032 | 4024 - Pesticide Residue Analysis |

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 3 – Environmental Sciences (continued)** | | | |
| Using "Datalog" Software for Single-component Data Acquisition | 1-P-QM-PRO-9015500 | DOD - SOP-PP-033 | 4024 - Pesticide Residue Analysis |
| Common Equations Used During Chromatographic Analyses | 1-P-QM-PRO-9015501 | DOD - SOP-PP-040 | 4024 - Pesticide Residue Analysis |
| Standards Traceability and Monitoring | 1-P-QM-PRO-9018220 | SOP-PP-003 | 4024 - Pesticide Residue Analysis |
| Standards Preparation, Coding, and Storage | 1-P-QM-PRO-9018222 | SOP-PP-021 | 4024 - Pesticide Residue Analysis |
| Data Audit Procedure for Department 4024 | 1-P-QM-PRO-9018224 | SOP-PP-023 | 4024 - Pesticide Residue Analysis |
| Uploading Data to the LIMS | 1-P-QM-PRO-9018225 | SOP-PP-027 | 4024 - Pesticide Residue Analysis |
| Setting Retention Time Windows | 1-P-QM-PRO-9018226 | SOP-PP-035 | 4024 - Pesticide Residue Analysis |
| Creating Calibration Timed Events in Chrom Perfect | 1-P-QM-PRO-9018227 | SOP-PP-036 | 4024 - Pesticide Residue Analysis |
| Setting Up Analysis Numbers in the Departmental Database | 1-P-QM-PRO-9018228 | SOP-PP-037 | 4024 - Pesticide Residue Analysis |
| Prescreening Water and Soil Samples for Pesticides and PCBs | 1-P-QM-PRO-9018229 | SOP-PP-041 | 4024 - Pesticide Residue Analysis |
| Micromass Quattro Micro Tandem Mass Spectrometer with a Waters 2795 HPLC System (LC/MS/MS) | 1-P-QM-PRO-9018230 | SOP-PP-042 | 4024 - Pesticide Residue Analysis |
| PCBs in Oil by SW-846 Method 8082 | 1-P-QM-WI -9011597 | Analysis 0174 | 4024 - Pesticide Residue Analysis |
| Medium Level Sonic Probe Extraction Procedure for the Determination of Pesticides and PCBs in a Solid Matrix | 1-P-QM-WI -9012745 | Analysis 0819M, 11144 | 4024 - Pesticide Residue Analysis |
| Liquid/Liquid Extraction Procedure for the Determination of Organophosphorous Pesticides in a Wastewater Matrix | 1-P-QM-WI -9012765 | Analysis 10240 | 4024 - Pesticide Residue Analysis |
| Determination of Picric Acid in Soil Samples by HPLC with UV | 1-P-QM-WI -9012797 | Analysis 10709 | 4024 - Pesticide Residue Analysis |
| Soxhlet Extraction Procedure for the Determination of Polychlorinated Biphenyls (PCBs) in a Solid Matrix | 1-P-QM-WI -9013065 | Analysis 11696 | 4024 - Pesticide Residue Analysis |
| Analysis of Low Level Polychlorinated Biphenyls (PCBs) in Aqueous Samples using Gas Chromatography with Electron Capture Detection (GC-ECD) | 1-P-QM-WI -9013081 | Analysis 12013 | 4024 - Pesticide Residue Analysis |
| Passive In-Situ Chemical Extraction Sampler (PISCES) Procedure for the Determination of Polychlorinated Biphenyls (PCBs) | 1-P-QM-WI -9013121 | Analysis 12801 | 4024 - Pesticide Residue Analysis |
| N-Methylcarbamates by Method 531.1 in Groundwater and Drinking Water using High Performance Liquid Chromatography (HPLC) | 1-P-QM-WI -9013126 | Analysis 1340 | 4024 - Pesticide Residue Analysis |
| N-Methylcarbamate Pesticides by Method 8318 / 8318A in Solids | 1-P-QM-WI -9013139 | Analysis 1509, 10597 | 4024 - Pesticide Residue Analysis |
| Extraction Procedure for the Determination of Carbamate and Urea Pesticides in a Soil or Solid Waste Matrix | 1-P-QM-WI -9013140 | Analysis 1510, 11143 | 4024 - Pesticide Residue Analysis |
| Analysis of Acephate and Methamidophos by 8141A in Aqueous and Solid Samples | 1-P-QM-WI -9013395 | Analysis 1782, 1785 | 4024 - Pesticide Residue Analysis |
| Chlorinated Acids in Water Using GC-ECD by Method 515.1 | 1-P-QM-WI -9013405 | Analysis 1864 | 4024 - Pesticide Residue Analysis |
| Analysis of Aqueous Samples for Chlorinated Pesticides and PCBs by Gas Chromatography with an Electron Capture Detector | 1-P-QM-WI -9013406 | Analysis 1869 | 4024 - Pesticide Residue Analysis |

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 3 – Environmental Sciences (continued)** | | | |
| Analysis of Aqueous Samples for Nitrogen- and Phosphorus-Containing Pesticides by Gas Chromatography with a Nitrogen-Phosphorus Detector | 1-P-QM-WI -9013407 | Analysis 1870 | 4024 - Pesticide Residue Analysis |
| Analysis of Captan and Captafol by Gas Chromatography with Electron Capture Detection of Waters and Solids Method 8081A | 1-P-QM-WI -9013435 | Analysis 2257, 2253 | 4024 - Pesticide Residue Analysis |
| Picric Acid in Water by Method 8015B Using HPLC with UV Detection | 1-P-QM-WI -9013439 | Analysis 2265 | 4024 - Pesticide Residue Analysis |
| Analysis of Formaldehyde and other Aldehydes in Aqueous and Solid Samples by High Performance Liquid Chromatography (HPLC) Method 8315A | 1-P-QM-WI -9013471 | Analysis 4144, 4173, 8044, 8045 | 4024 - Pesticide Residue Analysis |
| Extraction of Chlorinated Herbicides in a Soil Matrix | 1-P-QM-WI -9013472 | Analysis 4181 | 4024 - Pesticide Residue Analysis |
| Soxhlet Extraction Procedure for the Determination of Pesticides in a Solid Matrix | 1-P-QM-WI -9013991 | Analysis 6006SOX | 4024 - Pesticide Residue Analysis |
| Separatory Funnel Extraction Procedure for the Determination of Chlorinated Pesticides; Nitrogen and Phosphorus Containing Pesticides; and PCBs in a Drinking Water Matrix | 1-P-QM-WI -9014001 | Analysis 6368, 11127 | 4024 - Pesticide Residue Analysis |
| Extraction of Chlorinated Acids and Herbicides in Drinking Water by Method 515.1 | 1-P-QM-WI -9014002 | Analysis 6369 | 4024 - Pesticide Residue Analysis |
| Analysis of Pesticides and Polychlorinated Biphenyls (PCBs) in Aqueous Samples by Method 608 | 1-P-QM-WI -9014174 | Analysis 7572 | 4024 - Pesticide Residue Analysis |
| Microextraction of 1,2-Dibromoethane (EDB), 1,2-Dibromo-3-chloropropane (DBCP), and 1,2,3-Trichloropropane (TCP), in Water | 1-P-QM-WI -9014309 | Analysis 7786 | 4024 - Pesticide Residue Analysis |
| Organic Acids in Water by HPLC/UV Method 8015B/D | 1-P-QM-WI -9015063 | Analysis 8843, 12737 | 4024 - Pesticide Residue Analysis |
| Analysis of Pesticides in Aqueous Samples using GC-ECD | 1-P-QM-WI -9015066 | Analysis DOD - 0177, 0950, 0180, 1954 | 4024 - Pesticide Residue Analysis |
| Waste Dilution Procedure for the Determination of PCBs in Oil | 1-P-QM-WI -9015077 | Analysis DOD - 0815 | 4024 - Pesticide Residue Analysis |
| Extraction of Chlorinated Herbicides in a Water Matrix by SW-846 8151A | 1-P-QM-WI -9015078 | Analysis DOD - 0816, 11110, 11111 | 4024 - Pesticide Residue Analysis |
| Separatory Funnel Extraction Procedure for the Determination of Pesticides and PCBs in a Wastewater Matrix | 1-P-QM-WI -9015079 | Analysis DOD - 0817, 6654, 10241, 11112, 11113, 11114, 11116, 11117, 11118, 11119, 11120, 11121, 11123, 11126, 11960 | 4024 - Pesticide Residue Analysis |
| Waste Dilution Procedure for the Determination of Pesticides and PCBs in a Non-Water Soluble Leachate Matrix | 1-P-QM-WI -9015080 | Analysis DOD - 11114DIL | 4024 - Pesticide Residue Analysis |
| Sonic Probe Extraction Procedure for the Determination of Polychlorinated Biphenyls (PCBs) in a Solid Matrix | 1-P-QM-WI -9015081 | Analysis DOD - 0819, 11128, 11132, 11135 | 4024 - Pesticide Residue Analysis |
| Analysis of Chlorinated Herbicides by 8151A in Water | 1-P-QM-WI -9015088 | Analysis DOD - 0952, 10407 | 4024 - Pesticide Residue Analysis |
| Extraction Procedure for the Determination of Formaldehyde and Aldehydes in a Water Matrix | 1-P-QM-WI -9015090 | Analysis DOD - 1013 | 4024 - Pesticide Residue Analysis |
| EDB/DBCP and TCP by Method 504.1 or 8011 in Waters using Microextraction and GC-ECD | 1-P-QM-WI -9015094 | Analysis DOD - 1034, 7934, 10398 | 4024 - Pesticide Residue Analysis |
| Microwave Extraction Procedure for the Determination of Pesticides in a Solid Matrix | 1-P-QM-WI -9015103 | Analysis DOD - 10496, 11141 | 4024 - Pesticide Residue Analysis |
| Microwave Extraction Procedure for the Determination of PCBs in a Solid Matrix | 1-P-QM-WI -9015104 | Analysis DOD - 10497, 11140 | 4024 - Pesticide Residue Analysis |

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| Level 3 – Environmental Sciences (continued) | | | |
| Analysis of Pesticides in Aqueous Samples using Gas Chromatography with Electron Capture Detection (GC-ECD) by SW-846 Method 8081B | 1-P-QM-WI -9015107 | Analysis DOD - 10589 | 4024 - Pesticide Residue Analysis |
| Analysis of Pesticides by 8081B in Solid Samples using GC-ECD | 1-P-QM-WI -9015108 | Analysis DOD - 10590 | 4024 - Pesticide Residue Analysis |
| Analysis of Polychlorinated Biphenyls (PCBs) by 8082A in Aqueous Samples using GC-ECD | 1-P-QM-WI -9015109 | Analysis DOD - 10591 | 4024 - Pesticide Residue Analysis |
| Polychlorinated Biphenyls (PCBs) in Solid Samples by 8082A Using GC-ECD | 1-P-QM-WI -9015110 | Analysis DOD - 10592, 10885, 12718, 13099 | 4024 - Pesticide Residue Analysis |
| Polychlorinated Biphenyls (PCBs) by Method 8082 in Solids and Wipes | 1-P-QM-WI -9015126 | Analysis DOD - 0042, 1030, 6011, 7512, 10225, 10736, 10906, 12800 | 4024 - Pesticide Residue Analysis |
| Analysis of Pesticides in Solid Samples using Gas Chromatography with Electron Capture Detection (GC-ECD) | 1-P-QM-WI -9015128 | Analysis DOD - 1363, 1420, 4225, 10738 | 4024 - Pesticide Residue Analysis |
| Analysis of Organophosphorous Pesticides in Aqueous Samples by Methods 8141A/8141B/622 using GC-NPD | 1-P-QM-WI -9015156 | Analysis DOD - 5366, 10410, 10593, 12144 | 4024 - Pesticide Residue Analysis |
| Analysis of Organophosphorous Pesticides in Solid Samples by 8141A/8141B using GC-NPD | 1-P-QM-WI -9015157 | Analysis DOD - 5367, 10408, 10594 | 4024 - Pesticide Residue Analysis |
| Analysis of Chlorinated Herbicides by 8151A in Soil | 1-P-QM-WI -9015158 | Analysis DOD - 5592, 10401 | 4024 - Pesticide Residue Analysis |
| Extraction Procedure for the Determination of Formaldehyde and Aldehydes in a Solid Matrix | 1-P-QM-WI -9015162 | Analysis DOD - 5876, 11139 | 4024 - Pesticide Residue Analysis |
| Sonic Probe Extraction for the Determination of Pesticides in a Solid Matrix | 1-P-QM-WI -9015163 | Analysis DOD - 11129, 11131, 11134 | 4024 - Pesticide Residue Analysis |
| Polychlorinated Biphenyls (PCBs) by Method 608 or 8082 in Waters | 1-P-QM-WI -9015164 | Analysis DOD - 6030, 10227 | 4024 - Pesticide Residue Analysis |
| Determination of Perchlorate in Aqueous Samples and Soil Samples by LC/MS/MS, Method 6850 | 1-P-QM-WI -9015166 | Analysis DOD - 6386, 6557 | 4024 - Pesticide Residue Analysis |
| Extraction Procedure for Perchlorate in Soil Samples by LC/MS/MS | 1-P-QM-WI -9015167 | Analysis DOD - 6568 | 4024 - Pesticide Residue Analysis |
| Soxhlet Extraction Procedure for the Determination of Triazine Herbicides and Organophosphorous Pesticides in a Solid Matrix | 1-P-QM-WI -9015170 | Analysis DOD - 6677, 11130, 11133, 11142 | 4024 - Pesticide Residue Analysis |
| Extraction of Nitroaromatics and Nitroamines in Water | 1-P-QM-WI -9015171 | Analysis DOD - 6915, 11122, 11125 | 4024 - Pesticide Residue Analysis |
| Nitroaromatics and Nitroamines in Water and Solids by HPLC with UV Detection by Method 8330(A) | 1-P-QM-WI -9015172 | Analysis DOD - 6916, 6918, 10595, 10596, 10131, 10132 | 4024 - Pesticide Residue Analysis |
| Extraction of Nitroaromatics and Nitroamines in Soil | 1-P-QM-WI -9015173 | Analysis DOD - 6917, 11137, 11138 | 4024 - Pesticide Residue Analysis |
| Sonication Extraction of Nitroaromatics and Nitroamines in Soil (DoD) | 1-P-QM-WI -9015174 | Analysis DOD - 6917DoD | 4024 - Pesticide Residue Analysis |
| Separatory Funnel Extraction of Pesticides and PCBs in Aqueous Samples by SW-846 Method 3510C for OH VAP | 1-P-QM-WI -9022427 | Analysis 11117, 11118 OH VAP | 4024 - Pesticide Residue Analysis |
| Polychlorinated Biphenyls (PCBs) in Aqueous and Non-aqueous Samples by SW-846 Method 8082 for OH VAP | 1-P-QM-WI -9022429 | Analysis 10225, 10227, 10736 OH VAP | 4024 - Pesticide Residue Analysis |
| Pesticides in Aqueous and Non-aqueous Samples by SW-846 Method 8081A for OH VAP | 1-P-QM-WI -9022430 | Analysis 0177, 1363, 10738 OH VAP | 4024 - Pesticide Residue Analysis |
| Sonic Probe Extraction of Pesticides and PCBs in Solid Samples by SW-846 Method 3550C for OH VAP | 1-P-QM-WI -9022432 | Analysis 0819, 11134 OH VAP | 4024 - Pesticide Residue Analysis |
| Microwave Extraction of Pesticides and PCBs in Non-aqueous Samples by SW-846 Method 3546 for OH VAP | 1-P-QM-WI -9022433 | Analysis 10496, 10497 OH VAP | 4024 - Pesticide Residue Analysis |

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 3 – Environmental Sciences (continued)** | | | |
| Microwave Extraction of Pesticides and PCBs in Non-aqueous Samples by SW-846 Method 3546 for OH VAP | 1-P-QM-WI -9022433 | Analysis 10496, 10497 OH VAP | 4024 - Pesticide Residue Analysis |
| Determination of Benzene Sulfonic Acid and p-Phenol Sulfonic Acid in Water | 1-P-QM-WI -9023254 | Analysis 13147 | 4024 - Pesticide Residue Analysis |
| EDB, DBCP and TCP by Method 8011 in Solids using Microextraction and GC-ECD | 1-P-QM-WI -9025366 | Analysis 13214 | 4024 - Pesticide Residue Analysis |
| Microextraction of EDB, DBCP, and TCP in Solids by Method 8011 | 1-P-QM-WI -9025371 | Analysis 13218 | 4024 - Pesticide Residue Analysis |
| Statistical Calculations Used in the Analysis of Samples by EPA Methodology | 1-P-QM-PRO-9015491 | DOD - SOP-OR-020 | 4025 - Volatiles by GC |
| GC Routine and Nonroutine Maintenance | 1-P-QM-PRO-9015492 | DOD - SOP-OR-077 | 4025 - Volatiles by GC |
| Glassware Cleaning | 1-P-QM-PRO-9017814 | SOP-OR-070 | 4025 - Volatiles by GC |
| Calibrating the 1-uL Standard Delivery Groove on the Archon Model 5100A and O.I. 4660 Autosampler Systems | 1-P-QM-PRO-9017815 | SOP-OR-075 | 4025 - Volatiles by GC |
| Client Specific - Determination of Volatile Gasoline Range Organics in Soil and Water Maine Method | 1-P-QM-WI -9012774 | Analysis 10438, 10439 | 4025 - Volatiles by GC |
| Client Specific - GRO in Water for South Carolina | 1-P-QM-WI -9012789 | Analysis 10653 | 4025 - Volatiles by GC |
| Client Specific - GRO in Soils for South Carolina | 1-P-QM-WI -9012790 | Analysis 10654 | 4025 - Volatiles by GC |
| Client Specific - Method AK101 for the Determination of Gasoline Range Organics (GRO) in Water by Purge and Trap Gas Chromatography for the State of Alaska | 1-P-QM-WI -9013129 | Analysis 1438, 1440 | 4025 - Volatiles by GC |
| Client Specific - Method AK101 for the Determination of Gasoline Range Organics in Soil Analysis for the State of Alaska | 1-P-QM-WI -9013134 | Analysis 1450, 1451 | 4025 - Volatiles by GC |
| Determination of Volatile Gasoline Range Organics in Soil and Water - Northwest GX Method | 1-P-QM-WI -9013411 | Analysis 2005, 2006, 8273, 8274 | 4025 - Volatiles by GC |
| Client Specific - Determination of Volatile Gasoline Range Organics in Soil and Water Oklahoma Method | 1-P-QM-WI -9013441 | Analysis 2315, 8789 | 4025 - Volatiles by GC |
| Purgeable Aromatics in Water Samples by Method 602 | 1-P-QM-WI -9014655 | Analysis 8241 | 4025 - Volatiles by GC |
| Client Specific - Determination of Volatile Gasoline Range Organics and Petroleum Volatile Organic Compounds in Water - Wisconsin Method | 1-P-QM-WI -9015062 | Analysis 8803, 8805, 8806, 8807, 8809, 8810 | 4025 - Volatiles by GC |
| Gasoline Range Organics (GRO) in Water Samples Using Purge and Trap Gas Chromatography by SW-846, Method 8015B or SW-846, Method 8015C, Method 8015D | 1-P-QM-WI -9015131 | Analysis DOD - 1635, 1636, 1728, 1729, 2762, 2763, 8229, 8268, 10598 | 4025 - Volatiles by GC |
| Gasoline Range Organics (GRO) in Soils using Purge and Trap Gas Chromatography by SW-846, Method 8015B or SW-846, Method 8015C, or SW-846, Method 8015D | 1-P-QM-WI -9015132 | Analysis DOD - 1637, 1638, 1700, 1725, 1726, 2765, 2766, 5550, 5551, 10599, 12989 | 4025 - Volatiles by GC |
| Purgeable Aromatics in Water Samples | 1-P-QM-WI -9015135 | Analysis DOD - 2102, 6464, 8806 | 4025 - Volatiles by GC |
| Purgeable Aromatics in High-Level Soils | 1-P-QM-WI -9015190 | Analysis DOD - 8179 | 4025 - Volatiles by GC |
| GC/MS Preventative and Corrective Maintenance | 1-P-QM-PRO-9015393 | DOD - MC-EX-001 | 4026 - GC/MS Semivolatiles |
| Semivolatile Extract Cleanup Using Gel Permeation Chromatography | 1-P-QM-PRO-9015406 | DOD - MC-OE-003 | 4026 - GC/MS Semivolatiles |
| Semivolatile Spiking and Calibration Standards | 1-P-QM-PRO-9015452 | DOD - SOP-EX-001 | 4026 - GC/MS Semivolatiles |

Controlled Copy

| | | | |
|---|---|---|---|
| GC/MS Electronic Data Management and Handling | 1-P-QM-PRO-9015453 | DOD - SOP-EX-006 | 4026 - GC/MS Semivolatiles |
| **Document Title** | **Document ID** | **Historical Document ID** | **Department Owner** |
| **Level 3 – Environmental Sciences (continued)** | | | |
| Quality Control Spike Mix Verification | 1-P-QM-PRO-9015454 | DOD - SOP-EX-008 | 4026 - GC/MS Semivolatiles |
| GC/MS Audit Process | 1-P-QM-PRO-9015455 | DOD - SOP-EX-009 | 4026 - GC/MS Semivolatiles |
| Semivolatile Run/Injection Log Generation | 1-P-QM-PRO-9015456 | DOD - SOP-EX-019 | 4026 - GC/MS Semivolatiles |
| Monitoring QC Data Acceptance Limits | 1-P-QM-PRO-9015457 | DOD - SOP-EX-020 | 4026 - GC/MS Semivolatiles |
| Pesticide Extract Cleanup Using Gel Permeation Chromatography for OH VAP | 1-P-QM-PRO-9023663 | N/A | 4026 - GC/MS Semivolatiles |
| Semivolatile Extract Cleanup Using Gel Permeation Chromatography for OH VAP | 1-P-QM-PRO-9023664 | N/A | 4026 - GC/MS Semivolatiles |
| The Determination of d-Limonene in Plastic by Gas Chromatography/Mass Spectrometry (GC/MS) | 1-P-QM-WI -9012761 | Analysis 10215 | 4026 - GC/MS Semivolatiles |
| Extraction Procedure for the Determination of 2-Chlrorbenzalmalonotrile (CS) and 3-Quinuclidinyl Benzilate (BZ) in Water and Wastewater | 1-P-QM-WI -9012779 | Analysis 10475 | 4026 - GC/MS Semivolatiles |
| Microwave Extraction for the Determination of Semivolatiles in a Solid Matrix | 1-P-QM-WI -9012780 | Analysis 10481, 11598 | 4026 - GC/MS Semivolatiles |
| Determination of N-Nitrosodimethylamine (NDMA) in Water and Soil by EPA 1625C | 1-P-QM-WI -9012803 | Analysis 10962, 11622 | 4026 - GC/MS Semivolatiles |
| Solid Phase Extraction Procedure for the Determination of THPA, THPI and PA in a Water Matrix | 1-P-QM-WI -9012865 | Analysis 11011 | 4026 - GC/MS Semivolatiles |
| Liquid/Liquid Extraction Procedure for the Determination of Neutral Extractables in a Wastewater Matrix | 1-P-QM-WI -9013043 | Analysis 11629 | 4026 - GC/MS Semivolatiles |
| Determination of cis-1,2,3,6-Tetrahydrophthalic anhydride (THPA), cis-1,2,3,6-tetrahydrophthalimide (THPI), Phthalic anhydride (PA) in Water/Wastewater by SPE and Soil by Sonic Probe Extraction with analysis by GC/MS | 1-P-QM-WI -9013141 | Analysis 1542, 2345 | 4026 - GC/MS Semivolatiles |
| Analysis of Chlorinated Herbicides in Water by Selective Ion Monitoring Gas Chromatography/Mass Spectroscopy (SIM/GC/MS) | 1-P-QM-WI -9013416 | Analysis 2026 | 4026 - GC/MS Semivolatiles |
| The Determination of Semivolatiles by Large Volume Injection (LVI) Gas Chromatography/Mass Spectrometry (GC/MS) | 1-P-QM-WI -9014025 | Analysis 6570 | 4026 - GC/MS Semivolatiles |
| Determination of Benz(a)pyrene in Smokeless Tobacco by Selective Ion Monitoring Gas Chromatography/Mass Spectrometry (SIM/GC/MS) | 1-P-QM-WI -9014169 | Analysis 7325, 0089 | 4026 - GC/MS Semivolatiles |
| Low-Level Sonication Extraction Procedure for the Determination of Polynuclear Aromatic Hydrocarbons (PAHs) in a Solid Matrix by GC/MS | 1-P-QM-WI -9014490 | Analysis 7806 | 4026 - GC/MS Semivolatiles |
| Extraction Procedure for the Determination of PAHs in an XAD Air Tube Sample by TO-15A | 1-P-QM-WI -9014491 | Analysis 7806AIR | 4026 - GC/MS Semivolatiles |
| Low-Level Sonic Probe Extraction Procedure by Method 3550C for the Determination of Semivolatiles in a Solid Matrix | 1-P-QM-WI -9015070 | Analysis DOD - 0381, 10478, 10480, 10483, 10486, 10487L | 4026 - GC/MS Semivolatiles |
| Waste Dilution Procedure for the Determination of Acid Extractables and Base-Neutrals in a Non-Water Soluble Matrix | 1-P-QM-WI -9015071 | Analysis DOD - 0381DIL | 4026 - GC/MS Semivolatiles |
| Dioxin Screening of Water and Soils (Screening Procedure for 2,3,7,8-Tetrachlorodibenzo-p-Dioxin by Selective Ion Monitoring Gas | 1-P-QM-WI -9015072 | Analysis DOD - 0382, 1196 | 4026 - GC/MS Semivolatiles |

Uncontrolled Copy

| | | | |
|---|---|---|---|
| Chromatography/Mass Spectrometry) | | | |

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 3 – Environmental Sciences (continued)** | | | |
| Separatory Funnel Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables in a Wastewater Matrix by SW-846 Method 3510C | 1-P-QM-WI -9015076 | Analysis DOD - 0813, 11010, 11015, 10464, 10467, 10476 | 4026 - GC/MS Semivolatiles |
| Semivolatile Organics Tentatively Identified Compound Method | 1-P-QM-WI -9015083 | Analysis DOD - 0885, 0886, 0887, 0893, 7125, 12126 | 4026 - GC/MS Semivolatiles |
| Determination of Semivolatile Organic Compounds by Method 8270C | 1-P-QM-WI -9015087 | Analysis DOD - 0949, 1309, 1476, 1536, 1946, 1947, 1953, 2035, 2395, 4615, 4678, 4688, 6387, 6397, 7804, 7805, 10032, 10723, 10724, 10727, 10728, 11013 | 4026 - GC/MS Semivolatiles |
| Analysis of Semivolatile Compounds in Drinking Water by Method 525.2 | 1-P-QM-WI -9015092 | Analysis DOD - 10333 | 4026 - GC/MS Semivolatiles |
| Determination of Priority Pollutants by Method 625 | 1-P-QM-WI -9015093 | Analysis DOD - 10334, 2783 | 4026 - GC/MS Semivolatiles |
| Liquid/Liquid Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables in a Wastewater Matrix by Method 8270 | 1-P-QM-WI -9015098 | Analysis DOD - 10458 | 4026 - GC/MS Semivolatiles |
| Determination of Semivolatile Organic Compounds by Method 8270D | 1-P-QM-WI -9015100 | Analysis DOD - 10461, 10462, 10726 | 4026 - GC/MS Semivolatiles |
| Extraction Procedure for the Determination of Tetraethyl Lead in a Water or Wastewater Matrix | 1-P-QM-WI -9015101 | Analysis DOD - 10472 | 4026 - GC/MS Semivolatiles |
| Sonic Probe Extraction Procedure for the Determination of Semivolatiles in a Solid Matrix by SIM | 1-P-QM-WI -9015102 | Analysis DOD - 10479, 10484, 10489 | 4026 - GC/MS Semivolatiles |
| Microwave Extraction by Method 3546 for Semivolatiles | 1-P-QM-WI -9015105 | Analysis DOD - 10498, 10809, 10810, 10811, 10812, 10813, 10814, 11630, 11916 | 4026 - GC/MS Semivolatiles |
| Separatory Funnel Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables by SIM in a Wastewater Matrix | 1-P-QM-WI -9015121 | Analysis DOD - 11012, 10465, 10466, 10470, 10471, 11912 | 4026 - GC/MS Semivolatiles |
| Determination of Tetraethyl Lead (TEL) and Tetramethyl Lead (TML) by GC/MS Analysis | 1-P-QM-WI -9015145 | Analysis DOD - 4220, 4221 | 4026 - GC/MS Semivolatiles |
| CLP Semivolatile Analysis of Waters and Soils by the OLM03.2 and/or the OLM04.3 Statement of Work | 1-P-QM-WI -9015146 | Analysis DOD - 4372, 4438, 4722, 4723 | 4026 - GC/MS Semivolatiles |
| Liquid-Liquid Extraction Procedure for the Determination of Target Compound List Analytes in a Water Matrix | 1-P-QM-WI -9015147 | Analysis DOD - 4606 | 4026 - GC/MS Semivolatiles |
| Low-Level Sonic Probe Extraction Procedure for the Determination of Target Compound List Analytes in a Solid Matrix | 1-P-QM-WI -9015148 | Analysis DOD - 4607 | 4026 - GC/MS Semivolatiles |
| Waste Dilution Procedure for the Determination of Acid Extractables and Base-Neutrals in a Non-Water Soluble Leachate Matrix | 1-P-QM-WI -9015150 | Analysis DOD - 4731DIL | 4026 - GC/MS Semivolatiles |
| Extraction of Organic Compounds in Drinking Water By Method 525.2 | 1-P-QM-WI -9015152 | Analysis DOD - 4894 | 4026 - GC/MS Semivolatiles |
| Separatory Funnel Extraction for the Determination of PAHs in Water by GC/MS Using Method 3510C | 1-P-QM-WI -9015185 | Analysis DOD - 7807 | 4026 - GC/MS Semivolatiles |
| Separatory Funnel Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables in a Wastewater Matrix by Method 625 | 1-P-QM-WI -9015188 | Analysis DOD - 8108, 10463 | 4026 - GC/MS Semivolatiles |

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 3 – Environmental Sciences (continued)** | | | |
| Sonic Probe Extraction Procedure for the Determination of Semivolatiles in a Complex Matrix | 1-P-QM-WI -9015189 | Analysis DOD - 8108TJ | 4026 - GC/MS Semivolatiles |
| Semivolatiles by Methods 8270C/D SIM | 1-P-QM-WI -9015192 | Analysis DOD - 8357, 0038, 0039, 10010, 10137, 10138, 10725, 11915, 11917, 12969, 12970, 12971 | 4026 - GC/MS Semivolatiles |
| Separatory Funnel Extraction Semivolatile Organic Compounds in an Aqueous Samples by SW-846 Method 3510C for OH VAP | 1-P-QM-WI -9022472 | Analysis 10464 OH VAP | 4026 - GC/MS Semivolatiles |
| Semivolatile Organic Compounds in Aqueous and Non-Aqueous Samples by Method SW-846 8270C for OH VAP | 1-P-QM-WI -9022474 | Analysis 1309, 10725 OH VAP | 4026 - GC/MS Semivolatiles |
| Microwave Extraction of Semivolatiles in Non-Aqueous Samples by SW-846 Method 3546 for OH VAP | 1-P-QM-WI -9022475 | Analysis 10813 OH VAP | 4026 - GC/MS Semivolatiles |
| Sonic Probe Extraction Procedure for the Determination of Semivolatiles in Non-Aqueous Samples by SW-846 Method 3550C for OH VAP | 1-P-QM-WI -9022476 | Analysis 0381 10478 OH VAP | 4026 - GC/MS Semivolatiles |
| Adjustable Volume Handheld Pipettes | 1-P-QM-PRO-9015395 | DOD - MC-IC-001 | 4027 - Instrumental Water Quality |
| pH Electrodes and Meters | 1-P-QM-PRO-9015396 | DOD - MC-IC-003 | 4027 - Instrumental Water Quality |
| Maintenance and Calibration of A.I. Scientific AIM600 Digestor | 1-P-QM-PRO-9015397 | DOD - MC-IC-005 | 4027 - Instrumental Water Quality |
| Maintenance of the OI Analytical Model 1030 Total Organic Carbon Analyzer | 1-P-QM-PRO-9015398 | DOD - MC-IC-006 | 4027 - Instrumental Water Quality |
| Maintenance of Continuous Flow Analyzers | 1-P-QM-PRO-9015399 | DOD - MC-IC-007 | 4027 - Instrumental Water Quality |
| Accusterilizer - Steam Sterilizer | 1-P-QM-PRO-9015400 | DOD - MC-IC-008 | 4027 - Instrumental Water Quality |
| Automatic Pipette Dispensers | 1-P-QM-PRO-9015401 | DOD - MC-IC-009 | 4027 - Instrumental Water Quality |
| ICS-1000, ICS 1100, ICS-2000 and ICS-3000 Ion Chromatography Systems | 1-P-QM-PRO-9015402 | DOD - MC-IC-010 | 4027 - Instrumental Water Quality |
| Quality Control for Auto-Analyzer Analyses Performed in Instrumental Water Quality | 1-P-QM-PRO-9015459 | DOD - SOP-IC-004 | 4027 - Instrumental Water Quality |
| Department 4027 Chemical Inventory and Review Procedures | 1-P-QM-PRO-9015460 | DOD - SOP-IC-016 | 4027 - Instrumental Water Quality |
| Maintenance of the OI Analytical Total Organic Carbon Solids Analyzer | 1-P-QM-PRO-9015461 | DOD - SOP-IC-017 | 4027 - Instrumental Water Quality |
| Determination of Low Level Hexavalent Chromium by Ion Chromatography in Solids and Waters by EPA Method 218.7 | 1-P-QM-PRO-9020768 | N/A | 4027 - Instrumental Water Quality |
| Automated Determination of Ammonia Nitrogen in Water and Wastewater Using Segmented Flow Analysis and Gas Diffusion by EPA 350.1 | 1-P-QM-PRO-9020808 | Analysis 12892, 13000 | 4027 - Instrumental Water Quality |
| Automated Determination of Total Kjeldahl Nitrogen in Water, Wastewater, and Solids | 1-P-QM-WI -9011633 | Analysis 0217, 1511, 0223, 4235, 6165 | 4027 - Instrumental Water Quality |
| Nitrite Nitrogen in Water and Wastewater (Colorimetric, Automated) | 1-P-QM-WI -9011634 | Analysis 0219, 5991 | 4027 - Instrumental Water Quality |
| Nitrate Nitrogen in Water and Wastewater (Colorimetric, Automated Cadmium Reduction) | 1-P-QM-WI -9011635 | Analysis 0220, 7882, 5992 | 4027 - Instrumental Water Quality |
| Determination of Inorganic Anions by Ion Chromatography | 1-P-QM-WI -9011637 | Analysis 0224, 0228, 0332, 0368, 1504, 1505, 1506, 7322, 7332, 7333, 7334, 7335, 7336, 7337, 7338 | 4027 - Instrumental Water Quality |
| Determination of Total and Soluble Phosphorus in Water, Wastewater, and Soils (Colorimetric, | 1-P-QM-WI -9011640 | Analysis 0227, 0345, 1546, 5893, 5894 | 4027 - Instrumental Water Quality |

| | | | |
|---|---|---|---|
| Ascorbic Acid, Automated) | | | |
| **Document Title** | **Document ID** | **Historical Document ID** | **Department Owner** |
| **Level 3 – Environmental Sciences (continued)** | | | |
| Determination of Total and Amenable Cyanide in Water, Wastewater, and Soils, Free Cyanide in Water and Wastewater, Reactive Cyanide of Solids, and Weak Acid Dissociable Cyanide in Waters and Soils | 1-P-QM-WI -9011646 | Analysis 0237, 1123, 1549, 5895, 5898, 8255, 0241, 4814, 0961, 0957, 0959 | 4027 - Instrumental Water Quality |
| Determination of Total Organic Carbon, Dissolved Organic Carbon, and Inorganic Carbon in Water and Wastewater | 1-P-QM-WI -9011651 | Analysis 0273, 6090, 7547 | 4027 - Instrumental Water Quality |
| Determination of Total Organic Carbon in Water and Wastewater (Quadruplicate Studies) | 1-P-QM-WI -9011682 | Analysis 0354 | 4027 - Instrumental Water Quality |
| Determination of Nitrocellulose in Water and Soil | 1-P-QM-WI -9011683 | Analysis 0370, 0371, 1105, 1106 | 4027 - Instrumental Water Quality |
| Automated Determination of Phenols in Water, Wastewater, and Soils By Automated Flow Analyzer EPA 420.4, EPA 420.2, SW-846, 9066 | 1-P-QM-WI -9011690 | Analysis 0434, 2393, 5912 | 4027 - Instrumental Water Quality |
| Phenol Distillation (as Preparation for Analysis on the Flow Analyzer) | 1-P-QM-WI -9011693 | Analysis 0491, 5911, 8123 | 4027 - Instrumental Water Quality |
| Total and Amenable Cyanide Distillation (As Preparation for Analysis on the Automatic Flow Analyzer) | 1-P-QM-WI -9011694 | Analysis 0492, 1548, 5896, 5897, 8256, 0956, 0958 | 4027 - Instrumental Water Quality |
| Total Cyanide Analysis by Massachusetts Contingency Plan (MCP) | 1-P-QM-WI -9012873 | Analysis 11151 | 4027 - Instrumental Water Quality |
| Determination of Total and Available Cyanide in Water using Amperometric Detection by ASTM D 7511-09e2 and Method OIA-1677-09 | 1-P-QM-WI -9013123 | Analysis 12823, 12941, 12999 | 4027 - Instrumental Water Quality |
| Reagent Water Extraction (as Preparation for Analysis on the Ion Chromatograph or Autoanalyzer) | 1-P-QM-WI -9013127 | Analysis 1352, 10129 | 4027 - Instrumental Water Quality |
| Total Kjeldahl Nitrogen Digestion of Water and Wastewater (A Preparation for Analysis 0217) | 1-P-QM-WI -9013136 | Analysis 1460 | 4027 - Instrumental Water Quality |
| Total Kjeldahl Nitrogen Digestion of Solids and Soils (a preparation for Analysis #1511) | 1-P-QM-WI -9013138 | Analysis 1465 | 4027 - Instrumental Water Quality |
| Determination of Total Carbon in Water and Wastewater | 1-P-QM-WI -9013142 | Analysis 1550 | 4027 - Instrumental Water Quality |
| Determination of TOC and TC in Solids and Sludges by Combustion | 1-P-QM-WI -9013418 | Analysis 2079, 0383, 6623, 10065, 11356, 11763 | 4027 - Instrumental Water Quality |
| Moisture by Sartorius Moisture Analyzer/Moisture by Mettler Toledo HB43 SM20 2540 G and SOW OLM03.2 | 1-P-QM-WI -9013422 | Analysis 2111, 2118, 2121, 2353 | 4027 - Instrumental Water Quality |
| Determination of Hexavalent Chromium by Ion Chromatography in Solids and Waters SW-846 7199 and EPA 218.6 | 1-P-QM-WI -9013989 | Analysis 5892, 6467 | 4027 - Instrumental Water Quality |
| Determination of Perchlorate by Ion Chromatography | 1-P-QM-WI -9013993 | Analysis 6019, 10130, 10147 | 4027 - Instrumental Water Quality |
| Weak Acid Dissociable Cyanide Distillation (as Preparation for Analysis on the Flow Analyzer) | 1-P-QM-WI -9014171 | Analysis 7528, 0960 | 4027 - Instrumental Water Quality |
| Digestion of Total and Soluble Phosphorus in Water, Wastewater, and Soils EPA 361.1, SM20 4500 P B, and SM20 4500 P E | 1-P-QM-WI -9014675 | Analysis 8261, 8262, 8263, 8264, 8895 | 4027 - Instrumental Water Quality |
| Client Specific - Determination of Inorganic Anions by Ion Chromatography (Department of Defense) | 1-P-QM-WI -9015115 | Analysis DOD - 10697, 10698, 10699, 10700, 10701, 10702, 10703 | 4027 - Instrumental Water Quality |
| Client Specific - Determination of Total Cyanide in Water, Wastewater, and Soils (Department of Defense) SW-846 9012B, SW-846 9012A | 1-P-QM-WI -9015116 | Analysis DOD - 10704, 10705 | 4027 - Instrumental Water Quality |
| Client Specific - Total Cyanide Distillation (Department of Defense) | 1-P-QM-WI -9015117 | Analysis DOD - 10706, 10707 | 4027 - Instrumental Water Quality |
| Hexavalent Chromium (Cr VI) in Aqueous and Non-aqueous Samples by Method SW-846 | 1-P-QM-WI -9022443 | Analysis 5892, 6467 OH VAP | 4027 - Instrumental Water Quality |

| | | | |
|---|---|---|---|
| 7199 for OH VAP | | | |
| pH Meters and Probes | 1-P-QM-PRO-9015415 | DOD - MC-TL-001 | 4028 - Leachate Preparation |
| **Document Title** | **Document ID** | **Historical Document ID** | **Department Owner** |
| **Level 3 – Environmental Sciences (continued)** | | | |
| Calibration of the Leachate Tumblers | 1-P-QM-PRO-9015416 | DOD - MC-TL-002 | 4028 - Leachate Preparation |
| Glassware Cleaning for Leachate Extractions | 1-P-QM-PRO-9015525 | DOD - SOP-TL-001 | 4028 - Leachate Preparation |
| Leachate Blank Evaluations | 1-P-QM-PRO-9015526 | DOD - SOP-TL-002 | 4028 - Leachate Preparation |
| Subsampling and Preservation of Leachates | 1-P-QM-PRO-9015527 | DOD - SOP-TL-003 | 4028 - Leachate Preparation |
| Manually Pressurized Zero Headspace Extractor (ZHE) | 1-P-QM-PRO-9015528 | DOD - SOP-TL-004 | 4028 - Leachate Preparation |
| Procedure for Calculating and Reporting Weighted Average Results for TCLP Extracts | 1-P-QM-PRO-9015529 | DOD - SOP-TL-005 | 4028 - Leachate Preparation |
| Shake Extraction of Solid Waste with Water ASTM Method #D3987-85 | 1-P-QM-WI -9015074 | Analysis DOD - 0447 | 4028 - Leachate Preparation |
| Toxicity Characteristic Leaching Procedure TCLP Zero Headspace Leachates, Method 1311 | 1-P-QM-WI -9015085 | Analysis DOD - 0946, 2573, 0075 | 4028 - Leachate Preparation |
| Toxicity Characteristic Leaching Procedure TCLP Nonvolatile Leachates | 1-P-QM-WI -9015086 | Analysis DOD - 0947, 1339 | 4028 - Leachate Preparation |
| Waste Extraction Test Leaching Procedure for Volatile and Non-volatile Analytes | 1-P-QM-WI -9015129 | Analysis DOD - 1435, 1436 | 4028 - Leachate Preparation |
| Synthetic Precipitation Leaching Procedure (SPLP) for Nonvolatile Leachates | 1-P-QM-WI -9015130 | Analysis DOD - 1567 | 4028 - Leachate Preparation |
| Food and Tissue Preparation | 1-P-QM-WI -9015137 | Analysis DOD - 2487 | 4028 - Leachate Preparation |
| Cation Exchange Capacity of Soils (Sodium Acetate) by Method 9081 | 1-P-QM-WI -9015138 | Analysis DOD - 2595 | 4028 - Leachate Preparation |
| Synthetic Precipitation Leaching Procedure (SPLP) Zero Headspace Leachates | 1-P-QM-WI -9015194 | Analysis DOD - 8792, 1339 | 4028 - Leachate Preparation |
| Spectronic Genesys 2 Spectrophotometer | 1-P-QM-PRO-9015417 | DOD - MC-WQ-002 | 4029 - Water Quality |
| Accumet Model AB30 pH/Ion/Conductivity Meter | 1-P-QM-PRO-9015419 | DOD - MC-WQ-004 | 4029 - Water Quality |
| Equipment Incubators and Refrigerators | 1-P-QM-PRO-9015420 | DOD - MC-WQ-006 | 4029 - Water Quality |
| pH Probes and Meters | 1-P-QM-PRO-9015421 | DOD - MC-WQ-007 | 4029 - Water Quality |
| Equipment Muffle Furnaces and Ovens | 1-P-QM-PRO-9015422 | DOD - MC-WQ-009 | 4029 - Water Quality |
| Calibration of Hach 2100AN Turbidimeter | 1-P-QM-PRO-9015423 | DOD - MC-WQ-010 | 4029 - Water Quality |
| Maintenance of Desiccators | 1-P-QM-PRO-9015424 | DOD - MC-WQ-012 | 4029 - Water Quality |
| Fixed Volume Hand-Held Pipettes | 1-P-QM-PRO-9015425 | DOD - MC-WQ-013 | 4029 - Water Quality |
| Adjustable Volume Handheld Pipettes | 1-P-QM-PRO-9015426 | DOD - MC-WQ-014 | 4029 - Water Quality |
| Hach DR 2800 Spectrophotometer | 1-P-QM-PRO-9015427 | DOD - MC-WQ-017 | 4029 - Water Quality |
| Orion 960 Autotitration System | 1-P-QM-PRO-9015428 | DOD - MC-WQ-022 | 4029 - Water Quality |
| YSI Model 5100 Dissolved Oxygen Meter | 1-P-QM-PRO-9015429 | DOD - MC-WQ-023 | 4029 - Water Quality |
| Maintenance of Hot Plates | 1-P-QM-PRO-9015430 | DOD - MC-WQ-024 | 4029 - Water Quality |
| Standardization of 0.02 and 0.1 Normal Sulfuric Acid | 1-P-QM-PRO-9015530 | DOD - SOP-WQ-002 | 4029 - Water Quality |
| Standardization of 0.02 Normal Sodium Hydroxide | 1-P-QM-PRO-9015531 | DOD - SOP-WQ-005 | 4029 - Water Quality |
| Water Quality Washroom Procedures | 1-P-QM-PRO-9015532 | DOD - SOP-WQ-006 | 4029 - Water Quality |
| Instructions for Collecting Data on the LLENS System | 1-P-QM-PRO-9015533 | DOD - SOP-WQ-014 | 4029 - Water Quality |
| Chemical Review | 1-P-QM-PRO-9015534 | DOD - SOP-WQ-016 | 4029 - Water Quality |
| Quality Control Data for Wet Chemistry | 1-P-QM-PRO-9015535 | DOD - SOP-WQ-017 | 4029 - Water Quality |
| Total Solids by 2540 B-1997, EPA 160.3 or 2540 G-1997 | 1-P-QM-WI -9011623 | Analysis 0203 | 4029 - Water Quality |
| Total Fixed Solids Total Volatile Solids by 2540 | 1-P-QM-WI -9011624 | Analysis 0204, 0205 | 4029 - Water Quality |

| | | | |
|---|---|---|---|
| E-1997, 160.4 or 2540 G-1997 | | | |
| Total Suspended Solids by 2540 D-1997 or EPA 160.2 | 1-P-QM-WI -9011625 | Analysis 0206 | 4029 - Water Quality |
| **Document Title** | **Document ID** | **Historical Document ID** | **Department Owner** |
| **Level 3 – Environmental Sciences (continued)** | | | |
| Fixed Suspended Solids (Gravimetric) (#207) Volatile Suspended Solids (Gravimetric) (#208) by SM 2540 E - 1997 | 1-P-QM-WI -9011626 | Analysis 0207, 0208 | 4029 - Water Quality |
| Total Dissolved Solids (Calculation) | 1-P-QM-WI -9011627 | Analysis 0209 | 4029 - Water Quality |
| Fixed Dissolved Solids (Calculation) | 1-P-QM-WI -9011628 | Analysis 0210 | 4029 - Water Quality |
| Volatile Dissolved Solids (Calculation) | 1-P-QM-WI -9011629 | Analysis 0211 | 4029 - Water Quality |
| Total Dissolved Solids in Waters (Gravimetric) by 2540 C-1997 or EPA 160.1 | 1-P-QM-WI -9011630 | Analysis 0212 | 4029 - Water Quality |
| Settleable Solids by 2540 F-1997, or EPA 160.5 | 1-P-QM-WI -9011631 | Analysis 0215 | 4029 - Water Quality |
| Ammonia-Nitrogen for Waters (Titrimetric Distillation Procedure) by 4500-NH3 B/C (Modified)-1997, or EPA 350.2 | 1-P-QM-WI -9011636 | Analysis 0221 | 4029 - Water Quality |
| Methylene-Blue-Active Substances (MBAS) by 5540 C-2000 or EPA 425.1 | 1-P-QM-WI -9011638 | Analysis 0225 | 4029 - Water Quality |
| Orthophosphate by EPA 365.3, or 4500-P E-1999 | 1-P-QM-WI -9011639 | Analysis 0226 | 4029 - Water Quality |
| Sulfite by 4500-SO3 B-2000, or EPA 377.1 | 1-P-QM-WI -9011641 | Analysis 0229 | 4029 - Water Quality |
| Colorimetric Sulfide in Waters (#0230), Sulfide as H2S (#10293 Calculation), Dissolved Sulfide in Waters (#10499) by 4500-S2 B/C/D-2000, 4500-S2 F-2000, or EPA 376.2 | 1-P-QM-WI -9011642 | Analysis 0230, 10293, 10499 | 4029 - Water Quality |
| Chemical Oxygen Demand (COD) (Dichromate Reflux Method) (Titrimetric, Mid-Level) | 1-P-QM-WI -9011644 | Analysis 0234 | 4029 - Water Quality |
| Biochemical Oxygen Demand Determination in Waters by SM 5210 B-2001 or EPA 405.1 | 1-P-QM-WI -9011645 | Analysis 0235 | 4029 - Water Quality |
| Free Carbon Dioxide (Calculation) | 1-P-QM-WI -9011647 | Analysis 0238 | 4029 - Water Quality |
| Chlorine Residual by 4500 Cl F-2000, or EPA 330.4 | 1-P-QM-WI -9011648 | Analysis 0240 | 4029 - Water Quality |
| Hexavalent Chromium (Colorimetric) by SW-846 7196A | 1-P-QM-WI -9011652 | Analysis 0276, 10330 | 4029 - Water Quality |
| Color by 2120 B-2001, or EPA 110.2 | 1-P-QM-WI -9011653 | Analysis 0277 | 4029 - Water Quality |
| Turbidity (Nephelometric) | 1-P-QM-WI -9011654 | Analysis 0279 | 4029 - Water Quality |
| pH (SW) (Electrometric) | 1-P-QM-WI -9011685 | Analysis 0394, 0496 | 4029 - Water Quality |
| Hexavalent Chromium in Solids (Alkaline Digestion and Analysis Methods) | 1-P-QM-WI -9011687 | Analysis 0425, 7825, 2432 | 4029 - Water Quality |
| Dissolved Oxygen (Membrane Electrode) by 4500 O G-2001 or EPA 360.1 | 1-P-QM-WI -9011688 | Analysis 0428 | 4029 - Water Quality |
| Determination of Flash Point for Liquids and Solids | 1-P-QM-WI -9011689 | Analysis 0430 | 4029 - Water Quality |
| Acidity to pH 3.7 and pH 8.3 (Titrimetric) by EPA 305.2 | 1-P-QM-WI -9011691 | Analysis 0475, 0476 | 4029 - Water Quality |
| Soluble Biochemical Oxygen Demand Determination in Waters by Incubation by 5210 B Modified-2001 or EPA 405.1 | 1-P-QM-WI -9012740 | Analysis 0541 | 4029 - Water Quality |
| Ignitability of Solids | 1-P-QM-WI -9012741 | Analysis 0542 | 4029 - Water Quality |
| Dissolved Silica (Colorimetric) by SM4500SiO2 C-1997 or EPA 370.1 | 1-P-QM-WI -9012742 | Analysis 0559 | 4029 - Water Quality |
| Ammonia-Nitrogen for Soils (Tritrimetric Distillation Procedure) by 4500-NH3 B/C (Modified)-1997, or EPA 350.2 (Modified) | 1-P-QM-WI -9012743 | Analysis 0573 | 4029 - Water Quality |
| Ammonia Nitrogen by Ion-Selective Electrode Method (ISE) in Solids by EPA 350.3 (Modified) and SM 4500-NH3B-1997 | 1-P-QM-WI -9012763 | Analysis 10222, 10696 | 4029 - Water Quality |

Uncontrolled Copy

| | | | |
|---|---|---|---|
| Total Suspended Solids in Waters (Gravimetric) by SM 2540 D - 1997 | 1-P-QM-WI -9012778 | Analysis 10457 | 4029 - Water Quality |
| Hexavalent Chromium (Colorimetric) in Waters by MCP | 1-P-QM-WI -9012870 | Analysis 11145 | 4029 - Water Quality |
| **Document Title** | **Document ID** | **Historical Document ID** | **Department Owner** |
| **Level 3 – Environmental Sciences (continued)** | | | |
| Hexavalent Chromium in Solids by MCP (Alkaline Digestion and Analysis Methods) | 1-P-QM-WI -9012871 | Analysis 11146 | 4029 - Water Quality |
| Reactivity | 1-P-QM-WI -9013027 | Analysis 1121 | 4029 - Water Quality |
| Reactive Sulfide | 1-P-QM-WI -9013032 | Analysis 1122 | 4029 - Water Quality |
| Chloride (Titrimetric Determination) by SM 4500-Cl C-1997 | 1-P-QM-WI -9013035 | Analysis 1124 | 4029 - Water Quality |
| Sulfate (turbidimetric) in Waters | 1-P-QM-WI -9013037 | Analysis 1125 | 4029 - Water Quality |
| Analysis of Conductivity, Alkalinity, pH, Temperature of pH, Fluoride, Turbidity, Total Hardness, Carbonate, Bicarbonate, and Ammonia by Either Man-Tech Multi-Parameter System or Manual Technique | 1-P-QM-WI -9013112 | Analysis 12145, 12146, 12147, 12148, 12149, 12150, 12151, 12152, 12677, 12678, 12679 | 4029 - Water Quality |
| Specific Conductance (Solids) by SW-846 9050 (Modified), EPA 120.1 (Modified) or 2510B-1997 | 1-P-QM-WI -9013113 | Analysis 1215 | 4029 - Water Quality |
| Sulfide Titration for Water by 4500 S2 F-2000, EPA 376.1, or SW-846 Method 9034 | 1-P-QM-WI -9013125 | Analysis 1333 | 4029 - Water Quality |
| Carbonaceous Biochemical Oxygen Demand Determination in Waters by SM 5210 B-2001 | 1-P-QM-WI -9013128 | Analysis 1364 | 4029 - Water Quality |
| pH (CLP) (Electrometric) | 1-P-QM-WI -9013130 | Analysis 1441 | 4029 - Water Quality |
| #1443 Specific Gravity by SM 2710 F #6569 Bulk Density by ASTM E868-82 Sec 9.9 Modified | 1-P-QM-WI -9013131 | Analysis 1443, 6569 | 4029 - Water Quality |
| Low-Level Hexavalent Chromium (colorimetric) by 3500-Cr B-2009 | 1-P-QM-WI -9013132 | Analysis 1446 | 4029 - Water Quality |
| Bellack Distillation for Fluoride in Waters and Solids by SM 4500 F B–1997 or EPA 340.1 Procedure 6.1 | 1-P-QM-WI -9013133 | Analysis 1448 | 4029 - Water Quality |
| Chemical Oxygen Demand (COD) in Waters (Dichromate Reflux Method) (Titrimetric, Low-Level) | 1-P-QM-WI -9013143 | Analysis 1553 | 4029 - Water Quality |
| Acid Volatile Sulfide in Solids | 1-P-QM-WI -9013392 | Analysis 1630 | 4029 - Water Quality |
| Paint Filter Liquids Test (Free Liquids Test) | 1-P-QM-WI -9013402 | Analysis 1820 | 4029 - Water Quality |
| Oxidation-Reduction Potential | 1-P-QM-WI -9013403 | Analysis 1821 | 4029 - Water Quality |
| Hexavalent Chromium in Solids by CTRCP (Alkaline Digestion and Analysis Methods) | 1-P-QM-WI -9013409 | Analysis 1962, 7825 | 4029 - Water Quality |
| Hexavalent Chromium (Colorimetric) in Waters by CTRCP | 1-P-QM-WI -9013410 | Analysis 1968 | 4029 - Water Quality |
| Percent Solids for GC/MS | 1-P-QM-WI -9013444 | Analysis 2365 | 4029 - Water Quality |
| n-Hexane Extractable Material (HEM) in Solids and Silica Gel Treated n-Hexane Extractable Material (SGT-HEM) | 1-P-QM-WI -9013456 | Analysis 2562, 6598 | 4029 - Water Quality |
| Chemical Oxygen Demand (COD) (Dichromatic Reflux Method) (Colorimetric) | 1-P-QM-WI -9013470 | Analysis 4001 | 4029 - Water Quality |
| Total Acidity for Wastewater by SM 2310 B-1997 or EPA 305.1 | 1-P-QM-WI -9013474 | Analysis 4530 | 4029 - Water Quality |
| Total Dissolved Solids by 2540 C | 1-P-QM-WI -9014026 | Analysis 6649 | 4029 - Water Quality |
| Moisture (Gravimetric), Total Residue (#0521), Volatile Residue (#0522), Total Fixed Residue/Ash (#1029) by SM 2540 G-1997 or SM 2540 E-1997 | 1-P-QM-WI -9014030 | Analysis 6866, 0521, 0522, 1029 | 4029 - Water Quality |
| Particle Size Distribution of Soils and Solids/Grain Size Classification by ASTM D422 | 1-P-QM-WI -9014165 | Analysis 7103, 11601, 11604 | 4029 - Water Quality |

Uncontrolled Copy

| | | | |
|---|---|---|---|
| Hexane Extractable Material (HEM) and Silica Gel Treated Hexane Extractable Materials (SGT-HEM) in Waters by EPA Method 1664A and EPA Method 1664B | 1-P-QM-WI -9014492 | Analysis 8079, 8078, 0612 | 4029 - Water Quality |
| Ferrous Iron By Method 3500-Fe B (Modified) - 1997 | 1-P-QM-WI -9015060 | Analysis 8344, 10328 | 4029 - Water Quality |
| **Document Title** | **Document ID** | **Historical Document ID** | **Department Owner** |
| **Level 3 – Environmental Sciences (continued)** | | | |
| Client Specific - Hexavalent Chromium in Waters (Colorimetric) (Department of Defense) | 1-P-QM-WI -9015113 | Analysis DOD - 10678 | 4029 - Water Quality |
| Client Specific - Hexavalent Chromium in Solids by Alkaline Digestion and Analysis Methods (Department of Defense) | 1-P-QM-WI -9015114 | Analysis DOD - 10679, 7825 | 4029 - Water Quality |
| Digestion Procedure for the Determination of Hexavalent Chromium (Cr VI) Digestion of Non-aqueous Samples by Method SW-846 3060A for OH VAP | 1-P-QM-WI -9022448 | Analysis 7825 OH VAP | 4029 - Water Quality |
| Calibration of Pressure Gauges | 1-P-QM-PRO-9015391 | DOD - MC-AL-002 | 4030 - Volatiles in Air |
| Routine Instrument Maintenance for Volatiles in Air by GC and GC/MS | 1-P-QM-PRO-9015392 | DOD - MC-AL-003 | 4030 - Volatiles in Air |
| Cleaning and Handling of Summa Canisters | 1-P-QM-PRO-9015431 | DOD - SOP-AL-001 | 4030 - Volatiles in Air |
| Cleaning and Handling of Flow Controllers | 1-P-QM-PRO-9015432 | DOD - SOP-AL-002 | 4030 - Volatiles in Air |
| Volatiles in Air Audit Process | 1-P-QM-PRO-9015433 | DOD - SOP-AL-003 | 4030 - Volatiles in Air |
| Procedure for Compositing Samples from a Tedlar Bag | 1-P-QM-PRO-9017689 | SOP-AL-004 | 4030 - Volatiles in Air |
| Preparing Summa Can Order | 1-P-QM-PRO-9017690 | SOP-AL-005 | 4030 - Volatiles in Air |
| Oxygen and Carbon Dioxide in Air | 1-P-QM-WI -9011592 | Analysis 0034 | 4030 - Volatiles in Air |
| Volatiles in Air Tentatively Identified Compound Method (Interpretive) | 1-P-QM-WI -9012747 | Analysis 0888 | 4030 - Volatiles in Air |
| Helium as a Tracer Gas | 1-P-QM-WI -9012770 | Analysis 10341 | 4030 - Volatiles in Air |
| The Automated Determination of Volatile Organic Compounds in Air Collected in Specially Treated Canisters Using Cryogenic Preconcentration and Gas Chromatography with Mass Selective Detection Using NJDEP Modified Low Level Method TO-15 | 1-P-QM-WI -9012799 | Analysis 10734 | 4030 - Volatiles in Air |
| Analysis of Air for Selected Volatile Organic Compounds by Gas Chromatography with Flame Ionization Detector and Photoionization Detector for Louisiana RECAP Vapor Evaluation | 1-P-QM-WI -9014029 | Analysis 6820 | 4030 - Volatiles in Air |
| Volatiles in Air Tentatively Identified Compound Method | 1-P-QM-WI -9014034 | Analysis 6900 | 4030 - Volatiles in Air |
| The Determination of Volatile Organic Compounds in Air Collected in Summa Canisters or Tedlar Bags Using Cryogenic Preconcentration and GC/MS Detection Using EPA Method TO-14 or TO-15 | 1-P-QM-WI -9015155 | Analysis DOD - 5265, 5298, 0015, 0037, 7199, 7869 | 4030 - Volatiles in Air |
| Analysis of Air for Selected Volatile Organic Compounds by Gas Chromatography with Flame Ionization Detector and Photo Using EPA Method 18 and 25 | 1-P-QM-WI -9015177 | Analysis DOD - 7090 | 4030 - Volatiles in Air |
| SIM Analysis of Low-Level Volatile Organic Compounds in Air Collected in Specially Treated Canisters or Tedlar Bags Using Cryogenic Preconcentration and Gas Chromatography with SIM Mass Selective Detection Using EPA Method TO-15 | 1-P-QM-WI -9015182 | Analysis DOD - 7345 | 4030 - Volatiles in Air |
| Collecting Water Samples for Regulatory Purposes | 1-P-QM-PRO-9015458 | DOD - SOP-FS-012 | 4031 - Field Sampling |
| Calibration, Operation and Maintenance of pH Probes and Meters | 1-P-QM-PRO-9017426 | MC-FS-002 | 4031 - Field Sampling |

Controlled Copy

| | | | |
|---|---|---|---|
| Wastewater Field Sampling Procedures | 1-P-QM-PRO-9017757 | SOP-FS-002 | 4031 - Field Sampling |
| Soil Sampling Procedures | 1-P-QM-PRO-9017758 | SOP-FS-003 | 4031 - Field Sampling |
| Collecting Potable Water Samples | 1-P-QM-PRO-9017759 | SOP-FS-004 | 4031 - Field Sampling |
| Groundwater Monitoring Sampling Procedure | 1-P-QM-PRO-9017760 | SOP-FS-006 | 4031 - Field Sampling |
| **Document Title** | **Document ID** | **Historical Document ID** | **Department Owner** |
| **Level 3 – Environmental Sciences (continued)** | | | |
| Direct Field Readings Using Orion Model 1230 Multi-Parameter Meter | 1-P-QM-PRO-9017761 | SOP-FS-008 | 4031 - Field Sampling |
| Symphony Multi-Parameter Meter | 1-P-QM-PRO-9017762 | SOP-FS-009 | 4031 - Field Sampling |
| Low Level Mercury Sampling | 1-P-QM-PRO-9017763 | SOP-FS-010 | 4031 - Field Sampling |
| Performing Free Chlorine Residual Readings | 1-P-QM-PRO-9017764 | SOP-FS-011 | 4031 - Field Sampling |
| Sampling Swimming Pool Water | 1-P-QM-PRO-9018291 | SOP-TR-003 | 4031 - Field Sampling |
| Maintenance and Troubleshooting Procedures for GC-FID Instrumentation | 1-P-QM-PRO-9015447 | DOD - SOP-EP-006 | 4032 - EPH/Misc. GC |
| Common Equations Used During Chromatographic Analyses | 1-P-QM-PRO-9015448 | DOD - SOP-EP-008 | 4032 - EPH/Misc. GC |
| QC Data Acceptability and Corrective Action | 1-P-QM-PRO-9015449 | DOD - SOP-EP-009 | 4032 - EPH/Misc. GC |
| Monitoring QC Data Acceptance Limits | 1-P-QM-PRO-9015450 | DOD - SOP-EP-010 | 4032 - EPH/Misc. GC |
| Interpretation and Integration of Chromatographic Data | 1-P-QM-PRO-9015451 | DOD - SOP-EP-011 | 4032 - EPH/Misc. GC |
| Using "Range Compound Analysis" Software for Range Data Acquisition | 1-P-QM-PRO-9017817 | SOP-OR-082 | 4032 - EPH/Misc. GC |
| GC Routine and Nonroutine Maintenance for Instrumentation Used for VPH Analysis | 1-P-QM-PRO-9023979 | N/A | 4032 - EPH/Misc. GC |
| Extraction of Solids/Soils for Analysis of Alcohols by Method 8015B | 1-P-QM-WI -9011684 | Analysis 0380 | 4032 - EPH/Misc. GC |
| Silica Gel Fractionation for Hydrocarbons by GC in Soil and Water Matrices | 1-P-QM-WI -9012711 | Analysis 0497 | 4032 - EPH/Misc. GC |
| CCWE Water Miscible Solvents | 1-P-QM-WI -9012748 | Analysis 0969 | 4032 - EPH/Misc. GC |
| Determination of Terphenyls by Method 8015B in Water and Solids Using GC-FID | 1-P-QM-WI -9012769 | Analysis 10318, 10319 | 4032 - EPH/Misc. GC |
| Hydrocarbon Oil Index by ISO Method 9377-2:2000 | 1-P-QM-WI -9012775 | Analysis 10441 | 4032 - EPH/Misc. GC |
| Separatory Funnel Extraction of Hydrocarbon Oil Index in Waters | 1-P-QM-WI -9012776 | Analysis 10442 | 4032 - EPH/Misc. GC |
| Client Specific - Method for the Determination of Extractable Petroleum Hydrocarbons by New Jersey Protocol (NJEPH) using GC-FID | 1-P-QM-WI -9012863 | Analysis 10967, 10973 | 4032 - EPH/Misc. GC |
| Client Specific - Microwave Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons (EPH) in a Solid Matrix by New Jersey Protocol | 1-P-QM-WI -9012864 | Analysis 10979, 11990 | 4032 - EPH/Misc. GC |
| Extraction Procedure for Wisconsin DRO Soils and Solid Waste | 1-P-QM-WI -9012868 | Analysis 11029 | 4032 - EPH/Misc. GC |
| Client Specific - Separatory Funnel Extraction Procedure for the Determination of Diesel Range Organics in a Water or Wastewater Matrix by Maine Methodology | 1-P-QM-WI -9013014 | Analysis 11165 | 4032 - EPH/Misc. GC |
| Separatory Funnel Extraction Procedure for the Determination of Diesel Range Organics in a Water or Wastewater Matrix by Wisconsin Protocol | 1-P-QM-WI -9013015 | Analysis 11166 | 4032 - EPH/Misc. GC |
| Extraction Procedure for the Determination of Diesel Range Organics in a Water or Wastewater Matrix by Oklahoma Methodology | 1-P-QM-WI -9013016 | Analysis 11168 | 4032 - EPH/Misc. GC |
| Client Specific - Separatory Funnel Extraction Procedure for the Determination of Total Petroleum Hydrocarbon Organics in a Water or | 1-P-QM-WI -9013017 | Analysis 11170 | 4032 - EPH/Misc. GC |

| | | | |
|---|---|---|---|
| Wastewater Matrix by FL-PRO | | | |
| Separatory Funnel Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Water or Wastewater Matrix by Montana Protocol | 1-P-QM-WI -9013018 | Analysis 11174, 11243 | 4032 - EPH/Misc. GC |

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 3 – Environmental Sciences (continued)** | | | |
| Client Specific - Separatory Funnel Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Water Matrix by Washington Methodology | 1-P-QM-WI -9013019 | Analysis 11175 | 4032 - EPH/Misc. GC |
| Extraction Procedure for the Determination of Total Petroleum Hydrocarbons in a Water or Wastewater Matrix by Connecticut Methodology | 1-P-QM-WI -9013020 | Analysis 11178 | 4032 - EPH/Misc. GC |
| Client Specific - Separatory Funnel Extract Procedure for the Determination of Extractable Petroleum Hydrocarbons (EPH) in a Water or Wastewater Matrix by Tennessee Methodology | 1-P-QM-WI -9013021 | Analysis 11179 | 4032 - EPH/Misc. GC |
| Separatory Funnel Extraction Procedure for the Determination of Diesel Range Organics in a Water Matrix by Alaska 102/103 | 1-P-QM-WI -9013022 | Analysis 11184, 11185, 11242, 13027, 13030 | 4032 - EPH/Misc. GC |
| Client Specific - Extraction Procedure for the Determination of Total Petroleum Hydrocarbon Organics in a Water or Wastewater Matrix by Texas Methodology | 1-P-QM-WI -9013023 | Analysis 11192 | 4032 - EPH/Misc. GC |
| Client Specific - Sonication Extraction Procedure for the Determination of Diesel Organics in Soil or Solid Matrix Oklahoma Methodology | 1-P-QM-WI -9013024 | Analysis 11206 | 4032 - EPH/Misc. GC |
| Client Specific - Sonication Extraction Procedure for the Determination of Diesel Range Organics in Soil or Solid Matrix California Methodology | 1-P-QM-WI -9013025 | Analysis 11207, 11214 | 4032 - EPH/Misc. GC |
| Sonic Probe Extraction Procedure for the Determination of Total Petroleum Hydrocarbon Organics in Soil or Solid Matrix Florida Methodology | 1-P-QM-WI -9013026 | Analysis 11208 | 4032 - EPH/Misc. GC |
| Client Specific - Microwave Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Solid Matrix by Montana Protocol | 1-P-QM-WI -9013028 | Analysis 11212 | 4032 - EPH/Misc. GC |
| Client Specific - Microwave Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Solid Matrix by Washington Protocol | 1-P-QM-WI -9013029 | Analysis 11213 | 4032 - EPH/Misc. GC |
| Client Specific - Sonic Probe Extraction for the Determination of Extractable Total Petroleum Hydrocarbons in Soil or Solid Matrix Connecticut Methology | 1-P-QM-WI -9013030 | Analysis 11216 | 4032 - EPH/Misc. GC |
| Sonic Probe Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in Soil or Solid Matrix Tennessee Methodology | 1-P-QM-WI -9013031 | Analysis 11217 | 4032 - EPH/Misc. GC |
| Client Specific - Extraction Procedure for the Determination ofTotal Petroleum Hydrocarbons in a Soil or Solid Matrix by Texas Methodology | 1-P-QM-WI -9013033 | Analysis 11230, 11244 | 4032 - EPH/Misc. GC |
| Total Saturated Hydrocarbons by Method 8015C in Waters and Solids using GC/FID | 1-P-QM-WI -9013038 | Analysis 11507, 11554 | 4032 - EPH/Misc. GC |
| Extraction of Soils/Solids for Glycol Analysis | 1-P-QM-WI -9013039 | Analysis 11551 | 4032 - EPH/Misc. GC |
| Alumina Column Cleanup of Solids | 1-P-QM-WI -9013040 | Analysis 11599, 11600 | 4032 - EPH/Misc. GC |
| Waste Dilution for the Determination of Saturated Hydrocarbons in an Oil Matrix | 1-P-QM-WI -9013051 | Analysis 11657 | 4032 - EPH/Misc. GC |
| 10g Silica Gel Cleanup for Hydrocarbons by GC in Soil and Water Matrices | 1-P-QM-WI -9013055 | Analysis 11681 | 4032 - EPH/Misc. GC |
| Microextraction by Method 3511 for the Determination of Diesel Range Organics in Water | 1-P-QM-WI -9013110 | Analysis 12059, 12866, 12895, 12896, 12897, 12898 | 4032 - EPH/Misc. GC |

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 3 – Environmental Sciences (continued)** | | | |
| Client Specific - Total Extractable Hydrocarbons (TEH) by Method 8015B Modified Using GC-FID | 1-P-QM-WI -9013137 | Analysis 1464, 1469, 10007 | 4032 - EPH/Misc. GC |
| Analysis of DRO/RRO by Alaska 102/103 in Waters and Soils | 1-P-QM-WI -9013394 | Analysis 1738, 1741, 1742, 2238, 2244, 2245, 2923 | 4032 - EPH/Misc. GC |
| Qualitative/Quantitative GC Fingerprint by 8015B Mod/ 8015C Mod/ or 8015D Mod | 1-P-QM-WI -9013412 | Analysis 2012, 2535 | 4032 - EPH/Misc. GC |
| Determination of Petroleum Range Organics in Waters and Solids using FL-PRO | 1-P-QM-WI -9013420 | Analysis 0347, 0359, 2099, 2100 | 4032 - EPH/Misc. GC |
| Method for the Determination of Extractable Petroleum Hydrocarbons by GC/FID using OA-2 Iowa/Missouri Protocol for Waters and Soils | 1-P-QM-WI -9013421 | Analysis 2110, 2112 | 4032 - EPH/Misc. GC |
| Separatory Funnel Extraction Method ECY 97-602 NWTPH-DX for TPH in a Water or Wastewater Matrix | 1-P-QM-WI -9013424 | Analysis 2135, 11197, 12007, 12119, 12120, 12907, 12916, 12924 | 4032 - EPH/Misc. GC |
| Client Specific - Microwave Extraction for the Determination of Extractable Petroleum Hydrocarbons (EPH) in a Solid Matrix by Massachusetts Protocol | 1-P-QM-WI -9013429 | Analysis 2168, 11235 | 4032 - EPH/Misc. GC |
| Quick Silica Gel Cleanup for Hydrocarbons by GC in Solid and Water Matrices | 1-P-QM-WI -9013430 | Analysis 2176 | 4032 - EPH/Misc. GC |
| Client Specific - TNRCC TX Method 1005 - Total Petroleum Hydrocarbons (Gasoline Range, Diesel Range, and Extended Range Organics) | 1-P-QM-WI -9013442 | Analysis 2318, 2321 | 4032 - EPH/Misc. GC |
| PMI Volatile Organic Compounds by Direct Injection GC/FID | 1-P-QM-WI -9013445 | Analysis 2366, 2380 | 4032 - EPH/Misc. GC |
| Client Specific - Separatory Funnel Extraction Procedure for the Determination of Diesel Range Organics in a Water or Wastewater Matrix by California Methodology | 1-P-QM-WI -9013446 | Analysis 2376, 11169, 11180, 11187, 11188, 11198, 11199 | 4032 - EPH/Misc. GC |
| TPH by CT ETPH | 1-P-QM-WI -9013462 | Analysis 2768, 2769 | 4032 - EPH/Misc. GC |
| Client Specific - TPH by TN EPH in Water and Soil using GC/FID | 1-P-QM-WI -9013463 | Analysis 2784, 2785 | 4032 - EPH/Misc. GC |
| Client Specific - Method for the Determination of Extractable Petroleum Hydrocarbons by Massachusetts Protocol (MAEPH) | 1-P-QM-WI -9013971 | Analysis 5331, 5332, 5944, 5949, 5968, 5969 | 4032 - EPH/Misc. GC |
| VPH in Waters and Solids Using GC-FID by Method ECY 97-602 WA VPH | 1-P-QM-WI -9013982 | Analysis 5665, 5666 | 4032 - EPH/Misc. GC |
| EPH in Waters and Solids Using GC-FID by Method ECY97-602 WA EPH | 1-P-QM-WI -9013990 | Analysis 5979, 5970 | 4032 - EPH/Misc. GC |
| Client Specific - TNRCC TX Method 1006 Characterization of C6-C35 Petroleum Hydrocarbons in Environmental Samples | 1-P-QM-WI -9013996 | Analysis 6091, 6104 | 4032 - EPH/Misc. GC |
| Determination of the Volatile Organic Concentration of Waste Samples by FID and ELCD | 1-P-QM-WI -9014040 | Analysis 7001 | 4032 - EPH/Misc. GC |
| Sonic Probe Extraction for TPH in Solids by Washington DX | 1-P-QM-WI -9014041 | Analysis 7024, 11234, 12008, 12117, 12118 | 4032 - EPH/Misc. GC |
| Client Specific - Separatory Funnel Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Water or Wastewater Matrix by Massachusetts or New Jersey Protocol | 1-P-QM-WI -9014170 | Analysis 7326, 10980, 11200 MA/LA/NJ | 4032 - EPH/Misc. GC |
| Analysis for TPH-DRO (Diesel Range Organics) in Soils or Waters by Wisconsin DRO Methodology | 1-P-QM-WI -9014172 | Analysis 7553, 7554 | 4032 - EPH/Misc. GC |
| TPH DRO (Diesel Range Organics) by Oklahoma DEQ Method | 1-P-QM-WI -9014308 | Analysis 7784, 7785, 10024, 10027 | 4032 - EPH/Misc. GC |
| TPH by NWTPH-Dx (modified) in Waters using GC-FID | 1-P-QM-WI -9015026 | Analysis 8271, 2211, 12005 | 4032 - EPH/Misc. GC |

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 3 – Environmental Sciences (continued)** | | | |
| TPH by NWTPH-Dx (modified) in Soils using GC-FID | 1-P-QM-WI -9015027 | Analysis 8272, 2214, 12006 | 4032 - EPH/Misc. GC |
| Analysis of Glycols in Waters by Method 8015B or 8015C | 1-P-QM-WI -9015028 | Analysis 8278, 11099, 12926 | 4032 - EPH/Misc. GC |
| Analysis of Glycols in Soils by Method 8015B | 1-P-QM-WI -9015029 | Analysis 8283 | 4032 - EPH/Misc. GC |
| Method for the Determination of Fractionated Extractable Petroleum Hydrocarbons using LA RECAP Ranges | 1-P-QM-WI -9015030 | Analysis 8323, 8324, 6976, 7062 | 4032 - EPH/Misc. GC |
| Client Specific - MA VPH Analysis of Water and Soil Samples | 1-P-QM-WI -9015061 | Analysis 8754, 8765, 5869, 5988, 6629, 6630, 10886, 10889 | 4032 - EPH/Misc. GC |
| TPH-DRO by 8015C/8015D in Water using GC-FID (Diesel Range Organics) | 1-P-QM-WI -9015111 | Analysis DOD - 10600 | 4032 - EPH/Misc. GC |
| TPH-DRO by 8015C/8015D in Solids using GC-FID (Diesel Range Organics) | 1-P-QM-WI -9015112 | Analysis DOD - 10601, 12838 | 4032 - EPH/Misc. GC |
| Microwave Extraction for the Determination of Diesel Range Organics (DRO) and Saturated Hydrocarbons in a Solid Matrix | 1-P-QM-WI -9015120 | Analysis DOD - 10942, 11509 | 4032 - EPH/Misc. GC |
| Sonication Extraction Procedure for the Determination of Diesel Organics in Soil or Solid Matrix by Alaska Methodology | 1-P-QM-WI -9015123 | Analysis DOD - 11222, 11223, 11239, 11248 | 4032 - EPH/Misc. GC |
| Sonic Disruption Extraction Procedure for the Determination of GC Fingerprint on Petroleum Products in Soil or Solid Matrix | 1-P-QM-WI -9015151 | Analysis DOD - 4833, 11227 | 4032 - EPH/Misc. GC |
| TPH by GC-FID and TPH by Custom 8015B | 1-P-QM-WI -9015154 | Analysis DOD - 5256, 5260, 8734, 8735 | 4032 - EPH/Misc. GC |
| Water Miscible Solvents by Method 8015B/8015C/8015D Using GC-FID | 1-P-QM-WI -9015169 | Analysis DOD - 6624, 10501, 10603, 10604 | 4032 - EPH/Misc. GC |
| Separatory Funnel Extraction Method 3510C for DRO in Water or Wastewater | 1-P-QM-WI -9015175 | Analysis DOD - 7003, 10304, 11164, 11167, 11171, 11172, 11176, 11177, 11181, 11183, 11189, 11190, 11191, 11195, 11196, 11201, 11203, 11596, 12820, 12906, 12915, 12923, 13095 | 4032 - EPH/Misc. GC |
| Sonication Extraction Method 3550C for DRO in Soils or Solids | 1-P-QM-WI -9015176 | Analysis DOD - 7004, 10303, 11204, 11205, 11209, 11215, 11218, 11219, 11225, 11228, 11229, 11233, 11236, 11237, 11238, 13097 | 4032 - EPH/Misc. GC |
| Volatile Hydrocarbons in Water by Method RSK-175 Modified and SW-846 8015 Using Headspace Sampling Techniques and GC-FID | 1-P-QM-WI -9015178 | Analysis DOD - 7105, 10602 | 4032 - EPH/Misc. GC |
| Analysis of Total Petroleum Hydrocarbons with Ranges by GC-FID, Based on Method 8015B | 1-P-QM-WI -9015186 | Analysis DOD - 8093, 8107, 2500, 2516, 2729, 2740, 0071, 0072, 0965, 1020, 6631, 6635, 10199, 10365 | 4032 - EPH/Misc. GC |
| Determination of Carbon Dioxide in Water Using Headspace Sampling Techniques and Gas Chromatography with Thermal Conductivity Detection (GC-TCD) | 1-P-QM-WI -9015187 | Analysis DOD - 8097 | 4032 - EPH/Misc. GC |
| TPH-DRO by 8015B in Solids using GC-FID (Diesel Range Organics) | 1-P-QM-WI -9015191 | Analysis DOD - 1104, 2222, 5868, 6901, 6902, 8270, 8345, 10941, 12831 | 4032 - EPH/Misc. GC |

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 3 – Environmental Sciences (continued)** | | | |
| TPH-DRO by 8015B in Water using GC-FID (Diesel Range Organics) | 1-P-QM-WI -9020088 | 1070, 1737, 2216, 2251, 5867, 6609, 6610, 6884, 6885, 6912, 6913, 8269, 8349, 11918, 12680, 12816 | 4032 - EPH/Misc. GC |
| Silica Gel Column Cleanup for Hydrocarbons by GC in Aqueous Matrices | 1-P-QM-WI -9020897 | Analysis 12894 | 4032 - EPH/Misc. GC |
| Analysis of DRO/TPH by 8015B or NWTPH-Dx (Modified) in Waters using Microextraction and GC-FID | 1-P-QM-WI -9020899 | Analysis 12858, 12872, 12879 | 4032 - EPH/Misc. GC |
| Analysis of DRO by 8015B and TPH by NWTPH-DX (Modified) in Water using Mini-Extraction and GC-FID | 1-P-QM-WI -9021423 | Analysis 12899, 12908, 12917 | 4032 - EPH/Misc. GC |
| 3 g Silica Gel Column Cleanup for DRO | 1-P-QM-WI -9021425 | Analysis 12932 | 4032 - EPH/Misc. GC |
| Determination of Diesel and Residual Range Organics using Alaska 102/103 Small Volume (SV) Protocols in Aqueous Samples | 1-P-QM-WI -9021778 | Analysis 13025, 13028 | 4032 - EPH/Misc. GC |
| TPH-DX with Fuel Identification in Waters and Solids by NWTPH-DX | 1-P-QM-WI -9023949 | Analysis 12071, 12082, 12093, 12094 | 4032 - EPH/Misc. GC |
| TPH-DRO by 8015C South Carolina Methodology Using GC-FID | 1-P-QM-WI -9024963 | Analysis 13094, 13096 | 4032 - EPH/Misc. GC |
| Extraction of Nicotine from Tobacco Products Using the Centers for Disease Control Protocol | 1-P-QM-WI -9011593 | Analysis 0088 | 4035 - Nitrosamines |
| CDC Tobacco Moisture | 1-P-QM-WI -9011594 | Analysis 0091 | 4035 - Nitrosamines |
| Analysis of Nicotine in Tobacco by GC/FID for Smokeless Tobacco Products Using the CDC Method | 1-P-QM-WI -9011595 | Analysis 0097 | 4035 - Nitrosamines |
| Nitrite in Tobacco Prep | 1-P-QM-WI -9013438 | Analysis 2264 | 4035 - Nitrosamines |
| Nitrite Nitrogen Analysis in Tobacco | 1-P-QM-WI -9013440 | Analysis 2266 | 4035 - Nitrosamines |
| Extraction of Tobacco Specific N-Nitrosamines in Tobacco Filler | 1-P-QM-WI -9013443 | Analysis 2326LC | 4035 - Nitrosamines |
| Nitrate in Tobacco Prep | 1-P-QM-WI -9013457 | Analysis 2610 | 4035 - Nitrosamines |
| Nitrate Nitrogen in Tobacco (Colorimetric, Automated Cadmium Reduction) | 1-P-QM-WI -9013464 | Analysis 2808 | 4035 - Nitrosamines |
| Tobacco Drying and Grinding | 1-P-QM-WI -9013801 | Analysis 4998 | 4035 - Nitrosamines |
| Analysis of Tobacco Specific Nitrosamines (TSNA) in Tobacco Leaf by LC/MS/MS | 1-P-QM-WI -9013802 | Analysis 5102 | 4035 - Nitrosamines |
| Extraction of Nicotine from Tobacco and Tobacco Products | 1-P-QM-WI -9014031 | Analysis 6870 | 4035 - Nitrosamines |
| Analysis of Nicotine in Tobacco by GC/FID Following Coresta 62 | 1-P-QM-WI -9014032 | Analysis 6878 | 4035 - Nitrosamines |
| Extraction of Tobacco for Benzo[a]Pyrene | 1-P-QM-WI -9014033 | Analysis 6883 | 4035 - Nitrosamines |
| Column Cleanup of Tobacco for TSNAs | 1-P-QM-WI -9014036 | Analysis 6962 | 4035 - Nitrosamines |
| Ultrasonic Processor Maintenance and Tuning | 1-P-QM-PRO-9015405 | DOD - MC-OE-002 | 4036 - Organic Extraction |
| Semivolatile Extract Cleanup Using Gel Permeation Chromatography | 1-P-QM-PRO-9015406 | DOD - MC-OE-003 | 4036 - Organic Extraction |
| Pesticide Extract Cleanup Using Gel Permeation Chromatography | 1-P-QM-PRO-9015407 | DOD - MC-OE-004 | 4036 - Organic Extraction |
| Steam Bath and N-Evap Usage, Calibration and Maintenance | 1-P-QM-PRO-9015408 | DOD - MC-OE-007 | 4036 - Organic Extraction |
| Refrigerated Recirculators | 1-P-QM-PRO-9015409 | DOD - MC-OE-008 | 4036 - Organic Extraction |
| Electrothermal Heating Mantles | 1-P-QM-PRO-9015410 | DOD - MC-OE-009 | 4036 - Organic Extraction |
| N-Evap | 1-P-QM-PRO-9015411 | DOD - MC-OE-010 | 4036 - Organic Extraction |
| Glassware Cleaning for Organic Extractions | 1-P-QM-PRO-9015475 | DOD - SOP-OE-001 | 4036 - Organic Extraction |
| Solvent and Reagent Lot Testing for Organic | 1-P-QM-PRO-9015476 | DOD - SOP-OE-002 | 4036 - Organic Extraction |

Uncontrolled Copy

| Extractions | | | |
|---|---|---|---|
| **Document Title** | **Document ID** | **Historical Document ID** | **Department Owner** |
| **Level 3 – Environmental Sciences (continued)** | | | |
| Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs) | 1-P-QM-PRO-9015477 | DOD - SOP-OE-004 | 4036 - Organic Extraction |
| pH Meters and Electrodes | 1-P-QM-PRO-9015478 | DOD - SOP-OE-005 | 4036 - Organic Extraction |
| Procedure for Containment and Clean Up of Hazardous Materials Spills in Organic Prep Lab | 1-P-QM-PRO-9015479 | DOD - SOP-OE-006 | 4036 - Organic Extraction |
| Determining QC Sample Volume for Organic Extractions | 1-P-QM-PRO-9015480 | DOD - SOP-OE-007 | 4036 - Organic Extraction |
| Scheduling Extraction Batches | 1-P-QM-PRO-9015481 | DOD - SOP-OE-008 | 4036 - Organic Extraction |
| Spike Solution Testing and Approval | 1-P-QM-PRO-9015482 | DOD - SOP-OE-009 | 4036 - Organic Extraction |
| Ultrasonic Probe Horn Cleaning | 1-P-QM-PRO-9015483 | DOD - SOP-OE-010 | 4036 - Organic Extraction |
| Routine Maintenance of Miele Glass Washers | 1-P-QM-PRO-9015484 | DOD - SOP-OE-011 | 4036 - Organic Extraction |
| Pesticide Extract Concentration Using a Zymark TurboVap II Concentration Workstation | 1-P-QM-PRO-9015485 | DOD - SOP-OE-012 | 4036 - Organic Extraction |
| Maintenance of Accelerated Solvent Extractor (ASE) and the Pressurized Solvent Extractor (PSE) | 1-P-QM-PRO-9015486 | DOD - SOP-OE-013 | 4036 - Organic Extraction |
| Glassware Cleaning using Automatic Washers for non-Organic Extraction Glassware | 1-P-QM-PRO-9015487 | DOD - SOP-OE-014 | 4036 - Organic Extraction |
| Semivolatile Extract Concentration Using a Zymark TurboVap II Concentration Workstation | 1-P-QM-PRO-9015488 | DOD - SOP-OE-015 | 4036 - Organic Extraction |
| Concentration Using a TurboVap LV Concentration Workstation | 1-P-QM-PRO-9015489 | DOD - SOP-OE-016 | 4036 - Organic Extraction |
| Organic Extraction Standards Storage and Handling | 1-P-QM-PRO-9015490 | DOD - SOP-OE-017 | 4036 - Organic Extraction |
| Maintenance and Calibration of the Microwave Accelerated Reaction System | 1-P-QM-PRO-9017428 | MC-OE-013 | 4036 - Organic Extraction |
| Pesticide Extract Cleanup Using Gel Permeation Chromatography for OH VAP | 1-P-QM-PRO-9023663 | N/A | 4036 - Organic Extraction |
| Semivolatile Extract Cleanup Using Gel Permeation Chromatography for OH VAP | 1-P-QM-PRO-9023664 | N/A | 4036 - Organic Extraction |
| Pesticides and Polychlorinated Biphenyls (PCBs) Cleanup Procedures for OH VAP | 1-P-QM-PRO-9024148 | N/A | 4036 - Organic Extraction |
| Silica Gel Fractionation for Hydrocarbons by GC in Soil and Water Matrices | 1-P-QM-WI -9012711 | Analysis 0497 | 4036 - Organic Extraction |
| Medium Level Sonic Probe Extraction Procedure for the Determination of Pesticides and PCBs in a Solid Matrix | 1-P-QM-WI -9012745 | Analysis 0819M, 11144 | 4036 - Organic Extraction |
| Liquid/Liquid Extraction Procedure for the Determination of Organophosphorous Pesticides in a Wastewater Matrix | 1-P-QM-WI -9012765 | Analysis 10240 | 4036 - Organic Extraction |
| Separatory Funnel Extraction of Hydrocarbon Oil Index in Waters | 1-P-QM-WI -9012776 | Analysis 10442 | 4036 - Organic Extraction |
| Extraction Procedure for the Determination of 2-Chlrorbenzalmalonotrile (CS) and 3-Quinuclidinyl Benzilate (BZ) in Water and Wastewater | 1-P-QM-WI -9012779 | Analysis 10475 | 4036 - Organic Extraction |
| Microwave Extraction for the Determination of Semivolatiles in a Solid Matrix | 1-P-QM-WI -9012780 | Analysis 10481, 11598 | 4036 - Organic Extraction |
| Client Specific - Microwave Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons (EPH) in a Solid Matrix by New Jersey Protocol | 1-P-QM-WI -9012864 | Analysis 10979, 11990 | 4036 - Organic Extraction |
| Solid Phase Extraction Procedure for the Determination of THPA, THPI and PA in a Water Matrix | 1-P-QM-WI -9012865 | Analysis 11011 | 4036 - Organic Extraction |
| Extraction Procedure for Wisconsin DRO Soils | 1-P-QM-WI -9012868 | Analysis 11029 | 4036 - Organic Extraction |

| | | | |
|---|---|---|---|
| and Solid Waste | | | |

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 3 – Environmental Sciences (continued)** | | | |
| Client Specific - Separatory Funnel Extraction Procedure for the Determination of Diesel Range Organics in a Water or Wastewater Matrix by Maine Methodology | 1-P-QM-WI -9013014 | Analysis 11165 | 4036 - Organic Extraction |
| Separatory Funnel Extraction Procedure for the Determination of Diesel Range Organics in a Water or Wastewater Matrix by Wisconsin Protocol | 1-P-QM-WI -9013015 | Analysis 11166 | 4036 - Organic Extraction |
| Extraction Procedure for the Determination of Diesel Range Organics in a Water or Wastewater Matrix by Oklahoma Methodology | 1-P-QM-WI -9013016 | Analysis 11168 | 4036 - Organic Extraction |
| Client Specific - Separatory Funnel Extraction Procedure for the Determination of Total Petroleum Hydrocarbon Organics in a Water or Wastewater Matrix by FL-PRO | 1-P-QM-WI -9013017 | Analysis 11170 | 4036 - Organic Extraction |
| Separatory Funnel Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Water or Wastewater Matrix by Montana Protocol | 1-P-QM-WI -9013018 | Analysis 11174, 11243 | 4036 - Organic Extraction |
| Client Specific - Separatory Funnel Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Water Matrix by Washington Methodology | 1-P-QM-WI -9013019 | Analysis 11175 | 4036 - Organic Extraction |
| Extraction Procedure for the Determination of Total Petroleum Hydrocarbons in a Water or Wastewater Matrix by Connecticut Methodology | 1-P-QM-WI -9013020 | Analysis 11178 | 4036 - Organic Extraction |
| Client Specific - Separatory Funnel Extract Procedure for the Determination of Extractable Petroleum Hydrocarbons (EPH) in a Water or Wastewater Matrix by Tennessee Methodology | 1-P-QM-WI -9013021 | Analysis 11179 | 4036 - Organic Extraction |
| Separatory Funnel Extraction Procedure for the Determination of Diesel Range Organics in a Water Matrix by Alaska 102/103 | 1-P-QM-WI -9013022 | Analysis 11184, 11185, 11242, 13027, 13030 | 4036 - Organic Extraction |
| Client Specific - Extraction Procedure for the Determination of Total Petroleum Hydrocarbon Organics in a Water or Wastewater Matrix by Texas Methodology | 1-P-QM-WI -9013023 | Analysis 11192 | 4036 - Organic Extraction |
| Client Specific - Sonication Extraction Procedure for the Determination of Diesel Organics in Soil or Solid Matrix Oklahoma Methodology | 1-P-QM-WI -9013024 | Analysis 11206 | 4036 - Organic Extraction |
| Client Specific - Sonication Extraction Procedure for the Determination of Diesel Range Organics in Soil or Solid Matrix California Methodology | 1-P-QM-WI -9013025 | Analysis 11207, 11214 | 4036 - Organic Extraction |
| Sonic Probe Extraction Procedure for the Determination of Total Petroleum Hydrocarbon Organics in Soil or Solid Matrix Florida Methodology | 1-P-QM-WI -9013026 | Analysis 11208 | 4036 - Organic Extraction |
| Client Specific - Microwave Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Solid Matrix by Montana Protocol | 1-P-QM-WI -9013028 | Analysis 11212 | 4036 - Organic Extraction |
| Client Specific - Microwave Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Solid Matrix by Washington Protocol | 1-P-QM-WI -9013029 | Analysis 11213 | 4036 - Organic Extraction |

Uncontrolled Copy

| | | | |
|---|---|---|---|
| Client Specific - Sonic Probe Extraction for the Determination of Extractable Total Petroleum Hydrocarbons in Soil or Solid Matrix Connecticut Methodology | 1-P-QM-WI -9013030 | Analysis 11216 | 4036 - Organic Extraction |
| **Document Title** | **Document ID** | **Historical Document ID** | **Department Owner** |
| **Level 3 – Environmental Sciences (continued)** | | | |
| Sonic Probe Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in Soil or Solid Matrix Tennessee Methodology | 1-P-QM-WI -9013031 | Analysis 11217 | 4036 - Organic Extraction |
| Client Specific - Extraction Procedure for the Determination of Total Petroleum Hydrocarbons in a Soil or Solid Matrix by Texas Methodology | 1-P-QM-WI -9013033 | Analysis 11230, 11244 | 4036 - Organic Extraction |
| Alumina Column Cleanup of Solids | 1-P-QM-WI -9013040 | Analysis 11599, 11600 | 4036 - Organic Extraction |
| Liquid/Liquid Extraction Procedure for the Determination of Neutral Extractables in a Wastewater Matrix | 1-P-QM-WI -9013043 | Analysis 11629 | 4036 - Organic Extraction |
| Waste Dilution for the Determination of Saturated Hydrocarbons in an Oil Matrix | 1-P-QM-WI -9013051 | Analysis 11657 | 4036 - Organic Extraction |
| 10g Silica Gel Cleanup for Hydrocarbons by GC in Soil and Water Matrices | 1-P-QM-WI -9013055 | Analysis 11681 | 4036 - Organic Extraction |
| Soxhlet Extraction Procedure for the Determination of Polychlorinated Biphenyls (PCBs) in a Solid Matrix | 1-P-QM-WI -9013065 | Analysis 11696 | 4036 - Organic Extraction |
| Microextraction by Method 3511 for the Determination of Diesel Range Organics in Water | 1-P-QM-WI -9013110 | Analysis 12059, 12866, 12895, 12896, 12897, 12898 | 4036 - Organic Extraction |
| Passive In-Situ Chemical Extraction Sampler (PISCES) Procedure for the Determination of Polychlorinated Biphenyls (PCBs) | 1-P-QM-WI -9013121 | Analysis 12801 | 4036 - Organic Extraction |
| Extraction Procedure for the Determination of Carbamate and Urea Pesticides in a Soil or Solid Waste Matrix | 1-P-QM-WI -9013140 | Analysis 1510, 11143 | 4036 - Organic Extraction |
| Separatory Funnel Extraction Method ECY 97-602 NWTPH-DX for TPH in a Water or Wastewater Matrix | 1-P-QM-WI -9013424 | Analysis 2135, 11197, 12007, 12119, 12120, 12907, 12916, 12924 | 4036 - Organic Extraction |
| Client Specific - Microwave Extraction for the Determination of Extractable Petroleum Hydrocarbons (EPH) in a Solid Matrix by Massachusetts Protocol | 1-P-QM-WI -9013429 | Analysis 2168, 11235 | 4036 - Organic Extraction |
| Quick Silica Gel Cleanup for Hydrocarbons by GC in Solid and Water Matrices | 1-P-QM-WI -9013430 | Analysis 2176 | 4036 - Organic Extraction |
| Client Specific - Separatory Funnel Extraction Procedure for the Determination of Diesel Range Organics in a Water or Wastewater Matrix by California Methodology | 1-P-QM-WI -9013446 | Analysis 2376, 11169, 11180, 11187, 11188, 11198, 11199 | 4036 - Organic Extraction |
| Extraction of Chlorinated Herbicides in a Soil Matrix | 1-P-QM-WI -9013472 | Analysis 4181 | 4036 - Organic Extraction |
| Soxhlet Extraction Procedure for the Determination of Pesticides in a Solid Matrix | 1-P-QM-WI -9013991 | Analysis 6006SOX | 4036 - Organic Extraction |
| Separatory Funnel Extraction Procedure for the Determination of Chlorinated Pesticides; Nitrogen and Phosphorus Containing Pesticides; and PCBs in a Drinking Water Matrix | 1-P-QM-WI -9014001 | Analysis 6368, 11127 | 4036 - Organic Extraction |
| Extraction of Chlorinated Acids and Herbicides in Drinking Water by Method 515.1 | 1-P-QM-WI -9014002 | Analysis 6369 | 4036 - Organic Extraction |
| Sonic Probe Extraction for TPH in Solids by Washington DX | 1-P-QM-WI -9014041 | Analysis 7024, 11234, 12008, 12117, 12118 | 4036 - Organic Extraction |
| Client Specific - Separatory Funnel Extraction Procedure for the Determination of | 1-P-QM-WI -9014170 | Analysis 7326, 10980, 11200 MA/LA/NJ | 4036 - Organic Extraction |

Uncontrolled Copy

| | | | |
|---|---|---|---|
| Extractable Petroleum Hydrocarbons in a Water or Wastewater Matrix by Massachusetts or New Jersey Protocol | | | |
| **Document Title** | **Document ID** | **Historical Document ID** | **Department Owner** |
| **Level 3 – Environmental Sciences (continued)** | | | |
| Microextraction of 1,2-Dibromoethane (EDB), 1,2-Dibromo-3-chloropropane (DBCP), and 1,2,3-Trichloropropane (TCP), in Water | 1-P-QM-WI -9014309 | Analysis 7786 | 4036 - Organic Extraction |
| Low-Level Sonication Extraction Procedure for the Determination of Polynuclear Aromatic Hydrocarbons (PAHs) in a Solid Matrix by GC/MS | 1-P-QM-WI -9014490 | Analysis 7806 | 4036 - Organic Extraction |
| Extraction Procedure for the Determination of PAHs in an XAD Air Tube Sample by TO-15A | 1-P-QM-WI -9014491 | Analysis 7806AIR | 4036 - Organic Extraction |
| Low-Level Sonic Probe Extraction Procedure by Method 3550C for the Determination of Semivolatiles in a Solid Matrix | 1-P-QM-WI -9015070 | Analysis DOD - 0381, 10478, 10480, 10483, 10486, 10487L | 4036 - Organic Extraction |
| Waste Dilution Procedure for the Determination of Acid Extractables and Base-Neutrals in a Non-Water Soluble Matrix | 1-P-QM-WI -9015071 | Analysis DOD - 0381DIL | 4036 - Organic Extraction |
| Separatory Funnel Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables in a Wastewater Matrix by SW-846 Method 3510C | 1-P-QM-WI -9015076 | Analysis DOD - 0813, 11010, 11015, 10464, 10467, 10476 | 4036 - Organic Extraction |
| Waste Dilution Procedure for the Determination of PCBs in Oil | 1-P-QM-WI -9015077 | Analysis DOD - 0815 | 4036 - Organic Extraction |
| Extraction of Chlorinated Herbicides in a Water Matrix by SW-846 8151A | 1-P-QM-WI -9015078 | Analysis DOD - 0816, 11110, 11111 | 4036 - Organic Extraction |
| Separatory Funnel Extraction Procedure for the Determination of Pesticides and PCBs in a Wastewater Matrix | 1-P-QM-WI -9015079 | Analysis DOD - 0817, 6654, 10241, 11112, 11113, 11114, 11116, 11117, 11118, 11119, 11120, 11121, 11123, 11126, 11960 | 4036 - Organic Extraction |
| Waste Dilution Procedure for the Determination of Pesticides and PCBs in a Non-Water Soluble Leachate Matrix | 1-P-QM-WI -9015080 | Analysis DOD - 11114DIL | 4036 - Organic Extraction |
| Sonic Probe Extraction Procedure for the Determination of Polychlorinated Biphenyls (PCBs) in a Solid Matrix | 1-P-QM-WI -9015081 | Analysis DOD - 0819, 11128, 11132, 11135 | 4036 - Organic Extraction |
| Sampling Equipment Cleaning and Validation for Metals Analysis | 1-P-QM-WI -9015089 | Analysis DOD - 10068 | 4036 - Organic Extraction |
| Extraction Procedure for the Determination of Formaldehyde and Aldehydes in a Water Matrix | 1-P-QM-WI -9015090 | Analysis DOD - 1013 | 4036 - Organic Extraction |
| Liquid/Liquid Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables in a Wastewater Matrix by Method 8270 | 1-P-QM-WI -9015098 | Analysis DOD - 10458 | 4036 - Organic Extraction |
| Extraction Procedure for the Determination of Tetraethyl Lead in a Water or Wastewater Matrix | 1-P-QM-WI -9015101 | Analysis DOD - 10472 | 4036 - Organic Extraction |
| Sonic Probe Extraction Procedure for the Determination of Semivolatiles in a Solid Matrix by SIM | 1-P-QM-WI -9015102 | Analysis DOD - 10479, 10484, 10489 | 4036 - Organic Extraction |
| Microwave Extraction Procedure for the Determination of Pesticides in a Solid Matrix | 1-P-QM-WI -9015103 | Analysis DOD - 10496, 11141 | 4036 - Organic Extraction |
| Microwave Extraction Procedure for the Determination of PCBs in a Solid Matrix | 1-P-QM-WI -9015104 | Analysis DOD - 10497, 11140 | 4036 - Organic Extraction |
| Microwave Extraction by Method 3546 for Semivolatiles | 1-P-QM-WI -9015105 | Analysis DOD - 10498, 10809, 10810, 10811, 10812, 10813, 10814, 11630, 11916 | 4036 - Organic Extraction |

Uncontrolled Copy

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 3 – Environmental Sciences (continued)** | | | |
| Microwave Extraction for the Determination of Diesel Range Organics (DRO) and Saturated Hydrocarbons in a Solid Matrix | 1-P-QM-WI -9015120 | Analysis DOD - 10942, 11509 | 4036 - Organic Extraction |
| Separatory Funnel Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables by SIM in a Wastewater Matrix | 1-P-QM-WI -9015121 | Analysis DOD - 11012, 10465, 10466, 10470, 10471, 11912 | 4036 - Organic Extraction |
| Sonication Extraction Procedure for the Determination of Diesel Organics in Soil or Solid Matrix by Alaska Methodology | 1-P-QM-WI -9015123 | Analysis DOD - 11222, 11223, 11239, 11248 | 4036 - Organic Extraction |
| Soxhlet Extraction Procedure for Extractable Matter in Textiles | 1-P-QM-WI -9015134 | Analysis DOD - 1948, 1949, 1950, 1951, 1952 | 4036 - Organic Extraction |
| Determination of Percentage Fat Using Accelerated Solvent Extraction (ASE) | 1-P-QM-WI -9015144 | Analysis DOD - 4193ASE | 4036 - Organic Extraction |
| Liquid-Liquid Extraction Procedure for the Determination of Target Compound List Analytes in a Water Matrix | 1-P-QM-WI -9015147 | Analysis DOD - 4606 | 4036 - Organic Extraction |
| Low-Level Sonic Probe Extraction Procedure for the Determination of Target Compound List Analytes in a Solid Matrix | 1-P-QM-WI -9015148 | Analysis DOD - 4607 | 4036 - Organic Extraction |
| Separatory Funnel Extraction Procedure for the Determination of Base Neutrals and Acid Extractables in a Toxicity Characteristic Leachate by SW-846 Method 3510C | 1-P-QM-WI -9015149 | Analysis DOD - 4731 | 4036 - Organic Extraction |
| Waste Dilution Procedure for the Determination of Acid Extractables and Base-Neutrals in a Non-Water Soluble Leachate Matrix | 1-P-QM-WI -9015150 | Analysis DOD - 4731DIL | 4036 - Organic Extraction |
| Sonic Disruption Extraction Procedure for the Determination of GC Fingerprint on Petroleum Products in Soil or Solid Matrix | 1-P-QM-WI -9015151 | Analysis DOD - 4833, 11227 | 4036 - Organic Extraction |
| Extraction of Organic Compounds in Drinking Water By Method 525.2 | 1-P-QM-WI -9015152 | Analysis DOD - 4894 | 4036 - Organic Extraction |
| Extraction Procedure for the Determination of Formaldehyde and Aldehydes in a Solid Matrix | 1-P-QM-WI -9015162 | Analysis DOD - 5876, 11139 | 4036 - Organic Extraction |
| Sonic Probe Extraction for the Determination of Pesticides in a Solid Matrix | 1-P-QM-WI -9015163 | Analysis DOD - 11129, 11131, 11134 | 4036 - Organic Extraction |
| Extraction Procedure for Perchlorate in Soil Samples by LC/MS/MS | 1-P-QM-WI -9015167 | Analysis DOD - 6568 | 4036 - Organic Extraction |
| Soxhlet Extraction Procedure for the Determination of Triazine Herbicides and Organophosphorous Pesticides in a Solid Matrix | 1-P-QM-WI -9015170 | Analysis DOD - 6677, 11130, 11133, 11142 | 4036 - Organic Extraction |
| Extraction of Nitroaromatics and Nitroamines in Water | 1-P-QM-WI -9015171 | Analysis DOD - 6915, 11122, 11125 | 4036 - Organic Extraction |
| Extraction of Nitroaromatics and Nitroamines in Soil | 1-P-QM-WI -9015173 | Analysis DOD - 6917, 11137, 11138 | 4036 - Organic Extraction |
| Sonication Extraction of Nitroaromatics and Nitroamines in Soil (DoD) | 1-P-QM-WI -9015174 | Analysis DOD - 6917DoD | 4036 - Organic Extraction |
| Separatory Funnel Extraction Method 3510C for DRO in Water or Wastewater | 1-P-QM-WI -9015175 | Analysis DOD - 7003, 10304, 11164, 11167, 11171, 11172, 11176, 11177, 11181, 11183, 11189, 11190, 11191, 11195, 11196, 11201, 11203, 11596, 12820, 12906, 12915, 12923, 13095 | 4036 - Organic Extraction |

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 3 – Environmental Sciences (continued)** | | | |
| Sonication Extraction Method 3550C for DRO in Soils or Solids | 1-P-QM-WI -9015176 | Analysis DOD - 7004, 10303, 11204, 11205, 11209, 11215, 11218, 11219, 11225, 11228, 11229, 11233, 11236, 11237, 11238, 13097 | 4036 - Organic Extraction |
| Separatory Funnel Extraction for the Determination of PAHs in Water by GC/MS Using Method 3510C | 1-P-QM-WI -9015185 | Analysis DOD - 7807 | 4036 - Organic Extraction |
| Separatory Funnel Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables in a Wastewater Matrix by Method 625 | 1-P-QM-WI -9015188 | Analysis DOD - 8108, 10463 | 4036 - Organic Extraction |
| Sonic Probe Extraction Procedure for the Determination of Semivolatiles in a Complex Matrix | 1-P-QM-WI -9015189 | Analysis DOD - 8108TJ | 4036 - Organic Extraction |
| Silica Gel Column Cleanup for Hydrocarbons by GC in Aqueous Matrices | 1-P-QM-WI -9020897 | Analysis 12894 | 4036 - Organic Extraction |
| 3 g Silica Gel Column Cleanup for DRO | 1-P-QM-WI -9021425 | Analysis 12932 | 4036 - Organic Extraction |
| Separatory Funnel Extraction of Pesticides and PCBs in Aqueous Samples by SW-846 Method 3510C for OH VAP | 1-P-QM-WI -9022427 | Analysis 11117, 11118 OH VAP | 4036 - Organic Extraction |
| Sonic Probe Extraction of Pesticides and PCBs in Solid Samples by SW-846 Method 3550C for OH VAP | 1-P-QM-WI -9022432 | Analysis 0819, 11134 OH VAP | 4036 - Organic Extraction |
| Microwave Extraction of Pesticides and PCBs in Non-aqueous Samples by SW-846 Method 3546 for OH VAP | 1-P-QM-WI -9022433 | Analysis 10496, 10497 OH VAP | 4036 - Organic Extraction |
| Separatory Funnel Extraction Semivolatile Organic Compounds in an Aqueous Samples by SW-846 Method 3510C for OH VAP | 1-P-QM-WI -9022472 | Analysis 10464 OH VAP | 4036 - Organic Extraction |
| Microwave Extraction of Semivolatiles in Non-Aqueous Samples by SW-846 Method 3546 for OH VAP | 1-P-QM-WI -9022475 | Analysis 10813 OH VAP | 4036 - Organic Extraction |
| Sonic Probe Extraction Procedure for the Determination of Semivolatiles in Non-Aqueous Samples by SW-846 Method 3550C for OH VAP | 1-P-QM-WI -9022476 | Analysis 0381 10478 OH VAP | 4036 - Organic Extraction |
| Microextraction of EDB, DBCP, and TCP in Solids by Method 8011 | 1-P-QM-WI -9025371 | Analysis 13218 | 4036 - Organic Extraction |
| DFS HRGC/HRMS Preventative and Corrective Maintenance | 1-P-QM-PRO-9015412 | DOD - MC-SP-001 | 4037 - Specialty Services Group |
| Sample Extract Column Cleanup Procedure for HRMS Analysis | 1-P-QM-PRO-9015510 | DOD - SOP-SP-003 | 4037 - Specialty Services Group |
| Thermo Scientific Trace Ultra Gas Chromatograph Quantum XLS Tandem Mass Spectrometer (GC/MS/MS) Preventative and Corrective Maintenance | 1-P-QM-PRO-9017429 | MC-SP-002 | 4037 - Specialty Services Group |
| Maintenance and Tuning for Thermo Scientific TSQ Quantum Access Tandem Mass Spectrometer with a Thermo Electron Accela HPLC System (LC/MS/MS) | 1-P-QM-PRO-9018268 | SOP-SP-001 | 4037 - Specialty Services Group |
| Processing EPA 1613B PCDD/PCDF High Resolution Mass Spectrometry Data using TargetQuan 2.0 | 1-P-QM-PRO-9018269 | SOP-SP-004 | 4037 - Specialty Services Group |
| Standards Management in the High Resolution Mass Spectrometry Laboratory | 1-P-QM-PRO-9018270 | SOP-SP-005 | 4037 - Specialty Services Group |
| Glassware Cleaning for HRMS Extractions | 1-P-QM-PRO-9025452 | N/A | 4037 - Specialty Services Group |
| Determination of Selected Perfluorinated | 1-P-QM-WI -9012802 | Analysis 10954 | 4037 - Specialty Services |

Uncontrolled Copy

| | | | |
|---|---|---|---|
| Alkyl Acids (PFAAs) in Aqueous Samples by LC/MS/MS | | | Group |
| **Document Title** | **Document ID** | **Historical Document ID** | **Department Owner** |
| **Level 3 – Environmental Sciences (continued)** | | | |
| Determination of Perfluorooctanoic Acid (PFOA) in Aqueous Samples by LC/MS/MS | 1-P-QM-WI -9012866 | Analysis 11016 | 4037 - Specialty Services Group |
| Determination of Diuron, Fenuron and Monuron in Water Samples by SPE Extraction and LC/MS/MS | 1-P-QM-WI -9013044 | Analysis 11639 | 4037 - Specialty Services Group |
| Determination of Diuron, Fenuron and Monuron in Soil Samples by LC/MS/MS | 1-P-QM-WI -9013054 | Analysis 11663 | 4037 - Specialty Services Group |
| Determination of Dioxin-like Polychlorinated Biophenyls by HRGC/HRMS | 1-P-QM-WI -9013071 | Analysis 11773, 12416 | 4037 - Specialty Services Group |
| The Determination of Pesticides by Gas Chromatography/Tandem Mass Spectrometry (GC/MS/MS) | 1-P-QM-WI -9013072 | Analysis 11788 | 4037 - Specialty Services Group |
| Extraction of Vegetation utilizing the QuEChERS (Quick, Easy, Cheap, Effective, Rugged, Safe) Technique for Pesticides | 1-P-QM-WI -9013073 | Analysis 11911 | 4037 - Specialty Services Group |
| Determination of Perchlorate in Milk and Milk Powder by LCMSMS | 1-P-QM-WI -9013074 | Analysis 11962, 11964 | 4037 - Specialty Services Group |
| Determination of Glycols in Waters by Direct Injection LC/MS/MS Method | 1-P-QM-WI -9013111 | Analysis 12060 | 4037 - Specialty Services Group |
| Determination of Polychlorinated Biphenyl Congeners by HRGC/HRMS | 1-P-QM-WI -9013114 | Analysis 12154, 12429 | 4037 - Specialty Services Group |
| Determination of Hydrazine, Monomethylhydrazine and 1.1-Dimethylhydrazine in Aqueous Samples by LC/MS/MS Using SW-846 8315A Modified | 1-P-QM-WI -9015095 | Analysis DOD - 10342 | 4037 - Specialty Services Group |
| Determination of Hydrazine, Monomethylhydrazine and 1,1-Dimethylhydrazinein Soil Samples by LC/MS/MS | 1-P-QM-WI -9015096 | Analysis DOD - 10346 | 4037 - Specialty Services Group |
| Separatory Funnel Sample Extraction Procedure for HRMS Analysis in a Water Matrix | 1-P-QM-WI -9015118 | Analysis DOD - 10914 | 4037 - Specialty Services Group |
| Determination of Tetra- Through Octa-Chlorinated Dioxins and Furans using HRGC/HRMS by EPA 1613B or SW-846 8290A | 1-P-QM-WI -9015119 | Analysis DOD - 10915, 11031, 11645, 11650, 12935, 12936, 12937 | 4037 - Specialty Services Group |
| Soxhlet Sample Extraction Procedure for HRMS Analysis in a Solid Matrix | 1-P-QM-WI -9015122 | Analysis DOD - 11030 | 4037 - Specialty Services Group |
| Determination of Endothall in Soil Samples by LCMSMS | 1-P-QM-WI -9015125 | Analysis DOD - 11688 | 4037 - Specialty Services Group |
| Client Specific - Trace Analysis of 16 Phthalates in Cosmetic Products by Gas Chromatography Selective Ion Monitoring Mass Spectroscopy (GC/SIM/MS) (Client Specific Method) | 1-P-QM-WI -9017430 | NS-37-010 | 4037 - Specialty Services Group |
| Client Specific - Analysis of Furan in Tobacco Products by Headspace Gas Chromatography Mass Spectroscopy (HS/GC/MS) | 1-P-QM-WI -9020124 | NA | 4037 - Specialty Services Group |
| Determination of Hydrazine in Mainstream Smoke via Liquid Chromatography/Tandem Mass Spectrometry | 1-P-QM-WI -9020139 | NA | 4037 - Specialty Services Group |
| Client Specific - Analysis of Glycerol Monolaurate and Propylene Glycol Monolaurate in BioPolySan by Gas Chromatography Mass Spectroscopy (GC/MS) | 1-P-QM-WI -9020891 | N/A | 4037 - Specialty Services Group |
| Client Specific – Analysis of Aflatoxin B1 in Tobacco and Tobacco Related Products | 1-P-QM-WI -9021796 | N/A | 4037 - Specialty Services Group |

Uncontrolled Copy

| | | | |
|---|---|---|---|
| using LC/MS/MS | | | |
| Client Specific - Analysis of Piperonyl Butoxide (PBO) in Wastewater by GC/MS/MS | 1-P-QM-WI -9022844 | N/A | 4037 - Specialty Services Group |
| **Document Title** | **Document ID** | **Historical Document ID** | **Department Owner** |
| **Level 3 – Environmental Sciences (continued)** | | | |
| Client Specific - Trimethylamine by Headspace Gas Chromatography Mass Spectroscopy (HS GCMS) | 1-P-QM-WI -9023280 | N/A | 4037 - Specialty Services Group |
| Determination of Multiple Client Specific APIs in Surface Water by LCMSMS | 1-P-QM-WI -9023568 | N/A | 4037 - Specialty Services Group |
| Processing and Sending Data Packages | 1-P-QM-PRO-9015441 | DOD - SOP-DP-007 | 4038 - Data Deliverables |
| Overchecking the Electronic Data Deliverable | 1-P-QM-PRO-9015442 | DOD - SOP-DP-009 | 4038 - Data Deliverables |
| Preparation of Data Packages on CD ROM | 1-P-QM-PRO-9015444 | DOD - SOP-DP-014 | 4038 - Data Deliverables |
| Archiving Department 4025 Raw Sample Data and Other Miscellaneous Data | 1-P-QM-PRO-9015445 | DOD - SOP-DP-022 | 4038 - Data Deliverables |
| Generation and Content Review of GLP Compliant Data Packages | 1-P-QM-PRO-9017747 | SOP-DP-034 | 4038 - Data Deliverables |
| Assembly and Review of Environmental Data Packages | 1-P-QM-PRO-9017748 | SOP-DP-037 | 4038 - Data Deliverables |
| Tracking and Communicating Rush Results | 1-P-QM-PRO-9015434 | DOD - SOP-CL-005 | 4039 - Environmental Client Services and Inside Business Development |
| Phone Log and Email Documentation | 1-P-QM-PRO-9015435 | DOD - SOP-CL-006 | 4039 - Environmental Client Services and Inside Business Development |
| Auditing Client Paperwork | 1-P-QM-PRO-9015436 | DOD - SOP-CL-007 | 4039 - Environmental Client Services and Inside Business Development |
| Scheduling and Pricing of Rush Samples | 1-P-QM-PRO-9015437 | DOD - SOP-CL-010 | 4039 - Environmental Client Services and Inside Business Development |
| Sample Set-Up Form Creation Guide | 1-P-QM-PRO-9015438 | DOD - SOP-CL-014 | 4039 - Environmental Client Services and Inside Business Development |
| Client Concern and ISPD Code Entry | 1-P-QM-PRO-9015439 | DOD - SOP-CL-015 | 4039 - Environmental Client Services and Inside Business Development |
| Preparing Quotations | 1-P-QM-PRO-9017698 | SOP-CL-008 | 4039 - Environmental Client Services and Inside Business Development |
| Daily or Weekly DEP Reporting | 1-P-QM-PRO-9017699 | SOP-CL-012 | 4039 - Environmental Client Services and Inside Business Development |
| Monthly DEP Reporting | 1-P-QM-PRO-9017700 | SOP-CL-013 | 4039 - Environmental Client Services and Inside Business Development |
| Creating Bottle Orders | 1-P-QM-PRO-9017701 | SOP-CL-016 | 4039 - Environmental Client Services and Inside Business Development |
| Creating Project Information Lists | 1-P-QM-PRO-9017702 | SOP-CL-017 | 4039 - Environmental Client Services and Inside Business Development |
| Client/Prospects Visits | 1-P-QM-PRO-9017799 | SOP-MK-104 | 4039 - Environmental Client Services and Inside Business Development |
| Proposal Preparation | 1-P-QM-PRO-9017800 | SOP-MK-105 | 4039 - Environmental Client Services and Inside Business Development |
| ETM System Probe Calibration | 1-P-QM-PRO-9015418 | DOD - MC-WQ-003 | 4052 - Environmental Quality Assurance |
| Proficiency Test and Double Blind Samples | 1-P-QM-PRO-9018237 | SOP-QC-003 | 4052 - Environmental Quality |

Uncontrolled Copy

| | | | |
|---|---|---|---|
| | | | Assurance |
| Environmental Quality Assurance Approval of Subcontractor Laboratories | 1-P-QM-PRO-9018248 | SOP-QC-023 | 4052 - Environmental Quality Assurance |
| Quality Assurance Review of End-of-Month QC Reports | 1-P-QM-PRO-9018253 | SOP-QC-028 | 4052 - Environmental Quality Assurance |
| **Document Title** | **Document ID** | **Historical Document ID** | **Department Owner** |
| **Level 3 – Environmental Sciences (continued)** | | | |
| Environmental Quality Assurance Functions for GLP Compliance | 1-P-QM-PRO-9018256 | SOP-QC-032 | 4052 - Environmental Quality Assurance |
| Performing Electronic Data Audits using Mint Miner Software | 1-P-QM-PRO-9018259 | SOP-QC-036 | 4052 - Environmental Quality Assurance |
| Maintenance of Environmental Certifications and Accreditations | 1-P-QM-PRO-9018261 | SOP-QC-039 | 4052 - Environmental Quality Assurance |
| Performing Environmental Quality Assurance Audits | 1-P-QM-PRO-9020535 | N/A | 4052 - Environmental Quality Assurance |
| Preparing Environmental Quality Assurance Reports for Management | 1-P-QM-PRO-9020717 | N/A | 4052 - Environmental Quality Assurance |
| QA Approval of Environmental Analytical Procedures and Standard Operating Procedures | 1-P-QM-PRO-9022099 | N/A | 4052 - Environmental Quality Assurance |
| Hosting of Environmental Client and Agency Audits | 1-P-QM-PRO-9022134 | N/A | 4052 - Environmental Quality Assurance |
| Environmental Quality Assurance Review of Client Project and Bid Documents | 1-P-QM-PRO-9022599 | N/A | 4052 - Environmental Quality Assurance |
| Introduction to Software Quality | 1-P-QM-TMA-9018310 | TRN-CS-001 | 4057 - Environmental Software Quality |
| **Level 3 – Transportation** | | | |
| What to Do in Case of Vehicular Accident or Breakdown | 1-P-QM-PRO-9018292 | SOP-TR-010 | 6041 – Transportation |
| Sample Pick-Up, Transportation, and Delivery | 1-P-QM-PRO-9018293 | SOP-TR-018 | 6041 - Transportation |
| Transportation Summary SOP | 1-P-QM-PRO-9028514 | N/A | 6041 - Transportation |
| **Level 3 – Environmental Sample Administration** | | | |
| Environmental Sample Entry | 1-P-QM-PRO-9015502 | DOD - SOP-SA-101 | 6042 - Environmental Sample Administration |
| Sample Receipt at Sample Receipt Desk | 1-P-QM-PRO-9015503 | DOD - SOP-SA-102 | 6042 - Environmental Sample Administration |
| Environmental Sample Receipt and Unpacking | 1-P-QM-PRO-9015504 | DOD - SOP-SA-103 | 6042 - Environmental Sample Administration |
| Filing of Sample Information | 1-P-QM-PRO-9015505 | DOD - SOP-SA-107 | 6042 - Environmental Sample Administration |
| Assigning Sample Delivery Group Numbers and Five-Digit Sample Codes to Sample Groups | 1-P-QM-PRO-9015506 | DOD - SOP-SA-119 | 6042 - Environmental Sample Administration |
| Entry of Environmental Samples Requiring Subcontracting | 1-P-QM-PRO-9015507 | DOD - SOP-SA-129 | 6042 - Environmental Sample Administration |
| Taking the Temperature of Environmental Samples Upon Arrival at the Lab | 1-P-QM-PRO-9015508 | DOD - SOP-SA-138 | 6042 - Environmental Sample Administration |
| **Level 3 – Sample Support** | | | |
| Sample Support Ovens | 1-P-QM-PRO-9015413 | DOD - MC-SS-001 | 6055 - Sample Support |
| Maintenance of Desiccators | 1-P-QM-PRO-9015414 | DOD - MC-SS-002 | 6055 - Sample Support |
| Liquid Sample Preservation | 1-P-QM-PRO-9015511 | DOD - SOP-SS-002 | 6055 - Sample Support |

Uncontrolled Copy

| | | | |
|---|---|---|---|
| Automated Storage, Retrieval, and Discarding of Samples | 1-P-QM-PRO-9015512 | DOD - SOP-SS-006 | 6055 - Sample Support |
| Homogenization and Subsampling of Solid Waste Samples from Environmental Sources | 1-P-QM-PRO-9015513 | DOD - SOP-SS-009 | 6055 - Sample Support |

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 3 – Sample Support (continued)** | | | |
| Subsampling for Subcontracted Analyses | 1-P-QM-PRO-9015514 | DOD - SOP-SS-010 | 6055 - Sample Support |
| Hardware Procedures for ASRS | 1-P-QM-PRO-9015515 | DOD - SOP-SS-015 | 6055 - Sample Support |
| Preservation and Bottles Room Preservative Traceability | 1-P-QM-PRO-9015516 | DOD - SOP-SS-017 | 6055 - Sample Support |
| Pipette Dispenser Calibration Procedure | 1-P-QM-PRO-9015517 | DOD - SOP-SS-018 | 6055 - Sample Support |
| Automated Storage and Retrieval System (ASRS) Lockout/Tagout Procedure | 1-P-QM-PRO-9015518 | DOD - SOP-SS-019 | 6055 - Sample Support |
| Outlier Quality Control Data | 1-P-QM-PRO-9015519 | DOD - SOP-SS-020 | 6055 - Sample Support |
| Instructions for Collecting Data on the LLENS System | 1-P-QM-PRO-9015520 | DOD - SOP-SS-021 | 6055 - Sample Support |
| Non-Automated Storage, Retrieval, and Discarding of Samples | 1-P-QM-PRO-9015521 | DOD - SOP-SS-022 | 6055 - Sample Support |
| Prescreening Water and Soil Samples for Volatile Organic Compounds | 1-P-QM-PRO-9015522 | DOD - SOP-SS-023 | 6055 - Sample Support |
| ASRS Emergency Failure Procedure | 1-P-QM-PRO-9015523 | DOD - SOP-SS-024 | 6055 - Sample Support |
| Incremental Sampling of Soil/Solid Samples | 1-P-QM-PRO-9015524 | DOD - SOP-SS-025 | 6055 - Sample Support |
| Glassware Cleaning | 1-P-QM-PRO-9018271 | SOP-SS-026 | 6055 - Sample Support |
| Bulk Solid Sample Preparation by SW-846 5035A for OH VAP | 1-P-QM-WI -9012777 | Analysis 11967 OH VAP | 6055 - Sample Support |
| Water Content (Moisture) by ASTM D 2216 | 1-P-QM-WI -9014166 | Analysis 7116, 7119 | 6055 - Sample Support |
| Moisture (Gravimetric) | 1-P-QM-WI -9015065 | Analysis DOD - 0111, 6111, 7611, 11624, 12845 | 6055 - Sample Support |
| GC/MS - Bulk Solid Matrix Sample Preparation | 1-P-QM-WI -9015069 | Analysis DOD - 0374, 6646, 10445, 11966, 11967 | 6055 - Sample Support |
| Preparation of Vials for Field Preservation of Soils for Volatile Analysis | 1-P-QM-WI -9015073 | Analysis DOD - 0388, 6119, 6169, 6647, 0405, 1169, 6171, 6172, 6173, 6645, 2392, 6176, 7579, 0069, 11014, 11764 | 6055 - Sample Support |
| Preparation of Soil and Solid Samples for GC Volatile Analyses | 1-P-QM-WI -9015124 | Analysis DOD - 1150, 6170, 11968, 11969 | 6055 - Sample Support |
| Tobacco Moisture | 1-P-QM-WI -9015168 | Analysis DOD - 6611 | 6055 - Sample Support |
| Total Residue by SM 2540G-1997 | 1-P-QM-WI -9015183 | Analysis DOD - 7400 | 6055 - Sample Support |
| Preparation of Soils for Volatile Analysis by EPA SW-846 Method 5035 | 1-P-QM-WI -9015193 | Analysis DOD - 8389, 8390, 6130, 6117, 6174, 7578, 7320 | 6055 - Sample Support |
| Preparation of Solid Samples by SW-846 Method 5035A (Field Preserved and EnCores) for OH VAP | 1-P-QM-WI -9022845 | Analysis 2392, 6171, 6176, 7320, 7578, 7579, 8389, 8390 OH VAP | 6055 - Sample Support |

Uncontrolled Copy

| Document Title | Document ID | Historical Document ID | Department Owner |
|---|---|---|---|
| **Level 3 – Sample Bottles** | | | |
| Bottle Preparation | 1-P-QM-PRO-9018263 | SOP-SB-003 | 6059 - Sample Bottles |
| Packing Bottle Orders | 1-P-QM-PRO-9018264 | SOP-SB-008 | 6059 - Sample Bottles |
| Preparation of Trip Blanks | 1-P-QM-PRO-9018265 | SOP-SB-012 | 6059 - Sample Bottles |
| Processing Bottle Orders | 1-P-QM-PRO-9018266 | SOP-SB-016 | 6059 - Sample Bottles |
| Preparation of Acid Dilutions | 1-P-QM-PRO-9018267 | SOP-SB-017 | 6059 - Sample Bottles |

Uncontrolled Copy

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-GDL-9015383 | **Revision** | 3 |
| **Effective Date** | Aug 8, 2014 | **Status** | Effective |
| **Historical/Local Document Number** | DOD - Environmental Quality Policy Manual Appendix F | | |
| **Local Document Level** | Level 1 | | |
| **Local Document Type** | POL - Policy | | |
| **Local Document Category** | ES - Environmental Sciences | | |

| | |
|---|---|
| **Prepared by** | Kathryn Brungard |
| **Reviewed and Approved by** | Duane Luckenbill;Review;Tuesday, July 29, 2014 11:14:09 AM EDT<br>Robert Strocko;Review;Wednesday, July 30, 2014 1:25:50 PM EDT<br>Dorothy Love;Approval;Wednesday, July 30, 2014 2:13:19 PM EDT |

Uncontrolled Copy

| Instrument | # of Units | Manufacturer/Model # |
|---|---|---|
| **Liquid Chromatography/Gas Chromatography/Mass Spectrometry (LC/GC/MS)** | | |
| LC/MS/MS | 1 | Agilent 1200 LC with Agilent 6410 MS/MS |
| LC/MS/MS | 1 | Agilent 1290 LC with Micromass Quattro micro MS/MS and Waters 2996 Photodiode Array UV-Vis Detector |
| LC/MS/MS | 1 | Thermo Scientific TSQ Quantum Access with Acella LC |
| LC/MS/MS | 2 | Waters 2795 LC with Micromass Quattro micro MS/MS |
| GC/MS | 3 | Agilent 5972 |
| GC/MS | 20 | Agilent 5973 |
| GC/MS | 10 | Agilent 5975 |
| GC/MS | 2 | Agilent 5977A |
| GC/MS | 2 | Shimadzu |
| GC/MS | 1 | Thermo Scientific ISQ |
| GC/MS | 1 | DSQ II MS with Trace GC Ultra GC |
| GC/MS/MS | 1 | Thermo TSQ 8000 MSMS with Trace 1310 GC |
| GC/MS/MS | 1 | Thermo TSQ Quantum XLS MSMS with Trace GC Ultra GC |
| HRGC/HRMS | 4 | Thermo Scientific DFS |
| Gas Chromatograph | 14 | Agilent 5890 |
| Gas Chromatograph | 40 | Agilent 6890 |
| Gas Chromatograph | 2 | Shimadzu |
| Gas Chromatograph | 27 | Agilent 7890 |
| Gas Chromatograph | 1 | Varian 3400 |
| **Auxiliary Equipment for Gas Chromatographs** | | |
| Most of the GC/MS and GC systems include autosamplers and approximately half are fitted with purge and trap concentrators for analysis of volatiles. | | |
| Purge/Trap Concentrators | 30 | OI 4560/4660 |
| Autosamplers | 13 | Archon 5100/5100A |
| Autosamplers | 20 | Agilent 7673 |
| Autosamplers | 21 | Agilent 7683 |
| Autosamplers | 28 | Agilent 7693 |
| Autosamplers | 6 | OI 4551/4552 |
| Autosamplers | 5 | EST Centruion |
| Autosamplers | 7 | Thermo Scientific AS TriPlus |
| Autosamplers | 3 | CTC Combipal Headspace |
| Automated Sampling System (Tedlar Bags) | 1 | Tekmar 2016/2032/LSC2000 |
| Automated Sampling System (Summa Canisters) | 3 | Entech 7016CR Autosamplers |
| Automated Sampling System (Tedlar Bags/Summa Canisters) | 1 | Entech 7032A |
| Automated Concentrator | 3 | Entech 7100 |
| Detectors available for GC: Electron Capture, Flame Ionization, Photoionization, Hall Electrolytic Conductivity, Nitrogen/Phosphorus, and Thermal Conductivity. All of the chromatographs are connected to electronic integration systems. | | |

Uncontrolled Copy

| | | |
|---|---|---|
| **High Performance Liquid Chromatography** | | |
| High Performance Liquid Chromatograph | 2 | Agilent 1100 LC |
| High Performance Liquid Chromatograph | 2 | Agilent 1200 HPLC |
| High Performance Liquid Chromatograph | 1 | Waters alliance 2695 |
| High Performance Liquid Chromatograph | 1 | Waters alliance 2795 |
| **Gel Permeation Chromatography** | | |
| Gel Permeation Chromatograph | 3 | J2Scientific AccuPrep |
| **Ion Chromatography** | | |
| Ion Chromatograph | 1 | Metrohm 881 IC Pro |
| Ion Chromatograph | 2 | Dionex ICS1000 |
| Ion Chromatograph | 1 | Dionex ICS3000 |
| Ion Chromatograph | 1 | Dionex ICS2000 |
| Ion Chromatograph | 3 | Dionex ICS1100 |
| **Atomic Absorption/Emission Spectrophotometry** | | |
| ICAP™ 6000 Duo ICP Analyzer | 4 | Thermo |
| ICP/MS | 1 | P/E Sciex Elan 9000 |
| ICP/MS | 1 | Agilent 7500ce |
| ICP/MS | 1 | Agilent 7700x |
| Mercury Analyzer | 2 | Leeman Labs Hydra II |
| Mercury Analyzer | 1 | Leeman Labs HYDRA $AF_{GOLD+}$ |
| Prep Station | 3 | Thomas Cain DEENA 60 |
| **UV Vis/IR Spectrophotometry:** | | |
| UV-Vis Spectrophotometer | 3 | Spectronic Genesys |
| UV-Vis Spectrophotomenter | 1 | Hach DR2800 |
| **Miscellaneous Chemistry Instrumentation** | | |
| Auto-titrator System | 2 | Mantech |
| Block Digestion Systems | 8 | Environmental Express SC150 |
| Block Digestion Systems | 6 | Environmental Express SC154 |
| Centrifuge | 5 | Various |
| Chilled water recirculators | | Various |
| Closed Cup Flashpoint Apparatus, Pensky-Martin | 1 | Fisher Scientific TA6 |
| Cyanide Midi Distillation Kits | 3 | Various |
| Dissolved Oxygen Meter | 1 | YSI Model 59 |
| Flow Solution Autoanalyzer | 2 | Alpkem |
| Glassware washer - automated | 1 | Miele – (2) PG8257 (1) G7827 (1) G7704 |
| Kjehldal Distillation Apparatus | 2 | Fisher |
| Microwave Extractors | 3 | CEM MarsXpress |
| pH meters | 13 | Various |
| Phenol Midi Distillation | 2 | Andrews Glass |
| Pressurized Solvent Extractor | 2 | Dionex ASE200 |
| Sonicators | 12 | Various |
| Total Organic Carbon Analyzer | 2 | O.I. Corp. 1030 |
| Total Organic Carbon Combustion Analyzer | 1 | O.I. Corp. 1010 |
| Turbidimeter | 1 | Hach 2100AN |
| Zero Headspace Extractor | 74 | Various Models |

Uncontrolled Copy

| Microbiology Equipment | | |
|---|---|---|
| Autoclave | 2 | Steris – Amsco, |
| Balance | 5 | Mettler, PB 3002 |
| Balance | 1 | Mettler-Toledo, AT200 |
| Balance | 2 | Mettler-Toledo, PR2002 |
| Balance | 1 | Sartorius BP4100 |
| Biological Safety Cabinet | 4 | NuAire NU-425-600 Type A/B 3 |
| Biological Safety Cabinet | 1 | NuAire NU-435-600 Type B2 Fume Hood |
| Colony Counter | 3 | Quebec Dark Field |
| **Microbiology Equipment** | | |
| Incubator | 1 | PGC 9311-1127 |
| Incubator | 1 | PS WFY20SAWI |
| Microscope | 1 | Stereoscope with Zoom, AO Model 570 |
| Microscope | 1 | Zeiss |
| pH Meter | 2 | Orion Model 410A |
| Quanti-Tray Sealer | 1 | IDEXX Model 2X |
| Water Bath | 1 | Boekel Grant with Removal Heater Circulator |
| Water Bath | 1 | Thermo Electron Corp. |
| Water Bath | 1 | Precision Coliform Incubator Bath |
| Water Bath | 1 | VWR 1275PC |
| UV Light | 2 | Spectronics |
| UV Sterilizer | 1 | Millipore |

## Computer Equipment

Our laboratories make extensive use of computers for business applications, technical operations (e.g., our sample management system), and QA Program (see section on Quality Assurance). The following is a list of the major components of our computer systems.

Numerous physical and virtual servers used to support the systems

Oracle systems run on IBM UNIX servers:

- One IBM Power 740 Server running AIX UNIX with 6 - 3.3 GHz Power7 Cores CPUs, 128GB RAM.
- One IBM P5-520 Server running AIX UNIX with 4-way 1.90GHz CPUs, 24GB RAM.
- 40+ Terra Bytes of disk storage and several SAN devices including V7000, DS4100, HP2000 and Clarion CX4-40.
- Various tape backup systems
- On-line fail over databases are available for all corporate production Oracle databases.

Uncontrolled Copy

**Networks/Telecommunication:**

- TCP/IP based network
- Ten Gigabit switch to accommodate company server farm
- Dual Cisco 6506E network cores

**Personal Computers/Servers:**

- Internet access is provided with an ASA firewall to control incoming and outgoing traffic
- ArcServe backup server
- Microsoft Exchange server
- Dell PowerEdge file and print servers
- More than 30 Network File Servers
- More than 1000 Personal Computers

**Power Systems:**

- 3 Phase Uninterrupted Power System

Uncontrolled Copy

Uncontrolled Copy

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-GDL-9015384 | **Revision** | 3 |
| **Effective Date** | Aug 8, 2014 | **Status** | Effective |
| **Historical/Local Document Number** | DOD - Environmental Quality Policy Manual Appendix G | | |
| **Local Document Level** | Level 1 | | |
| **Local Document Type** | POL - Policy | | |
| **Local Document Category** | ES - Environmental Sciences | | |

| | |
|---|---|
| **Prepared by** | Kathryn Brungard |
| **Reviewed and Approved by** | Duane Luckenbill;Review;Tuesday, July 29, 2014 11:01:38 AM EDT<br>Robert Strocko;Review;Wednesday, July 30, 2014 1:13:46 PM EDT<br>Dorothy Love;Approval;Wednesday, July 30, 2014 2:16:10 PM EDT |

Uncontrolled Copy

# Preventive Maintenance Schedule

| Instrument | Preventive Maintenance | Frequency |
|---|---|---|
| GC/MS<br>GC/MS/MS | Change septum | AN* : Min. weekly |
| | Clean/replace injection port seal & liner | AN |
| | Check/clean fans | Monthly or AN |
| | Check/clean cool flow | Monthly or AN |
| | Clean source and replace parts | Bimonthly or AN |
| | Change oil in diffusion pump | Annually or AN |
| | Change oil and service rough pump | Annually |
| | Change column | AN |
| GC and GC/MS Purge and Trap Concentrators | Check gas flows and pressures | Prior to calib. or AN |
| | Replace adsorbent trap in concentrators | AN |
| | Flush purge pathways | Monthly or AN |
| | Clean/replace water management | AN |
| GC | Septum change | AN. Min. weekly |
| | Column/injection port maintenance | AN |
| | Clean detector | AN |
| | Leak check ECDs | Semiannually |
| | Change/clean PID lamp | AN |
| | Change/clean/Replace FID parts | AN |
| | Change column | AN |
| GC/HRMS | System bakeout | AN |
| | Replacing the Secondary Electron Multiplier (SEM) | AN |
| | Adjusting potentials on ion source | AN |
| | Check sensitivity and resolution on ion source | Daily |
| | Cleaning ion source | AN |
| | Replace filament on ion source | AN |
| | Cleaning reference inlet | AN |
| | Check oil level on forepumps | monthly |
| | Change oil on forepumps | Yearly or if oil is cloudy or discolored |
| | Exchange lubricant reservoir on turbopumps | Yearly or after 5000 hours of operation |
| | Replace injection port liner | AN |
| | Clip injection port end of column | AN |
| | Replace septum | AN |
| | Clean chiller water/air filters and inspect fluid level | Monthly |
| | Change column | AN |
| LC/MS/MS | Change rough pump (vacuum) oil | Annually |
| | Clean cones and spray chamber | As needed, before each calibration |
| | Clean source and ion lenses | Annually |
| | Check electrospray capillary | AN |
| | Empty waste liquid reservoir | AN |
| | Tune and calibrate MS | AN |

Uncontrolled Copy

| Instrument | Preventive Maintenance | Frequency |
|---|---|---|
| HPLC | Pump lubrication | Annually |
| | Check pump seals | Annually |
| | Check-valves cleaned or rebuilt | AN |
| | Replace and/or adjust detector bulb | AN |
| | Clean detector flow cell | AN |
| | Replace Teflon lines | AN |
| | Autosampler septa replacement | AN |
| | In-line filter sonication/cleaning | AN |
| | System passivation | AN |
| | PCRS pump lubrication | AN |
| | Empty waste liquid reservoir | AN |
| Cold Vapor AA and Cold Vapor AF | Replace pump tubing | AN |
| | Lubricate pump head & autosampler | AN |
| | Clean optical cells and windows | AN |
| ICP | Replace pump winding | AN |
| | Lubricate autosampler | AN |
| | Vacuum instrument airfilters and air intakes | AN |
| | Clean optics and lenses | AN |
| | Clean Torch and injector tip | AN |
| | Clean nebulizer and spray chamber | AN |
| ICP/MS | Change interface rough pump oil | AN |
| | Change MS rough pump oil | AN |
| | Clean cones and ion lenses | AN |
| | Clean Torch, injector tip, nebulizer and spray chamber | AN |
| | Change peristaltic tubing | AN |
| | Vacuum instrument airfilters and air intakes | AN |
| | Empty waste liquid reservoir | AN |
| Total Organic Carbon Analyzer | Check for leaks | AN |
| | Inspect rotary valve | AN |
| | Clean gas permeation tube | AN |
| | Check halide scrubber | AN |
| | Check dessicant tube | AN |
| | Dust back and clean circuit boards | AN |
| Autoanalyzer spectrophotometer | Clean sample probe | AN |
| | Clean proportioning pump | AN |
| | Inspect pump tubing, replace if worn | AN |
| | Clean wash receptacles | AN |

*AN = as needed. These actions may be performed more frequently as required by the instrument's operational response.

Uncontrolled Copy

Uncontrolled Copy

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-GDL-9015385 | **Revision** | 3 |
| **Effective Date** | Aug 8, 2014 | **Status** | Effective |
| **Historical/Local Document Number** | DOD - Environmental Quality Policy Manual Appendix H | | |
| **Local Document Level** | Level 1 | | |
| **Local Document Type** | POL - Policy | | |
| **Local Document Category** | ES - Environmental Sciences | | |

| | |
|---|---|
| **Prepared by** | Kathryn Brungard |
| **Reviewed and Approved by** | Duane Luckenbill;Review;Tuesday, July 29, 2014 11:06:27 AM EDT<br>Robert Strocko;Review;Wednesday, July 30, 2014 1:22:59 PM EDT<br>Dorothy Love;Approval;Wednesday, July 30, 2014 2:14:49 PM EDT |

Uncontrolled Copy

Details on method/instrument calibration processes are provided in the individual Analytical Procedures. This appendix provides an overview for representative methodology.
Note: This appendix is not applicable to OH VAP work. See the OH VAP approved SOPs for calibration information.

**Calibration Summary for SW-846 Methods**

| | Initial Calibration | | | Continuing Calibration Verification | | |
|---|---|---|---|---|---|---|
| Instrument | Frequency | # Std Conc | Acceptance Criteria | Frequency | # Std Conc | Acceptance Criteria |
| GC/MS Volatiles* (8260B) | After C-cal fails | 6 | RF for SPCCs >0.300 for chlorobenzene and 1,1,2,2-tetrachloroethane, and >0.100 for 1,1-dichloroethene, bromoform and chloromethane<br>%RSD CCCs <30% | Every 12 hours | 1 | RF for SPCCs >0.300 for chlorobenzene and 1,1,2,2-tetrachloro-ethane, and >0.100 for 1,1-dichloroethene, bromoform and chloromethane<br>%Drift for CCCs <20 |
| GC/MS Volatiles* (8260C) | After C-cal fails | 7 | RF must meet minimum RF listed in SOP<br>%RSD of <20% for all analytes (10% may fail) | Every 12 hours | 1 | RF must meet minimum RF listed in SOP<br>%Drift for CCCs <20, 20% can fail if not detected in proceeding samples |
| GC/MS Semivolatiles (8270C)* | After C-cal fails | 6 | RF for SPCCs >0.050 Max<br>%RSD for CCCs <30% | Every 12 hours | 1 | RF for SPCCs 0.050<br>%Drift for CCCs <20 |
| GC/MS Semivolatiles (8270D)* | After C-cal fails | 6 | % RSD ≤ 20% for each compound. (no more than 10% of the compounds can exceed 20% RSD); alternate fit must be used for any analyte with RSD >20% (use linear fit if correlation coefficient is 0.990 or greater; if correlation coefficient is < 0.990 then quadratic fit can be used, but the coefficient of determination must be 0.990 or greater). If linear fit is used, it must pass a linear regression check (the low standard must be within 30% of its true concentration) | Every 12 hours | 1 | %Drift ± 20%; (no more than 20% of the compounds can exceed 20% drift, and all compounds that exceed 20% drift must be ≤ 50% drift) |
| GC/MS Semi-volatiles SIM | After C-cal Fails | 6 | % RSD for all compounds ≤20% | Every 12 hours | 1 | %Drift ± 20% |

Uncontrolled Copy

**Calibration Summary for SW-846 Methods**

| | Initial Calibration | | | Continuing Calibration Verification | | |
|---|---|---|---|---|---|---|
| Instrument | Frequency | # Std Conc | Acceptance Criteria | Frequency | # Std Conc | Acceptance Criteria |
| GC VOA | After C-cal fails | At least 5 | % RSD ≤20% for individual compounds.<br>Alternatively, if the average of the %RSDs of all compounds in the calibration standard is ≤20% then the average RF can be used for all compounds. | Every 10 samples | 1 | %Drift ± 15% for individual compounds or average % drift for all compounds in the standard ± 15% |
| GC Pesticides (8081A) | After C-cal fails | 5 | 20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit. Degradation for DDT, endrin 15%<br>Alternatively, if the average of the %RSDs of all compounds in the calibration standard is ≤20%, then the AVG RF can be used for all compounds. | Every 20 samples or 12 hours | 1 | ≤15% drift from initial response for quantitation<br>C-cal - A CCV is also compliant if the average % difference is ≤15% for all compounds in the CCV standard.<br>DDT/Endrin breakdown check 15% every 12 hours or 20 injections |
| GC Pesticides (8081B) | After C-cal fails | 5 | 20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit. Degradation for DDT, endrin 15% | Every 20 samples or 12 hours , | 1 | ≤20% drift from initial response for quantitation<br>DDT/Endrin breakdown check 15% every 12 hours or 20 injections |
| GC PCBs (8082) | After C-cal fails | 5 | 20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit. Alternatively, if the average of the %RSDs of all compounds in the calibration standard is ≤20%, then the AVG RF can be used for all compounds. | Every 20 samples or 12 hours | 1 | ≤15% drift from initial response for quantitation<br>C-cal - A CCV is also compliant if the average % difference is ≤15% for all compounds in the CCV standard. |
| GC PCBs (8082A) | After C-cal fails | 5 | 20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit. | Every 20 samples or 12 hours | 1 | ≤20% drift from initial response for quantitation |
| GC Herbicides (8151A) | After C-cal fails | 5 | 20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit.<br>Alternatively, if the average of the %RSDs of all compounds in the calibration standard is ≤20%, then the AVG RF can be used for all compounds. | Every 10 samples | 1 | ≤15% drift from initial response for quantitation<br>C-cal - A CCV is also compliant if the average % difference is ≤15% for all compounds in the CCV standard. |

Uncontrolled Copy

**Calibration Summary for SW-846 Methods**

| | Initial Calibration | | | Continuing Calibration Verification | | |
|---|---|---|---|---|---|---|
| Instrument | Frequency | # Std Conc | Acceptance Criteria | Frequency | # Std Conc | Acceptance Criteria |
| Explosives by HPLC (8330) | Each new run or after C-cal fails | 5 | 20% RSD of RFs of initial calibration to use average RF, otherwise use curve fit<br>Alternatively, if the average of the %RSDs of all compounds in the calibration standard is ≤20%, then the AVG RF can be used for all compounds. | Every 10 samples | 1 | ≤15% drift from initial response for quantitation<br>C-cal - A CCV is also compliant if the average % difference is ≤15% for all compounds in the CCV standard. |
| Congeners by HRGC/HRMS | After C-cal fails | 6 | If %RSD for native compounds <20% and for labeled compounds <35%, otherwise a calibration curve is used | Every 12 hours | 1 | <15% valley peak resolution for 2378-TCDD<br>All native and labeled compounds meet method defined recovery limits<br>RTs within ±15 secs of RT in ICAL |
| Dioxins by HRGC/HRMS | After C-cal fails | 6 | If %RSD for native compounds <20% and for labeled compounds <35%, otherwise a calibration curve is used | Every 12 hours | 1 | <25% valley peak resolution for 2378-TCDD<br>All native and labeled compounds meet method defined recovery limits<br>RTs within ±15 secs of RT in ICAL |
| GC TPH-GRO | After C-cal fails | At least 5 | % RSD of <20% to use the average CF, otherwise use calibration curve | Every 12 hours | 1 | %Drift ±15% |
| GC TPH-DRO | After C-cal fails | 5 | 20% RSD of RFs of initial calibration to use average RF, otherwise use curve fit. | Every 12 hours | 1 | % Drift ±15% |
| ICP/MS | Each new run | 1 | Independent calibration verification (ICV) within ±10% | Every 10 samples | 1 | ±10% of true value |
| ICP | Each new run | 1 | Independent calibration verification within ±10%, standards <5%RSD | Every 10 samples | 1 | Same as initial |
| CVAA | Each new run | 5 | Independent calibration verification within ±10%<br>Correlation coefficient >0.995 | Every 10 samples | 1 | ±20% of true value |
| Autoanalyzer | Daily | 6 | Correlation coefficient >0.995 | Every 10 samples | 1 | ±10% of true value |
| TOC Analyzer | Monthly | Water – 6<br>Soil – 4 | Corr. Coeff. > 0.995 | Every 10 samples | 1 | ±10% of true value |

uncontrolled copy

| Calibration Summary for SW-846 Methods | | | | | | |
|---|---|---|---|---|---|---|
| | Initial Calibration | | | Continuing Calibration Verification | | |
| Instrument | Frequency | # Std Conc | Acceptance Criteria | Frequency | # Std Conc | Acceptance Criteria |
| Balance | Daily | bracket range of use | Top-loading: ± 2% or ± 0.02g of true value of weight, whichever is greater.<br>Analytical: ± 0.1% or ± 0.5mg of true value of weight, whichever is greater. | N/A | N/A | N/A |

*All compounds with %RSD >15 must use first or second order regression fit of the six calibration points. Alternatively, if average of the %RSD of all compounds in calibration standard is ≤15%, the AVG RF can be used for all compounds.

Abbreviations
# Std Conc - The number of standard concentrations used
%RSD - Percent Relative Standard Deviation CF – Calibration Factor
SPCCs - System Performance Check Compounds
CCCs - Calibration Check Compounds C-cal - Continuing Calibration
RF - Response factor
CVAA - Cold Vapor Atomic Absorption
ICP/MS - Inductively Coupled Plasma – Mass Spectrometry
ICP - Inductively Coupled Plasma spectrophotometer; ICP run also includes inter-element correction check standard (at beginning and end of run)

| GC/MS Tuning Criteria | | |
|---|---|---|
| **BFB Key Ions and Ion Abundance Criteria:** | | |
| **Mass** | **Method 8260B** | **Method 524.2** |
| 50 | 15% to 40% of mass 95 | 15% to 40% of mass 95 |
| 75 | 30% to 60% of mass 95 | 30% to 80% of mass 95 |
| 95 | Base peak = 100% | Base peak = 100% |
| 96 | 5% to 9% of mass 95 | 5% to 9% of mass 95 |
| 173 | <2% of mass 174 | <2% of mass 174 |
| 174 | >50% of mass 95 | >50% of mass 95 |
| 175 | 5% to 9% of mass 174 | 5% to 9% of mass 174 |
| 176 | >95% but <101% of mass 174 | >95% but <101% of mass 174 |
| 177 | 5% to 9% of mass 176 | 5% to 9% of mass 176 |

| DFTPP Key Ions and Ion Abundance Criteria: | | | |
|---|---|---|---|
| **Mass** | **Method 8270D** | **Method 8270C** | **Method 525.2** |
| 51 | 30 % to 80 % of mass 198 | 30 % to 60 % of mass 198 | 10 % to 80 % of base peak |
| 68 | <2% of mass 69 | <2% of mass 69 | <2% of mass 69 |
| 69 | mass 69 relative abundance | mass 69 relative abundance | mass 69 relative abundance |
| 70 | <2% of mass 69 | <2% of mass 69 | <2% of mass 69 |
| 127 | 25 % to 75 % of mass 198 | 40% to 60 % of mass 198 | 10% to 80 % of base peak |
| 197 | <1% of mass 198 | <1% of mass 198 | <2% of mass 198 |
| 198 | Base Peak = 100% | Base Peak = 100% | Base peak or >50 % of mass 442 |

Uncontrolled Copy

| | | | |
|---|---|---|---|
| 199 | 5% to 9% of mass 198 | 5% to 9% of mass 198 | 5% to 9% of mass 198 |
| 275 | 10% to 30% of mass 198 | 10% to 30% of mass 198 | 10% to 60% of base peak |
| 365 | >0.75% of mass 198 | >1% of mass 198 | >1% of base peak |
| 441 | Present but < 24% mass 442 | Present but < mass 443 | Present but < mass 443 |
| 442 | >50% of mass 198 | >40% of mass 198 | Base peak or >50% of mass 198 |
| 443 | 15% to 24% of mass 442 | 17% to 23% of mass 442 | 15% to 24% of mass 442 |

Uncontrolled Copy

**Calibration Summary for Drinking Water Methods**

| | Initial Calibration | | | Continuing Calibration Verification | | |
|---|---|---|---|---|---|---|
| Instrument | Frequency | # Std Conc | Acceptance Criteria | Frequency | # Std Conc | Acceptance Criteria |
| **GC/MS** 525.2 | After C-cal fails | 6 | The RSD for each analyte mean RF must be ≤30%. Or a linear regression calibration curve may be used. | Every 12 hours | 1 | %D for RF must be ≤30%. If curve used, the point must fall on curve from I-cal. |
| **GC** 504.1 | Every new run | 5 | % RSD <20% to use Average RF, otherwise use calibration curve. | Every 10 samples or each batch if <10 samples | 1 | 70% to 130% of expected value |
| **GC/MS** 524.2 | After C-cal fails | 4 | % RSD <20% otherwise use calibration curve | Every 12 hours | 1 | %D for RF must be ≤30%. If curved used, the % recovery based on the concentration spiked must be 70% to 130% of expected value. |
| **GC** 507 508 515.1 | Each new run, or after C-cal fails | 3 | ≤20% RSD of RFs of Initial Calibration to use avg. RF, otherwise use curve fit. (Degradation for DDT, Endrin ≤20% initially - Method 508.) | Every 10 samples | 1 | ≤20% drift from initial response for both quantitation and confirmation. |
| **HPLC** 531.1 | Each new run, or after C-cal fails | 3 | ≤20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit | Every 10 samples and/or blanks | 1 | ≤20% drift from initial response. |
| **Mercury auto-analyzer** | Each new run | 5 | Initial calibration verification with ±5% | Every 10 samples | 1 | ±10% of true value |
| **Auto-analyzer** | Daily | 6 | Correlation coefficient >0.995 | Every 10 samples | 1 | ±10% of true value |
| **Balance** | Daily | bracket range of use | Top-loading: ± 2% or ± 0.02g of true value of weight, whichever is greater. Analytical: ± 0.1% or ± 0.5mg of true value of weight, whichever is greater. | N/A | N/A | N/A |

Uncontrolled Copy

| Calibration Summary for Drinking Water Methods | | | | | | |
|---|---|---|---|---|---|---|
| | Initial Calibration | | | Continuing Calibration Verification | | |
| Instrument | Frequency | # Std Conc | Acceptance Criteria | Frequency | # Std Conc | Acceptance Criteria |
| **ICP** | Each new run | 1 | Initial calibration verification ±5% | Every 10 samples | 1 | ±10% of true value |
| **ICP-MS** | Each new run | 1 | Independent calibration verification within ±10% | Every 10 samples | 1 | ±15% of true value |
| **pH meter** | Daily | 3 | See SOP | Every 10 samples | 1 | Statistical limits |
| **IC** | Monthly | 5 | Correlation coefficient >0.995 | Every 10 samples | 1 | ±10% of true value |
| **ISE** | Every 3 months | 5 | Correlation coefficient >0.995 | Every 10 samples | 1 | ±10% of true value |

Abbreviations

# Std Conc - The number of standard concentrations used
SPCCs - System Performance Check Compounds
CCCs - Calibration Check Compounds
RF - Response Factor
%RSD - Percent Relative Standard Deviation
%D - Percent Difference
C-cal - Continuing Calibration
CVAF – Cold Vapor Atomic Fluorescence
HPLC - High Performance Liquid Chromatography
GC - Gas Chromatograph
GC/MS - Gas Chromatography/Mass Spectrometry
ICP - Inductively Coupled Plasma spectrophotometer
ICP/MS - Inductively Coupled Plasma – Mass Spectrometry
IC - Ion Chromatograph
ISE - Ion Specific Electrode

Uncontrolled Copy

| Method 507<br><br>Laboratory Performance Check Solution<br>(analyzed prior to system calibration) | | | |
|---|---|---|---|
| Test | Analyte | Conc. µg/mL | Requirements |
| Sensitivity | Vernolate | 0.05 | Detection of analyte; S/N > 3 |
| Chromatographic performance | Bromacil | 5.0 | 0.80 < PGF[a] <1.20 |
| Column performance | Prometon<br>Atrazine | 0.30<br>0.15 | Resolution[b] > 0.7 |

[a]PGF - Peak Gaussian factor. Calculated using the equation:

$$PGF = \frac{1.83 \times W(1/2)}{W(1/10)}$$

Where W(1/2) is the peak width at half height and W(1/10) is the peak width at 10% peak height.

[b]Resolution between the two peaks as defined by the equation:

$$R = \frac{t}{W}$$

Where t is the difference in elution times between the two peaks and W is the average peak width, at the baseline, of the two peaks.

Uncontrolled Copy

| Method 508<br><br>Laboratory Performance Check Solution<br>(analyzed prior to system calibration) | | | |
|---|---|---|---|
| Test | *1.* | Conc. µg/mL | Requirements |
| Sensitivity | Chlorpyrifos | 0.0020 | Detection of analyte; S/N > 3 |
| Chromatographic performance | DCPA | 0.0500 | 0.80 < PGF[a] < 1.15 |
| Column performance | Chlorothalonil<br><br>HCH-delta | 0.0500<br>0.0400 | Resolution[b] > 0.50 |

[a]PGF - Peak Gaussian factor. Calculated using the equation:

$$PGF = \frac{1.83 \times W(1/2)}{W(1/10)}$$

Where W(1/2) is the peak width at half height and W(1/10) is the peak width at 10% peak height.

[b]Resolution between the two peaks as defined by the equation:

$$R = \frac{t}{W}$$

Where t is the difference in elution times between the two peaks and W is the average peak width, at the baseline, of the two peaks.

Uncontrolled Copy

| Method 515<br><br>Laboratory Performance Check Solution<br>(analyzed prior to system calibration) | | | |
|---|---|---|---|
| Test | Analyte | Conc. µg/mL | Requirements |
| Sensitivity | Dinoseb | 0.004 | Detection of analyte; S/N >3 |
| Chromatographic performance | 4-Nitrophenol | 1.6 | 0.70 < PGF[a] < 1.05 |
| Column performance | 3,5-Dichlorobenzoic acid<br>4-Nitrophenol | 0.6<br>1.6 | Resolution[b] >0.40 |

[a]PGF - Peak Gaussian factor. Calculated using the equation:

$$PGF = \frac{1.83 \times W(1/2)}{W(1/10)}$$

Where W(1/2) is the peak width at half height and W(1/10) is the peak width at tenth height.

[b]Resolution between the two peaks as defined by the equation:

$$R = \frac{t}{W}$$

Where t is the difference in elution times between the two peaks and W is the average peak width, at the baseline, of the two peaks.

Uncontrolled Copy

**Calibration Summary for EPA 100, 200, 300, 600 & 1600 Series Methods**

| | Initial Calibration | | | Continuing Calibration Verification | | |
|---|---|---|---|---|---|---|
| Instrument | Frequency | # Std Conc | Acceptance Criteria | Frequency | # Std Conc | Acceptance Criteria |
| **GC/MS** Volatiles* | After C-cal fails | 5 | RSD ≤35% for all compounds*, or a linear regression may be used | Every 24 hours | 1 | All compounds must meet the QC acceptance criteria as stated in the method. Compounds not stated must meet a 65% -135% recovery criteria. |
| **GC/MS** Semivolatiles** | After C-cal fails | 5 | RSD ≤35% for all compounds**, or a linear regression may be used<br>Tailing factors:<br>Benzidine < 3<br>Pentachlorophenol < 5 | Every 24 hours | 1 | All compounds calibrating for <20 |
| **GC** Pesticides & PCBs (Method 608) | After C-cal fails | 5 | 10% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit. Degradation for DDT, Endrin 15% | Every 10 samples | 1 | ≤15% drift from initial response for quantitation |
| **GC** VOA Halocarbons and/or Aromatics | After C-cal fails | At least 5 | %RSD of ≤10% for individual compounds to use average RFs. If %RSD >10%, a quadratic fit type is used if correlation coefficient is >0.995. | Every 12 hours, or every 10 samples | 1 | Method defined limits |
| Dioxins by HRGC/HRMS | After C-cal fails | 6 | If %RSD for native compounds <20% and for labeled compounds <20%, otherwise a calibration curve is used | Every 12 hours | 1 | <25% valley peak resolution for 2378-TCDD<br>All native and labeled compounds meet method defined recovery limits<br>RTs within ±15 secs of RT in ICAL |
| **HPLC** | Each new run or after C-cal fails | 5 | 10% RSD of RFs of initial calibration to use average RF, otherwise use curve fit | Every 10 samples | 1 | ≤15% difference from initial response for quantitation |
| **ICP/MS** | Each new run | 1 | Independent calibration verification (ICV) within ±10% | Every 10 samples | 1 | ±15% of true value |
| **ICP** | Each new run | 1 | Independent calibration verification within ±3%, standards <5%RSD | Every 10 samples | 1 | ±10% of true value |

Uncontrolled Copy

| Calibration Summary for EPA 100, 200, 300, 600 & 1600 Series Methods | | | | | | |
|---|---|---|---|---|---|---|
| | Initial Calibration | | | Continuing Calibration Verification | | |
| Instrument | Frequency | # Std Conc | Acceptance Criteria | Frequency | # Std Conc | Acceptance Criteria |
| **CVAA** | Each new run | 5 | Independent calibration verification within ±5%<br>Correlation coefficient >0.995 | Every 10 samples | 1 | ±10% of true value |
| **CVAF** | Each new run | 5 | The RSD ≤ 15%, and the low standard recovers ±23% of the true value | After the calibration and at the end of the analytical batch | 1 | ±23% of the true value |
| **Auto-analyzer** | Daily | 6 | Correlation coefficient >0.995 | Every 10 samples | 1 | ±10% of true value |
| **TOC** | Monthly | 6 | Corr. Coeff. > 0.995 | Every 10 samples | 1 | ±10% of true value |
| **Balance** | Daily | 4 | Top-loading ±0.5%, Analytical ± 0.1% for weights >0.1 g<br>50 mg ± 0.5%, 20 mg ± 1.0%<br>10 mg and 5 mg ± 2.0% | N/A | N/A | N/A |

*All compounds with %RSD >35 must use first or second order regression fit of the five calibration points. The first order regression may only be used if the correlation coefficient r ≥0.990. The second order regression may only be used if the coefficient of determination r² ≥0.990.

* * All compounds with % RSD >35 must use first order regression fit of the five calibration points. The first order regression may only be used if the correlation coefficient r ≥0.990.

Abbreviations
# Std Conc - The number of standard concentrations used
SPCCs - System Performance Check Compounds
CCCs - Calibration Check Compounds
RF - Response Factor
%RSD - Percent Relative Standard Deviation
C-cal - Continuing Calibration
CVAA - Cold Vapor Atomic Absorption spectrophotometer
CVAF - Cold Vapor Fluorescence spectrophotometer
HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma spectrophotometer; ICP run also includes inter-element correction check standard (beginning and end of run)
ICP/MS - Inductively Coupled Plasma - Mass Spectrometry

Unofficial Copy

| Calibration Summary for EPA TO Series Methods | | | | | | |
|---|---|---|---|---|---|---|
| | Initial Calibration | | | Continuing Calibration Verification | | |
| Instrument | Frequency | # Std Conc | Acceptance Criteria | Frequency | # Std Conc | Acceptance Criteria |
| **GC/MS** Volatiles TO-15 | After C-cal fails | Minimum of 5 | RSD ≤30% for all compounds, 2 allowed to be >30% as long as <40%. | Every 24 hours | 1 | All compounds ≤30 difference. |
| **GC/MS** Volatiles TO-14A | After C-cal fails | Minimum of 5 | RSD ≤30% for all compounds, 2 allowed to be >30% as long as <40%. | Every 24 hours | 1 | All compounds ≤30 difference. |

Uncontrolled Copy

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-GDL-9015386 | **Revision** | 3 |
| **Effective Date** | Aug 8, 2014 | **Status** | Effective |
| **Historical/Local Document Number** | DOD - Environmental Quality Policy Manual Appendix I | | |
| **Local Document Level** | Level 1 | | |
| **Local Document Type** | POL - Policy | | |
| **Local Document Category** | ES - Environmental Sciences | | |

| | |
|---|---|
| **Prepared by** | Kathryn Brungard |
| **Reviewed and Approved by** | Duane Luckenbill;Review;Tuesday, July 29, 2014 11:03:54 AM EDT<br>Robert Strocko;Review;Wednesday, July 30, 2014 1:37:47 PM EDT<br>Dorothy Love;Approval;Wednesday, July 30, 2014 2:09:25 PM EDT |

Uncontrolled Copy

**NOTE: Current certificates are maintained by the QA Department and are available on our website at http://env.lancasterlabs.com/resources/certifications**

Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

Eurofins Lancaster Laboratories Environmental LLC
2425 New Holland Pike
Lancaster, PA 17601-5994

Uncontrolled Copy

### Matrix: Drinking Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 110.2 | | Color | NELAP | PA | 4/4/2005 |
| EPA 150.1 | | pH | NELAP | PA | 2/28/2002 |
| EPA 1613 | B | Dioxin | NELAP | PA | 10/5/2010 |
| EPA 1664 | B | Oil and grease | NELAP | PA | 1/27/2014 |
| EPA 1664 | A | Oil and grease | NELAP | PA | 5/24/2011 |
| EPA 180.1 | | Turbidity | NELAP | PA | 4/4/2005 |
| EPA 200.7 | 4.4 | Aluminum | NELAP | PA | 4/4/2005 |
| EPA 200.7 | 4.4 | Barium | NELAP | PA | 1/22/2001 |
| EPA 200.7 | 4.4 | Beryllium | NELAP | PA | 6/2/2004 |
| EPA 200.7 | 4.4 | Cadmium | NELAP | PA | 1/22/2001 |
| EPA 200.7 | 4.4 | Calcium | NELAP | PA | 11/28/2001 |
| EPA 200.7 | 4.4 | Chromium | NELAP | PA | 1/22/2001 |
| EPA 200.7 | 4.4 | Cobalt | NELAP | PA | 10/16/2008 |
| EPA 200.7 | 4.4 | Copper | NELAP | PA | 1/22/2001 |
| EPA 200.7 | 4.4 | Iron | NELAP | PA | 4/4/2005 |
| EPA 200.7 | 4.4 | Lithium | NELAP | PA | 11/13/2012 |
| EPA 200.7 | 4.4 | Magnesium | NELAP | PA | 12/4/2007 |
| EPA 200.7 | 4.4 | Manganese | NELAP | PA | 4/4/2005 |
| EPA 200.7 | 4.4 | Nickel | NELAP | PA | 1/22/2001 |
| EPA 200.7 | 4.4 | Potassium | NELAP | PA | 5/24/2011 |
| EPA 200.7 | 4.4 | Silver | NELAP | PA | 1/26/2001 |
| EPA 200.7 | 4.4 | Sodium | NELAP | PA | 1/22/2001 |
| EPA 200.7 | 4.4 | Strontium | NELAP | PA | 5/24/2011 |
| EPA 200.7 | 4.4 | Sulfur | NELAP | PA | 11/9/2012 |
| EPA 200.7 | 4.4 | Tin | NELAP | PA | 11/3/2008 |
| EPA 200.7 | 4.4 | Vanadium | NELAP | PA | 10/16/2008 |
| EPA 200.7 | 4.4 | Zinc | NELAP | PA | 4/4/2005 |
| EPA 200.8 | 5.4 | Antimony | NELAP | PA | 2/10/2005 |
| EPA 200.8 | 5.4 | Arsenic | NELAP | PA | 2/10/2005 |
| EPA 200.8 | 5.4 | Barium | NELAP | PA | 11/16/2011 |
| EPA 200.8 | 5.4 | Beryllium | NELAP | PA | 2/10/2005 |
| EPA 200.8 | 5.4 | Cadmium | NELAP | PA | 2/10/2005 |
| EPA 200.8 | 5.4 | Calcium | NELAP | PA | 11/16/2011 |
| EPA 200.8 | 5.4 | Chromium | NELAP | PA | 2/10/2005 |
| EPA 200.8 | 5.4 | Copper | NELAP | PA | 3/9/2007 |
| EPA 200.8 | 5.4 | Iron | NELAP | PA | 11/2/2012 |
| EPA 200.8 | 5.4 | Lead | NELAP | PA | 2/10/2005 |
| EPA 200.8 | 5.4 | Magnesium | NELAP | PA | 11/2/2012 |
| EPA 200.8 | 5.4 | Manganese | NELAP | PA | 11/16/2011 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Drinking Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 200.8 | 5.4 | Nickel | NELAP | PA | 2/10/2005 |
| EPA 200.8 | 5.4 | Potassium | NELAP | PA | 11/16/2011 |
| EPA 200.8 | 5.4 | Selenium | NELAP | PA | 2/10/2005 |
| EPA 200.8 | 5.4 | Sodium | NELAP | PA | 11/16/2011 |
| EPA 200.8 | 5.4 | Strontium | NELAP | PA | 11/16/2011 |
| EPA 200.8 | 5.4 | Thallium | NELAP | PA | 2/10/2005 |
| EPA 200.8 | 5.4 | Zinc | NELAP | PA | 11/16/2011 |
| EPA 218.7 | | Chromium VI | NELAP | PA | 11/27/2013 |
| EPA 245.1 | 3.0 | Mercury | NELAP | PA | 8/29/2001 |
| EPA 300.0 | 2.1 | Bromide | NELAP | PA | 11/9/2012 |
| EPA 300.0 | 2.1 | Chloride | NELAP | PA | 5/17/2005 |
| EPA 300.0 | 2.1 | Fluoride | NELAP | PA | 1/22/2004 |
| EPA 300.0 | 2.1 | Nitrate as N | NELAP | PA | 10/31/2002 |
| EPA 300.0 | 2.1 | Nitrite as N | NELAP | PA | 10/31/2002 |
| EPA 300.0 | 2.1 | Sulfate | NELAP | PA | 7/7/2003 |
| EPA 314.0 | | Perchlorate | NELAP | PA | 5/24/2007 |
| EPA 335.4 | | Cyanide | NELAP | PA | 7/11/2006 |
| EPA 353.2 | | Nitrate as N | NELAP | PA | 2/28/2002 |
| EPA 353.2 | | Nitrite as N | NELAP | PA | 2/28/2002 |
| EPA 353.2 | | Total nitrate-nitrite | NELAP | PA | 5/24/2011 |
| EPA 504.1 | 1.1 | 1,2,3-Trichloropropane (1,2,3-TCP) | NELAP | PA | 5/17/2005 |
| EPA 504.1 | 1.1 | 1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane) | NELAP | PA | 2/28/2002 |
| EPA 504.1 | 1.1 | 1,2-Dibromoethane (EDB, Ethylene dibromide) | NELAP | PA | 1/26/2001 |
| EPA 507 | 2.1 | Alachlor (Lasso) | NELAP | PA | 2/28/2002 |
| EPA 507 | 2.1 | Atrazine | NELAP | PA | 2/28/2002 |
| EPA 507 | 2.1 | Simazine | NELAP | PA | 2/28/2002 |
| EPA 508 | 3.1 | Aldrin (HHDN) | NELAP | PA | 5/18/2005 |
| EPA 508 | 3.1 | Aroclor-1016 (PCB-1016) | NELAP | PA | 4/24/2007 |
| EPA 508 | 3.1 | Aroclor-1221 (PCB-1221) | NELAP | PA | 4/24/2007 |
| EPA 508 | 3.1 | Aroclor-1232 (PCB-1232) | NELAP | PA | 4/24/2007 |
| EPA 508 | 3.1 | Aroclor-1242 (PCB-1242) | NELAP | PA | 4/24/2007 |
| EPA 508 | 3.1 | Aroclor-1248 (PCB-1248) | NELAP | PA | 4/24/2007 |
| EPA 508 | 3.1 | Aroclor-1254 (PCB-1254) | NELAP | PA | 4/24/2007 |
| EPA 508 | 3.1 | Aroclor-1260 (PCB-1260) | NELAP | PA | 4/24/2007 |
| EPA 508 | 3.1 | Chlordane (tech.) | NELAP | PA | 2/28/2002 |
| EPA 508 | 3.1 | Dieldrin | NELAP | PA | 1/3/2002 |
| EPA 508 | 3.1 | Endrin | NELAP | PA | 2/28/2002 |
| EPA 508 | 3.1 | Heptachlor | NELAP | PA | 2/28/2002 |
| EPA 508 | 3.1 | Heptachlor epoxide | NELAP | PA | 2/28/2002 |
| EPA 508 | 3.1 | Hexachlorobenzene | NELAP | PA | 2/28/2002 |
| EPA 508 | 3.1 | Hexachlorocyclopentadiene | NELAP | PA | 2/28/2002 |
| EPA 508 | 3.1 | Methoxychlor | NELAP | PA | 2/28/2002 |
| EPA 508 | 3.1 | Toxaphene (Chlorinated camphene) | NELAP | PA | 5/25/2007 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Drinking Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 508 | 3.1 | gamma-BHC (Lindane, gamma-Hexachlorocyclohexane) | NELAP | PA | 2/28/2002 |
| EPA 515.1 | 4.0 | 2,4,5-TP (Silvex) | NELAP | PA | 1/24/2001 |
| EPA 515.1 | 4.0 | 2,4-D | NELAP | PA | 1/24/2001 |
| EPA 515.1 | 4.0 | Dalapon (2,2-Dichloropropionic acid) | NELAP | PA | 1/24/2001 |
| EPA 515.1 | 4.0 | Dicamba | NELAP | PA | 1/24/2001. |
| EPA 515.1 | 4.0 | Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP) | NELAP | PA | 1/24/2001 |
| EPA 515.1 | 4.0 | Pentachlorophenol (PCP) | NELAP | PA | 1/24/2001 |
| EPA 515.1 | 4.0 | Picloram (4-Amino-3,5,6-trichloro-2-pyridinecarboxylic acid) | NELAP | PA | 1/24/2001 |
| EPA 524.2 | 4.1 | 1,1,1,2-Tetrachloroethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | 1,1,1-Trichloroethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | 1,1,2,2-Tetrachloroethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | 1,1,2-Trichloroethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | 1,1-Dichloro-2-propanone (1,1-Dichloropropanone) | NELAP | PA | 5/17/2005 |
| EPA 524.2 | 4.1 | 1,1-Dichloroethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | 1,1-Dichloroethene (1,1-Dichloroethylene) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | 1,1-Dichloropropene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | 1,2,3-Trichlorobenzene | NELAP | PA | 4/4/2005 |
| EPA 524.2 | 4.1 | 1,2,3-Trichloropropane (1,2,3-TCP) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | 1,2,4-Trichlorobenzene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | 1,2,4-Trimethylbenzene | NELAP | PA | 4/4/2005 |
| EPA 524.2 | 4.1 | 1,2-Dichlorobenzene (o-Dichlorobenzene) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | 1,2-Dichloroethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | 1,2-Dichloropropane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | 1,3,5-Trimethylbenzene | NELAP | PA | 5/17/2005 |
| EPA 524.2 | 4.1 | 1,3-Dichlorobenzene (m-Dichlorobenzene) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | 1,3-Dichloropropane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | 1,4-Dichlorobenzene (p-Dichlorobenzene) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | 1-Chlorobutane | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | 2,2-Dichloropropane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | 2-Butanone (Methyl ethyl ketone, MEK) | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | 2-Chlorotoluene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | 2-Hexanone | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | 2-Nitropropane | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | 4-Chlorotoluene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | 4-Methyl-2-pentanone (MIBK) | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | Acetone | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | Acrylonitrile | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | Allyl chloride (3-Chloropropene) | NELAP | PA | 7/3/2007 |
| EPA 524.2 | 4.1 | Benzene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Bromobenzene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Bromochloromethane | NELAP | PA | 4/4/2005 |
| EPA 524.2 | 4.1 | Bromodichloromethane | NELAP | PA | 10/31/2002 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Drinking Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 524.2 | 4.1 | Bromoform | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Carbon disulfide | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | Carbon tetrachloride | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Chloroacetonitrile | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | Chlorobenzene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Chloroethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Chloroform | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Dibromochloromethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Dibromomethane | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Dichlorodifluoromethane (Freon 12) | NELAP | PA | 4/4/2005 |
| EPA 524.2 | 4.1 | Diethyl ether (Ethyl ether) | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | Diisopropyl ether (DIPE) | NELAP | PA | 1/7/2010 |
| EPA 524.2 | 4.1 | Ethyl methacrylate | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | Ethyl tert-butyl ether (ETBE) | NELAP | PA | 1/24/2007 |
| EPA 524.2 | 4.1 | Ethylbenzene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Hexachlorobutadiene (1,3-Hexachlorobutadiene) | NELAP | PA | 4/4/2005 |
| EPA 524.2 | 4.1 | Hexachloroethane | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | Isopropylbenzene (Cumene) | NELAP | PA | 4/4/2005 |
| EPA 524.2 | 4.1 | Methacrylonitrile | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | Methyl bromide (Bromomethane) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Methyl chloride (Chloromethane) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Methyl iodide (Iodomethane) | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | Methyl tert-butyl ether (MTBE) | NELAP | PA | 4/4/2005 |
| EPA 524.2 | 4.1 | Methylacrylate | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | Methylene chloride (Dichloromethane) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Methylmethacrylate | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | Naphthalene | NELAP | PA | 5/17/2005 |
| EPA 524.2 | 4.1 | Nitrobenzene | NELAP | PA | 5/17/2005 |
| EPA 524.2 | 4.1 | Pentachloroethane | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | Propionitrile (Ethyl cyanide) | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | Styrene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Tetrachloroethene (PCE, Perchloroethylene) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Tetrahydrofuran (THF) | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | Toluene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Total trihalomethanes (TTHMs) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Trichloroethene (TCE, Trichloroethylene) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Trichlorofluoromethane (Freon 11) | NELAP | PA | 4/4/2005 |
| EPA 524.2 | 4.1 | Vinyl chloride (Chloroethene) | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | Xylenes, total | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | cis-1,2-Dichloroethene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | cis-1,3-Dichloropropene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | n-Butylbenzene | NELAP | PA | 4/4/2005 |
| EPA 524.2 | 4.1 | n-Propylbenzene | NELAP | PA | 5/17/2005 |
| EPA 524.2 | 4.1 | p-Isopropyltoluene (4-Isopropyltoluene) | NELAP | PA | 5/17/2005 |
| EPA 524.2 | 4.1 | sec-Butylbenzene | NELAP | PA | 4/4/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Drinking Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 524.2 | 4.1 | tert-Amyl methyl ether (TAME) | NELAP | PA | 1/24/2007 |
| EPA 524.2 | 4.1 | tert-Butyl alcohol (2-Methyl-2-propanol) | NELAP | PA | 5/24/2007 |
| EPA 524.2 | 4.1 | tert-Butylbenzene | NELAP | PA | 4/4/2005 |
| EPA 524.2 | 4.1 | trans-1,2-Dichloroethene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | trans-1,3-Dichloropropene | NELAP | PA | 10/31/2002 |
| EPA 524.2 | 4.1 | trans-1,4-Dichloro-2-butene | NELAP | PA | 5/24/2007 |
| EPA 525.2 | 2.0 | 2,3-Dichlorobiphenyl (BZ 5) | NELAP | PA | 5/17/2005 |
| EPA 525.2 | 2.0 | Acenaphthene | NELAP | PA | 5/25/2007 |
| EPA 525.2 | 2.0 | Acenaphthylene | NELAP | PA | 4/28/2010 |
| EPA 525.2 | 2.0 | Alachlor (Lasso) | NELAP | PA | 2/28/2002 |
| EPA 525.2 | 2.0 | Aldrin (HHDN) | NELAP | PA | 10/9/2013 |
| EPA 525.2 | 2.0 | Anthracene | NELAP | PA | 5/25/2007 |
| EPA 525.2 | 2.0 | Atrazine | NELAP | PA | 1/3/2002 |
| EPA 525.2 | 2.0 | Benzo[a]anthracene | NELAP | PA | 5/25/2007 |
| EPA 525.2 | 2.0 | Benzo[a]pyrene | NELAP | PA | 1/24/2001 |
| EPA 525.2 | 2.0 | Benzo[b]fluoranthene | NELAP | PA | 6/4/2007 |
| EPA 525.2 | 2.0 | Benzo[ghi]perylene | NELAP | PA | 7/3/2007 |
| EPA 525.2 | 2.0 | Benzo[k]fluoranthene | NELAP | PA | 6/4/2007 |
| EPA 525.2 | 2.0 | Benzyl butyl phthalate (Butyl benzyl phthalate) | NELAP | PA | 5/25/2007 |
| EPA 525.2 | 2.0 | Butachlor | NELAP | PA | 12/19/2002 |
| EPA 525.2 | 2.0 | Chrysene (Benzo[a]phenanthrene) | NELAP | PA | 5/25/2007 |
| EPA 525.2 | 2.0 | Di-n-butyl phthalate | NELAP | PA | 5/25/2007 |
| EPA 525.2 | 2.0 | Dibenzo[a,h]anthracene | NELAP | PA | 5/25/2007 |
| EPA 525.2 | 2.0 | Dieldrin | NELAP | PA | 5/17/2005 |
| EPA 525.2 | 2.0 | Diethyl phthalate | NELAP | PA | 5/25/2007 |
| EPA 525.2 | 2.0 | Dimethyl phthalate | NELAP | PA | 5/25/2007 |
| EPA 525.2 | 2.0 | Endrin | NELAP | PA | 5/17/2005 |
| EPA 525.2 | 2.0 | Fluoranthene | NELAP | PA | 3/7/2012 |
| EPA 525.2 | 2.0 | Fluorene | NELAP | PA | 2/7/2012 |
| EPA 525.2 | 2.0 | Heptachlor | NELAP | PA | 5/17/2005 |
| EPA 525.2 | 2.0 | Heptachlor epoxide | NELAP | PA | 5/17/2005 |
| EPA 525.2 | 2.0 | Hexachlorobenzene | NELAP | PA | 2/11/2005 |
| EPA 525.2 | 2.0 | Hexachlorocyclopentadiene | NELAP | PA | 1/24/2001 |
| EPA 525.2 | 2.0 | Indeno(1,2,3-cd)pyrene | NELAP | PA | 2/7/2012 |
| EPA 525.2 | 2.0 | Methoxychlor | NELAP | PA | 1/24/2001 |
| EPA 525.2 | 2.0 | Metolachlor | NELAP | PA | 12/19/2002 |
| EPA 525.2 | 2.0 | Metribuzin | NELAP | PA | 12/19/2002 |
| EPA 525.2 | 2.0 | Phenanthrene | NELAP | PA | 5/25/2007 |
| EPA 525.2 | 2.0 | Propachlor (Ramrod) | NELAP | PA | 1/24/2001 |
| EPA 525.2 | 2.0 | Pyrene | NELAP | PA | 5/25/2007 |
| EPA 525.2 | 2.0 | Simazine | NELAP | PA | 1/3/2002 |
| EPA 525.2 | 2.0 | bis(2-Ethylhexyl) adipate (di(2-Ethylhexyl) adipate) | NELAP | PA | 1/24/2001 |
| EPA 525.2 | 2.0 | bis(2-Ethylhexyl) phthalate (DEHP) | NELAP | PA | 1/24/2001 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Drinking Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 525.2 | 2.0 | gamma-BHC (Lindane, gamma-Hexachlorocyclohexane) | NELAP | PA | 1/24/2001 |
| EPA 531.1 | 3.1 | 3-Hydroxycarbofuran | NELAP | PA | 11/7/2006 |
| EPA 531.1 | 3.1 | Aldicarb (Temik) | NELAP | PA | 1/24/2001 |
| EPA 531.1 | 3.1 | Aldicarb sulfone | NELAP | PA | 1/24/2001 |
| EPA 531.1 | 3.1 | Aldicarb sulfoxide | NELAP | PA | 1/24/2001 |
| EPA 531.1 | 3.1 | Carbaryl (Sevin) | NELAP | PA | 10/9/2002 |
| EPA 531.1 | 3.1 | Carbofuran (Furadan) | NELAP | PA | 1/24/2001 |
| EPA 531.1 | 3.1 | Methomyl (Lannate) | NELAP | PA | 1/24/2001 |
| EPA 531.1 | 3.1 | Oxamyl (Vydate) | NELAP | PA | 1/24/2001 |
| EPA 8015 | | Ethane | NELAP | PA | 5/24/2011 |
| EPA 8015 | | Methane | NELAP | PA | 5/24/2011 |
| EPA 8015 | | Propane | NELAP | PA | 11/9/2012 |
| SM 2120 B | | Color | NELAP | PA | 5/25/2005 |
| SM 2130 B | | Turbidity | NELAP | PA | 5/17/2005 |
| SM 2320 B | | Alkalinity as CaCO3 | NELAP | PA | 1/24/2001 |
| SM 2340 C | | Total hardness as CaCO3 | NELAP | PA | 5/24/2011 |
| SM 2510 B | | Conductivity | NELAP | PA | 5/17/2005 |
| SM 2540 C | | Total dissolved solids (TDS) | NELAP | PA | 6/2/2004 |
| SM 2540 D | | Residue, nonfilterable (TSS) | NELAP | PA | 5/24/2011 |
| SM 2550 B | | Temperature, deg. C | NELAP | PA | 4/4/2005 |
| SM 4500-Cl F | | Total residual chlorine | NELAP | PA | 5/24/2011 |
| SM 4500-Cl G | | Residual free chlorine | NELAP | PA | 1/7/2010 |
| SM 4500-F- C | | Fluoride | NELAP | PA | 10/15/2003 |
| SM 4500-H+ B | | pH | NELAP | PA | 5/16/2007 |
| SM 4500-P E | | Orthophosphate as P | NELAP | PA | 6/12/2007 |
| SM 4500-SiO2 C | 20-22 | Silica, dissolved | NELAP | PA | 5/24/2007 |
| SM 5310 C | | Total organic carbon (TOC) | NELAP | PA | 4/18/2013 |
| SM 5540 C | | Surfactants as MBAS | NELAP | PA | 5/24/2007 |
| SM 9215 B | | Heterotrophic bacteria (Enumeration) | NELAP | PA | 2/5/2003 |
| SM 9223 Colilert | | Total coliform & E. coli | NELAP | PA | 1/26/2001 |

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| AK-101 | | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |
| AK-102 | | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| ASTM D7511-09 | | Total cyanide | NELAP | PA | 2/15/2013 |
| EPA 1010 | | Ignitability | NELAP | PA | 12/12/2005 |
| EPA 130.2 | | Hardness | NELAP | PA | 1/19/2005 |
| EPA 1311 | | Toxicity characteristic leaching procedure (TCLP) | NELAP | PA | 12/12/2005 |
| EPA 1312 | | Synthetic precipitation leaching procedure (SPLP) | NELAP | PA | 12/12/2005 |
| EPA 160.1 | | Residue, filterable (TDS) | NELAP | PA | 1/19/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 160.4 | | Residue, volatile | NELAP | PA | 1/19/2005 |
| EPA 1613 | B | 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD) | NELAP | PA | 6/30/2010 |
| EPA 1613 | B | 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF) | NELAP | PA | 6/30/2010 |
| EPA 1613 | B | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd) | NELAP | PA | 6/30/2010 |
| EPA 1613 | B | 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf) | NELAP | PA | 6/30/2010 |
| EPA 1613 | B | 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf) | NELAP | PA | 6/30/2010 |
| EPA 1613 | B | 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 1613 | B | 1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 1613 | B | 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 1613 | B | 1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 1613 | B | 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 1613 | B | 1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 1613 | B | 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD) | NELAP | PA | 6/30/2010 |
| EPA 1613 | B | 1,2,3,7,8-Pentachlorodibenzofuran (PeCDF) | NELAP | PA | 6/30/2010 |
| EPA 1613 | B | 2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 1613 | B | 2,3,4,7,8-Pentachlorodibenzofuran (PeCDF) | NELAP | PA | 6/30/2010 |
| EPA 1613 | B | 2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)(Dioxin) | NELAP | PA | 6/30/2010 |
| EPA 1613 | B | 2,3,7,8-Tetrachlorodibenzofuran (TCDF) | NELAP | PA | 6/30/2010 |
| EPA 1613 | B | Total heptachlorodibenzo-p-dioxin (HpCDD) | NELAP | PA | 8/6/2010 |
| EPA 1613 | B | Total heptachlorodibenzofuran (HpCDF) | NELAP | PA | 8/6/2010 |
| EPA 1613 | B | Total hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 8/6/2010 |
| EPA 1613 | B | Total hexachlorodibenzofuran (HxCDF) | NELAP | PA | 8/6/2010 |
| EPA 1613 | B | Total pentachlorodibenzo-p-dioxin (PeCDD) | NELAP | PA | 8/6/2010 |
| EPA 1613 | B | Total pentachlorodibenzofuran (PeCDF) | NELAP | PA | 8/6/2010 |
| EPA 1613 | B | Total tetrachlorodibenzo-p-dioxin (TCDD) | NELAP | PA | 8/6/2010 |
| EPA 1613 | B | Total tetrachlorodibenzofuran (TCDF) | NELAP | PA | 8/6/2010 |
| EPA 1625 | C | N-Nitrosodimethylamine | NELAP | PA | 11/23/2010 |
| EPA 1631 | E | Mercury | NELAP | PA | 6/11/2007 |
| EPA 1664 | A | Non-polar material | NELAP | PA | 11/17/2006 |
| EPA 1664 | B | Oil and grease | NELAP | PA | 1/27/2014 |
| EPA 1664 | A | Oil and grease | NELAP | PA | 1/19/2005 |
| EPA 1666 | A | 4-Methyl-2-pentanone (MIBK) | NELAP | PA | 12/12/2005 |
| EPA 1666 | A | Diisopropyl ether (DIPE) | NELAP | PA | 1/19/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 1666 | A | Ethyl acetate | NELAP | PA | 1/19/2005 |
| EPA 1666 | A | Isobutyraldehyde | NELAP | PA | 1/19/2005 |
| EPA 1666 | A | Isopropyl acetate | NELAP | PA | 1/19/2005 |
| EPA 1666 | A | Isopropyl alcohol (2-Propanol) | NELAP | PA | 12/2/2009 |
| EPA 1666 | A | Methyl formate | NELAP | PA | 1/19/2005 |
| EPA 1666 | A | Tetrahydrofuran (THF) | NELAP | PA | 1/19/2005 |
| EPA 1666 | A | Xylenes, total | NELAP | PA | 1/19/2005 |
| EPA 1666 | A | n-Amyl acetate (n-Pentyl acetate) | NELAP | PA | 4/4/2005 |
| EPA 1666 | A | n-Amyl alcohol (1-Pentanol) | NELAP | PA | 4/4/2005 |
| EPA 1666 | A | n-Butyl acetate | NELAP | PA | 4/4/2005 |
| EPA 1666 | A | n-Heptane | NELAP | PA | 1/19/2005 |
| EPA 1666 | A | n-Hexane | NELAP | PA | 1/19/2005 |
| EPA 1666 | A | tert-Butyl alcohol (2-Methyl-2-propanol) | NELAP | PA | 4/4/2005 |
| EPA 1668 | | 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206) | NELAP | PA | 2/1/2013 |
| EPA 1668 | | 2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ 194) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ 196) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ 207) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ 197) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ 171) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,4'-Hexachlorobiphenyl (BZ 128) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ 177) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ 201) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ 175) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5'-Hexachlorobiphenyl (BZ 130) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ 199) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ 208) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ 198) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ 172) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ 174) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ 200) | NELAP | PA | 12/17/2012 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 1668 | | 2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ 173) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5-Hexachlorobiphenyl (BZ 129) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,6'-Hexachlorobiphenyl (BZ 132) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ 176) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,6-Hexachlorobiphenyl (BZ 131) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4-Pentachlorobiphenyl (BZ 82) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ 202) | NELAP | PA | 2/1/2013 |
| EPA 1668 | | 2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ 178) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',5,5'-Hexachlorobiphenyl (BZ 133) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',5,6'-Hexachlorobiphenyl (BZ 135) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ 179) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',5,6-Hexachlorobiphenyl (BZ 134) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',5-Pentachlorobiphenyl (BZ 83) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',6,6'-Hexachlorobiphenyl (BZ 136) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',6-Pentachlorobiphenyl (BZ 84) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3'-Tetrachlorobiphenyl (BZ 40) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',5',6-Hexachlorobiphenyl (BZ 149) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',5'-Pentachlorobiphenyl (BZ 97) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',5,5'-Hexachlorobiphenyl (BZ 146) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',5,6'-Hexachlorobiphenyl (BZ 148) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ 188) | NELAP | PA | 2/1/2013 |
| EPA 1668 | | 2,2',3,4',5,6-Hexachlorobiphenyl (BZ 147) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',5-Pentachlorobiphenyl (BZ 90) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',6'-Pentachlorobiphenyl (BZ 98) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',6,6'-Hexachlorobiphenyl (BZ 150) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',6-Pentachlorobiphenyl (BZ 91) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4'-Tetrachlorobiphenyl (BZ 42) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ 203) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ 182) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ 204) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ 181) | NELAP | PA | 12/17/2012 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300

PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 1668 | | 2,2',3,4,4',5-Hexachlorobiphenyl (BZ 137) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',6'-Hexachlorobiphenyl (BZ 140) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ 184) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',6-Hexachlorobiphenyl (BZ 139) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4'-Pentachlorobiphenyl (BZ 85) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,5',6-Hexachlorobiphenyl (BZ 144) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,5'-Pentachlorobiphenyl (BZ 87) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ 185) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,5,6'-Hexachlorobiphenyl (BZ 143) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ 186) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,5,6-Hexachlorobiphenyl (BZ 142) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,5-Pentachlorobiphenyl (BZ 86) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,6'-Pentachlorobiphenyl (BZ 89) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,6,6'-Hexachlorobiphenyl (BZ 148) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,6-Pentachlorobiphenyl (BZ 88) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4-Tetrachlorobiphenyl (BZ 41) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,5',6-Pentachlorobiphenyl (BZ 95) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,5'-Tetrachlorobiphenyl (BZ 44) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,5,5'-Pentachlorobiphenyl (BZ 92) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,5,6-Pentachlorobiphenyl (BZ 94) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,5,6,6'-Hexachlorobiphenyl (BZ 152) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,5,6-Pentachlorobiphenyl (BZ 93) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,5-Tetrachlorobiphenyl (BZ 43) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,6'-Tetrachlorobiphenyl (BZ 46) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,6,6'-Pentachlorobiphenyl (BZ 96) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,6-Tetrachlorobiphenyl (BZ 45) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3-Trichlorobiphenyl (BZ 16) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',5,5'-Hexachlorobiphenyl (BZ 153) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,4',5,6'-Hexachlorobiphenyl (BZ 154) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,4',5-Pentachlorobiphenyl (BZ 99) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,4',6,6'-Hexachlorobiphenyl (BZ 155) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,4',6-Pentachlorobiphenyl (BZ 100) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,4'-Tetrachlorobiphenyl (BZ 47) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,5',6-Pentachlorobiphenyl (BZ 103) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,5'-Tetrachlorobiphenyl (BZ 49) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,5,5'-Pentachlorobiphenyl (BZ 101) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,5,6'-Pentachlorobiphenyl (BZ 102) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,5-Tetrachlorobiphenyl (BZ 48) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,6'-Tetrachlorobiphenyl (BZ 51) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,6,6'-Pentachlorobiphenyl (BZ 104) | NELAP | PA | 2/1/2013 |
| EPA 1668 | | 2,2',4,6-Tetrachlorobiphenyl (BZ 50) | NELAP | PA | 12/17/2012 |

Uncontrolled Copy

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 1668 | | 2,2',4-Trichlorobiphenyl (BZ 17) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',5,5'-Tetrachlorobiphenyl (BZ 52) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',5,6'-Tetrachlorobiphenyl (BZ 53) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',5-Trichlorobiphenyl (BZ 18) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',6,6'-Tetrachlorobiphenyl (BZ 54) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',6-Trichlorobiphenyl (BZ 19) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2'-Dichlorobiphenyl (BZ 4) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4',5',6-Pentachlorobiphenyl (BZ 125) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4',5'-Tetrachlorobiphenyl (BZ 76) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4',5,5'-Pentachlorobiphenyl (BZ 124) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4',5-Tetrachlorobiphenyl (BZ 70) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4',6-Tetrachlorobiphenyl (BZ 71) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4'-Trichlorobiphenyl (BZ 33) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,4',5',6-Hexachlorobiphenyl (BZ 168) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,4',5'-Pentachlorobiphenyl (BZ 123) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,4',5,5'-Hexachlorobiphenyl (BZ 167) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,4',5-Pentachlorobiphenyl (BZ 118) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,4',6-Pentachlorobiphenyl (BZ 119) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,4'-Tetrachlorobiphenyl (BZ 66) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,5',6-Pentachlorobiphenyl (BZ 121) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,5'-Tetrachlorobiphenyl (BZ 68) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,5,5'-Pentachlorobiphenyl (BZ 120) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,5-Tetrachlorobiphenyl (BZ 67) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,6-Tetrachlorobiphenyl (BZ 69) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4-Trichlorobiphenyl (BZ 25) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',5',6-Tetrachlorobiphenyl (BZ 73) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',5'-Trichlorobiphenyl (BZ 34) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',5,5'-Tetrachlorobiphenyl (BZ 72) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',5-Trichlorobiphenyl (BZ 26) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',6-Trichlorobiphenyl (BZ 27) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3'-Dichlorobiphenyl (BZ 6) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4',5',6-Hexachlorobiphenyl (BZ 164) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4',5'-Pentachlorobiphenyl (BZ 122) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ 193) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4',5,5'-Hexachlorobiphenyl (BZ 162) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4',5,6-Hexachlorobiphenyl (BZ 163) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4',5-Pentachlorobiphenyl (BZ 107) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4',6-Pentachlorobiphenyl (BZ 110) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4'-Tetrachlorobiphenyl (BZ 56) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ 191) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,4',5'-Hexachlorobiphenyl (BZ 157) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ 205) | NELAP | PA | 2/1/2013 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 1668 | | 2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ 189) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ 190) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,4',5-Hexachlorobiphenyl (BZ 156) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,4',6-Hexachlorobiphenyl (BZ 158) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,4'-Pentachlorobiphenyl (BZ 105) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,5',6-Hexachlorobiphenyl (BZ 161) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,5'-Pentachlorobiphenyl (BZ 108) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ 192) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,5,5'-Hexachlorobiphenyl (BZ 159) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,5,6-Hexachlorobiphenyl (BZ 160) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,5-Pentachlorobiphenyl (BZ 106) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,6-Pentachlorobiphenyl (BZ 109) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4-Tetrachlorobiphenyl (BZ 35) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',5',6-Pentachlorobiphenyl (BZ 113) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',5'-Tetrachlorobiphenyl (BZ 58) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',5,5',6-Hexachlorobiphenyl (BZ 165) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',5,5'-Pentachlorobiphenyl (BZ 111) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',5,6-Pentachlorobiphenyl (BZ 112) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',5-Tetrachlorobiphenyl (BZ 57) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',6-Tetrachlorobiphenyl (BZ 59) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3'-Trichlorobiphenyl (BZ 20) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4',5,6-Pentachlorobiphenyl (BZ 117) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4',5-Tetrachlorobiphenyl (BZ 63) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4',6-Tetrachlorobiphenyl (BZ 64) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4'-Trichlorobiphenyl (BZ 22) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4,4',5,6-Hexachlorobiphenyl (BZ 166) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4,4',5-Pentachlorobiphenyl (BZ 114) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4,4',6-Pentachlorobiphenyl (BZ 115) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4,4'-Tetrachlorobiphenyl (BZ 60) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4,5,6-Pentachlorobiphenyl (BZ 116) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4,5-Tetrachlorobiphenyl (BZ 61) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4,6-Tetrachlorobiphenyl (BZ 62) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4-Trichlorobiphenyl (BZ 21) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,5,6-Tetrachlorobiphenyl (BZ 65) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,5-Trichlorobiphenyl (BZ 23) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,6-Trichlorobiphenyl (BZ 24) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3-Dichlorobiphenyl (BZ 5) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,4',5-Trichlorobiphenyl (BZ 31) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,4',6-Trichlorobiphenyl (BZ 32) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,4'-Dichlorobiphenyl (BZ 8) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,4,4',5-Tetrachlorobiphenyl (BZ 74) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,4,4',6-Tetrachlorobiphenyl (BZ 75) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,4,4'-Trichlorobiphenyl (BZ 28) | NELAP | PA | 12/17/2012 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 1668 | | 2,4,5-Trichlorobiphenyl (BZ 29) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,4,6-Trichlorobiphenyl (BZ 30) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,4-Dichlorobiphenyl (BZ 7) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,5-Dichlorobiphenyl (BZ 9) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,6-Dichlorobiphenyl (BZ 10) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2-Chlorobiphenyl (BZ 1) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3',4,4',5,5'-Hexachlorobiphenyl (BZ 169) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3',4,4',5-Pentachlorobiphenyl (BZ 126) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3',4,4'-Tetrachlorobiphenyl (BZ 77) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3',4,5'-Tetrachlorobiphenyl (BZ 79) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3',4,5,5'-Pentachlorobiphenyl (BZ 127) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3',4,5-Tetrachlorobiphenyl (BZ 78) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3',4-Trichlorobiphenyl (BZ 35) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3',5,5'-Tetrachlorobiphenyl (BZ 80) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3',5-Trichlorobiphenyl (BZ 36) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3'-Dichlorobiphenyl (BZ 11) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,4',5-Trichlorobiphenyl (BZ 39) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,4'-Dichlorobiphenyl (BZ 13) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,4,4',5-Tetrachlorobiphenyl (BZ 81) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,4,4'-Trichlorobiphenyl (BZ 37) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,4,5-Trichlorobiphenyl (BZ 38) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,4-Dichlorobiphenyl (BZ 12) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,5-Dichlorobiphenyl (BZ 14) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3-Chlorobiphenyl (BZ 2) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 4,4'-Dichlorobiphenyl (BZ 15) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 4-Chlorobiphenyl (BZ 3) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | Decachlorobiphenyl | NELAP | PA | 2/1/2013 |
| EPA 1671 | A | Acetonitrile | NELAP | PA | 1/19/2005 |
| EPA 1671 | A | Diethylamine | NELAP | PA | 1/19/2005 |
| EPA 1671 | A | Dimethyl sulfoxide | NELAP | PA | 1/19/2005 |
| EPA 1671 | A | Ethanol | NELAP | PA | 1/19/2005 |
| EPA 1671 | A | Methanol | NELAP | PA | 1/19/2005 |
| EPA 1671 | A | Methyl cellosolve (2-Methoxyethanol) | NELAP | PA | 1/19/2005 |
| EPA 1671 | A | Triethylamine | NELAP | PA | 1/19/2005 |
| EPA 1671 | A | n-Propanol (1-Propanol) | NELAP | PA | 1/19/2005 |
| EPA 170.1 | | Temperature, deg. C | NELAP | PA | 4/4/2005 |
| EPA 180.1 | | Turbidity | NELAP | PA | 1/19/2005 |
| EPA 200.2 | | Metals sample preparation | NELAP | PA | 1/24/2007 |
| EPA 200.7 | 4.4 | Aluminum | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Antimony | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Arsenic | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Barium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Beryllium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Boron | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Cadmium | NELAP | PA | 1/19/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 200.7 | 4.4 | Calcium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Chromium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Cobalt | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Copper | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Iron | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Lead | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Lithium | NELAP | PA | 2/7/2012 |
| EPA 200.7 | 4.4 | Magnesium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Manganese | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Molybdenum | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Nickel | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Potassium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Selenium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Silver | NELAP | PA | 4/4/2005 |
| EPA 200.7 | 4.4 | Sodium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Strontium | NELAP | PA | 5/24/2011 |
| EPA 200.7 | 4.4 | Thallium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Tin | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Titanium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Vanadium | NELAP | PA | 1/19/2005 |
| EPA 200.7 | 4.4 | Zinc | NELAP | PA | 1/19/2005 |
| EPA 200.8 | 5.4 | Aluminum | NELAP | PA | 1/7/2010 |
| EPA 200.8 | 5.4 | Antimony | NELAP | PA | 4/4/2005 |
| EPA 200.8 | 5.4 | Arsenic | NELAP | PA | 4/4/2005 |
| EPA 200.8 | 5.4 | Barium | NELAP | PA | 4/4/2005 |
| EPA 200.8 | 5.4 | Beryllium | NELAP | PA | 4/4/2005 |
| EPA 200.8 | 5.4 | Boron | NELAP | PA | 1/11/2012 |
| EPA 200.8 | 5.4 | Cadmium | NELAP | PA | 4/4/2005 |
| EPA 200.8 | 5.4 | Calcium | NELAP | PA | 1/7/2010 |
| EPA 200.8 | 5.4 | Chromium | NELAP | PA | 4/4/2005 |
| EPA 200.8 | 5.4 | Cobalt | NELAP | PA | 11/23/2010 |
| EPA 200.8 | 5.4 | Copper | NELAP | PA | 4/4/2005 |
| EPA 200.8 | 5.4 | Iron | NELAP | PA | 11/23/2010 |
| EPA 200.8 | 5.4 | Lead | NELAP | PA | 4/4/2005 |
| EPA 200.8 | 5.4 | Magnesium | NELAP | PA | 1/7/2010 |
| EPA 200.8 | 5.4 | Manganese | NELAP | PA | 11/23/2010 |
| EPA 200.8 | 5.4 | Molybdenum | NELAP | PA | 1/7/2010 |
| EPA 200.8 | 5.4 | Nickel | NELAP | PA | 4/4/2005 |
| EPA 200.8 | 5.4 | Potassium | NELAP | PA | 1/7/2010 |
| EPA 200.8 | 5.4 | Selenium | NELAP | PA | 12/12/2005 |
| EPA 200.8 | 5.4 | Silver | NELAP | PA | 1/2/2007 |
| EPA 200.8 | 5.4 | Sodium | NELAP | PA | 1/7/2010 |
| EPA 200.8 | 5.4 | Strontium | NELAP | PA | 1/7/2010 |
| EPA 200.8 | 5.4 | Thallium | NELAP | PA | 5/31/2006 |
| EPA 200.8 | 5.4 | Tin | NELAP | PA | 1/7/2010 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

**Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 200.8 | 5.4 | Titanium | NELAP | PA | 1/7/2010 |
| EPA 200.8 | 5.4 | Vanadium | NELAP | PA | 1/7/2010 |
| EPA 200.8 | 5.4 | Zinc | NELAP | PA | 1/18/2011 |
| EPA 218.6 | | Chromium VI | NELAP | PA | 4/4/2005 |
| EPA 245.1 | 3.0 | Mercury | NELAP | PA | 1/19/2005 |
| EPA 300.0 | 2.1 | Bromide | NELAP | PA | 4/4/2005 |
| EPA 300.0 | 2.1 | Chloride | NELAP | PA | 1/19/2005 |
| EPA 300.0 | 2.1 | Fluoride | NELAP | PA | 5/25/2005 |
| EPA 300.0 | 2.1 | Nitrate as N | NELAP | PA | 1/19/2005 |
| EPA 300.0 | 2.1 | Nitrite as N | NELAP | PA | 1/19/2005 |
| EPA 300.0 | 2.1 | Sulfate | NELAP | PA | 1/19/2005 |
| EPA 3005 | A | Preconcentration under acid | NELAP | PA | 12/12/2005 |
| EPA 3010 | A | Hot plate acid digestion (HNO3 + HCl) | NELAP | PA | 12/12/2005 |
| EPA 3020 | A | Hot plate acid digestion (HNO3 only) | NELAP | PA | 12/12/2005 |
| EPA 305.2 | | Acidity as CaCO3 | NELAP | PA | 1/24/2007 |
| EPA 3060 | A | Alkaline digestion of Cr(VI) | NELAP | PA | 1/24/2007 |
| EPA 314.0 | | Perchlorate | NELAP | PA | 11/23/2009 |
| EPA 335.4 | | Total cyanide | NELAP | PA | 1/19/2005 |
| EPA 350.1 | | Ammonia as N | NELAP | PA | 10/9/2013 |
| EPA 351.2 | | Kjeldahl nitrogen, total (TKN) | NELAP | PA | 1/19/2005 |
| EPA 3510 | C | Separatory funnel liquid-liquid extraction | NELAP | PA | 12/12/2005 |
| EPA 3511 | | Organic compounds in water by microextraction | NELAP | PA | 3/7/2012 |
| EPA 3520 | C | Continuous liquid-liquid extraction | NELAP | PA | 12/12/2005 |
| EPA 353.2 | | Nitrate as N | NELAP | PA | 1/19/2005 |
| EPA 353.2 | | Nitrite as N | NELAP | PA | 1/19/2005 |
| EPA 353.2 | | Total nitrate-nitrite | NELAP | PA | 4/4/2005 |
| EPA 3620 | B | Florisil cleanup | NELAP | PA | 12/12/2005 |
| EPA 3630 | C | Silica gel cleanup | NELAP | PA | 12/12/2005 |
| EPA 3640 | A | Gel permeation cleanup (GPC) | NELAP | PA | 12/12/2005 |
| EPA 365.1 | | Phosphorus, total | NELAP | PA | 4/4/2005 |
| EPA 365.3 | | Orthophosphate as P | NELAP | PA | 1/19/2005 |
| EPA 3660 | B | Sulfur cleanup | NELAP | PA | 12/12/2005 |
| EPA 375.4 | | Sulfate | NELAP | PA | 4/4/2005 |
| EPA 410.4 | | Chemical oxygen demand (COD) | NELAP | PA | 4/1/2005 |
| EPA 415.1 | | Total organic carbon (TOC) | NELAP | PA | 1/19/2005 |
| EPA 420.4 | | Total phenolics | NELAP | PA | 4/17/2007 |
| EPA 425.1 | | Surfactants as MBAS | NELAP | PA | 1/19/2005 |
| EPA 5030 | B | Aqueous-phase purge-and-trap | NELAP | PA | 12/12/2005 |
| EPA 5030 | C | Aqueous-phase purge-and-trap | NELAP | PA | 1/27/2014 |
| EPA 524.2 | 4.1 | 1,2-Dichlorobenzene (o-Dichlorobenzene) | NELAP | PA | 1/18/2011 |
| EPA 524.2 | 4.1 | 1,2-Dichloroethane | NELAP | PA | 1/18/2011 |
| EPA 524.2 | 4.1 | 4-Methyl-2-pentanone (MIBK) | NELAP | PA | 5/24/2011 |
| EPA 524.2 | 4.1 | Acetone | NELAP | PA | 1/18/2011 |
| EPA 524.2 | 4.1 | Benzene | NELAP | PA | 1/18/2011 |
| EPA 524.2 | 4.1 | Chlorobenzene | NELAP | PA | 1/18/2011 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 524.2 | 4.1 | Chloroform | NELAP | PA | 1/18/2011 |
| EPA 524.2 | 4.1 | Methylene chloride (Dichloromethane) | NELAP | PA | 5/24/2011 |
| EPA 524.2 | 4.1 | Tetrahydrofuran (THF) | NELAP | PA | 5/24/2011 |
| EPA 524.2 | 4.1 | Toluene | NELAP | PA | 1/18/2011 |
| EPA 524.2 | 4.1 | m+p-Xylene | NELAP | PA | 7/25/2011 |
| EPA 524.2 | 4.1 | o-Xylene | NELAP | PA | 5/24/2011 |
| EPA 6010 | | Aluminum | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Antimony | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Arsenic | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Barium | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Beryllium | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Boron | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Cadmium | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Calcium | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Chromium | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Cobalt | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Copper | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Iron | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Lead | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Lithium | NELAP | PA | 1/18/2011 |
| EPA 6010 | | Magnesium | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Manganese | NELAP | PA | 12/12/2005 |
| EPA 6010 | C | Metals by ICP/AES | NELAP | PA | 3/26/2012 |
| EPA 6010 | B | Metals by ICP/AES | NELAP | PA | 3/26/2012 |
| EPA 6010 | | Molybdenum | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Nickel | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Potassium | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Selenium | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Silver | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Sodium | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Strontium | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Sulfur | NELAP | PA | 12/19/2011 |
| EPA 6010 | | Thallium | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Tin | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Titanium | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Vanadium | NELAP | PA | 12/12/2005 |
| EPA 6010 | | Zinc | NELAP | PA | 12/12/2005 |
| EPA 602 | | Benzene | NELAP | PA | 1/19/2005 |
| EPA 602 | | Ethylbenzene | NELAP | PA | 1/19/2005 |
| EPA 602 | | Methyl tert-butyl ether (MTBE) | NELAP | PA | 1/19/2005 |
| EPA 602 | | Naphthalene | NELAP | PA | 1/18/2011 |
| EPA 602 | | Styrene | NELAP | PA | 6/24/2008 |
| EPA 602 | | Toluene | NELAP | PA | 1/19/2005 |
| EPA 602 | | Xylenes, total | NELAP | PA | 1/19/2005 |
| EPA 602 | | m+p-Xylene | NELAP | PA | 1/18/2011 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

**Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**DEP Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **TNI Code:** **(717) 656-2300**
**PADWIS ID: 36037**

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 602 | | o-Xylene | NELAP | PA | 1/18/2011 |
| EPA 6020 | | Aluminum | NELAP | PA | 1/7/2010 |
| EPA 6020 | | Antimony | NELAP | PA | 12/12/2005 |
| EPA 6020 | | Arsenic | NELAP | PA | 12/12/2005 |
| EPA 6020 | | Barium | NELAP | PA | 12/12/2005 |
| EPA 6020 | | Beryllium | NELAP | PA | 12/12/2005 |
| EPA 6020 | | Boron | NELAP | PA | 1/11/2012 |
| EPA 6020 | | Cadmium | NELAP | PA | 12/12/2005 |
| EPA 6020 | | Calcium | NELAP | PA | 1/7/2010 |
| EPA 6020 | | Chromium | NELAP | PA | 12/12/2005 |
| EPA 6020 | | Cobalt | NELAP | PA | 11/23/2010 |
| EPA 6020 | | Copper | NELAP | PA | 12/12/2005 |
| EPA 6020 | | Iron | NELAP | PA | 11/23/2010 |
| EPA 6020 | | Lead | NELAP | PA | 12/12/2005 |
| EPA 6020 | | Magnesium | NELAP | PA | 1/7/2010 |
| EPA 6020 | | Manganese | NELAP | PA | 11/23/2010 |
| EPA 6020 | A | Metals by ICP/MS | NELAP | PA | 3/26/2012 |
| EPA 6020 | | Molybdenum | NELAP | PA | 1/7/2010 |
| EPA 6020 | | Nickel | NELAP | PA | 7/23/2008 |
| EPA 6020 | | Potassium | NELAP | PA | 1/7/2010 |
| EPA 6020 | | Selenium | NELAP | PA | 12/12/2005 |
| EPA 6020 | | Silver | NELAP | PA | 1/12/2007 |
| EPA 6020 | | Sodium | NELAP | PA | 1/7/2010 |
| EPA 6020 | | Strontium | NELAP | PA | 1/7/2010 |
| EPA 6020 | | Thallium | NELAP | PA | 12/12/2005 |
| EPA 6020 | | Tin | NELAP | PA | 1/7/2010 |
| EPA 6020 | | Titanium | NELAP | PA | 1/7/2010 |
| EPA 6020 | | Vanadium | NELAP | PA | 1/7/2010 |
| EPA 6020 | | Zinc | NELAP | PA | 1/18/2011 |
| EPA 608 | | 4,4'-DDD | NELAP | PA | 1/19/2005 |
| EPA 608 | | 4,4'-DDE | NELAP | PA | 1/19/2005 |
| EPA 608 | | 4,4'-DDT | NELAP | PA | 1/19/2005 |
| EPA 608 | | Aldrin (HHDN) | NELAP | PA | 1/19/2005 |
| EPA 608 | | Aroclor-1016 (PCB-1016) | NELAP | PA | 12/11/2006 |
| EPA 608 | | Aroclor-1221 (PCB-1221) | NELAP | PA | 12/11/2006 |
| EPA 608 | | Aroclor-1232 (PCB-1232) | NELAP | PA | 12/11/2006 |
| EPA 608 | | Aroclor-1242 (PCB-1242) | NELAP | PA | 12/11/2006 |
| EPA 608 | | Aroclor-1248 (PCB-1248) | NELAP | PA | 12/11/2006 |
| EPA 608 | | Aroclor-1254 (PCB-1254) | NELAP | PA | 12/11/2006 |
| EPA 608 | | Aroclor-1260 (PCB-1260) | NELAP | PA | 12/11/2006 |
| EPA 608 | | Aroclor-1268 (PCB-1268) | NELAP | PA | 11/13/2012 |
| EPA 608 | | Chlordane (tech.) | NELAP | PA | 1/19/2005 |
| EPA 608 | | Dieldrin | NELAP | PA | 1/19/2005 |
| EPA 608 | | Endosulfan I | NELAP | PA | 1/19/2005 |
| EPA 608 | | Endosulfan II | NELAP | PA | 1/19/2005 |

Uncontrolled Copy

**The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.**

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 608 | | Endosulfan sulfate | NELAP | PA | 1/19/2005 |
| EPA 608 | | Endrin | NELAP | PA | 1/19/2005 |
| EPA 608 | | Endrin aldehyde | NELAP | PA | 1/19/2005 |
| EPA 608 | | Heptachlor | NELAP | PA | 1/19/2005 |
| EPA 608 | | Heptachlor epoxide | NELAP | PA | 1/19/2005 |
| EPA 608 | | Methoxychlor | NELAP | PA | 5/2/2006 |
| EPA 608 | | Mirex | NELAP | PA | 11/13/2012 |
| EPA 608 | | Toxaphene (Chlorinated camphene) | NELAP | PA | 1/19/2005 |
| EPA 608 | | alpha-BHC (alpha-Hexachlorocyclohexane) | NELAP | PA | 1/19/2005 |
| EPA 608 | | beta-BHC (beta-Hexachlorocyclohexane) | NELAP | PA | 1/19/2005 |
| EPA 608 | | delta-BHC (delta-Hexachlorocyclohexane) | NELAP | PA | 1/19/2005 |
| EPA 608 | | gamma-BHC (Lindane, gamma-Hexachlorocyclohexane) | NELAP | PA | 1/19/2005 |
| EPA 622 | | Azinphos-methyl (Guthion) | NELAP | PA | 6/15/2009 |
| EPA 622 | | Bolstar (Sulprofos) | NELAP | PA | 6/15/2009 |
| EPA 622 | | Carbophenothion (Trithion) | NELAP | PA | 4/28/2010 |
| EPA 622 | | Chlorpyrifos | NELAP | PA | 6/15/2009 |
| EPA 622 | | Coumaphos | NELAP | PA | 6/15/2009 |
| EPA 622 | | Demeton-O | NELAP | PA | 6/15/2009 |
| EPA 622 | | Demeton-S | NELAP | PA | 6/15/2009 |
| EPA 622 | | Diazinon (Spectracide) | NELAP | PA | 6/15/2009 |
| EPA 622 | | Dichlorovos (DDVP, Dichlorvos) | NELAP | PA | 6/15/2009 |
| EPA 622 | | Disulfoton | NELAP | PA | 6/15/2009 |
| EPA 622 | | EPN (Santox) | NELAP | PA | 6/15/2009 |
| EPA 622 | | Ethion | NELAP | PA | 6/15/2009 |
| EPA 622 | | Ethoprop (Prophos) | NELAP | PA | 6/15/2009 |
| EPA 622 | | Famphur | NELAP | PA | 6/15/2009 |
| EPA 622 | | Fensulfothion | NELAP | PA | 6/15/2009 |
| EPA 622 | | Fenthion | NELAP | PA | 6/15/2009 |
| EPA 622 | | Malathion | NELAP | PA | 6/15/2009 |
| EPA 622 | | Merphos | NELAP | PA | 6/15/2009 |
| EPA 622 | | Methyl parathion (Parathion, methyl) | NELAP | PA | 6/15/2009 |
| EPA 622 | | Mevinphos | NELAP | PA | 6/15/2009 |
| EPA 622 | | Naled | NELAP | PA | 6/15/2009 |
| EPA 622 | | Parathion, ethyl (Ethyl parathion, Parathion) | NELAP | PA | 6/15/2009 |
| EPA 622 | | Phorate (Thimet) | NELAP | PA | 6/15/2009 |
| EPA 622 | | Ronnel | NELAP | PA | 6/15/2009 |
| EPA 622 | | Stirophos (Tetrachlorovinphos) | NELAP | PA | 6/15/2009 |
| EPA 622 | | Tokuthion (Prothiophos) | NELAP | PA | 6/15/2009 |
| EPA 622 | | Trichloronate | NELAP | PA | 6/15/2009 |
| EPA 624 | | 1,1,1,2-Tetrachloroethane | NELAP | PA | 1/19/2005 |
| EPA 624 | | 1,1,1-Trichloroethane | NELAP | PA | 1/19/2005 |
| EPA 624 | | 1,1,2,2-Tetrachloroethane | NELAP | PA | 1/19/2005 |
| EPA 624 | | 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113) | NELAP | PA | 7/3/2007 |
| EPA 624 | | 1,1,2-Trichloroethane | NELAP | PA | 1/19/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 624 | | 1,1-Dichloroethane | NELAP | PA | 1/19/2005 |
| EPA 624 | | 1,1-Dichloroethene (1,1-Dichloroethylene) | NELAP | PA | 1/19/2005 |
| EPA 624 | | 1,1-Dichloropropene | NELAP | PA | 7/3/2007 |
| EPA 624 | | 1,2,3-Trichlorobenzene | NELAP | PA | 7/3/2007 |
| EPA 624 | | 1,2,3-Trichloropropane (1,2,3-TCP) | NELAP | PA | 7/3/2007 |
| EPA 624 | | 1,2,3-Trimethylbenzene | NELAP | PA | 7/3/2007 |
| EPA 624 | | 1,2,4-Trichlorobenzene | NELAP | PA | 7/3/2007 |
| EPA 624 | | 1,2,4-Trimethylbenzene | NELAP | PA | 7/3/2007 |
| EPA 624 | | 1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane) | NELAP | PA | 7/3/2007 |
| EPA 624 | | 1,2-Dibromoethane (EDB, Ethylene dibromide) | NELAP | PA | 7/3/2007 |
| EPA 624 | | 1,2-Dichlorobenzene (o-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 624 | | 1,2-Dichloroethane | NELAP | PA | 1/19/2005 |
| EPA 624 | | 1,2-Dichloropropane | NELAP | PA | 1/19/2005 |
| EPA 624 | | 1,3,5-Trimethylbenzene | NELAP | PA | 7/3/2007 |
| EPA 624 | | 1,3-Dichlorobenzene (m-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 624 | | 1,3-Dichloropropane | NELAP | PA | 7/3/2007 |
| EPA 624 | | 1,4-Dichlorobenzene (p-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 624 | | 1,4-Dioxane (1,4-Diethyleneoxide) | NELAP | PA | 7/3/2007 |
| EPA 624 | | 2,2-Dichloropropane | NELAP | PA | 7/3/2007 |
| EPA 624 | | 2-Butanone (Methyl ethyl ketone, MEK) | NELAP | PA | 7/3/2007 |
| EPA 624 | | 2-Chloroethyl vinyl ether | NELAP | PA | 1/19/2005 |
| EPA 624 | | 2-Chlorotoluene | NELAP | PA | 7/3/2007 |
| EPA 624 | | 2-Hexanone | NELAP | PA | 7/3/2007 |
| EPA 624 | | 4-Chloro-2-nitrophenol | NELAP | PA | 7/3/2007 |
| EPA 624 | | 4-Chlorotoluene | NELAP | PA | 7/3/2007 |
| EPA 624 | | 4-Methyl-2-pentanone (MIBK) | NELAP | PA | 5/2/2006 |
| EPA 624 | | Acetone | NELAP | PA | 7/3/2007 |
| EPA 624 | | Acetonitrile | NELAP | PA | 7/3/2007 |
| EPA 624 | | Acrolein (Propenal) | NELAP | PA | 1/19/2005 |
| EPA 624 | | Acrylonitrile | NELAP | PA | 1/19/2005 |
| EPA 624 | | Allyl chloride (3-Chloropropene) | NELAP | PA | 7/3/2007 |
| EPA 624 | | Benzene | NELAP | PA | 1/19/2005 |
| EPA 624 | | Bromobenzene | NELAP | PA | 7/3/2007 |
| EPA 624 | | Bromochloromethane | NELAP | PA | 5/2/2006 |
| EPA 624 | | Bromodichloromethane | NELAP | PA | 1/19/2005 |
| EPA 624 | | Bromoform | NELAP | PA | 1/19/2005 |
| EPA 624 | | Carbon disulfide | NELAP | PA | 7/3/2007 |
| EPA 624 | | Carbon tetrachloride | NELAP | PA | 1/19/2005 |
| EPA 624 | | Chlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 624 | | Chloroethane | NELAP | PA | 1/19/2005 |
| EPA 624 | | Chloroform | NELAP | PA | 1/19/2005 |
| EPA 624 | | Chloroprene (2-Chloro-1,3-butadiene) | NELAP | PA | 6/12/2009 |
| EPA 624 | | Cyclohexane | NELAP | PA | 7/3/2007 |
| EPA 624 | | Dibromochloromethane | NELAP | PA | 4/4/2005 |

Uncontrolled Copy

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 624 | | Dibromomethane | NELAP | PA | 7/3/2007 |
| EPA 624 | | Dichlorodifluoromethane (Freon 12) | NELAP | PA | 7/3/2007 |
| EPA 624 | | Diisopropyl ether (DIPE) | NELAP | PA | 5/2/2006 |
| EPA 624 | | Ethyl acetate | NELAP | PA | 1/20/2012 |
| EPA 624 | | Ethyl methacrylate | NELAP | PA | 7/3/2007 |
| EPA 624 | | Ethylbenzene | NELAP | PA | 1/19/2005 |
| EPA 624 | | Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane) | NELAP | PA | 2/1/2011 |
| EPA 624 | | Freon-123A | NELAP | PA | 2/1/2011 |
| EPA 624 | | Isobutyl alcohol (2-Methyl-1-propanol) | NELAP | PA | 7/3/2007 |
| EPA 624 | | Isopropylbenzene (Cumene) | NELAP | PA | 5/2/2006 |
| EPA 624 | | Methacrylonitrile | NELAP | PA | 7/3/2007 |
| EPA 624 | | Methyl bromide (Bromomethane) | NELAP | PA | 1/19/2005 |
| EPA 624 | | Methyl chloride (Chloromethane) | NELAP | PA | 1/19/2005 |
| EPA 624 | | Methyl iodide (Iodomethane) | NELAP | PA | 7/3/2007 |
| EPA 624 | | Methyl tert-butyl ether (MTBE) | NELAP | PA | 12/12/2005 |
| EPA 624 | | Methylene chloride (Dichloromethane) | NELAP | PA | 1/19/2005 |
| EPA 624 | | Methylmethacrylate | NELAP | PA | 7/3/2007 |
| EPA 624 | | Naphthalene | NELAP | PA | 7/3/2007 |
| EPA 624 | | Pentachloroethane | NELAP | PA | 7/3/2007 |
| EPA 624 | | Propionitrile (Ethyl cyanide) | NELAP | PA | 7/3/2007 |
| EPA 624 | | Styrene | NELAP | PA | 5/2/2006 |
| EPA 624 | | Tetrachloroethene (PCE, Perchloroethylene) | NELAP | PA | 1/19/2005 |
| EPA 624 | | Tetrahydrofuran (THF) | NELAP | PA | 7/3/2007 |
| EPA 624 | | Toluene | NELAP | PA | 1/19/2005 |
| EPA 624 | | Trichloroethene (TCE, Trichloroethylene) | NELAP | PA | 1/19/2005 |
| EPA 624 | | Trichlorofluoromethane (Freon 11) | NELAP | PA | 1/19/2005 |
| EPA 624 | | Vinyl acetate | NELAP | PA | 7/3/2007 |
| EPA 624 | | Vinyl chloride (Chloroethene) | NELAP | PA | 1/19/2005 |
| EPA 624 | | Xylenes, total | NELAP | PA | 1/19/2005 |
| EPA 624 | | cis-1,2-Dichloroethene | NELAP | PA | 6/12/2009 |
| EPA 624 | | cis-1,3-Dichloropropene | NELAP | PA | 1/19/2005 |
| EPA 624 | | n-Butylbenzene | NELAP | PA | 7/3/2007 |
| EPA 624 | | n-Heptane | NELAP | PA | 7/3/2007 |
| EPA 624 | | n-Hexane | NELAP | PA | 7/3/2007 |
| EPA 624 | | n-Propylbenzene | NELAP | PA | 7/3/2007 |
| EPA 624 | | p-Isopropyltoluene (4-Isopropyltoluene) | NELAP | PA | 7/3/2007 |
| EPA 624 | | sec-Butylbenzene | NELAP | PA | 7/3/2007 |
| EPA 624 | | tert-Amyl methyl ether (TAME) | NELAP | PA | 5/2/2006 |
| EPA 624 | | tert-Butyl alcohol (2-Methyl-2-propanol) | NELAP | PA | 5/2/2006 |
| EPA 624 | | tert-Butyl ethyl ether | NELAP | PA | 5/2/2006 |
| EPA 624 | | tert-Butylbenzene | NELAP | PA | 7/3/2007 |
| EPA 624 | | trans-1,2-Dichloroethene | NELAP | PA | 1/19/2005 |
| EPA 624 | | trans-1,3-Dichloropropene | NELAP | PA | 1/19/2005 |
| EPA 625 | | 1,1'-Biphenyl (Biphenyl, Lemonene) | NELAP | PA | 7/3/2007 |
| EPA 625 | | 1,2,4,5-Tetrachlorobenzene | NELAP | PA | 5/2/2006 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

**Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 625 | | 1,2,4-Trichlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 625 | | 1,2-Dichlorobenzene (o-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 625 | | 1,2-Diphenylhydrazine | NELAP | PA | 5/2/2006 |
| EPA 625 | | 1,3-Dichlorobenzene (m-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 625 | | 1,4-Dichlorobenzene (p-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 625 | | 1,4-Dioxane (1,4-Diethyleneoxide) | NELAP | PA | 7/3/2007 |
| EPA 625 | | 1-Methylphenanthrene | NELAP | PA | 5/2/2006 |
| EPA 625 | | 2,3,4,6-Tetrachlorophenol | NELAP | PA | 7/3/2007 |
| EPA 625 | | 2,3-Dichloroaniline | NELAP | PA | 5/2/2006 |
| EPA 625 | | 2,3-Dinitrotoluene | NELAP | PA | 7/3/2007 |
| EPA 625 | | 2,4,5-Trichlorophenol | NELAP | PA | 7/3/2007 |
| EPA 625 | | 2,4,6-Trichlorophenol | NELAP | PA | 1/19/2005 |
| EPA 625 | | 2,4-Dichlorophenol | NELAP | PA | 1/19/2005 |
| EPA 625 | | 2,4-Dimethylphenol | NELAP | PA | 1/19/2005 |
| EPA 625 | | 2,4-Dinitrophenol | NELAP | PA | 1/19/2005 |
| EPA 625 | | 2,4-Dinitrotoluene (2,4-DNT) | NELAP | PA | 1/19/2005 |
| EPA 625 | | 2,6-Dichlorophenol | NELAP | PA | 7/3/2007 |
| EPA 625 | | 2,6-Dinitrotoluene (2,6-DNT) | NELAP | PA | 1/19/2005 |
| EPA 625 | | 2-Chloronaphthalene | NELAP | PA | 1/19/2005 |
| EPA 625 | | 2-Chlorophenol | NELAP | PA | 1/19/2005 |
| EPA 625 | | 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol) | NELAP | PA | 1/19/2005 |
| EPA 625 | | 2-Methylnaphthalene | NELAP | PA | 7/3/2007 |
| EPA 625 | | 2-Methylphenol (o-Cresol) | NELAP | PA | 7/3/2007 |
| EPA 625 | | 2-Nitroaniline | NELAP | PA | 7/3/2007 |
| EPA 625 | | 2-Nitrophenol | NELAP | PA | 1/19/2005 |
| EPA 625 | | 3+4-Methylphenol (m+p-Cresol) | NELAP | PA | 7/3/2007 |
| EPA 625 | | 3,3'-Dichlorobenzidine | NELAP | PA | 1/19/2005 |
| EPA 625 | | 3-Nitroaniline | NELAP | PA | 7/3/2007 |
| EPA 625 | | 4-Bromophenyl phenyl ether | NELAP | PA | 1/19/2005 |
| EPA 625 | | 4-Chloro-3-methylphenol | NELAP | PA | 1/19/2005 |
| EPA 625 | | 4-Chloroaniline | NELAP | PA | 7/3/2007 |
| EPA 625 | | 4-Chlorophenyl phenyl ether | NELAP | PA | 1/19/2005 |
| EPA 625 | | 4-Nitroaniline | NELAP | PA | 7/3/2007 |
| EPA 625 | | 4-Nitrophenol | NELAP | PA | 1/19/2005 |
| EPA 625 | | Acenaphthene | NELAP | PA | 1/19/2005 |
| EPA 625 | | Acenaphthylene | NELAP | PA | 1/19/2005 |
| EPA 625 | | Acetophenone | NELAP | PA | 5/2/2006 |
| EPA 625 | | Aniline | NELAP | PA | 5/2/2006 |
| EPA 625 | | Anthracene | NELAP | PA | 4/4/2005 |
| EPA 625 | | Benzidine | NELAP | PA | 1/19/2005 |
| EPA 625 | | Benzo[a]anthracene | NELAP | PA | 1/19/2005 |
| EPA 625 | | Benzo[a]pyrene | NELAP | PA | 1/19/2005 |
| EPA 625 | | Benzo[b]fluoranthene | NELAP | PA | 1/19/2005 |
| EPA 625 | | Benzo[ghi]perylene | NELAP | PA | 1/19/2005 |
| EPA 625 | | Benzo[k]fluoranthene | NELAP | PA | 1/19/2005 |

**The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.**



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 625 | | Benzoic acid | NELAP | PA | 5/2/2006 |
| EPA 625 | | Benzyl alcohol | NELAP | PA | 7/3/2007 |
| EPA 625 | | Butyl benzyl phthalate (Benzyl butyl phthalate) | NELAP | PA | 1/19/2005 |
| EPA 625 | | Carbazole | NELAP | PA | 5/2/2006 |
| EPA 625 | | Chrysene (Benzo[a]phenanthrene) | NELAP | PA | 1/19/2005 |
| EPA 625 | | Di-n-butyl phthalate | NELAP | PA | 1/19/2005 |
| EPA 625 | | Di-n-octyl phthalate | NELAP | PA | 1/19/2005 |
| EPA 625 | | Dibenzo[a,h]anthracene | NELAP | PA | 1/19/2005 |
| EPA 625 | | Dibenzofuran | NELAP | PA | 7/3/2007 |
| EPA 625 | | Diethyl phthalate | NELAP | PA | 1/19/2005 |
| EPA 625 | | Dimethyl phthalate | NELAP | PA | 1/19/2005 |
| EPA 625 | | Diphenyl ether | NELAP | PA | 7/3/2007 |
| EPA 625 | | Fluoranthene | NELAP | PA | 1/19/2005 |
| EPA 625 | | Fluorene | NELAP | PA | 1/19/2005 |
| EPA 625 | | Hexachlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 625 | | Hexachlorobutadiene (1,3-Hexachlorobutadiene) | NELAP | PA | 1/19/2005 |
| EPA 625 | | Hexachlorocyclopentadiene | NELAP | PA | 1/19/2005 |
| EPA 625 | | Hexachloroethane | NELAP | PA | 1/19/2005 |
| EPA 625 | | Indeno(1,2,3-cd)pyrene | NELAP | PA | 1/19/2005 |
| EPA 625 | | Isophorone | NELAP | PA | 1/19/2005 |
| EPA 625 | | N-Nitrosodi-n-butylamine | NELAP | PA | 5/2/2006 |
| EPA 625 | | N-Nitrosodi-n-propylamine | NELAP | PA | 1/19/2005 |
| EPA 625 | | N-Nitrosodiethylamine | NELAP | PA | 5/2/2006 |
| EPA 625 | | N-Nitrosodimethylamine | NELAP | PA | 1/19/2005 |
| EPA 625 | | N-Nitrosodiphenylamine | NELAP | PA | 1/19/2005 |
| EPA 625 | | N-Nitrosopyrrolidine | NELAP | PA | 5/2/2006 |
| EPA 625 | | Naphthalene | NELAP | PA | 1/19/2005 |
| EPA 625 | | Nitrobenzene | NELAP | PA | 1/19/2005 |
| EPA 625 | | Pentachlorobenzene | NELAP | PA | 7/3/2007 |
| EPA 625 | | Pentachlorophenol (PCP) | NELAP | PA | 1/19/2005 |
| EPA 625 | | Phenanthrene | NELAP | PA | 1/19/2005 |
| EPA 625 | | Phenol | NELAP | PA | 1/19/2005 |
| EPA 625 | | Pyrene | NELAP | PA | 1/19/2005 |
| EPA 625 | | Pyridine | NELAP | PA | 5/2/2006 |
| EPA 625 | | alpha-Terpineol | NELAP | PA | 5/2/2006 |
| EPA 625 | | bis(2-Chloroethoxy)methane | NELAP | PA | 1/19/2005 |
| EPA 625 | | bis(2-Chloroethyl) ether | NELAP | PA | 1/19/2005 |
| EPA 625 | | bis(2-Chloroisopropyl) ether | NELAP | PA | 1/19/2005 |
| EPA 625 | | bis(2-Ethylhexyl) phthalate (DEHP) | NELAP | PA | 1/19/2005 |
| EPA 625 | | n-Decane | NELAP | PA | 5/2/2006 |
| EPA 625 | | n-Docosane | NELAP | PA | 5/2/2006 |
| EPA 625 | | n-Dodecane | NELAP | PA | 5/2/2006 |
| EPA 625 | | n-Eicosane | NELAP | PA | 5/2/2006 |
| EPA 625 | | n-Hexadecane | NELAP | PA | 5/2/2006 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 625 | | n-Octadecane | NELAP | PA | 5/2/2006 |
| EPA 625 | | n-Tetradecane | NELAP | PA | 5/2/2006 |
| EPA 625 | | o-Toluidine (2-Toluidine, 2-Methylaniline) | NELAP | PA | 7/3/2007 |
| EPA 6850 | | Perchlorate | NELAP | PA | 1/19/2011 |
| EPA 7196 | A | Chromium VI | NELAP | PA | 4/6/2006 |
| EPA 7199 | | Chromium VI | NELAP | PA | 1/4/2006 |
| EPA 7470 | | Mercury | NELAP | PA | 11/21/2005 |
| EPA 8011 | | 1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane) | NELAP | PA | 5/2/2006 |
| EPA 8011 | | 1,2-Dibromoethane (EDB, Ethylene dibromide) | NELAP | PA | 12/12/2005 |
| EPA 8015 | | 2-Methyl-propanoic acid (Isobutyric acid) | NELAP | PA | 12/14/2012 |
| EPA 8015 | | Acetic acid (Ethanoic acid) | NELAP | PA | 12/14/2012 |
| EPA 8015 | | Butanedoic acid (Succinic acid) | NELAP | PA | 12/14/2012 |
| EPA 8015 | | Butyric acid | NELAP | PA | 12/14/2012 |
| EPA 8015 | | Citric acid | NELAP | PA | 12/14/2012 |
| EPA 8015 | | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| EPA 8015 | | Diethylene glycol | NELAP | PA | 1/20/2012 |
| EPA 8015 | | Ethane | NELAP | PA | 12/4/2007 |
| EPA 8015 | | Ethanol | NELAP | PA | 12/4/2007 |
| EPA 8015 | | Ethene | NELAP | PA | 12/4/2007 |
| EPA 8015 | | Ethylene glycol | NELAP | PA | 12/4/2007 |
| EPA 8015 | | Formic acid | NELAP | PA | 12/14/2012 |
| EPA 8015 | | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |
| EPA 8015 | | Isobutyl alcohol (2-Methyl-1-propanol) | NELAP | PA | 2/7/2012 |
| EPA 8015 | | Isopropyl alcohol (2-Propanol) | NELAP | PA | 12/4/2007 |
| EPA 8015 | | Lactic acid | NELAP | PA | 12/14/2012 |
| EPA 8015 | | Methane | NELAP | PA | 12/4/2007 |
| EPA 8015 | | Methanol | NELAP | PA | 12/4/2007 |
| EPA 8015 | C | Nonhalogenated organics by GC/FID | NELAP | PA | 3/26/2012 |
| EPA 8015 | B | Nonhalogenated organics by GC/FID | NELAP | PA | 3/26/2012 |
| EPA 8015 | | Oxalic acid | NELAP | PA | 12/14/2012 |
| EPA 8015 | | Propane | NELAP | PA | 12/4/2007 |
| EPA 8015 | | Propionic acid | NELAP | PA | 12/14/2012 |
| EPA 8015 | | Propylene glycol | NELAP | PA | 1/20/2012 |
| EPA 8015 | | Pyruvic acid | NELAP | PA | 12/14/2012 |
| EPA 8015 | | Quinic acid | NELAP | PA | 12/21/2012 |
| EPA 8015 | | Tartaric acid | NELAP | PA | 12/14/2012 |
| EPA 8015 | | Tetraethylene glycol | NELAP | PA | 1/20/2012 |
| EPA 8015 | | Total petroleum hydrocarbons (TPH) | NELAP | PA | 1/24/2007 |
| EPA 8015 | | Triethylene glycol | NELAP | PA | 1/20/2012 |
| EPA 8015 | | n-Butyl alcohol (n-Butanol, 1-Butanol) | NELAP | PA | 2/7/2012 |
| EPA 8015 | | n-Propanol (1-Propanol) | NELAP | PA | 2/7/2012 |
| EPA 8021 | | Benzene | NELAP | PA | 12/12/2005 |
| EPA 8021 | | Ethylbenzene | NELAP | PA | 12/12/2005 |
| EPA 8021 | | Isopropylbenzene (Cumene) | NELAP | PA | 12/12/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8021 | | Methyl tert-butyl ether (MTBE) | NELAP | PA | 2/11/2011 |
| EPA 8021 | | Naphthalene | NELAP | PA | 6/24/2008 |
| EPA 8021 | | Toluene | NELAP | PA | 12/12/2005 |
| EPA 8021 | B | VOCs by GC/PID/ELCD | NELAP | PA | 3/26/2012 |
| EPA 8021 | | Xylenes, total | NELAP | PA | 12/12/2005 |
| EPA 8021 | | m-Xylene | NELAP | PA | 11/23/2009 |
| EPA 8021 | | o-Xylene | NELAP | PA | 11/23/2009 |
| EPA 8021 | | p-Xylene | NELAP | PA | 11/23/2009 |
| EPA 8081 | | 4,4'-DDD | NELAP | PA | 2/10/2006 |
| EPA 8081 | | 4,4'-DDE | NELAP | PA | 12/12/2005 |
| EPA 8081 | | 4,4'-DDT | NELAP | PA | 12/12/2005 |
| EPA 8081 | | Aldrin (HHDN) | NELAP | PA | 12/12/2005 |
| EPA 8081 | | Chlordane (tech.) | NELAP | PA | 12/12/2005 |
| EPA 8081 | | Dieldrin | NELAP | PA | 12/12/2005 |
| EPA 8081 | | Endosulfan I | NELAP | PA | 2/10/2006 |
| EPA 8081 | | Endosulfan II | NELAP | PA | 12/12/2005 |
| EPA 8081 | | Endosulfan sulfate | NELAP | PA | 12/12/2005 |
| EPA 8081 | | Endrin | NELAP | PA | 12/12/2005 |
| EPA 8081 | | Endrin aldehyde | NELAP | PA | 12/12/2005 |
| EPA 8081 | | Endrin ketone | NELAP | PA | 2/10/2006 |
| EPA 8081 | | Heptachlor | NELAP | PA | 12/12/2005 |
| EPA 8081 | | Heptachlor epoxide | NELAP | PA | 12/12/2005 |
| EPA 8081 | | Kepone | NELAP | PA | 5/2/2006 |
| EPA 8081 | | Methoxychlor | NELAP | PA | 12/12/2005 |
| EPA 8081 | | Mirex | NELAP | PA | 12/12/2005 |
| EPA 8081 | B | Organochlorine pesticides by GC/ECD | NELAP | PA | 1/1/2013 |
| EPA 8081 | A | Organochlorine pesticides by GC/ECD | NELAP | PA | 3/26/2012 |
| EPA 8081 | | Toxaphene (Chlorinated camphene) | NELAP | PA | 12/12/2005 |
| EPA 8081 | | alpha-BHC (alpha-Hexachlorocyclohexane) | NELAP | PA | 2/10/2006 |
| EPA 8081 | | alpha-Chlordane | NELAP | PA | 2/10/2006 |
| EPA 8081 | | beta-BHC (beta-Hexachlorocyclohexane) | NELAP | PA | 2/10/2006 |
| EPA 8081 | | delta-BHC (delta-Hexachlorocyclohexane) | NELAP | PA | 2/10/2006 |
| EPA 8081 | | gamma-BHC (Lindane, gamma-Hexachlorocyclohexane) | NELAP | PA | 2/10/2006 |
| EPA 8081 | | gamma-Chlordane | NELAP | PA | 2/10/2006 |
| EPA 8082 | | Aroclor-1016 (PCB-1016) | NELAP | PA | 12/11/2006 |
| EPA 8082 | | Aroclor-1221 (PCB-1221) | NELAP | PA | 12/11/2006 |
| EPA 8082 | | Aroclor-1232 (PCB-1232) | NELAP | PA | 12/11/2006 |
| EPA 8082 | | Aroclor-1242 (PCB-1242) | NELAP | PA | 12/11/2006 |
| EPA 8082 | | Aroclor-1248 (PCB-1248) | NELAP | PA | 12/11/2006 |
| EPA 8082 | | Aroclor-1254 (PCB-1254) | NELAP | PA | 12/11/2006 |
| EPA 8082 | | Aroclor-1260 (PCB-1260) | NELAP | PA | 12/11/2006 |
| EPA 8082 | | Aroclor-1262 (PCB-1262) | NELAP | PA | 7/23/2008 |
| EPA 8082 | | Aroclor-1268 (PCB-1268) | NELAP | PA | 7/23/2008 |
| EPA 8082 | | Decachlorobiphenyl | NELAP | PA | 12/17/2012 |
| EPA 8082 | A | PCBs by GC/ECD | NELAP | PA | 3/26/2012 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8141 | | Alachlor (Lasso) | NELAP | PA | 1/21/2009 |
| EPA 8141 | | Atrazine | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Azinphos-methyl (Guthion) | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Bolstar (Sulprofos) | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Carbophenothion (Trithion) | NELAP | PA | 11/9/2012 |
| EPA 8141 | | Chlorpyrifos | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Coumaphos | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Demeton-O | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Demeton-S | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Diazinon (Spectracide) | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Dichlorovos (DDVP, Dichlorvos) | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Disulfoton | NELAP | PA | 12/12/2005 |
| EPA 8141 | | EPN (Santox) | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Ethion | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Ethoprop (Prophos) | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Famphur | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Fensulfothion | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Fenthion | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Malathion | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Merphos | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Methyl parathion (Parathion, methyl) | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Metolachlor | NELAP | PA | 1/24/2007 |
| EPA 8141 | | Mevinphos | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Naled | NELAP | PA | 12/12/2005 |
| EPA 8141 | B | Organophosphorus compounds by GC/NPD | NELAP | PA | 3/26/2012 |
| EPA 8141 | A | Organophosphorus compounds by GC/NPD | NELAP | PA | 3/26/2012 |
| EPA 8141 | | Parathion, ethyl (Ethyl parathion, Parathion) | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Phorate (Thimet) | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Ronnel | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Simazine | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Stirophos (Tetrachlorovinphos) | NELAP | PA | 5/2/2006 |
| EPA 8141 | | Tokuthion (Prothiophos) | NELAP | PA | 12/12/2005 |
| EPA 8141 | | Trichloronate | NELAP | PA | 5/2/2006 |
| EPA 8151 | | 2,4,5-T | NELAP | PA | 12/12/2005 |
| EPA 8151 | | 2,4,5-TP (Silvex) | NELAP | PA | 12/12/2005 |
| EPA 8151 | | 2,4-D | NELAP | PA | 12/12/2005 |
| EPA 8151 | | 2,4-DB (Butoxon) | NELAP | PA | 12/12/2005 |
| EPA 8151 | A | Chlorinated herbicides by GC/ECD | NELAP | PA | 3/26/2012 |
| EPA 8151 | | Dalapon (2,2-Dichloropropionic acid) | NELAP | PA | 12/12/2005 |
| EPA 8151 | | Dicamba | NELAP | PA | 12/12/2005 |
| EPA 8151 | | Dichloroprop (Dichlorprop) | NELAP | PA | 1/24/2007 |
| EPA 8151 | | Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP) | NELAP | PA | 12/12/2005 |
| EPA 8151 | | MCPA | NELAP | PA | 12/12/2005 |
| EPA 8151 | | MCPP (Mecoprop) | NELAP | PA | 12/12/2005 |
| EPA 8151 | | Pentachlorophenol (PCP) | NELAP | PA | 12/12/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300

PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8151 | | Picloram (4-Amino-3,5,6-trichloro-2-pyridinecarboxylic acid) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,1,1,2-Tetrachloroethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,1,1-Trichloroethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,1,2,2-Tetrachloroethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,1,2-Trichloroethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,1-Dichloroethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,1-Dichloroethene (1,1-Dichloroethylene) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,1-Dichloropropene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,2,3-Trichlorobenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,2,3-Trichloropropane (1,2,3-TCP) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,2,4-Trichlorobenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,2,4-Trimethylbenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,2-Dibromoethane (EDB, Ethylene dibromide) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,2-Dichlorobenzene (o-Dichlorobenzene) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,2-Dichloroethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,2-Dichloropropane | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,3,5-Trimethylbenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,3-Dichlorobenzene (m-Dichlorobenzene) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,3-Dichloropropane | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,4-Dichlorobenzene (p-Dichlorobenzene) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 1,4-Dioxane (1,4-Diethyleneoxide) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 2,2-Dichloropropane | NELAP | PA | 5/2/2006 |
| EPA 8260 | | 2-Butanone (Methyl ethyl ketone, MEK) | NELAP | PA | 5/2/2006 |
| EPA 8260 | | 2-Chloroethyl vinyl ether | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 2-Chlorotoluene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 2-Hexanone | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 2-Nitropropane | NELAP | PA | 1/19/2011 |
| EPA 8260 | | 3,3'-Dimethyl-1-butanol | NELAP | PA | 4/17/2009 |
| EPA 8260 | | 4-Chlorotoluene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | 4-Methyl-2-pentanone (MIBK) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Acetone | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Acetonitrile | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Acrolein (Propenal) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Acrylonitrile | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Allyl chloride (3-Chloropropene) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Benzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Benzyl chloride | NELAP | PA | 7/3/2007 |
| EPA 8260 | | Bromobenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Bromochloromethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Bromodichloromethane | NELAP | PA | 12/12/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8260 | | Bromoform | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Carbon disulfide | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Carbon tetrachloride | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Chlorobenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Chloroethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Chloroform | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Chloroprene (2-Chloro-1,3-butadiene) | NELAP | PA | 7/3/2007 |
| EPA 8260 | | Cyclohexane | NELAP | PA | 7/3/2007 |
| EPA 8260 | | Cyclohexanone | NELAP | PA | 6/7/2012 |
| EPA 8260 | | Dibromochloromethane | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Dibromomethane | NELAP | PA | 5/2/2006 |
| EPA 8260 | | Dichlorodifluoromethane (Freon 12) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Diethyl ether (Ethyl ether) | NELAP | PA | 2/1/2011 |
| EPA 8260 | | Diisopropyl ether (DIPE) | NELAP | PA | 7/3/2007 |
| EPA 8260 | | Dimethyl ether | NELAP | PA | 6/7/2012 |
| EPA 8260 | | Epichlorohydrin (1-Chloro-2,3-epoxypropane) | NELAP | PA | 4/17/2009 |
| EPA 8260 | | Ethanol | NELAP | PA | 1/24/2007 |
| EPA 8260 | | Ethyl acetate | NELAP | PA | 1/24/2007 |
| EPA 8260 | | Ethyl methacrylate | NELAP | PA | 1/24/2007 |
| EPA 8260 | | Ethyl tert-butyl ether (ETBE) | NELAP | PA | 1/24/2007 |
| EPA 8260 | | Ethylbenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Gasoline-range organics (GRO) | NELAP | PA | 6/8/2006 |
| EPA 8260 | | Heptane | NELAP | PA | 1/20/2012 |
| EPA 8260 | | Hexachlorobutadiene (1,3-Hexachlorobutadiene) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Hexachloroethane | NELAP | PA | 5/23/2012 |
| EPA 8260 | | Isobutyl alcohol (2-Methyl-1-propanol) | NELAP | PA | 7/3/2007 |
| EPA 8260 | | Isopropyl alcohol (2-Propanol) | NELAP | PA | 1/18/2011 |
| EPA 8260 | | Isopropylbenzene (Cumene) | NELAP | PA | 5/2/2006 |
| EPA 8260 | | Methacrylonitrile | NELAP | PA | 7/3/2007 |
| EPA 8260 | | Methyl acetate | NELAP | PA | 1/24/2007 |
| EPA 8260 | | Methyl bromide (Bromomethane) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Methyl chloride (Chloromethane) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Methyl iodide (Iodomethane) | NELAP | PA | 5/25/2007 |
| EPA 8260 | | Methyl tert-butyl ether (MTBE) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Methylcyclohexane | NELAP | PA | 1/21/2009 |
| EPA 8260 | | Methylene chloride (Dichloromethane) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Methylmethacrylate | NELAP | PA | 5/25/2007 |
| EPA 8260 | | Naphthalene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Pentachloroethane | NELAP | PA | 1/24/2007 |
| EPA 8260 | | Propionitrile (Ethyl cyanide) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Styrene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Tetrachloroethene (PCE, Perchloroethylene) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Tetrahydrofuran (THF) | NELAP | PA | 1/18/2011 |
| EPA 8260 | | Toluene | NELAP | PA | 12/12/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8260 | | Trichloroethene (TCE, Trichloroethylene) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Trichlorofluoromethane (Freon 11) | NELAP | PA | 12/12/2005 |
| EPA 8260 | B | VOCs by GC/MS | NELAP | PA | 3/26/2012 |
| EPA 8260 | C | VOCs by GC/MS | NELAP | PA | 3/26/2012 |
| EPA 8260 | | Vinyl acetate | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Vinyl chloride (Chloroethene) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | Xylenes, total | NELAP | PA | 12/12/2005 |
| EPA 8260 | | cis-1,2-Dichloroethene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | cis-1,3-Dichloropropene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | m+p-Xylene | NELAP | PA | 4/17/2009 |
| EPA 8260 | | n-Butyl alcohol (n-Butanol, 1-Butanol) | NELAP | PA | 4/17/2009 |
| EPA 8260 | | n-Butylbenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | n-Hexane | NELAP | PA | 1/20/2012 |
| EPA 8260 | | n-Propylamine | NELAP | PA | 12/12/2005 |
| EPA 8260 | | n-Propylbenzene | NELAP | PA | 1/24/2007 |
| EPA 8260 | | o-Xylene | NELAP | PA | 4/17/2009 |
| EPA 8260 | | p-Isopropyltoluene (4-Isopropyltoluene) | NELAP | PA | 1/24/2007 |
| EPA 8260 | | sec-Butylbenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | tert-Amyl alcohol (2-Methyl-2-butanol) | NELAP | PA | 4/17/2009 |
| EPA 8260 | | tert-Amyl methyl ether (TAME) | NELAP | PA | 1/24/2007 |
| EPA 8260 | | tert-Butyl alcohol (2-Methyl-2-propanol) | NELAP | PA | 12/12/2005 |
| EPA 8260 | | tert-Butyl formate | NELAP | PA | 4/17/2009 |
| EPA 8260 | | tert-Butylbenzene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | trans-1,2-Dichloroethene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | trans-1,3-Dichloropropene | NELAP | PA | 12/12/2005 |
| EPA 8260 | | trans-1,4-Dichloro-2-butene | NELAP | PA | 7/3/2007 |
| EPA 8260 SIM | | 1,4-Dioxane (1,4-Diethyleneoxide) | NELAP | PA | 12/4/2007 |
| EPA 8270 | | 1,1'-Biphenyl (Biphenyl, Lemonene) | NELAP | PA | 4/17/2009 |
| EPA 8270 | | 1,2,3,4-Tetrachlorobenzene | NELAP | PA | 7/3/2007 |
| EPA 8270 | | 1,2,3,4-Tetrahydronaphthalene | NELAP | PA | 4/17/2009 |
| EPA 8270 | | 1,2,3,5-Tetrachlorobenzene | NELAP | PA | 7/3/2007 |
| EPA 8270 | | 1,2,4,5-Tetrachlorobenzene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 1,2,4-Trichlorobenzene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 1,2-Dichlorobenzene (o-Dichlorobenzene) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 1,2-Diphenylhydrazine | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 1,3,5-Trinitrobenzene (1,3,5-TNB) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 1,3-Dichlorobenzene (m-Dichlorobenzene) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 1,3-Dinitrobenzene (1,3-DNB) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 1,4-Dichlorobenzene (p-Dichlorobenzene) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 1,4-Dinitrobenzene (1,4-DNB) | NELAP | PA | 4/17/2009 |
| EPA 8270 | | 1,4-Dioxane (1,4-Diethyleneoxide) | NELAP | PA | 4/17/2009 |
| EPA 8270 | | 1,4-Naphthoquinone | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 1,4-Phenylenediamine | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 1-Chloronaphthalene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 1-Methylnaphthalene | NELAP | PA | 4/17/2009 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8270 | | 1-Naphthylamine (alpha-Naphthylamine) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2,2'-Oxybis(1-chloropropane) (bis(2-Chloro-1-methylethyl) ether) | NELAP | PA | 1/19/2011 |
| EPA 8270 | | 2,3,4,6-Tetrachlorophenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2,4,5-Trichlorophenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2,4,6-Trichlorophenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2,4-Dichlorophenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2,4-Dimethylphenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2,4-Dinitrophenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2,4-Dinitrotoluene (2,4-DNT) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2,6-Dichlorophenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2,6-Dinitrotoluene (2,6-DNT) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2-Acetylaminofluorene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2-Butoxyethanol | NELAP | PA | 2/7/2012 |
| EPA 8270 | | 2-Chloronaphthalene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2-Chlorophenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2-Methylnaphthalene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2-Methylphenol (o-Cresol) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2-Naphthylamine (beta-Naphthylamine) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2-Nitroaniline | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2-Nitrophenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 2-Picoline (2-Methylpyridine) | NELAP | PA | 5/2/2006 |
| EPA 8270 | | 3+4-Methylphenol (m+p-Cresol) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 3,3'-Dichlorobenzidine | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 3,3'-Dimethylbenzidine | NELAP | PA | 7/3/2007 |
| EPA 8270 | | 3-Methylcholanthrene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 3-Nitroaniline | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 4,4'-Methylenebis(2-chloroaniline) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 4-Aminobiphenyl | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 4-Bromophenyl phenyl ether | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 4-Chloro-3-methylphenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 4-Chloroaniline | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 4-Chlorophenyl phenyl ether | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 4-Nitroaniline | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 4-Nitrophenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 4-Nitroquinoline-1-oxide | NELAP | PA | 7/3/2007 |
| EPA 8270 | | 5-Nitro-o-toluidine | NELAP | PA | 12/12/2005 |
| EPA 8270 | | 6-Methylchrysene | NELAP | PA | 1/19/2011 |
| EPA 8270 | | 7,12-Dimethylbenz(a)anthracene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Acenaphthene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Acenaphthylene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Acetophenone | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Aniline | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Anthracene | NELAP | PA | 12/12/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8270 | | Aramite | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Atrazine | NELAP | PA | 1/22/2007 |
| EPA 8270 | | Benzaldehyde | NELAP | PA | 4/17/2009 |
| EPA 8270 | | Benzenethiol | NELAP | PA | 4/17/2009 |
| EPA 8270 | | Benzidine | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Benzo[a]anthracene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Benzo[a]pyrene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Benzo[b]fluoranthene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Benzo[ghi]perylene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Benzo[k]fluoranthene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Benzoic acid | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Benzyl alcohol | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Butyl benzyl phthalate (Benzyl butyl phthalate) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Caprolactam | NELAP | PA | 4/17/2009 |
| EPA 8270 | | Carbazole | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Chlorobenzilate | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Chrysene (Benzo[a]phenanthrene) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Di-n-butyl phthalate | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Di-n-octyl phthalate | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Diallate (cis or trans) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Dibenz[a,h]acridine | NELAP | PA | 4/17/2009 |
| EPA 8270 | | Dibenz[a,j]acridine | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Dibenzo[a,h]anthracene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Dibenzofuran | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Diethyl phthalate | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Dinoseb | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Dimethyl phthalate | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Dimethylaminoazobenzene (4-Dimethylaminoazobenzene) | NELAP | PA | 5/2/2006 |
| EPA 8270 | | Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Diphenylamine | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Disulfoton | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Ethyl methanesulfonate | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Famphur | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Fluoranthene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Fluorene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Hexachlorobenzene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Hexachlorobutadiene (1,3-Hexachlorobutadiene) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Hexachlorocyclopentadiene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Hexachloroethane | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Hexachloropropene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Indene | NELAP | PA | 4/17/2009 |
| EPA 8270 | | Indeno(1,2,3-cd)pyrene | NELAP | PA | 12/12/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8270 | | Isodrin | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Isophorone | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Isosafrole | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Kepone | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Methapyrilene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Methyl methanesulfonate | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Methyl parathion (Parathion, methyl) | NELAP | PA | 5/25/2007 |
| EPA 8270 | | N,N-Dimethylacetamide | NELAP | PA | 4/17/2009 |
| EPA 8270 | | N,N-Dimethylformamide | NELAP | PA | 4/17/2009 |
| EPA 8270 | | N-Nitrosodi-n-butylamine | NELAP | PA | 12/12/2005 |
| EPA 8270 | | N-Nitrosodi-n-propylamine | NELAP | PA | 12/12/2005 |
| EPA 8270 | | N-Nitrosodiethylamine | NELAP | PA | 12/12/2005 |
| EPA 8270 | | N-Nitrosodimethylamine | NELAP | PA | 12/12/2005 |
| EPA 8270 | | N-Nitrosodiphenylamine | NELAP | PA | 12/12/2005 |
| EPA 8270 | | N-Nitrosomethylethylamine | NELAP | PA | 12/12/2005 |
| EPA 8270 | | N-Nitrosomorpholine | NELAP | PA | 12/12/2005 |
| EPA 8270 | | N-Nitrosopiperidine | NELAP | PA | 12/12/2005 |
| EPA 8270 | | N-Nitrosopyrrolidine | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Naphthalene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Nitrobenzene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | O,O,O-Triethyl phosphorothioate | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Parathion, ethyl (Ethyl parathion, Parathion) | NELAP | PA | 5/25/2007 |
| EPA 8270 | | Pentachlorobenzene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Pentachloronitrobenzene (PCNB) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Pentachlorophenol (PCP) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Phenacetin | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Phenanthrene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Phenol | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Phorate (Thimet) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Phthalic anhydride | NELAP | PA | 1/21/2009 |
| EPA 8270 | | Pronamide (Kerb) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Pyrene | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Pyridine | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Quinoline | NELAP | PA | 4/17/2009 |
| EPA 8270 | C | SOCs by GC/MS | NELAP | PA | 3/26/2012 |
| EPA 8270 | D | SOCs by GC/MS | NELAP | PA | 3/26/2012 |
| EPA 8270 | | Safrole | NELAP | PA | 12/12/2005 |
| EPA 8270 | | Sulfotepp (Tetraethyl dithiopyrophosphate) | NELAP | PA | 4/17/2009 |
| EPA 8270 | | Tetraethyl lead | NELAP | PA | 3/7/2012 |
| EPA 8270 | | Thionazine (Thionazin, Zinophos) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | a,a-Dimethylphenethylamine (Phentermine) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | a-Methylstyrene | NELAP | PA | 4/17/2009 |
| EPA 8270 | | bis(2-Chloroethoxy)methane | NELAP | PA | 12/12/2005 |
| EPA 8270 | | bis(2-Chloroethyl) ether | NELAP | PA | 12/12/2005 |
| EPA 8270 | | bis(2-Chloroisopropyl) ether | NELAP | PA | 12/12/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8270 | | bis(2-Chloromethyl) ether | NELAP | PA | 1/21/2009 |
| EPA 8270 | | bis(2-Ethylhexyl) phthalate (DEHP) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | o-Toluidine (2-Toluidine, 2-Methylaniline) | NELAP | PA | 12/12/2005 |
| EPA 8270 | | p-(Dimethylamino)azobenzene | NELAP | PA | 4/17/2009 |
| EPA 8270 | | tris-(2,3-Dibromopropyl) phosphate (tris-BP) | NELAP | PA | 4/17/2009 |
| EPA 8270 SIM | | 1-Methylnaphthalene | NELAP | PA | 7/25/2011 |
| EPA 8270 SIM | | 2-Methylnaphthalene | NELAP | PA | 5/23/2012 |
| EPA 8270 SIM | | Acenaphthene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Acenaphthylene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Anthracene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Benzo[a]anthracene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Benzo[a]pyrene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Benzo[b]fluoranthene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Benzo[ghi]perylene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Benzo[k]fluoranthene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Chrysene (Benzo[a]phenanthrene) | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Dibenzo[a,h]anthracene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Fluoranthene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Fluorene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Indeno(1,2,3-cd)pyrene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Naphthalene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Phenanthrene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Pyrene | NELAP | PA | 12/4/2007 |
| EPA 8290 | | 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 8/6/2010 |
| EPA 8290 | | 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD) | NELAP | PA | 6/30/2010 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

**Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8290 | | 1,2,3,7,8-Pentachlorodibenzofuran (PeCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 2,3,4,7,8-Pentachlorodibenzofuran (PeCDF) | NELAP | PA | 8/6/2010 |
| EPA 8290 | | 2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)(Dioxin) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 2,3,7,8-Tetrachlorodibenzofuran (TCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | PCDDs and PCDFs by HRGC-HRMS | NELAP | PA | 3/26/2012 |
| EPA 8290 | | Total TCDD | NELAP | PA | 6/30/2010 |
| EPA 8290 | | Total TCDF | NELAP | PA | 6/30/2010 |
| EPA 8290 | | Total heptachlorodibenzo-p-dioxin (HpCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | Total heptachlorodibenzofuran (HpCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | Total hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | Total hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | Total pentachlorodibenzo-p-dioxin (PeCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | Total pentachlorodibenzofuran (PeCDF) | NELAP | PA | 6/30/2010 |
| EPA 8315 | | 2,5-Dimethylbenzaldehyde | NELAP | PA | 12/12/2005 |
| EPA 8315 | | Acetaldehyde | NELAP | PA | 12/12/2005 |
| EPA 8315 | | Benzaldehyde | NELAP | PA | 12/12/2005 |
| EPA 8315 | | Butanal (Butyraldehyde) | NELAP | PA | 5/2/2006 |
| EPA 8315 | A | Carbonyl compounds by HPLC | NELAP | PA | 3/26/2012 |
| EPA 8315 | | Crotonaldehyde | NELAP | PA | 12/12/2005 |
| EPA 8315 | | Formaldehyde | NELAP | PA | 12/12/2005 |
| EPA 8315 | | Hexanal (Hexaldehyde) | NELAP | PA | 1/21/2009 |
| EPA 8315 | | Isovaleraldehyde | NELAP | PA | 12/12/2005 |
| EPA 8315 | | Pentanal (Valeraldehyde) | NELAP | PA | 12/12/2005 |
| EPA 8315 | | Propanal (Propionaldehyde) | NELAP | PA | 1/21/2009 |
| EPA 8315 | | m-Tolualdehyde (1,3-Tolualdehyde) | NELAP | PA | 5/2/2006 |
| EPA 8315 | | o-Tolualdehyde (1,2-Tolualdehyde) | NELAP | PA | 1/24/2007 |
| EPA 8315 | | p-Tolualdehyde (1,4-Tolualdehyde) | NELAP | PA | 1/24/2007 |
| EPA 8330 | | 1,3,5-Trinitrobenzene (1,3,5-TNB) | NELAP | PA | 12/12/2005 |
| EPA 8330 | | 1,3-Dinitrobenzene (1,3-DNB) | NELAP | PA | 12/12/2005 |
| EPA 8330 | | 2,4,6-Trinitrotoluene (2,4,6-TNT) | NELAP | PA | 12/12/2005 |
| EPA 8330 | | 2,4-Dinitrotoluene (2,4-DNT) | NELAP | PA | 6/11/2007 |
| EPA 8330 | | 2,6-Dinitrotoluene (2,6-DNT) | NELAP | PA | 6/11/2007 |
| EPA 8330 | | 2-Amino-4,6-dinitrotoluene (2-Am-DNT) | NELAP | PA | 12/12/2005 |
| EPA 8330 | | 2-Nitrotoluene | NELAP | PA | 12/12/2005 |
| EPA 8330 | | 3-Nitrotoluene | NELAP | PA | 12/12/2005 |
| EPA 8330 | | 4-Amino-2,6-dinitrotoluene (4-Am-DNT) | NELAP | PA | 12/12/2005 |
| EPA 8330 | | 4-Nitrotoluene | NELAP | PA | 12/12/2005 |
| EPA 8330 | | Methyl-2,4,6-trinitrophenylnitramine (Tetryl) | NELAP | PA | 12/12/2005 |
| EPA 8330 | A | Nitroaromatics and nitramines by HPLC/UV | NELAP | PA | 3/26/2012 |
| EPA 8330 | | Nitroaromatics and nitramines by HPLC/UV | NELAP | PA | 3/26/2012 |
| EPA 8330 | | Nitrobenzene | NELAP | PA | 6/11/2007 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8330 | | Nitroglycerin | NELAP | PA | 1/24/2007 |
| EPA 8330 | | Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) | NELAP | PA | 12/12/2005 |
| EPA 8330 | | Pentacrythritol tetranitrate (PETN) | NELAP | PA | 5/2/2006 |
| EPA 8330 | | RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine) | NELAP | PA | 12/12/2005 |
| EPA 8332 | | Nitroglycerin | NELAP | PA | 12/12/2005 |
| EPA 9012 | | Total cyanide | NELAP | PA | 12/12/2005 |
| EPA 9040 | | pH | NELAP | PA | 12/12/2005 |
| EPA 9050 | A | Conductivity | NELAP | PA | 1/27/2014 |
| EPA 9050 | | Conductivity | NELAP | PA | 12/12/2005 |
| EPA 9056 | | Bromide | NELAP | PA | 12/12/2005 |
| EPA 9056 | | Chloride | NELAP | PA | 12/12/2005 |
| EPA 9056 | | Fluoride | NELAP | PA | 12/12/2005 |
| EPA 9056 | | Nitrate as N | NELAP | PA | 12/12/2005 |
| EPA 9056 | | Nitrite as N | NELAP | PA | 1/19/2005 |
| EPA 9056 | | Sulfate | NELAP | PA | 12/12/2005 |
| EPA 9060 | | Total organic carbon (TOC) | NELAP | PA | 12/12/2005 |
| EPA 9066 | | Total phenolics | NELAP | PA | 12/12/2005 |
| FL-PRO | | Total petroleum hydrocarbons (TPH) | NELAP | PA | 12/12/2005 |
| MA DEP EPH | 1.1 | C11-C22 Aromatics | NELAP | PA | 7/15/2013 |
| MA DEP EPH | 1.1 | C19-C36 Aliphatics | NELAP | PA | 7/15/2013 |
| MA DEP EPH | 1.1 | C9-C18 Aliphatics | NELAP | PA | 7/15/2013 |
| MA DEP VPH | 1.1 | C5-C8 Aliphatics | NELAP | PA | 7/15/2013 |
| MA DEP VPH | 1.1 | C9-C12 Aliphatics | NELAP | PA | 7/15/2013 |
| NWTPH-Dx | | Diesel range organics (DRO) | NELAP | PA | 12/12/2005 |
| NWTPH-Gx | | Gasoline range organics (GRO) | NELAP | PA | 12/12/2005 |
| NWTPH-HCID | | GRO/DRO/HRO Screen | NELAP | PA | 10/16/2008 |
| OIA 1677 | | Available cyanide | NELAP | PA | 10/9/2013 |
| OIA 1677 | | Free cyanide | NELAP | PA | 10/9/2013 |
| PA-DEP 3686 | | Acetylene (Ethyne) | NELAP | PA | 2/1/2013 |
| PA-DEP 3686 | | Ethane | NELAP | PA | 2/1/2013 |
| PA-DEP 3686 | | Ethene | NELAP | PA | 2/1/2013 |
| PA-DEP 3686 | | Methane | NELAP | PA | 2/1/2013 |
| PA-DEP 3686 | | Propane | NELAP | PA | 2/1/2013 |
| PA-DEP 3686 | | n-Butane | NELAP | PA | 2/1/2013 |
| RSK-175 | | Acetylene (Ethyne) | NELAP | PA | 1/20/2012 |
| RSK-175 | | Ethane | NELAP | PA | 6/29/2010 |
| RSK-175 | | Ethene | NELAP | PA | 6/29/2010 |
| RSK-175 | | Methane | NELAP | PA | 6/29/2010 |
| RSK-175 | | Propane | NELAP | PA | 6/29/2010 |
| RSK-175 | | n-Butane | NELAP | PA | 12/22/2011 |
| SM 2120 B | | Color | NELAP | PA | 4/17/2007 |
| SM 2310 B | | Acidity as CaCO3 | NELAP | PA | 4/17/2007 |
| SM 2320 B | | Alkalinity as CaCO3 | NELAP | PA | 1/19/2005 |
| SM 2340 C | | Total hardness as CaCO3 | NELAP | PA | 4/17/2007 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Non-Potable Water

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| SM 2510 B | | Conductivity | NELAP | PA | 12/12/2005 |
| SM 2540 B | | Residue, total | NELAP | PA | 4/17/2007 |
| SM 2540 C | | Residue, filterable (TDS) | NELAP | PA | 4/17/2007 |
| SM 2540 D | | Residue, nonfilterable (TSS) | NELAP | PA | 4/17/2007 |
| SM 2540 F | | Residue, settleable | NELAP | PA | 4/17/2007 |
| SM 3500-Cr B | 20-22 | Chromium VI | NELAP | PA | 5/24/2007 |
| SM 3500-Fe B | 20/21 | Ferrous iron | NELAP | PA | 6/15/2009 |
| SM 4500-CN- G | | Amenable cyanide | NELAP | PA | 5/24/2007 |
| SM 4500-Cl F | | Total residual chlorine | NELAP | PA | 1/11/2012 |
| SM 4500-Cl- C | | Chloride | NELAP | PA | 4/17/2007 |
| SM 4500-F- B | | Preliminary distillation of fluoride | NELAP | PA | 4/28/2010 |
| SM 4500-F- C | | Fluoride | NELAP | PA | 1/19/2005 |
| SM 4500-H+ B | | pH | NELAP | PA | 4/17/2007 |
| SM 4500-NH3 B | | Ammonia distillation | NELAP | PA | 4/17/2007 |
| SM 4500-NH3 C | | Ammonia as N | NELAP | PA | 4/17/2007 |
| SM 4500-NH3 D | | Ammonia as N | NELAP | PA | 4/17/2007 |
| SM 4500-O G | | Oxygen (dissolved) | NELAP | PA | 4/17/2007 |
| SM 4500-P B | | Phosphorus, total | NELAP | PA | 4/28/2010 |
| SM 4500-P E | | Orthophosphate as P | NELAP | PA | 12/12/2005 |
| SM 4500-P F | | Phosphorus, total | NELAP | PA | 4/28/2010 |
| SM 4500-S D | | Sulfide | NELAP | PA | 4/17/2007 |
| SM 4500-S F | | Sulfide | NELAP | PA | 4/17/2007 |
| SM 4500-SO3 B | | Sulfite, SO3 | NELAP | PA | 4/17/2007 |
| SM 4500-SiO2 C | 20-22 | Silica, as SiO2 | NELAP | PA | 5/25/2007 |
| SM 4500-SiO2 C | 20-22 | Silica, dissolved | NELAP | PA | 5/24/2007 |
| SM 5210 B | | Biochemical oxygen demand (BOD) | NELAP | PA | 4/4/2005 |
| SM 5210 B | | Carbonaceous BOD (CBOD) | NELAP | PA | 1/19/2005 |
| SM 5310 B | | Total organic carbon (TOC) | NELAP | PA | 4/17/2007 |
| SM 5310 C | | Total organic carbon (TOC) | NELAP | PA | 5/24/2007 |
| SM 5540 C | | Surfactants as MBAS | NELAP | PA | 4/17/2007 |
| SM 9222 D | | Fecal coliforms | NELAP | PA | 7/6/2007 |
| TX1005 (TNRCC) | | Total petroleum hydrocarbons (TPH) | NELAP | PA | 12/12/2005 |
| TX1006 (TNRCC) | | Total petroleum hydrocarbons (TPH) | NELAP | PA | 12/12/2005 |
| WA-EPH | | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| WA-VPH | | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |
| WI-DRO | | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| WI-GRO | | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| AK-101 | | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |
| AK-102 | | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| AK-103 | | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| EPA 1010 | | Ignitability | NELAP | PA | 1/19/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 1311 | | Toxicity characteristic leaching procedure (TCLP) | NELAP | PA | 12/12/2005 |
| EPA 1312 | | Synthetic precipitation leaching procedure (SPLP) | NELAP | PA | 12/12/2005 |
| EPA 1668 | | 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ 194) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,4',5,6'-Octachlorobiphenyl (BZ 196) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ 207) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ 197) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ 171) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,4'-Hexachlorobiphenyl (BZ 128) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ 177) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ 201) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ 178) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5',6-Hexachlorobiphenyl (BZ 130) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ 199) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ 208) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ 198) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ 172) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ 174) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ 200) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ 173) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,5-Hexachlorobiphenyl (BZ 129) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,6'-Hexachlorobiphenyl (BZ 132) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ 176) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4,6-Hexachlorobiphenyl (BZ 131) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',4-Pentachlorobiphenyl (BZ 82) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ 202) | NELAP | PA | 12/17/2012 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 1668 | | 2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ 178) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',5,5'-Hexachlorobiphenyl (BZ 133) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',5,6'-Hexachlorobiphenyl (BZ 135) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ 179) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',5,6-Hexachlorobiphenyl (BZ 134) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',5-Pentachlorobiphenyl (BZ 83) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',6,6'-Hexachlorobiphenyl (BZ 136) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3',6-Pentachlorobiphenyl (BZ 84) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,3'-Tetrachlorobiphenyl (BZ 40) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',5',6-Hexachlorobiphenyl (BZ 149) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',5'-Pentachlorobiphenyl (BZ 97) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',5,5'-Hexachlorobiphenyl (BZ 146) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',5,6'-Hexachlorobiphenyl (BZ 148) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ 188) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',5,6-Hexachlorobiphenyl (BZ 147) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',5-Pentachlorobiphenyl (BZ 99) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',6'-Pentachlorobiphenyl (BZ 98) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',6,6'-Hexachlorobiphenyl (BZ 150) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4',6-Pentachlorobiphenyl (BZ 91) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4'-Tetrachlorobiphenyl (BZ 42) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ 203) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',5,6'-Heptachlorobiphenyl (BZ 182) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ 204) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ 181) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',5-Hexachlorobiphenyl (BZ 137) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',6'-Hexachlorobiphenyl (BZ 140) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ 184) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4',6-Hexachlorobiphenyl (BZ 139) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,4'-Pentachlorobiphenyl (BZ 85) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,5',6-Hexachlorobiphenyl (BZ 144) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,5'-Pentachlorobiphenyl (BZ 87) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ 185) | NELAP | PA | 12/17/2012 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 1668 | | 2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,5,6'-Hexachlorobiphenyl (BZ 143) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ 186) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,5,6-Hexachlorobiphenyl (BZ 142) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,5-Pentachlorobiphenyl (BZ 86) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,6'-Pentachlorobiphenyl (BZ 89) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,6,6'-Hexachlorobiphenyl (BZ 145) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4,6-Pentachlorobiphenyl (BZ 88) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,4-Tetrachlorobiphenyl (BZ 41) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,5',6-Pentachlorobiphenyl (BZ 95) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,5'-Tetrachlorobiphenyl (BZ 44) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,5,5'-Pentachlorobiphenyl (BZ 92) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,5,6'-Pentachlorobiphenyl (BZ 94) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,5,6,6'-Hexachlorobiphenyl (BZ 152) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,5,6-Pentachlorobiphenyl (BZ 93) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,5-Tetrachlorobiphenyl (BZ 43) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,6'-Tetrachlorobiphenyl (BZ 46) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,6,6'-Pentachlorobiphenyl (BZ 98) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3,6-Tetrachlorobiphenyl (BZ 45) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',3-Trichlorobiphenyl (BZ 16) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,4',5,6'-Hexachlorobiphenyl (BZ 154) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,4',5-Pentachlorobiphenyl (BZ 99) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,4',6,6'-Hexachlorobiphenyl (BZ 155) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,4',6-Pentachlorobiphenyl (BZ 100) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,4'-Tetrachlorobiphenyl (BZ 47) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,5',6-Pentachlorobiphenyl (BZ 103) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,5'-Tetrachlorobiphenyl (BZ 49) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,5,5'-Pentachlorobiphenyl (BZ 101) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,5,6'-Pentachlorobiphenyl (BZ 102) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,5-Tetrachlorobiphenyl (BZ 48) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,6'-Tetrachlorobiphenyl (BZ 51) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,6,6'-Pentachlorobiphenyl (BZ 104) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4,6-Tetrachlorobiphenyl (BZ 50) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',4-Trichlorobiphenyl (BZ 17) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',5,5'-Tetrachlorobiphenyl (BZ 52) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',5,6'-Tetrachlorobiphenyl (BZ 53) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',5-Trichlorobiphenyl (BZ 18) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',6,6'-Tetrachlorobiphenyl (BZ 54) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2',6-Trichlorobiphenyl (BZ 19) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,2'-Dichlorobiphenyl (BZ 4) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4',5',6-Pentachlorobiphenyl (BZ 125) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4',5'-Tetrachlorobiphenyl (BZ 76) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4',5,5'-Pentachlorobiphenyl (BZ 124) | NELAP | PA | 12/17/2012 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 1668 | | 2,3',4',5-Tetrachlorobiphenyl (BZ 70) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4',6-Tetrachlorobiphenyl (BZ 71) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4'-Trichlorobiphenyl (BZ 33) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,4',5',6-Hexachlorobiphenyl (BZ 168) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,4',5'-Pentachlorobiphenyl (BZ 123) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,4',5,5'-Hexachlorobiphenyl (BZ 167) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,4',5-Pentachlorobiphenyl (BZ 118) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,4',6-Pentachlorobiphenyl (BZ 119) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,4'-Tetrachlorobiphenyl (BZ 66) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,5',6-Pentachlorobiphenyl (BZ 121) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,5'-Tetrachlorobiphenyl (BZ 68) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,5,5'-Pentachlorobiphenyl (BZ 120) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,5-Tetrachlorobiphenyl (BZ 67) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4,6-Tetrachlorobiphenyl (BZ 69) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',4-Trichlorobiphenyl (BZ 25) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',5',6-Tetrachlorobiphenyl (BZ 73) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',5'-Trichlorobiphenyl (BZ 34) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',5,5'-Tetrachlorobiphenyl (BZ 72) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',5-Trichlorobiphenyl (BZ 26) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3',6-Trichlorobiphenyl (BZ 27) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3'-Dichlorobiphenyl (BZ 6) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4',5',6-Hexachlorobiphenyl (BZ 164) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4',5'-Pentachlorobiphenyl (BZ 122) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ 193) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4',5,5'-Hexachlorobiphenyl (BZ 162) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4',5,6-Hexachlorobiphenyl (BZ 163) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4',5-Pentachlorobiphenyl (BZ 107) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4',6-Pentachlorobiphenyl (BZ 110) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4'-Tetrachlorobiphenyl (BZ 56) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4',5',6-Heptachlorobiphenyl (BZ 191) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,4',5'-Hexachlorobiphenyl (BZ 157) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ 205) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ 189) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ 190) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,4',5-Hexachlorobiphenyl (BZ 156) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,4',6-Hexachlorobiphenyl (BZ 158) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,4'-Pentachlorobiphenyl (BZ 105) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,5',6-Hexachlorobiphenyl (BZ 161) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,5'-Pentachlorobiphenyl (BZ 108) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,5,5',6-Heptachlorobiphenyl (BZ 192) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,5,5'-Hexachlorobiphenyl (BZ 159) | NELAP | PA | 12/17/2012 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 1668 | | 2,3,3',4,5,6-Hexachlorobiphenyl (BZ 160) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,5-Pentachlorobiphenyl (BZ 106) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4,6-Pentachlorobiphenyl (BZ 109) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',4-Tetrachlorobiphenyl (BZ 55) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',5',6-Pentachlorobiphenyl (BZ 113) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',5'-Tetrachlorobiphenyl (BZ 58) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',5,5',6-Hexachlorobiphenyl (BZ 165) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',5,5'-Pentachlorobiphenyl (BZ 111) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',5,6-Pentachlorobiphenyl (BZ 112) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',5-Tetrachlorobiphenyl (BZ 57) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3',6-Tetrachlorobiphenyl (BZ 59) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,3'-Trichlorobiphenyl (BZ 20) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4',5,6-Pentachlorobiphenyl (BZ 117) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4',5-Tetrachlorobiphenyl (BZ 63) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4',6-Tetrachlorobiphenyl (BZ 64) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4'-Trichlorobiphenyl (BZ 22) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4,4',5,6-Hexachlorobiphenyl (BZ 166) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4,4',5-Pentachlorobiphenyl (BZ 114) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4,4',6-Pentachlorobiphenyl (BZ 115) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4,4'-Tetrachlorobiphenyl (BZ 60) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4,5,6-Pentachlorobiphenyl (BZ 116) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4,5-Tetrachlorobiphenyl (BZ 61) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4,6-Tetrachlorobiphenyl (BZ 62) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,4-Trichlorobiphenyl (BZ 21) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,5,6-Tetrachlorobiphenyl (BZ 65) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,5-Trichlorobiphenyl (BZ 23) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3,6-Trichlorobiphenyl (BZ 24) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,3-Dichlorobiphenyl (BZ 5) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,4,5-Trichlorobiphenyl (BZ 31) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,4',6-Trichlorobiphenyl (BZ 32) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,4'-Dichlorobiphenyl (BZ 8) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,4,4',5-Tetrachlorobiphenyl (BZ 74) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,4,4',6-Tetrachlorobiphenyl (BZ 75) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,4,4'-Trichlorobiphenyl (BZ 28) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,4,5-Trichlorobiphenyl (BZ 29) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,4,6-Trichlorobiphenyl (BZ 30) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,4-Dichlorobiphenyl (BZ 7) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,5-Dichlorobiphenyl (BZ 9) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2,6-Dichlorobiphenyl (BZ 10) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 2-Chlorobiphenyl (BZ 1) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3',4,4',5,5'-Hexachlorobiphenyl (BZ 169) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3',4,4',5-Pentachlorobiphenyl (BZ 126) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3',4,4'-Tetrachlorobiphenyl (BZ 77) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3',4,5'-Tetrachlorobiphenyl (BZ 79) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3',4,5,5'-Pentachlorobiphenyl (BZ 127) | NELAP | PA | 12/17/2012 |

Uncontrolled Copy

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 1668 | | 3,3',4,5-Tetrachlorobiphenyl (BZ 78) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3',4-Trichlorobiphenyl (BZ 35) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3',5,5'-Tetrachlorobiphenyl (BZ 80) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3',5-Trichlorobiphenyl (BZ 36) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,3'-Dichlorobiphenyl (BZ 11) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,4',5-Trichlorobiphenyl (BZ 39) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,4'-Dichlorobiphenyl (BZ 13) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,4,4',5-Tetrachlorobiphenyl (BZ 81) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,4,4'-Trichlorobiphenyl (BZ 37) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,4,5-Trichlorobiphenyl (BZ 38) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,4-Dichlorobiphenyl (BZ 12) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3,5-Dichlorobiphenyl (BZ 14) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 3-Chlorobiphenyl (BZ 2) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 4,4'-Dichlorobiphenyl (BZ 15) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | 4-Chlorobiphenyl (BZ 3) | NELAP | PA | 12/17/2012 |
| EPA 1668 | | Decachlorobiphenyl | NELAP | PA | 12/17/2012 |
| EPA 300.0 | 2.1 | Bromide | NELAP | PA | 10/16/2012 |
| EPA 300.0 | 2.1 | Fluoride | NELAP | PA | 10/16/2012 |
| EPA 300.0 | 2.1 | Nitrate as N | NELAP | PA | 10/16/2012 |
| EPA 300.0 | 2.1 | Nitrite as N | NELAP | PA | 10/16/2012 |
| EPA 300.0 | 2.1 | Sulfate | NELAP | PA | 10/16/2012 |
| EPA 3050 | B | Acid digestion of solids | NELAP | PA | 4/4/2005 |
| EPA 3060 | A | Alkaline digestion of Cr(VI) | NELAP | PA | 4/4/2005 |
| EPA 3510 | C | Separatory funnel liquid-liquid extraction | NELAP | PA | 4/4/2005 |
| EPA 3540 | C | Soxhlet extraction | NELAP | PA | 4/4/2005 |
| EPA 3546 | | Microwave extraction | NELAP | PA | 9/25/2009 |
| EPA 3550 | | Ultrasonic extraction | NELAP | PA | 4/4/2005 |
| EPA 3620 | B | Florisil cleanup | NELAP | PA | 4/4/2005 |
| EPA 3630 | C | Silica gel cleanup | NELAP | PA | 4/4/2005 |
| EPA 3640 | A | Gel permeation cleanup (GPC) | NELAP | PA | 4/4/2005 |
| EPA 3660 | B | Sulfur cleanup | NELAP | PA | 4/4/2005 |
| EPA 3665 | A | Sulfuric acid/permanganate clean-up | NELAP | PA | 4/4/2005 |
| EPA 5030 | | Bulk purge-and-trap (methanol) | NELAP | PA | 12/4/2007 |
| EPA 5035 | | Closed-system purge-and-trap (bisulfate option) | NELAP | PA | 12/12/2005 |
| EPA 5035 | | Closed-system purge-and-trap (methanol option) | NELAP | PA | 4/4/2005 |
| EPA 5035 | | Closed-system purge-and-trap (unpreserved) | NELAP | PA | 4/4/2005 |
| EPA 6010 | | Aluminum | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Antimony | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Arsenic | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Barium | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Beryllium | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Boron | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Cadmium | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Calcium | NELAP | PA | 1/19/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 6010 | | Chromium | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Cobalt | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Copper | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Iron | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Lead | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Lithium | NELAP | PA | 1/20/2012 |
| EPA 6010 | | Magnesium | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Manganese | NELAP | PA | 1/19/2005 |
| EPA 6010 | C | Metals by ICP/AES | NELAP | PA | 3/26/2012 |
| EPA 6010 | B | Metals by ICP/AES | NELAP | PA | 3/26/2012 |
| EPA 6010 | | Molybdenum | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Nickel | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Potassium | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Selenium | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Silica, as SiO2 | NELAP | PA | 1/20/2012 |
| EPA 6010 | | Silver | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Sodium | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Strontium | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Sulfur | NELAP | PA | 12/19/2011 |
| EPA 6010 | | Thallium | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Tin | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Titanium | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Vanadium | NELAP | PA | 1/19/2005 |
| EPA 6010 | | Zinc | NELAP | PA | 1/19/2005 |
| EPA 6020 | | Aluminum | NELAP | PA | 4/29/2010 |
| EPA 6020 | | Antimony | NELAP | PA | 1/19/2005 |
| EPA 6020 | | Arsenic | NELAP | PA | 1/19/2005 |
| EPA 6020 | | Barium | NELAP | PA | 1/20/2012 |
| EPA 6020 | | Beryllium | NELAP | PA | 1/19/2005 |
| EPA 6020 | | Boron | NELAP | PA | 4/29/2010 |
| EPA 6020 | | Cadmium | NELAP | PA | 1/19/2005 |
| EPA 6020 | | Calcium | NELAP | PA | 4/29/2010 |
| EPA 6020 | | Chromium | NELAP | PA | 1/19/2005 |
| EPA 6020 | | Cobalt | NELAP | PA | 4/29/2010 |
| EPA 6020 | | Copper | NELAP | PA | 1/19/2005 |
| EPA 6020 | | Iron | NELAP | PA | 4/29/2010 |
| EPA 6020 | | Lead | NELAP | PA | 1/19/2005 |
| EPA 6020 | | Magnesium | NELAP | PA | 4/29/2010 |
| EPA 6020 | | Manganese | NELAP | PA | 4/29/2010 |
| EPA 6020 | A | Metals by ICP/MS | NELAP | PA | 3/26/2012 |
| EPA 6020 | | Molybdenum | NELAP | PA | 7/25/2011 |
| EPA 6020 | | Nickel | NELAP | PA | 4/4/2005 |
| EPA 6020 | | Potassium | NELAP | PA | 4/29/2010 |
| EPA 6020 | | Selenium | NELAP | PA | 4/4/2005 |
| EPA 6020 | | Silver | NELAP | PA | 2/23/2010 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 6020 | | Sodium | NELAP | PA | 4/29/2010 |
| EPA 6020 | | Strontium | NELAP | PA | 4/29/2010 |
| EPA 6020 | | Thallium | NELAP | PA | 1/19/2005 |
| EPA 6020 | | Tin | NELAP | PA | 4/29/2010 |
| EPA 6020 | | Titanium | NELAP | PA | 4/29/2010 |
| EPA 6020 | | Vanadium | NELAP | PA | 1/7/2010 |
| EPA 6020 | | Zinc | NELAP | PA | 2/1/2011 |
| EPA 6850 | | Perchlorate | NELAP | PA | 1/19/2011 |
| EPA 7.3.3.2 | | Reactive cyanide | NELAP | PA | 12/12/2005 |
| EPA 7.3.4.2 | | Reactive sulfide | NELAP | PA | 12/12/2005 |
| EPA 7196 | | Chromium VI | NELAP | PA | 1/19/2005 |
| EPA 7199 | | Chromium VI | NELAP | PA | 5/2/2006 |
| EPA 7471 | | Mercury | NELAP | PA | 10/17/2007 |
| EPA 8015 | | Diesel-range organics (DRO) | NELAP | PA | 4/4/2005 |
| EPA 8015 | | Ethanol | NELAP | PA | 1/19/2005 |
| EPA 8015 | | Ethylene glycol | NELAP | PA | 12/4/2007 |
| EPA 8015 | | Gasoline-range organics (GRO) | NELAP | PA | 4/4/2005 |
| EPA 8015 | | Isopropyl alcohol (2-Propanol) | NELAP | PA | 12/4/2007 |
| EPA 8015 | | Methanol | NELAP | PA | 1/19/2005 |
| EPA 8015 | C | Nonhalogenated organics by GC/FID | NELAP | PA | 3/26/2012 |
| EPA 8015 | B | Nonhalogenated organics by GC/FID | NELAP | PA | 3/26/2012 |
| EPA 8021 | | Benzene | NELAP | PA | 1/19/2005 |
| EPA 8021 | | Ethylbenzene | NELAP | PA | 1/19/2005 |
| EPA 8021 | | Isopropylbenzene (Cumene) | NELAP | PA | 1/24/2007 |
| EPA 8021 | | Methyl tert-butyl ether (MTBE) | NELAP | PA | 5/2/2006 |
| EPA 8021 | | Naphthalene | NELAP | PA | 12/4/2007 |
| EPA 8021 | | Toluene | NELAP | PA | 1/19/2005 |
| EPA 8021 | B | VOCs by GC/PID/ELCD | NELAP | PA | 3/26/2012 |
| EPA 8021 | | Xylenes, total | NELAP | PA | 1/19/2005 |
| EPA 8021 | | m-Xylene | NELAP | PA | 1/24/2007 |
| EPA 8021 | | o-Xylene | NELAP | PA | 1/24/2007 |
| EPA 8021 | | p-Xylene | NELAP | PA | 1/24/2007 |
| EPA 8081 | | 4,4'-DDD | NELAP | PA | 1/19/2005 |
| EPA 8081 | | 4,4'-DDE | NELAP | PA | 1/19/2005 |
| EPA 8081 | | 4,4'-DDT | NELAP | PA | 1/19/2005 |
| EPA 8081 | | Aldrin (HHDN) | NELAP | PA | 1/19/2005 |
| EPA 8081 | | Chlordane (tech.) | NELAP | PA | 1/19/2005 |
| EPA 8081 | | Dieldrin | NELAP | PA | 1/19/2005 |
| EPA 8081 | | Endosulfan I | NELAP | PA | 1/19/2005 |
| EPA 8081 | | Endosulfan II | NELAP | PA | 1/19/2005 |
| EPA 8081 | | Endosulfan sulfate | NELAP | PA | 1/19/2005 |
| EPA 8081 | | Endrin | NELAP | PA | 1/19/2005 |
| EPA 8081 | | Endrin aldehyde | NELAP | PA | 1/19/2005 |
| EPA 8081 | | Endrin ketone | NELAP | PA | 1/19/2005 |
| EPA 8081 | | Heptachlor | NELAP | PA | 1/19/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8081 | | Heptachlor epoxide | NELAP | PA | 1/19/2005 |
| EPA 8081 | | Kepone | NELAP | PA | 1/19/2005 |
| EPA 8081 | | Methoxychlor | NELAP | PA | 1/19/2005 |
| EPA 8081 | | Mirex | NELAP | PA | 1/19/2005 |
| EPA 8081 | A | Organochlorine pesticides by GC/ECD | NELAP | PA | 3/26/2012 |
| EPA 8081 | B | Organochlorine pesticides by GC/ECD | NELAP | PA | 1/1/2013 |
| EPA 8081 | | Toxaphene (Chlorinated camphene) | NELAP | PA | 1/19/2005 |
| EPA 8081 | | alpha-BHC (alpha-Hexachlorocyclohexane) | NELAP | PA | 1/19/2005 |
| EPA 8081 | | alpha-Chlordane | NELAP | PA | 4/4/2005 |
| EPA 8081 | | beta-BHC (beta-Hexachlorocyclohexane) | NELAP | PA | 1/19/2005 |
| EPA 8081 | | delta-BHC (delta-Hexachlorocyclohexane) | NELAP | PA | 1/19/2005 |
| EPA 8081 | | gamma-BHC (Lindane, gamma-Hexachlorocyclohexane) | NELAP | PA | 1/19/2005 |
| EPA 8081 | | gamma-Chlordane | NELAP | PA | 4/4/2005 |
| EPA 8082 | | Aroclor-1016 (PCB-1016) | NELAP | PA | 1/2/2007 |
| EPA 8082 | | Aroclor-1016 (in oil) | NELAP | PA | 5/24/2011 |
| EPA 8082 | | Aroclor-1221 (PCB-1221) | NELAP | PA | 1/2/2007 |
| EPA 8082 | | Aroclor-1221 (in oil) | NELAP | PA | 5/24/2011 |
| EPA 8082 | | Aroclor-1232 (PCB-1232) | NELAP | PA | 1/2/2007 |
| EPA 8082 | | Aroclor-1232 (in oil) | NELAP | PA | 5/24/2011 |
| EPA 8082 | | Aroclor-1242 (PCB-1242) | NELAP | PA | 1/2/2007 |
| EPA 8082 | | Aroclor-1242 (in oil) | NELAP | PA | 5/24/2011 |
| EPA 8082 | | Aroclor-1248 (PCB-1248) | NELAP | PA | 1/2/2007 |
| EPA 8082 | | Aroclor-1248 (in oil) | NELAP | PA | 5/24/2011 |
| EPA 8082 | | Aroclor-1254 (PCB-1254) | NELAP | PA | 1/2/2007 |
| EPA 8082 | | Aroclor-1254 (in oil) | NELAP | PA | 5/24/2011 |
| EPA 8082 | | Aroclor-1260 (PCB-1260) | NELAP | PA | 1/2/2007 |
| EPA 8082 | | Aroclor-1260 (in oil) | NELAP | PA | 5/24/2011 |
| EPA 8082 | | Aroclor-1262 (PCB-1262) | NELAP | PA | 7/23/2008 |
| EPA 8082 | | Aroclor-1268 (PCB-1268) | NELAP | PA | 7/23/2008 |
| EPA 8082 | | Decachlorobiphenyl | NELAP | PA | 12/17/2012 |
| EPA 8082 | A | PCBs by GC/ECD | NELAP | PA | 3/26/2012 |
| EPA 8141 | | Alachlor (Lasso) | NELAP | PA | 1/21/2009 |
| EPA 8141 | | Atrazine | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Azinphos-methyl (Guthion) | NELAP | PA | 4/4/2005 |
| EPA 8141 | | Bolstar (Sulprofos) | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Carbophenothion (Trithion) | NELAP | PA | 11/9/2012 |
| EPA 8141 | | Chlorpyrifos | NELAP | PA | 4/4/2005 |
| EPA 8141 | | Coumaphos | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Demeton-O | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Demeton-S | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Diazinon (Spectracide) | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Dichlorovos (DDVP, Dichlorvos) | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Disulfoton | NELAP | PA | 1/19/2005 |
| EPA 8141 | | EPN (Santox) | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Ethion | NELAP | PA | 1/19/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

**Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**DEP Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **TNI Code:** **(717) 656-2300**
**PADWIS ID: 36037**

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8141 | | Ethoprop (Prophos) | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Famphur | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Fensulfothion | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Fenthion | NELAP | PA | 4/4/2005 |
| EPA 8141 | | Malathion | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Merphos | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Methyl parathion (Parathion, methyl) | NELAP | PA | 5/25/2005 |
| EPA 8141 | | Mevinphos | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Naled | NELAP | PA | 1/19/2005 |
| EPA 8141 | B | Organophosphorus compounds by GC/NPD | NELAP | PA | 3/26/2012 |
| EPA 8141 | A | Organophosphorus compounds by GC/NPD | NELAP | PA | 3/26/2012 |
| EPA 8141 | | Parathion, ethyl (Ethyl parathion, Parathion) | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Phorate (Thimet) | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Ronnel | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Simazine | NELAP | PA | 1/4/2006 |
| EPA 8141 | | Stirophos (Tetrachlorovinphos) | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Tokuthion (Prothiophos) | NELAP | PA | 1/19/2005 |
| EPA 8141 | | Trichloronate | NELAP | PA | 1/19/2005 |
| EPA 8151 | | 2,4,5-T | NELAP | PA | 1/19/2005 |
| EPA 8151 | | 2,4,5-TP (Silvex) | NELAP | PA | 1/19/2005 |
| EPA 8151 | | 2,4-D | NELAP | PA | 1/19/2005 |
| EPA 8151 | | 2,4-DB (Butoxon) | NELAP | PA | 4/4/2005 |
| EPA 8151 | A | Chlorinated herbicides by GC/ECD | NELAP | PA | 3/26/2012 |
| EPA 8151 | | Dalapon (2,2-Dichloropropionic acid) | NELAP | PA | 1/19/2005 |
| EPA 8151 | | Dicamba | NELAP | PA | 1/19/2005 |
| EPA 8151 | | Dichloroprop (Dichlorprop) | NELAP | PA | 1/19/2005 |
| EPA 8151 | | Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP) | NELAP | PA | 1/19/2005 |
| EPA 8151 | | MCPA | NELAP | PA | 1/19/2005 |
| EPA 8151 | | MCPP (Mecoprop) | NELAP | PA | 5/2/2006 |
| EPA 8151 | | Pentachlorophenol (PCP) | NELAP | PA | 1/19/2005 |
| EPA 8151 | | Picloram (4-Amino-3,5,6-trichloro-2-pyridinecarboxylic acid) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,1,1,2-Tetrachloroethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,1,1-Trichloroethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,1,2,2-Tetrachloroethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113) | NELAP | PA | 5/2/2006 |
| EPA 8260 | | 1,1,2-Trichloroethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,1-Dichloroethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,1-Dichloroethene (1,1-Dichloroethylene) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,1-Dichloropropene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,2,3-Trichlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,2,3-Trichloropropane (1,2,3-TCP) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,2,4-Trichlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,2,4-Trimethylbenzene | NELAP | PA | 1/19/2005 |

Uncontrolled Copy

**The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.**

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8260 | | 1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,2-Dibromoethane (EDB, Ethylene dibromide) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,2-Dichlorobenzene (o-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,2-Dichloroethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,2-Dichloropropane | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,3,5-Trimethylbenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,3-Dichlorobenzene (m-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,3-Dichloropropane | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,4-Dichlorobenzene (p-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 1,4-Dioxane (1,4-Diethyleneoxide) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 2,2-Dichloropropane | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 2-Butanone (Methyl ethyl ketone, MEK) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 2-Chloroethyl vinyl ether | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 2-Chlorotoluene | NELAP | PA | 5/2/2006 |
| EPA 8260 | | 2-Hexanone | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 2-Nitropropane | NELAP | PA | 12/17/2012 |
| EPA 8260 | | 3,3'-Dimethyl-1-butanol | NELAP | PA | 4/17/2009 |
| EPA 8260 | | 4-Chloro-2-nitrophenol | NELAP | PA | 5/2/2006 |
| EPA 8260 | | 4-Chlorotoluene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | 4-Methyl-2-pentanone (MIBK) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Acetone | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Acetonitrile | NELAP | PA | 1/4/2006 |
| EPA 8260 | | Acrolein (Propenal) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Acrylonitrile | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Allyl chloride (3-Chloropropene) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Benzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Benzyl chloride | NELAP | PA | 1/4/2006 |
| EPA 8260 | | Bromobenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Bromochloromethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Bromodichloromethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Bromoform | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Carbon disulfide | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Carbon tetrachloride | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Chlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Chloroethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Chloroform | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Chloroprene (2-Chloro-1,3-butadiene) | NELAP | PA | 4/17/2009 |
| EPA 8260 | | Cyclohexane | NELAP | PA | 6/29/2010 |
| EPA 8260 | | Cyclohexanone | NELAP | PA | 7/3/2007 |
| EPA 8260 | | Dibromochloromethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Dibromomethane | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Dichlorodifluoromethane (Freon 12) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Diisopropyl ether (DIPE) | NELAP | PA | 7/3/2007 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

**Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

**DEP Laboratory ID: 36-00037** **EPA Lab Code: PA00009** **TNI Code:** **(717) 656-2300**
**PADWIS ID: 36037**

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8260 | | Epichlorohydrin (1-Chloro-2,3-epoxypropane) | NELAP | PA | 1/4/2006 |
| EPA 8260 | | Ethanol | NELAP | PA | 1/4/2006 |
| EPA 8260 | | Ethyl acetate | NELAP | PA | 1/4/2006 |
| EPA 8260 | | Ethyl methacrylate | NELAP | PA | 1/4/2006 |
| EPA 8260 | | Ethyl tert-butyl ether (ETBE) | NELAP | PA | 7/3/2007 |
| EPA 8260 | | Ethylbenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Gasoline-range organics (GRO) | NELAP | PA | 6/8/2006 |
| EPA 8260 | | Hexachlorobutadiene (1,3-Hexachlorobutadiene) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Isobutyl alcohol (2-Methyl-1-propanol) | NELAP | PA | 7/3/2007 |
| EPA 8260 | | Isopropyl alcohol (2-Propanol) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Isopropylbenzene (Cumene) | NELAP | PA | 8/7/2005 |
| EPA 8260 | | Methacrylonitrile | NELAP | PA | 1/24/2007 |
| EPA 8260 | | Methyl acetate | NELAP | PA | 6/29/2010 |
| EPA 8260 | | Methyl bromide (Bromomethane) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Methyl chloride (Chloromethane) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Methyl iodide (Iodomethane) | NELAP | PA | 5/2/2006 |
| EPA 8260 | | Methyl tert-butyl ether (MTBE) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Methylcyclohexane | NELAP | PA | 1/21/2009 |
| EPA 8260 | | Methylene chloride (Dichloromethane) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Methylmethacrylate | NELAP | PA | 5/2/2006 |
| EPA 8260 | | Naphthalene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Pentachloroethane | NELAP | PA | 1/24/2007 |
| EPA 8260 | | Propionitrile (Ethyl cyanide) | NELAP | PA | 1/24/2007 |
| EPA 8260 | | Styrene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Tetrachloroethene (PCE, Perchloroethylene) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Tetrahydrofuran (THF) | NELAP | PA | 6/7/2012 |
| EPA 8260 | | Toluene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Trichloroethene (TCE, Trichloroethylene) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Trichlorofluoromethane (Freon 11) | NELAP | PA | 1/19/2005 |
| EPA 8260 | B | VOCs by GC/MS | NELAP | PA | 3/26/2012 |
| EPA 8260 | C | VOCs by GC/MS | NELAP | PA | 3/26/2012 |
| EPA 8260 | | Vinyl acetate | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Vinyl chloride (Chloroethene) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | Xylenes, total | NELAP | PA | 1/19/2005 |
| EPA 8260 | | cis-1,2-Dichloroethene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | cis-1,3-Dichloropropene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | m+p-Xylene | NELAP | PA | 1/24/2007 |
| EPA 8260 | | n-Butyl alcohol (n-Butanol, 1-Butanol) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | n-Butylbenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | n-Propylbenzene | NELAP | PA | 1/4/2006 |
| EPA 8260 | | o-Xylene | NELAP | PA | 1/24/2007 |
| EPA 8260 | | p-Isopropyltoluene (4-Isopropyltoluene) | NELAP | PA | 1/24/2007 |
| EPA 8260 | | sec-Butylbenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | tert-Amyl alcohol (2-Methyl-2-butanol) | NELAP | PA | 4/17/2009 |

**The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.**



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8260 | | tert-Amyl methyl ether (TAME) | NELAP | PA | 7/3/2007 |
| EPA 8260 | | tert-Butyl alcohol (2-Methyl-2-propanol) | NELAP | PA | 1/19/2005 |
| EPA 8260 | | tert-Butyl ethyl ether | NELAP | PA | 5/25/2007 |
| EPA 8260 | | tert-Butyl formate | NELAP | PA | 4/17/2009 |
| EPA 8260 | | tert-Butylbenzene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | trans-1,2-Dichloroethene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | trans-1,3-Dichloropropene | NELAP | PA | 1/19/2005 |
| EPA 8260 | | trans-1,4-Dichloro-2-butene | NELAP | PA | 7/3/2007 |
| EPA 8260 SIM | | 1,4-Dioxane (1,4-Diethyleneoxide) | NELAP | PA | 4/17/2009 |
| EPA 8270 | | 1,1'-Biphenyl (Biphenyl, Lemonene) | NELAP | PA | 12/4/2007 |
| EPA 8270 | | 1,2,3,4-Tetrachlorobenzene | NELAP | PA | 7/3/2007 |
| EPA 8270 | | 1,2,3,4-Tetrahydronaphthalene | NELAP | PA | 12/4/2007 |
| EPA 8270 | | 1,2,3,5-Tetrachlorobenzene | NELAP | PA | 7/3/2007 |
| EPA 8270 | | 1,2,4,5-Tetrachlorobenzene | NELAP | PA | 4/4/2005 |
| EPA 8270 | | 1,2,4-Trichlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 1,2-Dichlorobenzene (o-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 1,2-Dinitrobenzene (1,2-DNB) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 1,2-Diphenylhydrazine | NELAP | PA | 5/2/2006 |
| EPA 8270 | | 1,3,5-Trinitrobenzene (1,3,5-TNB) | NELAP | PA | 1/4/2006 |
| EPA 8270 | | 1,3-Dichlorobenzene (m-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 1,3-Dinitrobenzene (1,3-DNB) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 1,4-Dichlorobenzene (p-Dichlorobenzene) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 1,4-Dinitrobenzene (1,4-DNB) | NELAP | PA | 5/2/2006 |
| EPA 8270 | | 1,4-Dioxane (1,4-Diethyleneoxide) | NELAP | PA | 12/4/2007 |
| EPA 8270 | | 1,4-Naphthoquinone | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 1,4-Phenylenediamine | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 1-Chloronaphthalene | NELAP | PA | 1/4/2006 |
| EPA 8270 | | 1-Methylnaphthalene | NELAP | PA | 12/4/2007 |
| EPA 8270 | | 1-Naphthylamine (alpha-Naphthylamine) | NELAP | PA | 4/4/2005 |
| EPA 8270 | | 2,3,4,6-Tetrachlorophenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 2,4,5-Trichlorophenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 2,4,6-Trichlorophenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 2,4-Dichlorophenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 2,4-Dimethylphenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 2,4-Dinitrophenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 2,4-Dinitrotoluene (2,4-DNT) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 2,6-Dichlorophenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 2,6-Dinitrotoluene (2,6-DNT) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 2-Acetylaminofluorene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 2-Chloronaphthalene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 2-Chlorophenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 2-Methylnaphthalene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 2-Methylphenol (o-Cresol) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 2-Naphthylamine (beta-Naphthylamine) | NELAP | PA | 5/17/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

**Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8270 | | 2-Nitroaniline | NELAP | PA | 4/4/2005 |
| EPA 8270 | | 2-Nitrophenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 2-Picoline (2-Methylpyridine) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 3+4-Methylphenol (m+p-Cresol) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 3,3'-Dichlorobenzidine | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 3,3'-Dimethoxybenzidine | NELAP | PA | 4/17/2009 |
| EPA 8270 | | 3,3'-Dimethylbenzidine | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 3-Methylcholanthrene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 3-Nitroaniline | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 4,4'-Methylenebis(2-chloroaniline) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 4-Aminobiphenyl | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 4-Bromophenyl phenyl ether | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 4-Chloro-3-methylphenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 4-Chloroaniline | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 4-Chlorophenyl phenyl ether | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 4-Nitroaniline | NELAP | PA | 4/4/2005 |
| EPA 8270 | | 4-Nitrophenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | | 4-Nitroquinoline-1-oxide | NELAP | PA | 7/3/2007 |
| EPA 8270 | | 5-Nitro-o-toluidine | NELAP | PA | 4/4/2005 |
| EPA 8270 | | 6-Methylchrysene | NELAP | PA | 12/4/2007 |
| EPA 8270 | | 7,12-Dimethylbenz[a]anthracene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Acenaphthene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Acenaphthylene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Acetophenone | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Acetylamide | NELAP | PA | 1/21/2009 |
| EPA 8270 | | Aniline | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Anthracene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Aramite | NELAP | PA | 5/17/2005 |
| EPA 8270 | | Atrazine | NELAP | PA | 1/12/2007 |
| EPA 8270 | | Benzaldehyde | NELAP | PA | 12/4/2007 |
| EPA 8270 | | Benzenethiol | NELAP | PA | 12/4/2007 |
| EPA 8270 | | Benzidine | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Benzo[a]anthracene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Benzo[a]pyrene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Benzo[b]fluoranthene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Benzo[ghi]perylene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Benzo[k]fluoranthene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Benzoic acid | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Benzyl alcohol | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Butyl benzyl phthalate (Benzyl butyl phthalate) | NELAP | PA | 5/17/2005 |
| EPA 8270 | | Caprolactam | NELAP | PA | 12/4/2007 |
| EPA 8270 | | Carbazole | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Chlorobenzilate | NELAP | PA | 5/2/2006 |
| EPA 8270 | | Chrysene (Benzo[a]phenanthrene) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Di-n-butyl phthalate | NELAP | PA | 1/19/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8270 | | Di-n-octyl phthalate | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Diallate (cis or trans) | NELAP | PA | 5/2/2006 |
| EPA 8270 | | Dibenz[a,h]acridine | NELAP | PA | 12/4/2007 |
| EPA 8270 | | Dibenz[a,j]acridine | NELAP | PA | 5/17/2005 |
| EPA 8270 | | Dibenzo[a,h]anthracene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Dibenzofuran | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Diethyl phthalate | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Dimethoate | NELAP | PA | 5/2/2006 |
| EPA 8270 | | Dimethyl phthalate | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Diphenylamine | NELAP | PA | 5/2/2006 |
| EPA 8270 | | Disulfoton | NELAP | PA | 7/1/2007 |
| EPA 8270 | | Ethyl methanesulfonate | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Famphur | NELAP | PA | 5/2/2006 |
| EPA 8270 | | Fluoranthene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Fluorene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Hexachlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Hexachlorobutadiene (1,3-Hexachlorobutadiene) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Hexachlorocyclopentadiene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Hexachloroethane | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Hexachloropropene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Indene | NELAP | PA | 12/4/2007 |
| EPA 8270 | | Indeno(1,2,3-cd)pyrene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Isodrin | NELAP | PA | 5/2/2006 |
| EPA 8270 | | Isophorone | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Isosafrole | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Kepone | NELAP | PA | 5/2/2006 |
| EPA 8270 | | Malononitrile | NELAP | PA | 5/23/2013 |
| EPA 8270 | | Methapyrilene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Methyl methanesulfonate | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Methyl parathion (Parathion, methyl) | NELAP | PA | 5/25/2007 |
| EPA 8270 | | N,N-Dimethylacetamide | NELAP | PA | 12/4/2007 |
| EPA 8270 | | N,N-Dimethylformamide | NELAP | PA | 12/4/2007 |
| EPA 8270 | | N-Nitrosodi-n-butylamine | NELAP | PA | 1/19/2005 |
| EPA 8270 | | N-Nitrosodi-n-propylamine | NELAP | PA | 1/19/2005 |
| EPA 8270 | | N-Nitrosodiethylamine | NELAP | PA | 1/19/2005 |
| EPA 8270 | | N-Nitrosodimethylamine | NELAP | PA | 1/19/2005 |
| EPA 8270 | | N-Nitrosodiphenylamine | NELAP | PA | 1/19/2005 |
| EPA 8270 | | N-Nitrosomethylethylamine | NELAP | PA | 1/19/2005 |
| EPA 8270 | | N-Nitrosomorpholine | NELAP | PA | 1/19/2005 |
| EPA 8270 | | N-Nitrosopiperidine | NELAP | PA | 1/19/2005 |
| EPA 8270 | | N-Nitrosopyrrolidine | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Naphthalene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Nitrobenzene | NELAP | PA | 1/4/2006 |
| EPA 8270 | | O,O,O-Triethyl phosphorothioate | NELAP | PA | 5/2/2006 |
| EPA 8270 | | Parathion, ethyl (Ethyl parathion, Parathion) | NELAP | PA | 5/25/2007 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

**Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.**

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8270 | | Pentachlorobenzene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Pentachloronitrobenzene (PCNB) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Pentachlorophenol (PCP) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Phenacetin | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Phenanthrene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Phenol | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Phorate (Thimet) | NELAP | PA | 5/2/2006 |
| EPA 8270 | | Phthalic anhydride | NELAP | PA | 1/21/2009 |
| EPA 8270 | | Pronamide (Kerb) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Pyrene | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Pyridine | NELAP | PA | 4/4/2005 |
| EPA 8270 | | Quinoline | NELAP | PA | 12/4/2007 |
| EPA 8270 | D | SOCs by GC/MS | NELAP | PA | 3/26/2012 |
| EPA 8270 | C | SOCs by GC/MS | NELAP | PA | 3/26/2012 |
| EPA 8270 | | Safrole | NELAP | PA | 1/19/2005 |
| EPA 8270 | | Sulfotepp (Tetraethyl dithiopyrophosphate) | NELAP | PA | 12/4/2007 |
| EPA 8270 | | Tetraethyl lead | NELAP | PA | 3/7/2012 |
| EPA 8270 | | Thionazine (Thionazin, Zinophos) | NELAP | PA | 5/2/2006 |
| EPA 8270 | | a,a-Dimethylphenethylamine (Phentermine) | NELAP | PA | 5/2/2006 |
| EPA 8270 | | bis(2-Chloroethoxy)methane | NELAP | PA | 1/19/2005 |
| EPA 8270 | | bis(2-Chloroethyl) ether | NELAP | PA | 1/19/2005 |
| EPA 8270 | | bis(2-Chloroisopropyl) ether | NELAP | PA | 1/4/2006 |
| EPA 8270 | | bis(2-Chloromethyl) ether | NELAP | PA | 1/21/2009 |
| EPA 8270 | | bis(2-Ethylhexyl) adipate (di(2-Ethylhexyl) adipate) | NELAP | PA | 1/21/2009 |
| EPA 8270 | | bis(2-Ethylhexyl) phthalate (DEHP) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | o-Toluidine (2-Toluidine, 2-Methylaniline) | NELAP | PA | 1/19/2005 |
| EPA 8270 | | p-(Dimethylamino)azobenzene | NELAP | PA | 5/2/2006 |
| EPA 8270 | | p-Chloronitrobenzene | NELAP | PA | 1/21/2009 |
| EPA 8270 | | tris-(2,3-Dibromopropyl) phosphate (tris-BP) | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | 1-Methylnaphthalene | NELAP | PA | 7/25/2011 |
| EPA 8270 SIM | | 2-Methylnaphthalene | NELAP | PA | 5/23/2012 |
| EPA 8270 SIM | | Acenaphthene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Acenaphthylene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Anthracene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Benzo[a]anthracene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Benzo[a]pyrene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Benzo[b]fluoranthene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Benzo[ghi]perylene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Benzo[k]fluoranthene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Chrysene (Benzo[a]phenanthrene) | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Dibenzo[a,h]anthracene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Fluoranthene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Fluorene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Indeno(1,2,3-cd)pyrene | NELAP | PA | 12/4/2007 |

**The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.**



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8270 SIM | | Naphthalene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Phenanthrene | NELAP | PA | 12/4/2007 |
| EPA 8270 SIM | | Pyrene | NELAP | PA | 12/4/2007 |
| EPA 8290 | | 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 8/6/2010 |
| EPA 8290 | | 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 1,2,3,7,8-Pentachlorodibenzofuran (PeCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 2,3,4,7,8-Pentachlorodibenzofuran (PeCDF) | NELAP | PA | 8/6/2010 |
| EPA 8290 | | 2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)(Dioxin) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | 2,3,7,8-Tetrachlorodibenzofuran (TCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | PCDDs and PCDFs by HRGC-HRMS | NELAP | PA | 3/26/2012 |
| EPA 8290 | | Total TCDD | NELAP | PA | 6/30/2010 |
| EPA 8290 | | Total TCDF | NELAP | PA | 6/30/2010 |
| EPA 8290 | | Total heptachlorodibenzo-p-dioxin (HpCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | Total heptachlorodibenzofuran (HpCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | Total hexachlorodibenzo-p-dioxin (HxCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | Total hexachlorodibenzofuran (HxCDF) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | Total pentachlorodibenzo-p-dioxin (PeCDD) | NELAP | PA | 6/30/2010 |
| EPA 8290 | | Total pentachlorodibenzofuran (PeCDF) | NELAP | PA | 6/30/2010 |
| EPA 8315 | | 2,5-Dimethylbenzaldehyde | NELAP | PA | 1/21/2009 |
| EPA 8315 | | Acetaldehyde | NELAP | PA | 1/21/2009 |
| EPA 8315 | | Benzaldehyde | NELAP | PA | 1/21/2009 |
| EPA 8315 | | Butanal (Butyraldehyde) | NELAP | PA | 1/21/2009 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300
PADWIS ID: 36037

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 8315 | A | Carbonyl compounds by HPLC | NELAP | PA | 3/26/2012 |
| EPA 8315 | | Crotonaldehyde | NELAP | PA | 1/21/2009 |
| EPA 8315 | | Formaldehyde | NELAP | PA | 1/19/2005 |
| EPA 8315 | | Hexanal (Hexaldehyde) | NELAP | PA | 1/21/2009 |
| EPA 8315 | | Isovaleraldehyde | NELAP | PA | 1/21/2009 |
| EPA 8315 | | Pentanal (Valeraldehyde) | NELAP | PA | 1/21/2009 |
| EPA 8315 | | Propanal (Propionaldehyde) | NELAP | PA | 1/21/2009 |
| EPA 8315 | | m-Tolualdehyde (1,3-Tolualdehyde) | NELAP | PA | 1/21/2009 |
| EPA 8315 | | o-Tolualdehyde (1,2-Tolualdehyde) | NELAP | PA | 1/21/2009 |
| EPA 8315 | | p-Tolualdehyde (1,4-Tolualdehyde) | NELAP | PA | 1/21/2009 |
| EPA 8318 | | 3-Hydroxycarbofuran | NELAP | PA | 4/4/2005 |
| EPA 8318 | | Aldicarb (Temik) | NELAP | PA | 4/4/2005 |
| EPA 8318 | | Aldicarb sulfone | NELAP | PA | 4/4/2005 |
| EPA 8318 | | Aldicarb sulfoxide | NELAP | PA | 12/12/2005 |
| EPA 8318 | | Carbaryl (Sevin) | NELAP | PA | 4/4/2005 |
| EPA 8318 | | Carbofuran (Furadan) | NELAP | PA | 4/4/2005 |
| EPA 8318 | | Methiocarb (Mesurol) | NELAP | PA | 4/4/2005 |
| EPA 8318 | | Methomyl (Lannate) | NELAP | PA | 4/4/2005 |
| EPA 8318 | A | N-Methylcarbamates by HPLC | NELAP | PA | 10/15/2012 |
| EPA 8318 | | Oxamyl (Vydate) | NELAP | PA | 12/12/2005 |
| EPA 8318 | | Propoxur (Baygon) | NELAP | PA | 4/4/2005 |
| EPA 8330 | | 1,3,5-Trinitrobenzene (1,3,5-TNB) | NELAP | PA | 1/19/2005 |
| EPA 8330 | | 1,3-Dinitrobenzene (1,3-DNB) | NELAP | PA | 1/19/2005 |
| EPA 8330 | | 2,4,6-Trinitrotoluene (2,4,6-TNT) | NELAP | PA | 1/19/2005 |
| EPA 8330 | | 2,4-Dinitrotoluene (2,4-DNT) | NELAP | PA | 1/19/2005 |
| EPA 8330 | | 2,6-Dinitrotoluene (2,6-DNT) | NELAP | PA | 1/19/2005 |
| EPA 8330 | | 2-Amino-4,6-dinitrotoluene (2-Am-DNT) | NELAP | PA | 1/19/2005 |
| EPA 8330 | | 2-Nitrotoluene | NELAP | PA | 1/19/2005 |
| EPA 8330 | | 3-Nitrotoluene | NELAP | PA | 1/19/2005 |
| EPA 8330 | | 4-Amino-2,6-dinitrotoluene (4-Am-DNT) | NELAP | PA | 1/19/2005 |
| EPA 8330 | | 4-Nitrotoluene | NELAP | PA | 1/19/2005 |
| EPA 8330 | | Methyl-2,4,6-trinitrophenylnitromine (Tetryl) | NELAP | PA | 1/19/2005 |
| EPA 8330 | A | Nitroaromatics and nitramines by HPLC/UV | NELAP | PA | 3/26/2012 |
| EPA 8330 | | Nitroaromatics and nitramines by HPLC/UV | NELAP | PA | 3/26/2012 |
| EPA 8330 | | Nitrobenzene | NELAP | PA | 1/19/2005 |
| EPA 8330 | | Nitroglycerin | NELAP | PA | 10/9/2013 |
| EPA 8330 | | Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) | NELAP | PA | 1/24/2006 |
| EPA 8330 | | Pentaerythritol tetranitrate (PETN) | NELAP | PA | 11/21/2005 |
| EPA 8330 | | RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine) | NELAP | PA | 1/19/2005 |
| EPA 9012 | | Total cyanide | NELAP | PA | 4/18/2013 |
| EPA 9045 | | pH | NELAP | PA | 11/19/2008 |
| EPA 9050 | A | Conductivity | NELAP | PA | 1/27/2014 |
| EPA 9050 | | Conductivity | NELAP | PA | 5/17/2005 |

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.



Uncontrolled Copy

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

## Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 013-003 expiration date January 31, 2015. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 36-00037 EPA Lab Code: PA00009 TNI Code: (717) 656-2300

PADWIS ID: 36037

### Matrix: Solid and Chemical Materials

| Method | Revision | Analyte | Accreditation Type | Primary | Effective Date |
|---|---|---|---|---|---|
| EPA 9060 | | Total organic carbon (TOC) | NELAP | PA | 1/19/2005 |
| EPA 9066 | | Total phenolics | NELAP | PA | 4/4/2005 |
| EPA 9071 | B | Oil and grease | NELAP | PA | 1/19/2005 |
| EPA 9081 | | Cation exchange capacity of soils (Ammonium acetate) | NELAP | PA | 5/25/2005 |
| EPA 9095 | A | Paint filter liquids test | NELAP | PA | 1/24/2007 |
| EPA Lloyd Kahn Method | | Total organic carbon (TOC) | NELAP | PA | 10/9/2013 |
| FL-PRO | | Total petroleum hydrocarbons (TPH) | NELAP | PA | 12/12/2005 |
| MA DEP EPH | 1.1 | C11-C22 Aromatics | NELAP | PA | 7/15/2013 |
| MA DEP EPH | 1.1 | C19-C36 Aliphatics | NELAP | PA | 7/15/2013 |
| MA DEP EPH | 1.1 | C9-C18 Aliphatics | NELAP | PA | 7/15/2013 |
| MA DEP VPH | 1.1 | C5-C8 Aliphatics | NELAP | PA | 7/15/2013 |
| MA DEP VPH | 1.1 | C9-C10 Aromatics | NELAP | PA | 7/15/2013 |
| MA DEP VPH | 1.1 | C9-C12 Aliphatics | NELAP | PA | 7/15/2013 |
| NWTPH-Dx | | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| NWTPH-Gx | | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |
| NWTPH-HCID | | GRO/DRO/HRO Screen | NELAP | PA | 10/16/2008 |
| SM 2540 G | | Residue, total | NELAP | PA | 2/25/2014 |
| SM 5310 B | | Total organic carbon (TOC) | NELAP | PA | 10/9/2013 |
| TX1005 (TNRCC) | | Total petroleum hydrocarbons (TPH) | NELAP | PA | 12/12/2005 |
| TX1006 (TNRCC) | | Total petroleum hydrocarbons (TPH) | NELAP | PA | 12/12/2005 |
| WA-EPH | | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| WA-VPH | | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |
| WI-DRO | | Diesel-range organics (DRO) | NELAP | PA | 12/12/2005 |
| WI-GRO | | Gasoline-range organics (GRO) | NELAP | PA | 12/12/2005 |

Uncontrolled Copy

Karen Alger

The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.

STATE OF LOUISIANA
DEPARTMENT OF ENVIRONMENTAL QUALITY
Issue Date: July 1, 2014

Eurofins Lancaster Laboratory Environmental LLC
AI Number: 30729
Expiration Date: June 30, 2015

2425 New Holland Pike, Lancaster, Pennsylvania 17601-5994

**Certificate Number: 02055**

## Air Emissions

| Analyte | Method Name | Method Code | | AII |
|---|---|---|---|---|
| 4385 - Bromobenzene | EPA TO-15 (extended) | 2368 | NELAP | LA |
| 4577 - Chlorodifluoromethane (Freon-22) | EPA TO-15 (extended) | 2368 | NELAP | LA |
| 4627 - Dichlorofluoromethane (Freon 21) | EPA TO-15 (extended) | 2368 | NELAP | LA |
| 4645 - cis-1,2-Dichloroethylene | EPA TO-15 (extended) | 2368 | NELAP | LA |
| 5027 - n-Octane | EPA TO-15 (extended) | 2368 | NELAP | LA |
| 5028 - n-Pentane | EPA TO-15 (extended) | 2368 | NELAP | LA |
| 100170 - Gaseous Organic Compound Emissions | EPA 18 | 10246636 | NELAP | LA |
| 100077 - Gaseous Nonmethane Organic Emissions | EPA Method 25 | 10246738 | NELAP | LA |
| 5105 - 1,1,I,2-Tetrachloroethane | EPA TO-15 | 10248803 | NELAP | LA |
| 5160 - 1,1,1-Trichloroethane | EPA TO-15 | 10248803 | NELAP | LA |
| 5110 - 1,1,2,2-Tetrachloroethane | EPA TO-15 | 10248803 | NELAP | LA |
| 5195 - 1,1,2-Trichloro-I,2,2-trifluoroethane | EPA TO-15 | 10248803 | NELAP | LA |
| 5165 - 1,1,2-Trichloroethane | EPA TO-15 | 10248803 | NELAP | LA |
| 4630 - 1,1-Dichloroethane | EPA TO-15 | 10248803 | NELAP | LA |
| 4640 - 1,1-Dichloroethylene | EPA TO-15 | 10248803 | NELAP | LA |
| 5155 - 1,2,4-Trichlorobenzene | EPA TO-15 | 10248803 | NELAP | LA |
| 5210 - 1,2,4-Trimethylbenzene | EPA TO-15 | 10248803 | NELAP | LA |
| 4570 - 1,2-Dibromo-3-chloropropane (DBCP) | EPA TO-15 | 10248803 | NELAP | LA |
| 4585 - 1,2-Dibromoethane (EDB, Ethylene dibromide) | EPA TO-15 | 10248803 | NELAP | LA |
| 4695 - 1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114) | EPA TO-15 | 10248803 | NELAP | LA |
| 4610 - 1,2-Dichlorobenzene | EPA TO-15 | 10248803 | NELAP | LA |
| 4635 - 1,2-Dichloroethane (Ethylene dichloride) | EPA TO-15 | 10248803 | NELAP | LA |
| 4655 - 1,2-Dichloropropane | EPA TO-15 | 10248803 | NELAP | LA |
| 5215 - 1,3,5-Trimethylbenzene | EPA TO-15 | 10248803 | NELAP | LA |
| 9318 - 1,3-Butadiene | EPA TO-15 | 10248803 | NELAP | LA |
| 4615 - 1,3-Dichlorobenzene | EPA TO-15 | 10248803 | NELAP | LA |
| 4620 - 1,4-Dichlorobenzene | EPA TO-15 | 10248803 | NELAP | LA |
| 4735 - 1,4-Dioxane (1,4-Diethyleneoxide) | EPA TO-15 | 10248803 | NELAP | LA |
| 5220 - 2,2,4-Trimethylpentane (Isooctane) | EPA TO-15 | 10248803 | NELAP | LA |
| 4410 - 2-Butanone (Methyl ethyl ketone, MEK) | EPA TO-15 | 10248803 | NELAP | LA |
| 4535 - 2-Chlorotoluene | EPA TO-15 | 10248803 | NELAP | LA |
| 4860 - 2-Hexanone | EPA TO-15 | 10248803 | NELAP | LA |
| 4542 - 4-Ethyltoluene | EPA TO-15 | 10248803 | NELAP | LA |
| 4995 - 4-Methyl-2-pentanone (MIBK) | EPA TO-15 | 10248803 | NELAP | LA |
| 4315 - Acetone | EPA TO-15 | 10248803 | NELAP | LA |
| 4320 - Acetonitrile | EPA TO-15 | 10248803 | NELAP | LA |
| 4325 - Acrolein (Propenal) | EPA TO-15 | 10248803 | NELAP | LA |
| 4340 - Acrylonitrile | EPA TO-15 | 10248803 | NELAP | LA |
| 4355 - Allyl chloride (3-Chloropropene) | EPA TO-15 | 10248803 | NELAP | LA |
| 4375 - Benzene | EPA TO-15 | 10248803 | NELAP | LA |
| 5635 - Benzyl chloride | EPA TO-15 | 10248803 | NELAP | LA |
| 4395 - Bromodichloromethane | EPA TO-15 | 10248803 | NELAP | LA |
| 4400 - Bromoform | EPA TO-15 | 10248803 | NELAP | LA |

Clients and Customers are urged to verify the laboratory's current certification status with the Louisiana Environmental Laboratory Accreditation Program.



Uncontrolled Copy

## Air Emissions

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 4450 - Carbon disulfide | EPA TO-15 | 10248803 | NELAP | LA |
| 4455 - Carbon tetrachloride | EPA TO-15 | 10248803 | NELAP | LA |
| 4475 - Chlorobenzene | EPA TO-15 | 10248803 | NELAP | LA |
| 4575 - Chlorodibromomethane | EPA TO-15 | 10248803 | NELAP | LA |
| 4485 - Chloroethane (Ethyl chloride) | EPA TO-15 | 10248803 | NELAP | LA |
| 4505 - Chloroform | EPA TO-15 | 10248803 | NELAP | LA |
| 4555 - Cyclohexane | EPA TO-15 | 10248803 | NELAP | LA |
| 9375 - Di-isopropylether (DIPE) (Isopropyl ether) | EPA TO-15 | 10248803 | NELAP | LA |
| 4595 - Dibromomethane (Methylene bromide) | EPA TO-15 | 10248803 | NELAP | LA |
| 4625 - Dichlorodifluoromethane (Freon-12) | EPA TO-15 | 10248803 | NELAP | LA |
| 4750 - Ethanol | EPA TO-15 | 10248803 | NELAP | LA |
| 4755 - Ethyl acetate | EPA TO-15 | 10248803 | NELAP | LA |
| 4760 - Ethyl acrylate | EPA TO-15 | 10248803 | NELAP | LA |
| 4810 - Ethyl methacrylate | EPA TO-15 | 10248803 | NELAP | LA |
| 4770 - Ethyl-t-butyl ether (ETBE) (2-Ethoxy-2-methylpropane) | EPA TO-15 | 10248803 | NELAP | LA |
| 4765 - Ethylbenzene | EPA TO-15 | 10248803 | NELAP | LA |
| 4835 - Hexachlorobutadiene | EPA TO-15 | 10248803 | NELAP | LA |
| 4840 - Hexachloroethane | EPA TO-15 | 10248803 | NELAP | LA |
| 4870 - Iodomethane (Methyl iodide) | EPA TO-15 | 10248803 | NELAP | LA |
| 4900 - Isopropylbenzene | EPA TO-15 | 10248803 | NELAP | LA |
| 4945 - Methyl acrylate | EPA TO-15 | 10248803 | NELAP | LA |
| 4950 - Methyl bromide (Bromomethane) | EPA TO-15 | 10248803 | NELAP | LA |
| 4960 - Methyl chloride (Chloromethane) | EPA TO-15 | 10248803 | NELAP | LA |
| 100201 - Methyl isobutyl ketone (Hexanone) | EPA TO-15 | 10248803 | NELAP | LA |
| 4990 - Methyl methacrylate | EPA TO-15 | 10248803 | NELAP | LA |
| 5000 - Methyl tert-butyl ether (MTBE) | EPA TO-15 | 10248803 | NELAP | LA |
| 4975 - Methylene chloride (Dichloromethane) | EPA TO-15 | 10248803 | NELAP | LA |
| 5005 - Naphthalene | EPA TO-15 | 10248803 | NELAP | LA |
| 4836 - Propylene | EPA TO-15 | 10248803 | NELAP | LA |
| 5100 - Styrene | EPA TO-15 | 10248803 | NELAP | LA |
| 4370 - T-amylmethylether (TAME) | EPA TO-15 | 10248803 | NELAP | LA |
| 5115 - Tetrachloroethylene (Perchloroethylene) | EPA TO-15 | 10248803 | NELAP | LA |
| 5120 - Tetrahydrofuran (THF) | EPA TO-15 | 10248803 | NELAP | LA |
| 5140 - Toluene | EPA TO-15 | 10248803 | NELAP | LA |
| 5170 - Trichloroethene (Trichloroethylene) | EPA TO-15 | 10248803 | NELAP | LA |
| 5175 - Trichlorofluoromethane (Fluorotrichloromethane, Freon 11) | EPA TO-15 | 10248803 | NELAP | LA |
| 5225 - Vinyl acetate | EPA TO-15 | 10248803 | NELAP | LA |
| 5230 - Vinyl bromide (Bromoethane) | EPA TO-15 | 10248803 | NELAP | LA |
| 5235 - Vinyl chloride | EPA TO-15 | 10248803 | NELAP | LA |
| 5260 - Xylene (total) | EPA TO-15 | 10248803 | NELAP | LA |
| 4705 - cis & trans-1,2-Dichloroethene | EPA TO-15 | 10248803 | NELAP | LA |
| 4645 - cis-1,2-Dichloroethylene | EPA TO-15 | 10248803 | NELAP | LA |
| 4680 - cis-1,3-Dichloropropene | EPA TO-15 | 10248803 | NELAP | LA |
| 5240 - m+p-xylene | EPA TO-15 | 10248803 | NELAP | LA |
| 5245 - m-Xylene | EPA TO-15 | 10248803 | NELAP | LA |
| 4435 - n-Butylbenzene | EPA TO-15 | 10248803 | NELAP | LA |
| 4825 - n-Heptane | EPA TO-15 | 10248803 | NELAP | LA |
| 4855 - n-Hexane | EPA TO-15 | 10248803 | NELAP | LA |
| 5090 - n-Propylbenzene | EPA TO-15 | 10248803 | NELAP | LA |



Uncontrolled Copy

## Air Emissions

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 5250 - o-Xylene | EPA TO-15 | 10248803 | NELAP | LA |
| 5255 - p-Xylene | EPA TO-15 | 10248803 | NELAP | LA |
| 4440 - sec-Butylbenzene | EPA TO-15 | 10248803 | NELAP | LA |
| 4420 - tert-Butyl alcohol | EPA TO-15 | 10248803 | NELAP | LA |
| 4445 - tert-Butylbenzene | EPA TO-15 | 10248803 | NELAP | LA |
| 4700 - trans-1,2-Dichloroethylene | EPA TO-15 | 10248803 | NELAP | LA |
| 4685 - trans-1,3-Dichloropropylene | EPA TO-15 | 10248803 | NELAP | LA |
| 5105 - 1,1,1,2-Tetrachloroethane | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5160 - 1,1,1-Trichloroethane | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5110 - 1,1,2,2-Tetrachloroethane | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5195 - 1,1,2-Trichloro-1,2,2-trifluoroethane | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5165 - 1,1,2-Trichloroethane | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4630 - 1,1-Dichloroethane | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4640 - 1,1-Dichloroethylene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5180 - 1,2,3-Trichloropropane | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5155 - 1,2,4-Trichlorobenzene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5210 - 1,2,4-Trimethylbenzene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4585 - 1,2-Dibromoethane (EDB, Ethylene dibromide) | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4695 - 1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114) | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4610 - 1,2-Dichlorobenzene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4635 - 1,2-Dichloroethane (Ethylene dichloride) | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4655 - 1,2-Dichloropropane | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5215 - 1,3,5-Trimethylbenzene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4615 - 1,3-Dichlorobenzene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4835 - 1,3-Hexachlorobutadiene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4620 - 1,4-Dichlorobenzene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4735 - 1,4-Dioxane (1,4- Diethyleneoxide) | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5220 - 2,2,4-Trimethylpentane (Isooctane) | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4410 - 2-Butanone (Methyl ethyl ketone, MEK) | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4860 - 2-Hexanone | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4542 - 4-Ethyltoluene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4995 - 4-Methyl-2-pentanone (MIBK) | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4315 - Acetone | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4375 - Benzene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5635 - Benzyl chloride | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4385 - Bromobenzene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4395 - Bromodichloromethane | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4400 - Bromoform | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4450 - Carbon disulfide | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4455 - Carbon tetrachloride | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4475 - Chlorobenzene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4485 - Chloroethane (Ethyl chloride) | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4505 - Chloroform | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4555 - Cyclohexane | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4625 - Dichlorodifluoromethane (Freon-12) | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4755 - Ethyl acetate | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4765 - Ethylbenzene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4835 - Hexachlorobutadiene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4950 - Methyl bromide (Bromomethane) | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4960 - Methyl chloride (Chloromethane) | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4990 - Methyl methacrylate | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5000 - Methyl tert-butyl ether (MTBE) | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |



Uncontrolled Copy

## Air Emissions

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 4975 - Methylene chloride (Dichloromethane) | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5100 - Styrene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5115 - Tetrachloroethylene (Perchloroethylene) | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5140 - Toluene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5170 - Trichloroethene (Trichloroethylene) | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5175 - Trichlorofluoromethane (Fluorotrichloromethane, Freon 11) | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5225 - Vinyl acetate | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5235 - Vinyl chloride | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5260 - Xylene (total) | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4645 - cis-1,2-Dichloroethylene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4680 - cis-1,3-Dichloropropene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5240 - m+p-xylene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5027 - n-Octane | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5028 - n-Pentane | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5090 - n-Propylbenzene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 5250 - o-Xylene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4700 - trans-1,2-Dichloroethylene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |
| 4685 - trans-1,3-Dichloropropylene | EPA TO-14A, Rev.2 | 10312002 | NELAP | LA |

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 1605 - Color | EPA 110.2 | 10005400 | NELAP | PA |
| 1755 - Total hardness as CaCO3 | EPA 120.1 | 10006209 | NELAP | PA |
| 1610 - Conductivity | EPA 120.1 | 10006403 | NELAP | PA |
| 1750 - Hardness | EPA 130.2 | 10007202 | NELAP | PA |
| 1755 - Total hardness as CaCO3 | EPA 130.2 | 10007202 | NELAP | PA |
| 1900 - pH | EPA 150.1 | 10008205 | NELAP | PA |
| 1955 - Residue-filterable (TDS) | EPA 160.1 | 10009004 | NELAP | PA |
| 1955 - Residue-filterable (TDS) | EPA 160.1 | 10009208 | NELAP | PA |
| 1960 - Residue-nonfilterable (TSS) | EPA 160.2 | 10009402 | NELAP | PA |
| 1950 - Residue-total | EPA 160.3 | 10009800 | NELAP | PA |
| 1970 - Residue-volatile | EPA 160.4 | 10010205 | NELAP | PA |
| 2030 - Temperature, deg. C | EPA 170.1 | 10011004 | NELAP | PA |
| 2055 - Turbidity | EPA 180.1 | 10011402 | NELAP | PA |
| 2055 - Turbidity | EPA 180.1, Rev.2 | 10011800 | NELAP | PA |
| 1015 - Barium | EPA 200.7 | 10013408 | NELAP | PA |
| 1000 - Aluminum | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1005 - Antimony | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1010 - Arsenic | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1015 - Barium | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1020 - Beryllium | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1025 - Boron | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1030 - Cadmium | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1035 - Calcium | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1040 - Chromium | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1050 - Cobalt | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1055 - Copper | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1070 - Iron | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1075 - Lead | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1085 - Magnesium | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1090 - Manganese | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |



Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | All |
|---|---|---|---|---|
| 1100 - Molybdenum | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1105 - Nickel | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1125 - Potassium | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1140 - Selenium | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1150 - Silver | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1155 - Sodium | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1160 - Strontium | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1165 - Thallium | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1175 - Tin | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1180 - Titanium | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1185 - Vanadium | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1190 - Zinc | EPA 200.7, Rev.4.4 | 10013806 | NELAP | PA |
| 1000 - Aluminum | EPA 200.7 | 10014207 | NELAP | PA |
| 1005 - Antimony | EPA 200.7 | 10014207 | NELAP | PA |
| 1010 - Arsenic | EPA 200.7 | 10014207 | NELAP | PA |
| 1015 - Barium | EPA 200.7 | 10014207 | NELAP | PA |
| 1020 - Beryllium | EPA 200.7 | 10014207 | NELAP | PA |
| 1025 - Boron | EPA 200.7 | 10014207 | NELAP | PA |
| 1030 - Cadmium | EPA 200.7 | 10014207 | NELAP | PA |
| 1035 - Calcium | EPA 200.7 | 10014207 | NELAP | PA |
| 1040 - Chromium | EPA 200.7 | 10014207 | NELAP | PA |
| 1050 - Cobalt | EPA 200.7 | 10014207 | NELAP | PA |
| 1055 - Copper | EPA 200.7 | 10014207 | NELAP | PA |
| 1070 - Iron | EPA 200.7 | 10014207 | NELAP | PA |
| 1075 - Lead | EPA 200.7 | 10014207 | NELAP | PA |
| 1085 - Magnesium | EPA 200.7 | 10014207 | NELAP | PA |
| 1090 - Manganese | EPA 200.7 | 10014207 | NELAP | PA |
| 1100 - Molybdenum | EPA 200.7 | 10014207 | NELAP | PA |
| 1105 - Nickel | EPA 200.7 | 10014207 | NELAP | PA |
| 1125 - Potassium | EPA 200.7 | 10014207 | NELAP | PA |
| 1140 - Selenium | EPA 200.7 | 10014207 | NELAP | PA |
| 1150 - Silver | EPA 200.7 | 10014207 | NELAP | PA |
| 1155 - Sodium | EPA 200.7 | 10014207 | NELAP | PA |
| 1165 - Thallium | EPA 200.7 | 10014207 | NELAP | PA |
| 1175 - Tin | EPA 200.7 | 10014207 | NELAP | PA |
| 1185 - Vanadium | EPA 200.7 | 10014207 | NELAP | PA |
| 1190 - Zinc | EPA 200.7 | 10014207 | NELAP | PA |
| 1000 - Aluminum | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1005 - Antimony | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1010 - Arsenic | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1015 - Barium | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1020 - Beryllium | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1025 - Boron | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1030 - Cadmium | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1035 - Calcium | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1040 - Chromium | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1050 - Cobalt | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1055 - Copper | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1070 - Iron | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1075 - Lead | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1085 - Magnesium | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1090 - Manganese | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1100 - Molybdenum | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1105 - Nickel | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1125 - Potassium | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1140 - Selenium | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |



Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 1150 - Silver | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1155 - Sodium | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1160 - Strontium | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1165 - Thallium | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1175 - Tin | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1180 - Titanium | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1185 - Vanadium | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1190 - Zinc | EPA 200.8, Rev.5.4 | 10014605 | NELAP | PA |
| 1045 - Chromium VI | EPA 218.6 | 10027802 | NELAP | PA |
| 1045 - Chromium VI | EPA 218.6, Rev.3.3 | 10028009 | NELAP | PA |
| 1095 - Mercury | EPA 245.1, Rev.3 | 10036609 | NELAP | PA |
| 1540 - Bromide | EPA 300.0 | 10053006 | NELAP | PA |
| 1730 - Fluoride | EPA 300.0 | 10053006 | NELAP | PA |
| 1810 - Nitrate as N | EPA 300.0 | 10053006 | NELAP | PA |
| 1540 - Bromide | EPA 300.0, Rev.2.1 | 10053200 | NELAP | PA |
| 1575 - Chloride | EPA 300.0, Rev.2.1 | 10053200 | NELAP | PA |
| 1730 - Fluoride | EPA 300.0, Rev.2.1 | 10053200 | NELAP | PA |
| 1810 - Nitrate as N | EPA 300.0, Rev.2.1 | 10053200 | NELAP | PA |
| 1835 - Nitrite | EPA 300.0, Rev.2.1 | 10053200 | NELAP | PA |
| 1840 - Nitrite as N | EPA 300.0, Rev.2.1 | 10053200 | NELAP | PA |
| 2000 - Sulfate | EPA 300.0, Rev.2.1 | 10053200 | NELAP | PA |
| 1505 - Alkalinity as CaCO3 | EPA 310.1 | 10054601 | NELAP | PA |
| 1895 - Perchlorate | EPA 314, Rev.1 | 10055604 | NELAP | PA |
| 1575 - Chloride | EPA 325.3 | 10057406 | NELAP | PA |
| 1645 - Total Cyanide | EPA 335.4 | 10061402 | NELAP | PA |
| 1515 - Ammonia as N | EPA 350.2 | 10063806 | NELAP | PA |
| 1515 - Ammonia as N | EPA 350.3 | 10064207 | NELAP | PA |
| 1795 - Kjeldahl nitrogen - total | EPA 351.2 | 10065006 | NELAP | PA |
| 1795 - Kjeldahl nitrogen - total | EPA 351.2, Rev.2 | 10065404 | NELAP | PA |
| 1840 - Nitrite as N | EPA 353.2 | 10067206 | NELAP | PA |
| 1825 - Total Nitrate+Nitrite | EPA 353.2 | 10067206 | NELAP | PA |
| 1810 - Nitrate as N | EPA 353.2, Rev.2 | 10067604 | NELAP | PA |
| 1820 - Nitrate-Nitrite | EPA 353.2, Rev.2 | 10067604 | NELAP | PA |
| 1840 - Nitrite as N | EPA 353.2, Rev.2 | 10067604 | NELAP | PA |
| 1880 - Oxygen, dissolved | EPA 360.1 | 10069008 | NELAP | PA |
| 1910 - Total Phosphorus | EPA 365.1, Rev.2 | 10070005 | NELAP | PA |
| 1870 - Orthophosphate as P | EPA 365.3 | 10070607 | NELAP | PA |
| 2005 - Sulfide | EPA 376.2 | 10074405 | NELAP | PA |
| 1555 - Carbonaceous BOD, CBOD | EPA 405.1 | 10075408 | NELAP | PA |
| 1565 - Chemical oxygen demand | EPA 410.4, Rev.2 | 10077404 | NELAP | PA |
| 1905 - Total Phenolics | EPA 420.4, Rev.1 | 10080203 | NELAP | PA |
| 2025 - Surfactants - MBAS | EPA 425.1 | 10080601 | NELAP | PA |
| 4375 - Benzene | EPA 602 | 10102202 | NELAP | PA |
| 4765 - Ethylbenzene | EPA 602 | 10102202 | NELAP | PA |
| 5000 - Methyl tert-butyl ether (MTBE) | EPA 602 | 10102202 | NELAP | PA |
| 5005 - Naphthalene | EPA 602 | 10102202 | NELAP | PA |
| 5100 - Styrene | EPA 602 | 10102202 | NELAP | PA |
| 5140 - Toluene | EPA 602 | 10102202 | NELAP | PA |
| 5260 - Xylene (total) | EPA 602 | 10102202 | NELAP | PA |
| 5250 - o-Xylene | EPA 602 | 10102202 | NELAP | PA |
| 5255 - p-Xylene | EPA 602 | 10102202 | NELAP | PA |
| 7355 - 4,4'-DDD | EPA 608 | 10103603 | NELAP | PA |
| 7360 - 4,4'-DDE | EPA 608 | 10103603 | NELAP | PA |
| 7365 - 4,4'-DDT | EPA 608 | 10103603 | NELAP | PA |
| 7025 - Aldrin | EPA 608 | 10103603 | NELAP | PA |
| 8880 - Aroclor-1016 (PCB-1016) | EPA 608 | 10103603 | NELAP | PA |



Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 8885 - Aroclor-1221 (PCB-1221) | EPA 608 | 10103603 | NELAP | PA |
| 8890 - Aroclor-1232 (PCB-1232) | EPA 608 | 10103603 | NELAP | PA |
| 8895 - Aroclor-1242 (PCB-1242) | EPA 608 | 10103603 | NELAP | PA |
| 8900 - Aroclor-1248 (PCB-1248) | EPA 608 | 10103603 | NELAP | PA |
| 8905 - Aroclor-1254 (PCB-1254) | EPA 608 | 10103603 | NELAP | PA |
| 8910 - Aroclor-1260 (PCB-1260) | EPA 608 | 10103603 | NELAP | PA |
| 7250 - Chlordane (tech.) | EPA 608 | 10103603 | NELAP | PA |
| 7470 - Dieldrin | EPA 608 | 10103603 | NELAP | PA |
| 7510 - Endosulfan I | EPA 608 | 10103603 | NELAP | PA |
| 7515 - Endosulfan II | EPA 608 | 10103603 | NELAP | PA |
| 7520 - Endosulfan sulfate | EPA 608 | 10103603 | NELAP | PA |
| 7540 - Endrin | EPA 608 | 10103603 | NELAP | PA |
| 7530 - Endrin aldehyde | EPA 608 | 10103603 | NELAP | PA |
| 7685 - Heptachlor | EPA 608 | 10103603 | NELAP | PA |
| 7690 - Heptachlor epoxide | EPA 608 | 10103603 | NELAP | PA |
| 8250 - Toxaphene (Chlorinated camphene) | EPA 608 | 10103603 | NELAP | PA |
| 7110 - alpha-BHC (alpha-Hexachlorocyclohexane) | EPA 608 | 10103603 | NELAP | PA |
| 7115 - beta-BHC (beta-Hexachlorocyclohexane) | EPA 608 | 10103603 | NELAP | PA |
| 7120 - gamma-BHC (Lindane, gamma-HexachlorocyclohexanE) | EPA 608 | 10103603 | NELAP | PA |
| 5160 - 1,1,1-Trichloroethane | EPA 624 | 10107207 | NELAP | PA |
| 5110 - 1,1,2,2-Tetrachloroethane | EPA 624 | 10107207 | NELAP | PA |
| 5165 - 1,1,2-Trichloroethane | EPA 624 | 10107207 | NELAP | PA |
| 4630 - 1,1-Dichloroethane | EPA 624 | 10107207 | NELAP | PA |
| 4640 - 1,1-Dichloroethylene | EPA 624 | 10107207 | NELAP | PA |
| 4610 - 1,2-Dichlorobenzene | EPA 624 | 10107207 | NELAP | PA |
| 4635 - 1,2-Dichloroethane (Ethylene dichloride) | EPA 624 | 10107207 | NELAP | PA |
| 4655 - 1,2-Dichloropropane | EPA 624 | 10107207 | NELAP | PA |
| 4615 - 1,3-Dichlorobenzene | EPA 624 | 10107207 | NELAP | PA |
| 4620 - 1,4-Dichlorobenzene | EPA 624 | 10107207 | NELAP | PA |
| 4500 - 2-Chloroethyl vinyl ether | EPA 624 | 10107207 | NELAP | PA |
| 4325 - Acrolein (Propenal) | EPA 624 | 10107207 | NELAP | PA |
| 4340 - Acrylonitrile | EPA 624 | 10107207 | NELAP | PA |
| 4375 - Benzene | EPA 624 | 10107207 | NELAP | PA |
| 4395 - Bromodichloromethane | EPA 624 | 10107207 | NELAP | PA |
| 4400 - Bromoform | EPA 624 | 10107207 | NELAP | PA |
| 4455 - Carbon tetrachloride | EPA 624 | 10107207 | NELAP | PA |
| 4475 - Chlorobenzene | EPA 624 | 10107207 | NELAP | PA |
| 4485 - Chloroethane (Ethyl chloride) | EPA 624 | 10107207 | NELAP | PA |
| 4505 - Chloroform | EPA 624 | 10107207 | NELAP | PA |
| 4595 - Dibromomethane (Methylene bromide) | EPA 624 | 10107207 | NELAP | PA |
| 4765 - Ethylbenzene | EPA 624 | 10107207 | NELAP | PA |
| 4930 - Methyl bromide (Bromomethane) | EPA 624 | 10107207 | NELAP | PA |
| 4960 - Methyl chloride (Chloromethane) | EPA 624 | 10107207 | NELAP | PA |
| 4975 - Methylene chloride (Dichloromethane) | EPA 624 | 10107207 | NELAP | PA |
| 5115 - Tetrachloroethylene (Perchloroethylene) | EPA 624 | 10107207 | NELAP | PA |
| 5140 - Toluene | EPA 624 | 10107207 | NELAP | PA |
| 5170 - Trichloroethene (Trichloroethylene) | EPA 624 | 10107207 | NELAP | PA |
| 5175 - Trichlorofluoromethane (Fluorotrichloromethane, Freon 11) | EPA 624 | 10107207 | NELAP | PA |



Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | All |
|---|---|---|---|---|
| 5235 - Vinyl chloride | EPA 624 | 10107207 | NELAP | PA |
| 5260 - Xylene (total) | EPA 624 | 10107207 | NELAP | PA |
| 4680 - cis-1,3-Dichloropropene | EPA 624 | 10107207 | NELAP | PA |
| 4700 - trans-1,2-Dichloroethylene | EPA 624 | 10107207 | NELAP | PA |
| 4685 - trans-1,3-Dichloropropylene | EPA 624 | 10107207 | NELAP | PA |
| 6715 - 1,2,4,5-Tetrachlorobenzene | EPA 625 | 10107401 | NELAP | PA |
| 5155 - 1,2,4-Trichlorobenzene | EPA 625 | 10107401 | NELAP | PA |
| 4610 - 1,2-Dichlorobenzene | EPA 625 | 10107401 | NELAP | PA |
| 6220 - 1,2-Diphenylhydrazine | EPA 625 | 10107401 | NELAP | PA |
| 4615 - 1,3-Dichlorobenzene | EPA 625 | 10107401 | NELAP | PA |
| 4620 - 1,4-Dichlorobenzene | EPA 625 | 10107401 | NELAP | PA |
| 6380 - 1-Methylnaphthalene | EPA 625 | 10107401 | NELAP | PA |
| 6735 - 2,3,4,6-Tetrachlorophenol | EPA 625 | 10107401 | NELAP | PA |
| 9363 - 2,3-Dichloroaniline | EPA 625 | 10107401 | NELAP | PA |
| 6835 - 2,4,5-Trichlorophenol | EPA 625 | 10107401 | NELAP | PA |
| 6840 - 2,4,6-Trichlorophenol | EPA 625 | 10107401 | NELAP | PA |
| 6000 - 2,4-Dichlorophenol | EPA 625 | 10107401 | NELAP | PA |
| 6130 - 2,4-Dimethylphenol | EPA 625 | 10107401 | NELAP | PA |
| 6175 - 2,4-Dinitrophenol | EPA 625 | 10107401 | NELAP | PA |
| 6185 - 2,4-Dinitrotoluene (2,4-DNT) | EPA 625 | 10107401 | NELAP | PA |
| 6005 - 2,6-Dichlorophenol | EPA 625 | 10107401 | NELAP | PA |
| 6190 - 2,6-Dinitrotoluene (2,6-DNT) | EPA 625 | 10107401 | NELAP | PA |
| 5795 - 2-Chloronaphthalene | EPA 625 | 10107401 | NELAP | PA |
| 5800 - 2-Chlorophenol | EPA 625 | 10107401 | NELAP | PA |
| 6360 - 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol) | EPA 625 | 10107401 | NELAP | PA |
| 6400 - 2-Methylphenol (o-Cresol) | EPA 625 | 10107401 | NELAP | PA |
| 6460 - 2-Nitroaniline | EPA 625 | 10107401 | NELAP | PA |
| 6490 - 2-Nitrophenol | EPA 625 | 10107401 | NELAP | PA |
| 5945 - 3,3'-Dichlorobenzidine | EPA 625 | 10107401 | NELAP | PA |
| 6405 - 3-Methylphenol (m-Cresol) | EPA 625 | 10107401 | NELAP | PA |
| 6465 - 3-Nitroaniline | EPA 625 | 10107401 | NELAP | PA |
| 5660 - 4-Bromophenyl phenyl ether | EPA 625 | 10107401 | NELAP | PA |
| 5700 - 4-Chloro-3-methylphenol | EPA 625 | 10107401 | NELAP | PA |
| 5745 - 4-Chloroaniline | EPA 625 | 10107401 | NELAP | PA |
| 5825 - 4-Chlorophenyl phenylether | EPA 625 | 10107401 | NELAP | PA |
| 6410 - 4-Methylphenol (p-Cresol) | EPA 625 | 10107401 | NELAP | PA |
| 6470 - 4-Nitroaniline | EPA 625 | 10107401 | NELAP | PA |
| 6500 - 4-Nitrophenol | EPA 625 | 10107401 | NELAP | PA |
| 5500 - Acenaphthene | EPA 625 | 10107401 | NELAP | PA |
| 5505 - Acenaphthylene | EPA 625 | 10107401 | NELAP | PA |
| 5510 - Acetophenone | EPA 625 | 10107401 | NELAP | PA |
| 5545 - Aniline | EPA 625 | 10107401 | NELAP | PA |
| 5555 - Anthracene | EPA 625 | 10107401 | NELAP | PA |
| 5595 - Benzidine | EPA 625 | 10107401 | NELAP | PA |
| 5575 - Benzo(a)anthracene | EPA 625 | 10107401 | NELAP | PA |
| 5580 - Benzo(a)pyrene | EPA 625 | 10107401 | NELAP | PA |
| 5585 - Benzo(b)fluoranthene | EPA 625 | 10107401 | NELAP | PA |
| 5590 - Benzo(g,h,i)perylene | EPA 625 | 10107401 | NELAP | PA |
| 5600 - Benzo(k)fluoranthene | EPA 625 | 10107401 | NELAP | PA |
| 5610 - Benzoic acid | EPA 625 | 10107401 | NELAP | PA |
| 5630 - Benzyl alcohol | EPA 625 | 10107401 | NELAP | PA |
| 5670 - Butyl benzyl phthalate | EPA 625 | 10107401 | NELAP | PA |
| 5680 - Carbazole | EPA 625 | 10107401 | NELAP | PA |
| 5855 - Chrysene | EPA 625 | 10107401 | NELAP | PA |
| 6065 - Di(2-ethylhexyl) phthalate (bis(2- | EPA 625 | 10107401 | NELAP | LA |

Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| Ethylhexyl)phthalate, DEHP) | | | | |
| 5925 - Di-n-butyl phthalate | EPA 625 | 10107401 | NELAP | PA |
| 6200 - Di-n-octyl phthalate | EPA 625 | 10107401 | NELAP | PA |
| 5895 - Dibenz(a,h) anthracene | EPA 625 | 10107401 | NELAP | PA |
| 5905 - Dibenzofuran | EPA 625 | 10107401 | NELAP | PA |
| 6070 - Diethyl phthalate | EPA 625 | 10107401 | NELAP | PA |
| 6135 - Dimethyl phthalate | EPA 625 | 10107401 | NELAP | PA |
| 6265 - Fluoranthene | EPA 625 | 10107401 | NELAP | PA |
| 6270 - Fluorene | EPA 625 | 10107401 | NELAP | PA |
| 6275 - Hexachlorobenzene | EPA 625 | 10107401 | NELAP | PA |
| 4835 - Hexachlorobutadiene | EPA 625 | 10107401 | NELAP | PA |
| 6285 - Hexachlorocyclopentadiene | EPA 625 | 10107401 | NELAP | PA |
| 4840 - Hexachloroethane | EPA 625 | 10107401 | NELAP | PA |
| 6315 - Indeno(1,2,3-cd) pyrene | EPA 625 | 10107401 | NELAP | PA |
| 6320 - Isophorone | EPA 625 | 10107401 | NELAP | PA |
| 5005 - Naphthalene | EPA 625 | 10107401 | NELAP | PA |
| 5015 - Nitrobenzene | EPA 625 | 10107401 | NELAP | PA |
| 6590 - Pentachlorobenzene | EPA 625 | 10107401 | NELAP | PA |
| 6605 - Pentachlorophenol | EPA 625 | 10107401 | NELAP | PA |
| 6615 - Phenanthrene | EPA 625 | 10107401 | NELAP | PA |
| 6625 - Phenol | EPA 625 | 10107401 | NELAP | PA |
| 6665 - Pyrene | EPA 625 | 10107401 | NELAP | PA |
| 5095 - Pyridine | EPA 625 | 10107401 | NELAP | PA |
| 5760 - bis(2-Chloroethoxy)methane | EPA 625 | 10107401 | NELAP | PA |
| 5765 - bis(2-Chloroethyl) ether | EPA 625 | 10107401 | NELAP | PA |
| 5780 - bis(2-Chloroisopropyl) ether | EPA 625 | 10107401 | NELAP | PA |
| 6062 - bis(2-Ethylhexyl)adipate | EPA 625 | 10107401 | NELAP | PA |
| 6545 - n-Nitrosodi-n-propylamine | EPA 625 | 10107401 | NELAP | PA |
| 6530 - n-Nitrosodimethylamine | EPA 625 | 10107401 | NELAP | PA |
| 6535 - n-Nitrosodiphenylamine | EPA 625 | 10107401 | NELAP | PA |
| 6565 - n-Nitrosopyrrolidine | EPA 625 | 10107401 | NELAP | PA |
| 6580 - n-Octadecane | EPA 625 | 10107401 | NELAP | PA |
| 9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD) | EPA 1613B | 10120602 | NELAP | PA |
| 9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF) | EPA 1613B | 10120602 | NELAP | PA |
| 9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd) | EPA 1613B | 10120602 | NELAP | PA |
| 9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf) | EPA 1613B | 10120602 | NELAP | PA |
| 9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf) | EPA 1613B | 10120602 | NELAP | PA |
| 9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd) | EPA 1613B | 10120602 | NELAP | PA |
| 9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf) | EPA 1613B | 10120602 | NELAP | PA |
| 9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-Hxcdd) | EPA 1613B | 10120602 | NELAP | PA |
| 9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf) | EPA 1613B | 10120602 | NELAP | PA |
| 9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd) | EPA 1613B | 10120602 | NELAP | PA |
| 9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf) | EPA 1613B | 10120602 | NELAP | PA |



Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd) | EPA 1613B | 10120602 | NELAP | PA |
| 9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf) | EPA 1613B | 10120602 | NELAP | PA |
| 9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran | EPA 1613B | 10120602 | NELAP | PA |
| 9549 - 2,3,4,7,8-Pentachlorodibenzofuran | EPA 1613B | 10120602 | NELAP | PA |
| 9612 - 2,3,7,8-Tetrachlorodibenzofuran | EPA 1613B | 10120602 | NELAP | PA |
| 9438 - Total Hpcdd | EPA 1613B | 10120602 | NELAP | PA |
| 9444 - Total Hpcdf | EPA 1613B | 10120602 | NELAP | PA |
| 9468 - Total Hxcdd | EPA 1613B | 10120602 | NELAP | PA |
| 9483 - Total Hxcdf | EPA 1613B | 10120602 | NELAP | PA |
| 9555 - Total Pecdd | EPA 1613B | 10120602 | NELAP | PA |
| 9552 - Total Pecdf | EPA 1613B | 10120602 | NELAP | PA |
| 9609 - Total TCDD | EPA 1613B | 10120602 | NELAP | PA |
| 9615 - Total TCDF | EPA 1613B | 10120602 | NELAP | PA |
| 1860 - Oil & Grease | EPA 1664A | 10127409 | NELAP | PA |
| 1860 - Oil & Grease | EPA 1664A (HEM) | 10127807 | NELAP | PA |
| 2050 - Total Petroleum Hydrocarbons (TPH) | EPA 1664A (HEM) | 10127807 | NELAP | PA |
| 100003 - Acid Digestion of waters for Total Recoverable or Dissolved Metals | EPA 3005A | 10133207 | NELAP | PA |
| 100004 - Acid Digestion of Aqueous samples and Extracts for Total Metals | EPA 3010A | 10133605 | NELAP | PA |
| 100642 - Acid Digestion of Aqueous samples and Extracts for Total Metals (HNO3 only) | EPA 3020A | 10134404 | NELAP | PA |
| 1444 - Separatory Funnel Liquid-liquid extraction | EPA 3510C | 10138202 | NELAP | PA |
| 1000 - Aluminum | EPA 6010B | 10155609 | NELAP | PA |
| 1005 - Antimony | EPA 6010B | 10155609 | NELAP | PA |
| 1010 - Arsenic | EPA 6010B | 10155609 | NELAP | PA |
| 1015 - Barium | EPA 6010B | 10155609 | NELAP | PA |
| 1020 - Beryllium | EPA 6010B | 10155609 | NELAP | PA |
| 1025 - Boron | EPA 6010B | 10155609 | NELAP | PA |
| 1030 - Cadmium | EPA 6010B | 10155609 | NELAP | PA |
| 1035 - Calcium | EPA 6010B | 10155609 | NELAP | PA |
| 1040 - Chromium | EPA 6010B | 10155609 | NELAP | PA |
| 1050 - Cobalt | EPA 6010B | 10155609 | NELAP | PA |
| 1055 - Copper | EPA 6010B | 10155609 | NELAP | PA |
| 1070 - Iron | EPA 6010B | 10155609 | NELAP | PA |
| 1075 - Lead | EPA 6010B | 10155609 | NELAP | PA |
| 1080 - Lithium | EPA 6010B | 10155609 | NELAP | PA |
| 1085 - Magnesium | EPA 6010B | 10155609 | NELAP | PA |
| 1090 - Manganese | EPA 6010B | 10155609 | NELAP | PA |
| 1100 - Molybdenum | EPA 6010B | 10155609 | NELAP | PA |
| 1105 - Nickel | EPA 6010B | 10155609 | NELAP | PA |
| 1125 - Potassium | EPA 6010B | 10155609 | NELAP | PA |
| 1140 - Selenium | EPA 6010B | 10155609 | NELAP | PA |
| 1150 - Silver | EPA 6010B | 10155609 | NELAP | PA |
| 1155 - Sodium | EPA 6010B | 10155609 | NELAP | PA |
| 1160 - Strontium | EPA 6010B | 10155609 | NELAP | PA |
| 1165 - Thallium | EPA 6010B | 10155609 | NELAP | PA |
| 1175 - Tin | EPA 6010B | 10155609 | NELAP | PA |
| 1180 - Titanium | EPA 6010B | 10155609 | NELAP | PA |
| 1185 - Vanadium | EPA 6010B | 10155609 | NELAP | PA |
| 1190 - Zinc | EPA 6010B | 10155609 | NELAP | PA |



Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 1000 - Aluminum | EPA 6010C | 10155803 | NELAP | PA |
| 1005 - Antimony | EPA 6010C | 10155803 | NELAP | PA |
| 1010 - Arsenic | EPA 6010C | 10155803 | NELAP | PA |
| 1015 - Barium | EPA 6010C | 10155803 | NELAP | PA |
| 1020 - Beryllium | EPA 6010C | 10155803 | NELAP | PA |
| 1025 - Boron | EPA 6010C | 10155803 | NELAP | PA |
| 1030 - Cadmium | EPA 6010C | 10155803 | NELAP | PA |
| 1035 - Calcium | EPA 6010C | 10155803 | NELAP | PA |
| 1040 - Chromium | EPA 6010C | 10155803 | NELAP | PA |
| 1050 - Cobalt | EPA 6010C | 10155803 | NELAP | PA |
| 1055 - Copper | EPA 6010C | 10155803 | NELAP | PA |
| 1070 - Iron | EPA 6010C | 10155803 | NELAP | PA |
| 1075 - Lead | EPA 6010C | 10155803 | NELAP | PA |
| 1080 - Lithium | EPA 6010C | 10155803 | NELAP | PA |
| 1085 - Magnesium | EPA 6010C | 10155803 | NELAP | PA |
| 1090 - Manganese | EPA 6010C | 10155803 | NELAP | PA |
| 1100 - Molybdenum | EPA 6010C | 10155803 | NELAP | PA |
| 1105 - Nickel | EPA 6010C | 10155803 | NELAP | PA |
| 1125 - Potassium | EPA 6010C | 10155803 | NELAP | PA |
| 1140 - Selenium | EPA 6010C | 10155803 | NELAP | PA |
| 1150 - Silver | EPA 6010C | 10155803 | NELAP | PA |
| 1155 - Sodium | EPA 6010C | 10155803 | NELAP | PA |
| 1160 - Strontium | EPA 6010C | 10155803 | NELAP | PA |
| 2017 - Sulfur | EPA 6010C | 10155803 | NELAP | PA |
| 1165 - Thallium | EPA 6010C | 10155803 | NELAP | PA |
| 1175 - Tin | EPA 6010C | 10155803 | NELAP | PA |
| 1180 - Titanium | EPA 6010C | 10155803 | NELAP | PA |
| 1185 - Vanadium | EPA 6010C | 10155803 | NELAP | PA |
| 1190 - Zinc | EPA 6010C | 10155803 | NELAP | PA |
| 1000 - Aluminum | EPA 6020 | 10156000 | NELAP | PA |
| 1005 - Antimony | EPA 6020 | 10156000 | NELAP | PA |
| 1010 - Arsenic | EPA 6020 | 10156000 | NELAP | PA |
| 1015 - Barium | EPA 6020 | 10156000 | NELAP | PA |
| 1020 - Beryllium | EPA 6020 | 10156000 | NELAP | PA |
| 1025 - Boron | EPA 6020 | 10156000 | NELAP | PA |
| 1030 - Cadmium | EPA 6020 | 10156000 | NELAP | PA |
| 1035 - Calcium | EPA 6020 | 10156000 | NELAP | PA |
| 1055 - Copper | EPA 6020 | 10156000 | NELAP | PA |
| 1075 - Lead | EPA 6020 | 10156000 | NELAP | PA |
| 1085 - Magnesium | EPA 6020 | 10156000 | NELAP | PA |
| 1090 - Manganese | EPA 6020 | 10156000 | NELAP | PA |
| 1100 - Molybdenum | EPA 6020 | 10156000 | NELAP | PA |
| 1105 - Nickel | EPA 6020 | 10156000 | NELAP | PA |
| 1125 - Potassium | EPA 6020 | 10156000 | NELAP | PA |
| 1140 - Selenium | EPA 6020 | 10156000 | NELAP | PA |
| 1150 - Silver | EPA 6020 | 10156000 | NELAP | PA |
| 1155 - Sodium | EPA 6020 | 10156000 | NELAP | PA |
| 1160 - Strontium | EPA 6020 | 10156000 | NELAP | PA |
| 1165 - Thallium | EPA 6020 | 10156000 | NELAP | PA |
| 1175 - Tin | EPA 6020 | 10156000 | NELAP | PA |
| 1180 - Titanium | EPA 6020 | 10156000 | NELAP | PA |
| 1185 - Vanadium | EPA 6020 | 10156000 | NELAP | PA |
| 1040 - Chromium | EPA 6020 | 10156204 | NELAP | PA |
| 1050 - Cobalt | EPA 6020 | 10156204 | NELAP | PA |
| 1070 - Iron | EPA 6020 | 10156204 | NELAP | PA |
| 1190 - Zinc | EPA 6020 | 10156204 | NELAP | PA |



Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 1000 - Aluminum | EPA 6020A | 10156408 | NELAP | PA |
| 1005 - Antimony | EPA 6020A | 10156408 | NELAP | PA |
| 1010 - Arsenic | EPA 6020A | 10156408 | NELAP | PA |
| 1015 - Barium | EPA 6020A | 10156408 | NELAP | PA |
| 1020 - Beryllium | EPA 6020A | 10156408 | NELAP | PA |
| 1025 - Boron | EPA 6020A | 10156408 | NELAP | PA |
| 1030 - Cadmium | EPA 6020A | 10156408 | NELAP | PA |
| 1035 - Calcium | EPA 6020A | 10156408 | NELAP | PA |
| 1040 - Chromium | EPA 6020A | 10156408 | NELAP | PA |
| 1050 - Cobalt | EPA 6020A | 10156408 | NELAP | PA |
| 1055 - Copper | EPA 6020A | 10156408 | NELAP | PA |
| 1070 - Iron | EPA 6020A | 10156408 | NELAP | PA |
| 1075 - Lead | EPA 6020A | 10156408 | NELAP | PA |
| 1085 - Magnesium | EPA 6020A | 10156408 | NELAP | PA |
| 1090 - Manganese | EPA 6020A | 10156408 | NELAP | PA |
| 1100 - Molybdenum | EPA 6020A | 10156408 | NELAP | PA |
| 1105 - Nickel | EPA 6020A | 10156408 | NELAP | PA |
| 1125 - Potassium | EPA 6020A | 10156408 | NELAP | PA |
| 1140 - Selenium | EPA 6020A | 10156408 | NELAP | PA |
| 1150 - Silver | EPA 6020A | 10156408 | NELAP | PA |
| 1155 - Sodium | EPA 6020A | 10156408 | NELAP | PA |
| 1160 - Strontium | EPA 6020A | 10156408 | NELAP | PA |
| 1165 - Thallium | EPA 6020A | 10156408 | NELAP | PA |
| 1175 - Tin | EPA 6020A | 10156408 | NELAP | PA |
| 1180 - Titanium | EPA 6020A | 10156408 | NELAP | PA |
| 1185 - Vanadium | EPA 6020A | 10156408 | NELAP | PA |
| 1190 - Zinc | EPA 6020A | 10156408 | NELAP | PA |
| 1045 - Chromium VI | EPA 7196A | 10162400 | NELAP | PA |
| 1045 - Chromium VI | EPA 7199 | 10163005 | NELAP | PA |
| 1095 - Mercury | EPA 7470A | 10165807 | NELAP | PA |
| 4570 - 1,2-Dibromo-3-chloropropane (DBCP) | EPA 8011 | 10173009 | NELAP | PA |
| 4585 - 1,2-Dibromoethane (EDB, Ethylene dibromide) | EPA 8011 | 10173009 | NELAP | PA |
| 4750 - Ethanol | EPA 8015 | 10173203 | NELAP | PA |
| 4785 - Ethylene glycol | EPA 8015 | 10173203 | NELAP | PA |
| 4895 - Isopropyl alcohol (2-Propanol, Isopropanol) | EPA 8015 | 10173203 | NELAP | PA |
| 4930 - Methanol | EPA 8015 | 10173203 | NELAP | PA |
| 4420 - tert-Butyl alcohol | EPA 8015 | 10173203 | NELAP | PA |
| 9369 - Diesel range organics (DRO) | EPA 8015B | 10173601 | NELAP | PA |
| 9408 - Gasoline range organics (GRO) | EPA 8015B | 10173601 | NELAP | PA |
| 2050 - Total Petroleum Hydrocarbons (TPH) | EPA 8015B | 10173601 | NELAP | PA |
| 9369 - Diesel range organics (DRO) | EPA 8015C | 10173805 | NELAP | PA |
| 9408 - Gasoline range organics (GRO) | EPA 8015C | 10173805 | NELAP | PA |
| 4375 - Benzene | EPA 8021B | 10174808 | NELAP | PA |
| 4765 - Ethylbenzene | EPA 8021B | 10174808 | NELAP | PA |
| 4900 - Isopropylbenzene | EPA 8021B | 10174808 | NELAP | PA |
| 5000 - Methyl tert-butyl ether (MTBE) | EPA 8021B | 10174808 | NELAP | PA |
| 5005 - Naphthalene | EPA 8021B | 10174808 | NELAP | PA |
| 5140 - Toluene | EPA 8021B | 10174808 | NELAP | PA |
| 5260 - Xylene (total) | EPA 8021B | 10174808 | NELAP | PA |
| 5245 - m-Xylene | EPA 8021B | 10174808 | NELAP | PA |
| 5250 - o-Xylene | EPA 8021B | 10174808 | NELAP | PA |
| 5255 - p-Xylene | EPA 8021B | 10174808 | NELAP | PA |



Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 7355 - 4,4'-DDD | EPA 8081B | 10178800 | NELAP | PA |
| 7360 - 4,4'-DDE | EPA 8081B | 10178800 | NELAP | PA |
| 7365 - 4,4'-DDT | EPA 8081B | 10178800 | NELAP | PA |
| 7025 - Aldrin | EPA 8081B | 10178800 | NELAP | PA |
| 7250 - Chlordane (tech.) | EPA 8081B | 10178800 | NELAP | PA |
| 7470 - Dieldrin | EPA 8081B | 10178800 | NELAP | PA |
| 7510 - Endosulfan I | EPA 8081B | 10178800 | NELAP | PA |
| 7515 - Endosulfan II | EPA 8081B | 10178800 | NELAP | PA |
| 7520 - Endosulfan sulfate | EPA 8081B | 10178800 | NELAP | PA |
| 7540 - Endrin | EPA 8081B | 10178800 | NELAP | PA |
| 7530 - Endrin aldehyde | EPA 8081B | 10178800 | NELAP | PA |
| 7535 - Endrin ketone | EPA 8081B | 10178800 | NELAP | PA |
| 7685 - Heptachlor | EPA 8081B | 10178800 | NELAP | PA |
| 7690 - Heptachlor epoxide | EPA 8081B | 10178800 | NELAP | PA |
| 7740 - Kepone | EPA 8081B | 10178800 | NELAP | PA |
| 7810 - Methoxychlor | EPA 8081B | 10178800 | NELAP | PA |
| 8250 - Toxaphene (Chlorinated camphene) | EPA 8081B | 10178800 | NELAP | PA |
| 7110 - alpha-BHC (alpha-Hexachlorocyclohexane) | EPA 8081B | 10178800 | NELAP | PA |
| 7115 - beta-BHC (beta-Hexachlorocyclohexane) | EPA 8081B | 10178800 | NELAP | PA |
| 7105 - delta-BHC | EPA 8081B | 10178800 | NELAP | PA |
| 7120 - gamma-BHC (Lindane, gamma-HexachlorocyclohexanE) | EPA 8081B | 10178800 | NELAP | PA |
| 8880 - Aroclor-1016 (PCB-1016) | EPA 8082 | 10179007 | NELAP | PA |
| 8885 - Aroclor-1221 (PCB-1221) | EPA 8082 | 10179007 | NELAP | PA |
| 8890 - Aroclor-1232 (PCB-1232) | EPA 8082 | 10179007 | NELAP | PA |
| 8895 - Aroclor-1242 (PCB-1242) | EPA 8082 | 10179007 | NELAP | PA |
| 8900 - Aroclor-1248 (PCB-1248) | EPA 8082 | 10179007 | NELAP | PA |
| 8905 - Aroclor-1254 (PCB-1254) | EPA 8082 | 10179007 | NELAP | PA |
| 8910 - Aroclor-1260 (PCB-1260) | EPA 8082 | 10179007 | NELAP | PA |
| 8912 - Aroclor-1262 (PCB-1262) | EPA 8082 | 10179007 | NELAP | PA |
| 8913 - Aroclor-1268 (PCB-1268) | EPA 8082 | 10179007 | NELAP | PA |
| 7065 - Atrazine | EPA 8141 | 10181803 | NELAP | PA |
| 7075 - Azinphos-methyl (Guthion) | EPA 8141 | 10181803 | NELAP | PA |
| 7125 - Bolstar (Sulprofos) | EPA 8141 | 10181803 | NELAP | PA |
| 7300 - Chlorpyrifos | EPA 8141 | 10181803 | NELAP | PA |
| 7315 - Coumaphos | EPA 8141 | 10181803 | NELAP | PA |
| 7395 - Demeton-o | EPA 8141 | 10181803 | NELAP | PA |
| 7385 - Demeton-s | EPA 8141 | 10181803 | NELAP | PA |
| 7410 - Diazinon | EPA 8141 | 10181803 | NELAP | PA |
| 8610 - Dichlorovos (DDVP, Dichlorvos) | EPA 8141 | 10181803 | NELAP | PA |
| 8625 - Disulfoton | EPA 8141 | 10181803 | NELAP | PA |
| 7550 - EPN | EPA 8141 | 10181803 | NELAP | PA |
| 7565 - Ethion | EPA 8141 | 10181803 | NELAP | PA |
| 7570 - Ethoprop | EPA 8141 | 10181803 | NELAP | PA |
| 7580 - Famphur | EPA 8141 | 10181803 | NELAP | PA |
| 7600 - Fensulfothion | EPA 8141 | 10181803 | NELAP | PA |
| 7770 - Malathion | EPA 8141 | 10181803 | NELAP | PA |
| 7785 - Merphos | EPA 8141 | 10181803 | NELAP | PA |
| 7825 - Methyl parathion (Parathion, methyl) | EPA 8141 | 10181803 | NELAP | PA |
| 7850 - Mevinphos | EPA 8141 | 10181803 | NELAP | PA |
| 7905 - Naled | EPA 8141 | 10181803 | NELAP | PA |
| 7955 - Parathion, ethyl | EPA 8141 | 10181803 | NELAP | PA |
| 7985 - Phorate | EPA 8141 | 10181803 | NELAP | PA |
| 8110 - Ronnel | EPA 8141 | 10181803 | NELAP | PA |



Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 8125 - Simazine | EPA 8141 | 10181803 | NELAP | PA |
| 8140 - Stirophos | EPA 8141 | 10181803 | NELAP | PA |
| 8245 - Tokuthion (Prothiophos) | EPA 8141 | 10181803 | NELAP | PA |
| 8275 - Trichloronate | EPA 8141 | 10181803 | NELAP | PA |
| 7065 - Atrazine | EPA 8141A | 10182000 | NELAP | PA |
| 7075 - Azinphos-methyl (Guthion) | EPA 8141A | 10182000 | NELAP | PA |
| 7125 - Bolstar (Sulprofos) | EPA 8141A | 10182000 | NELAP | PA |
| 7300 - Chlorpyrifos | EPA 8141A | 10182000 | NELAP | PA |
| 7315 - Coumaphos | EPA 8141A | 10182000 | NELAP | PA |
| 7395 - Demeton-o | EPA 8141A | 10182000 | NELAP | PA |
| 7385 - Demeton-s | EPA 8141A | 10182000 | NELAP | PA |
| 7410 - Diazinon | EPA 8141A | 10182000 | NELAP | PA |
| 8610 - Dichlorovos (DDVP, Dichlorvos) | EPA 8141A | 10182000 | NELAP | PA |
| 8625 - Disulfoton | EPA 8141A | 10182000 | NELAP | PA |
| 7550 - EPN | EPA 8141A | 10182000 | NELAP | PA |
| 7565 - Ethion | EPA 8141A | 10182000 | NELAP | PA |
| 7570 - Ethoprop | EPA 8141A | 10182000 | NELAP | PA |
| 7580 - Famphur | EPA 8141A | 10182000 | NELAP | PA |
| 7600 - Fensulfothion | EPA 8141A | 10182000 | NELAP | PA |
| 7770 - Malathion | EPA 8141A | 10182000 | NELAP | PA |
| 7785 - Merphos | EPA 8141A | 10182000 | NELAP | PA |
| 7825 - Methyl parathion (Parathion, methyl) | EPA 8141A | 10182000 | NELAP | PA |
| 7850 - Mevinphos | EPA 8141A | 10182000 | NELAP | PA |
| 7905 - Naled | EPA 8141A | 10182000 | NELAP | PA |
| 7955 - Parathion, ethyl | EPA 8141A | 10182000 | NELAP | PA |
| 7985 - Phorate | EPA 8141A | 10182000 | NELAP | PA |
| 8110 - Ronnel | EPA 8141A | 10182000 | NELAP | PA |
| 8125 - Simazine | EPA 8141A | 10182000 | NELAP | PA |
| 8140 - Stirophos | EPA 8141A | 10182000 | NELAP | PA |
| 8245 - Tokuthion (Prothiophos) | EPA 8141A | 10182000 | NELAP | PA |
| 8275 - Trichloronate | EPA 8141A | 10182000 | NELAP | PA |
| 8655 - 2,4,5-T | EPA 8151 | 10183003 | NELAP | PA |
| 8545 - 2,4-D | EPA 8151 | 10183003 | NELAP | PA |
| 8555 - Dalapon | EPA 8151 | 10183003 | NELAP | PA |
| 8595 - Dicamba | EPA 8151 | 10183003 | NELAP | PA |
| 8605 - Dichloroprop (Dichlorprop) | EPA 8151 | 10183003 | NELAP | PA |
| 7775 - MCPA | EPA 8151 | 10183003 | NELAP | PA |
| 7780 - MCPP | EPA 8151 | 10183003 | NELAP | PA |
| 8650 - Silvex (2,4,5-TP) | EPA 8151 | 10183003 | NELAP | PA |
| 5105 - 1,1,1,2-Tetrachloroethane | EPA 8260B | 10184802 | NELAP | PA |
| 5160 - 1,1,1-Trichloroethane | EPA 8260B | 10184802 | NELAP | PA |
| 5110 - 1,1,2,2-Tetrachloroethane | EPA 8260B | 10184802 | NELAP | PA |
| 5195 - 1,1,2-Trichloro-1,2,2-trifluoroethane | EPA 8260B | 10184802 | NELAP | PA |
| 5185 - 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113) | EPA 8260B | 10184802 | NELAP | PA |
| 5165 - 1,1,2-Trichloroethane | EPA 8260B | 10184802 | NELAP | PA |
| 4630 - 1,1-Dichloroethane | EPA 8260B | 10184802 | NELAP | PA |
| 4640 - 1,1-Dichloroethylene | EPA 8260B | 10184802 | NELAP | PA |
| 4670 - 1,1-Dichloropropene | EPA 8260B | 10184802 | NELAP | PA |
| 5150 - 1,2,3-Trichlorobenzene | EPA 8260B | 10184802 | NELAP | PA |
| 5180 - 1,2,3-Trichloropropane | EPA 8260B | 10184802 | NELAP | PA |
| 5155 - 1,2,4-Trichlorobenzene | EPA 8260B | 10184802 | NELAP | PA |
| 5210 - 1,2,4-Trimethylbenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4570 - 1,2-Dibromo-3-chloropropane (DBCP) | EPA 8260B | 10184802 | NELAP | PA |
| 4585 - 1,2-Dibromoethane (EDB, Ethylene | EPA 8260B | 10184802 | NELAP | PA |



Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| dibromide) | | | | |
| 4610 - 1,2-Dichlorobenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4635 - 1,2-Dichloroethane (Ethylene dichloride) | EPA 8260B | 10184802 | NELAP | PA |
| 4655 - 1,2-Dichloropropane | EPA 8260B | 10184802 | NELAP | PA |
| 5215 - 1,3,5-Trimethylbenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4615 - 1,3-Dichlorobenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4660 - 1,3-Dichloropropane | EPA 8260B | 10184802 | NELAP | PA |
| 4620 - 1,4-Dichlorobenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4735 - 1,4-Dioxane (1,4- Diethyleneoxide) | EPA 8260B | 10184802 | NELAP | PA |
| 4665 - 2,2-Dichloropropane | EPA 8260B | 10184802 | NELAP | PA |
| 4410 - 2-Butanone (Methyl ethyl ketone, MEK) | EPA 8260B | 10184802 | NELAP | PA |
| 4500 - 2-Chloroethyl vinyl ether | EPA 8260B | 10184802 | NELAP | PA |
| 4535 - 2-Chlorotoluene | EPA 8260B | 10184802 | NELAP | PA |
| 4860 - 2-Hexanone | EPA 8260B | 10184802 | NELAP | PA |
| 4540 - 4-Chlorotoluene | EPA 8260B | 10184802 | NELAP | PA |
| 4910 - 4-Isopropyltoluene (p-Cymene) | EPA 8260B | 10184802 | NELAP | PA |
| 4995 - 4-Methyl-2-pentanone (MIBK) | EPA 8260B | 10184802 | NELAP | PA |
| 4315 - Acetone | EPA 8260B | 10184802 | NELAP | PA |
| 4320 - Acetonitrile | EPA 8260B | 10184802 | NELAP | PA |
| 4325 - Acrolein (Propenal) | EPA 8260B | 10184802 | NELAP | PA |
| 4340 - Acrylonitrile | EPA 8260B | 10184802 | NELAP | PA |
| 4350 - Allyl alcohol | EPA 8260B | 10184802 | NELAP | PA |
| 4355 - Allyl chloride (3-Chloropropene) | EPA 8260B | 10184802 | NELAP | PA |
| 4375 - Benzene | EPA 8260B | 10184802 | NELAP | PA |
| 5635 - Benzyl chloride | EPA 8260B | 10184802 | NELAP | PA |
| 4385 - Bromobenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4390 - Bromochloromethane | EPA 8260B | 10184802 | NELAP | PA |
| 4395 - Bromodichloromethane | EPA 8260B | 10184802 | NELAP | PA |
| 4400 - Bromoform | EPA 8260B | 10184802 | NELAP | PA |
| 4450 - Carbon disulfide | EPA 8260B | 10184802 | NELAP | PA |
| 4455 - Carbon tetrachloride | EPA 8260B | 10184802 | NELAP | PA |
| 4475 - Chlorobenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4575 - Chlorodibromomethane | EPA 8260B | 10184802 | NELAP | PA |
| 4485 - Chloroethane (Ethyl chloride) | EPA 8260B | 10184802 | NELAP | PA |
| 4505 - Chloroform | EPA 8260B | 10184802 | NELAP | PA |
| 4525 - Chloroprene (2-Chloro-1,3-butadiene) | EPA 8260B | 10184802 | NELAP | PA |
| 4555 - Cyclohexane | EPA 8260B | 10184802 | NELAP | PA |
| 9375 - Di-isopropylether (DIPE) (Isopropyl ether) | EPA 8260B | 10184802 | NELAP | PA |
| 4580 - Dibromochloropropane | EPA 8260B | 10184802 | NELAP | PA |
| 4590 - Dibromofluoromethane | EPA 8260B | 10184802 | NELAP | PA |
| 4595 - Dibromomethane (Methylene bromide) | EPA 8260B | 10184802 | NELAP | PA |
| 4625 - Dichlorodifluoromethane (Freon-12) | EPA 8260B | 10184802 | NELAP | PA |
| 4745 - Epichlorohydrin (1-Chloro-2,3-epoxypropane) | EPA 8260B | 10184802 | NELAP | PA |
| 4750 - Ethanol | EPA 8260B | 10184802 | NELAP | PA |
| 4755 - Ethyl acetate | EPA 8260B | 10184802 | NELAP | PA |
| 4810 - Ethyl methacrylate | EPA 8260B | 10184802 | NELAP | PA |
| 4770 - Ethyl-t-butyl ether (ETBE) (2-Ethoxy-2-methylpropane) | EPA 8260B | 10184802 | NELAP | PA |
| 4765 - Ethylbenzene | EPA 8260B | 10184802 | NELAP | PA |
| 9408 - Gasoline range organics (GRO) | EPA 8260B | 10184802 | NELAP | PA |



Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 4835 - Hexachlorobutadiene | EPA 8260B | 10184802 | NELAP | PA |
| 4870 - Iodomethane (Methyl iodide) | EPA 8260B | 10184802 | NELAP | PA |
| 4875 - Isobutyl alcohol (2-Methyl-1-propanol) | EPA 8260B | 10184802 | NELAP | PA |
| 4900 - Isopropylbenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4925 - Methacrylonitrile | EPA 8260B | 10184802 | NELAP | PA |
| 4940 - Methyl acetate | EPA 8260B | 10184802 | NELAP | PA |
| 4950 - Methyl bromide (Bromomethane) | EPA 8260B | 10184802 | NELAP | PA |
| 4960 - Methyl chloride (Chloromethane) | EPA 8260B | 10184802 | NELAP | PA |
| 5000 - Methyl tert-butyl ether (MTBE) | EPA 8260B | 10184802 | NELAP | PA |
| 4975 - Methylene chloride (Dichloromethane) | EPA 8260B | 10184802 | NELAP | PA |
| 5005 - Naphthalene | EPA 8260B | 10184802 | NELAP | PA |
| 5035 - Pentachloroethane | EPA 8260B | 10184802 | NELAP | PA |
| 5080 - Propionitrile (Ethyl cyanide) | EPA 8260B | 10184802 | NELAP | PA |
| 5100 - Styrene | EPA 8260B | 10184802 | NELAP | PA |
| 4370 - T-amylmethylether (TAME) | EPA 8260B | 10184802 | NELAP | PA |
| 5115 - Tetrachloroethylene (Perchloroethylene) | EPA 8260B | 10184802 | NELAP | PA |
| 5120 - Tetrahydrofuran (THF) | EPA 8260B | 10184802 | NELAP | PA |
| 5140 - Toluene | EPA 8260B | 10184802 | NELAP | PA |
| 5170 - Trichloroethene (Trichloroethylene) | EPA 8260B | 10184802 | NELAP | PA |
| 5175 - Trichlorofluoromethane (Fluorotrichloromethane, Freon 11) | EPA 8260B | 10184802 | NELAP | PA |
| 5225 - Vinyl acetate | EPA 8260B | 10184802 | NELAP | PA |
| 5235 - Vinyl chloride | EPA 8260B | 10184802 | NELAP | PA |
| 5260 - Xylene (total) | EPA 8260B | 10184802 | NELAP | PA |
| 4705 - cis & trans-1,2-Dichloroethene | EPA 8260B | 10184802 | NELAP | PA |
| 4645 - cis-1,2-Dichloroethylene | EPA 8260B | 10184802 | NELAP | PA |
| 4680 - cis-1,3-Dichloropropene | EPA 8260B | 10184802 | NELAP | PA |
| 5240 - m+p-xylene | EPA 8260B | 10184802 | NELAP | PA |
| 4435 - n-Butylbenzene | EPA 8260B | 10184802 | NELAP | PA |
| 5085 - n-Propylamine | EPA 8260B | 10184802 | NELAP | PA |
| 5090 - n-Propylbenzene | EPA 8260B | 10184802 | NELAP | PA |
| 5250 - o-Xylene | EPA 8260B | 10184802 | NELAP | PA |
| 4440 - sec-Butylbenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4420 - tert-Butyl alcohol | EPA 8260B | 10184802 | NELAP | PA |
| 4445 - tert-Butylbenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4700 - trans-1,2-Dichloroethylene | EPA 8260B | 10184802 | NELAP | PA |
| 4685 - trans-1,3-Dichloropropylene | EPA 8260B | 10184802 | NELAP | PA |
| 4605 - trans-1,4-Dichloro-2-butene | EPA 8260B | 10184802 | NELAP | PA |
| 6715 - 1,2,4,5-Tetrachlorobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 5155 - 1,2,4-Trichlorobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 4610 - 1,2-Dichlorobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 6220 - 1,2-Diphenylhydrazine | EPA 8270C | 10185805 | NELAP | PA |
| 6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB) | EPA 8270C | 10185805 | NELAP | PA |
| 4615 - 1,3-Dichlorobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 6160 - 1,3-Dinitrobenzene (1,3-DNB) | EPA 8270C | 10185805 | NELAP | PA |
| 4620 - 1,4-Dichlorobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 6165 - 1,4-Dinitrobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 4735 - 1,4-Dioxane (1,4- Diethyleneoxide) | EPA 8270C | 10185805 | NELAP | PA |
| 6420 - 1,4-Naphthoquinone | EPA 8270C | 10185805 | NELAP | PA |
| 6630 - 1,4-Phenylenediamine | EPA 8270C | 10185805 | NELAP | PA |
| 5790 - 1-Chloronaphthalene | EPA 8270C | 10185805 | NELAP | PA |
| 6380 - 1-Methylnaphthalene | EPA 8270C | 10185805 | NELAP | PA |
| 6425 - 1-Naphthylamine | EPA 8270C | 10185805 | NELAP | PA |



Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 6735 - 2,3,4,6-Tetrachlorophenol | EPA 8270C | 10185805 | NELAP | PA |
| 6835 - 2,4,5-Trichlorophenol | EPA 8270C | 10185805 | NELAP | PA |
| 6840 - 2,4,6-Trichlorophenol | EPA 8270C | 10185805 | NELAP | PA |
| 6000 - 2,4-Dichlorophenol | EPA 8270C | 10185805 | NELAP | PA |
| 6130 - 2,4-Dimethylphenol | EPA 8270C | 10185805 | NELAP | PA |
| 6175 - 2,4-Dinitrophenol | EPA 8270C | 10185805 | NELAP | PA |
| 6185 - 2,4-Dinitrotoluene (2,4-DNT) | EPA 8270C | 10185805 | NELAP | PA |
| 6005 - 2,6-Dichlorophenol | EPA 8270C | 10185805 | NELAP | PA |
| 6190 - 2,6-Dinitrotoluene (2,6-DNT) | EPA 8270C | 10185805 | NELAP | PA |
| 5515 - 2-Acetylaminofluorene | EPA 8270C | 10185805 | NELAP | PA |
| 5795 - 2-Chloronaphthalene | EPA 8270C | 10185805 | NELAP | PA |
| 5800 - 2-Chlorophenol | EPA 8270C | 10185805 | NELAP | PA |
| 6360 - 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol) | EPA 8270C | 10185805 | NELAP | PA |
| 5145 - 2-Methylaniline (o-Toluidine) | EPA 8270C | 10185805 | NELAP | PA |
| 6385 - 2-Methylnaphthalene | EPA 8270C | 10185805 | NELAP | PA |
| 6400 - 2-Methylphenol (o-Cresol) | EPA 8270C | 10185805 | NELAP | PA |
| 6430 - 2-Naphthylamine | EPA 8270C | 10185805 | NELAP | PA |
| 6460 - 2-Nitroaniline | EPA 8270C | 10185805 | NELAP | PA |
| 6490 - 2-Nitrophenol | EPA 8270C | 10185805 | NELAP | PA |
| 5050 - 2-Picoline (2-Methylpyridine) | EPA 8270C | 10185805 | NELAP | PA |
| 5945 - 3,3'-Dichlorobenzidine | EPA 8270C | 10185805 | NELAP | PA |
| 6120 - 3,3'-Dimethylbenzidine | EPA 8270C | 10185805 | NELAP | PA |
| 6355 - 3-Methylcholanthrene | EPA 8270C | 10185805 | NELAP | PA |
| 6405 - 3-Methylphenol (m-Cresol) | EPA 8270C | 10185805 | NELAP | PA |
| 6465 - 3-Nitroaniline | EPA 8270C | 10185805 | NELAP | PA |
| 5540 - 4-Aminobiphenyl | EPA 8270C | 10185805 | NELAP | PA |
| 5660 - 4-Bromophenyl phenyl ether | EPA 8270C | 10185805 | NELAP | PA |
| 5700 - 4-Chloro-3-methylphenol | EPA 8270C | 10185805 | NELAP | PA |
| 5745 - 4-Chloroaniline | EPA 8270C | 10185805 | NELAP | PA |
| 5825 - 4-Chlorophenyl phenylether | EPA 8270C | 10185805 | NELAP | PA |
| 6410 - 4-Methylphenol (p-Cresol) | EPA 8270C | 10185805 | NELAP | PA |
| 6470 - 4-Nitroaniline | EPA 8270C | 10185805 | NELAP | PA |
| 6500 - 4-Nitrophenol | EPA 8270C | 10185805 | NELAP | PA |
| 6510 - 4-Nitroquinoline 1-oxide | EPA 8270C | 10185805 | NELAP | PA |
| 6570 - 5-Nitro-o-toluidine | EPA 8270C | 10185805 | NELAP | PA |
| 6115 - 7,12-Dimethylbenz(a) anthracene | EPA 8270C | 10185805 | NELAP | PA |
| 5500 - Acenaphthene | EPA 8270C | 10185805 | NELAP | PA |
| 5505 - Acenaphthylene | EPA 8270C | 10185805 | NELAP | PA |
| 5510 - Acetophenone | EPA 8270C | 10185805 | NELAP | PA |
| 5545 - Aniline | EPA 8270C | 10185805 | NELAP | PA |
| 5555 - Anthracene | EPA 8270C | 10185805 | NELAP | PA |
| 5560 - Aramite | EPA 8270C | 10185805 | NELAP | PA |
| 5595 - Benzidine | EPA 8270C | 10185805 | NELAP | PA |
| 5575 - Benzo(a)anthracene | EPA 8270C | 10185805 | NELAP | PA |
| 5580 - Benzo(a)pyrene | EPA 8270C | 10185805 | NELAP | PA |
| 5585 - Benzo(b)fluoranthene | EPA 8270C | 10185805 | NELAP | PA |
| 5590 - Benzo(g,h,i)perylene | EPA 8270C | 10185805 | NELAP | PA |
| 5600 - Benzo(k)fluoranthene | EPA 8270C | 10185805 | NELAP | PA |
| 5610 - Benzoic acid | EPA 8270C | 10185805 | NELAP | PA |
| 5630 - Benzyl alcohol | EPA 8270C | 10185805 | NELAP | PA |
| 5670 - Butyl benzyl phthalate | EPA 8270C | 10185805 | NELAP | PA |
| 7180 - Caprolactam | EPA 8270C | 10185805 | NELAP | PA |
| 5680 - Carbazole | EPA 8270C | 10185805 | NELAP | PA |
| 5855 - Chrysene | EPA 8270C | 10185805 | NELAP | PA |
| 6065 - Di(2-ethylhexyl) phthalate (bis(2- | EPA 8270C | 10185805 | NELAP | PA |

Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| Ethylhexyl)phthalate, DEHP) | | | | |
| 5925 - Di-n-butyl phthalate | EPA 8270C | 10185805 | NELAP | PA |
| 6200 - Di-n-octyl phthalate | EPA 8270C | 10185805 | NELAP | PA |
| 7405 - Diallate | EPA 8270C | 10185805 | NELAP | PA |
| 5895 - Dibenz(a,h) anthracene | EPA 8270C | 10185805 | NELAP | PA |
| 5905 - Dibenzofuran | EPA 8270C | 10185805 | NELAP | PA |
| 6135 - Dimethyl phthalate | EPA 8270C | 10185805 | NELAP | PA |
| 8620 - Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP) | EPA 8270C | 10185805 | NELAP | PA |
| 6205 - Diphenylamine | EPA 8270C | 10185805 | NELAP | PA |
| 8625 - Disulfoton | EPA 8270C | 10185805 | NELAP | PA |
| 6260 - Ethyl methanesulfonate | EPA 8270C | 10185805 | NELAP | PA |
| 7580 - Famphur | EPA 8270C | 10185805 | NELAP | PA |
| 6265 - Fluoranthene | EPA 8270C | 10185805 | NELAP | PA |
| 6270 - Fluorene | EPA 8270C | 10185805 | NELAP | PA |
| 6275 - Hexachlorobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 4835 - Hexachlorobutadiene | EPA 8270C | 10185805 | NELAP | PA |
| 6285 - Hexachlorocyclopentadiene | EPA 8270C | 10185805 | NELAP | PA |
| 4840 - Hexachloroethane | EPA 8270C | 10185805 | NELAP | PA |
| 6295 - Hexachloropropene | EPA 8270C | 10185805 | NELAP | PA |
| 6315 - Indeno(1,2,3-cd) pyrene | EPA 8270C | 10185805 | NELAP | PA |
| 7725 - Isodrin | EPA 8270C | 10185805 | NELAP | PA |
| 6320 - Isophorone | EPA 8270C | 10185805 | NELAP | PA |
| 6325 - Isosafrole | EPA 8270C | 10185805 | NELAP | PA |
| 7740 - Kepone | EPA 8270C | 10185805 | NELAP | PA |
| 6345 - Methapyrilene | EPA 8270C | 10185805 | NELAP | PA |
| 6375 - Methyl methanesulfonate | EPA 8270C | 10185805 | NELAP | PA |
| 7825 - Methyl parathion (Parathion, methyl) | EPA 8270C | 10185805 | NELAP | PA |
| 5005 - Naphthalene | EPA 8270C | 10185805 | NELAP | PA |
| 5015 - Nitrobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 7955 - Parathion, ethyl | EPA 8270C | 10185805 | NELAP | PA |
| 6600 - Pentachloronitrobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 6605 - Pentachlorophenol | EPA 8270C | 10185805 | NELAP | PA |
| 6610 - Phenacetin | EPA 8270C | 10185805 | NELAP | PA |
| 6615 - Phenanthrene | EPA 8270C | 10185805 | NELAP | PA |
| 6625 - Phenol | EPA 8270C | 10185805 | NELAP | PA |
| 7985 - Phorate | EPA 8270C | 10185805 | NELAP | PA |
| 6650 - Pronamide (Kerb) | EPA 8270C | 10185805 | NELAP | PA |
| 6665 - Pyrene | EPA 8270C | 10185805 | NELAP | PA |
| 5095 - Pyridine | EPA 8270C | 10185805 | NELAP | PA |
| 6670 - Quinoline | EPA 8270C | 10185805 | NELAP | PA |
| 6685 - Safrole | EPA 8270C | 10185805 | NELAP | PA |
| 8155 - Sulfotepp | EPA 8270C | 10185805 | NELAP | PA |
| 8235 - Thionazin (Zinophos) | EPA 8270C | 10185805 | NELAP | PA |
| 6750 - Thiophenol (Benzenethiol) | EPA 8270C | 10185805 | NELAP | PA |
| 6125 - a-a-Dimethylphenethylamine | EPA 8270C | 10185805 | NELAP | PA |
| 5760 - bis(2-Chloroethoxy)methane | EPA 8270C | 10185805 | NELAP | PA |
| 5765 - bis(2-Chloroethyl) ether | EPA 8270C | 10185805 | NELAP | PA |
| 5780 - bis(2-Chloroisopropyl) ether | EPA 8270C | 10185805 | NELAP | PA |
| 5025 - n-Nitroso-di-n-butylamine | EPA 8270C | 10185805 | NELAP | PA |
| 6545 - n-Nitrosodi-n-propylamine | EPA 8270C | 10185805 | NELAP | PA |
| 6525 - n-Nitrosodiethylamine | EPA 8270C | 10185805 | NELAP | PA |
| 6530 - n-Nitrosodimethylamine | EPA 8270C | 10185805 | NELAP | PA |
| 6535 - n-Nitrosodiphenylamine | EPA 8270C | 10185805 | NELAP | PA |
| 6550 - n-Nitrosomethylethylamine | EPA 8270C | 10185805 | NELAP | PA |
| 6555 - n-Nitrosomorpholine | EPA 8270C | 10185805 | NELAP | PA |



Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 6560 - n-Nitrosopiperidine | EPA 8270C | 10185805 | NELAP | PA |
| 6565 - n-Nitrosopyrrolidine | EPA 8270C | 10185805 | NELAP | PA |
| 8290 - o,o,o-Triethyl phosphorothioate | EPA 8270C | 10185805 | NELAP | PA |
| 8310 - tris-(2,3-Dibromopropyl) phosphate (tris-BP) | EPA 8270C | 10185805 | NELAP | PA |
| 6715 - 1,2,4,5-Tetrachlorobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 5155 - 1,2,4-Trichlorobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 4610 - 1,2-Dichlorobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 6220 - 1,2-Diphenylhydrazine | EPA 8270D | 10186002 | NELAP | PA |
| 6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB) | EPA 8270D | 10186002 | NELAP | PA |
| 4615 - 1,3-Dichlorobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 6160 - 1,3-Dinitrobenzene (1,3-DNB) | EPA 8270D | 10186002 | NELAP | PA |
| 4620 - 1,4-Dichlorobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 6165 - 1,4-Dinitrobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 4735 - 1,4-Dioxane (1,4- Diethyleneoxide) | EPA 8270D | 10186002 | NELAP | PA |
| 6420 - 1,4-Naphthoquinone | EPA 8270D | 10186002 | NELAP | PA |
| 6630 - 1,4-Phenylenediamine | EPA 8270D | 10186002 | NELAP | PA |
| 5790 - 1-Chloronaphthalene | EPA 8270D | 10186002 | NELAP | PA |
| 6380 - 1-Methylnaphthalene | EPA 8270D | 10186002 | NELAP | PA |
| 6425 - 1-Naphthylamine | EPA 8270D | 10186002 | NELAP | PA |
| 6735 - 2,3,4,6-Tetrachlorophenol | EPA 8270D | 10186002 | NELAP | PA |
| 6835 - 2,4,5-Trichlorophenol | EPA 8270D | 10186002 | NELAP | PA |
| 6840 - 2,4,6-Trichlorophenol | EPA 8270D | 10186002 | NELAP | PA |
| 6000 - 2,4-Dichlorophenol | EPA 8270D | 10186002 | NELAP | PA |
| 6130 - 2,4-Dimethylphenol | EPA 8270D | 10186002 | NELAP | PA |
| 6175 - 2,4-Dinitrophenol | EPA 8270D | 10186002 | NELAP | PA |
| 6185 - 2,4-Dinitrotoluene (2,4-DNT) | EPA 8270D | 10186002 | NELAP | PA |
| 6005 - 2,6-Dichlorophenol | EPA 8270D | 10186002 | NELAP | PA |
| 6190 - 2,6-Dinitrotoluene (2,6-DNT) | EPA 8270D | 10186002 | NELAP | PA |
| 5515 - 2-Acetylaminofluorene | EPA 8270D | 10186002 | NELAP | PA |
| 5795 - 2-Chloronaphthalene | EPA 8270D | 10186002 | NELAP | PA |
| 5800 - 2-Chlorophenol | EPA 8270D | 10186002 | NELAP | PA |
| 6360 - 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol) | EPA 8270D | 10186002 | NELAP | PA |
| 5145 - 2-Methylaniline (o-Toluidine) | EPA 8270D | 10186002 | NELAP | PA |
| 6385 - 2-Methylnaphthalene | EPA 8270D | 10186002 | NELAP | PA |
| 6400 - 2-Methylphenol (o-Cresol) | EPA 8270D | 10186002 | NELAP | PA |
| 6430 - 2-Naphthylamine | EPA 8270D | 10186002 | NELAP | PA |
| 6460 - 2-Nitroaniline | EPA 8270D | 10186002 | NELAP | PA |
| 6490 - 2-Nitrophenol | EPA 8270D | 10186002 | NELAP | PA |
| 5050 - 2-Picoline (2-Methylpyridine) | EPA 8270D | 10186002 | NELAP | PA |
| 5945 - 3,3'-Dichlorobenzidine | EPA 8270D | 10186002 | NELAP | PA |
| 6120 - 3,3'-Dimethylbenzidine | EPA 8270D | 10186002 | NELAP | PA |
| 6355 - 3-Methylcholanthrene | EPA 8270D | 10186002 | NELAP | PA |
| 6405 - 3-Methylphenol (m-Cresol) | EPA 8270D | 10186002 | NELAP | PA |
| 6465 - 3-Nitroaniline | EPA 8270D | 10186002 | NELAP | PA |
| 5540 - 4-Aminobiphenyl | EPA 8270D | 10186002 | NELAP | PA |
| 5660 - 4-Bromophenyl phenyl ether | EPA 8270D | 10186002 | NELAP | PA |
| 5700 - 4-Chloro-3-methylphenol | EPA 8270D | 10186002 | NELAP | PA |
| 5745 - 4-Chloroaniline | EPA 8270D | 10186002 | NELAP | PA |
| 5825 - 4-Chlorophenyl phenylether | EPA 8270D | 10186002 | NELAP | PA |
| 6410 - 4-Methylphenol (p-Cresol) | EPA 8270D | 10186002 | NELAP | PA |
| 6470 - 4-Nitroaniline | EPA 8270D | 10186002 | NELAP | PA |
| 6500 - 4-Nitrophenol | EPA 8270D | 10186002 | NELAP | PA |
| 6510 - 4-Nitroquinoline 1-oxide | EPA 8270D | 10186002 | NELAP | PA |
| 6570 - 5-Nitro-o-toluidine | EPA 8270D | 10186002 | NELAP | PA |

Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 6115 - 7,12-Dimethylbenz(a) anthracene | EPA 8270D | 10186002 | NELAP | PA |
| 5500 - Acenaphthene | EPA 8270D | 10186002 | NELAP | PA |
| 5505 - Acenaphthylene | EPA 8270D | 10186002 | NELAP | PA |
| 5510 - Acetophenone | EPA 8270D | 10186002 | NELAP | PA |
| 5545 - Aniline | EPA 8270D | 10186002 | NELAP | PA |
| 5555 - Anthracene | EPA 8270D | 10186002 | NELAP | PA |
| 5560 - Aramite | EPA 8270D | 10186002 | NELAP | PA |
| 5595 - Benzidine | EPA 8270D | 10186002 | NELAP | PA |
| 5575 - Benzo(a)anthracene | EPA 8270D | 10186002 | NELAP | PA |
| 5580 - Benzo(a)pyrene | EPA 8270D | 10186002 | NELAP | PA |
| 5585 - Benzo(b)fluoranthene | EPA 8270D | 10186002 | NELAP | PA |
| 5590 - Benzo(g,h,i)perylene | EPA 8270D | 10186002 | NELAP | PA |
| 5600 - Benzo(k)fluoranthene | EPA 8270D | 10186002 | NELAP | PA |
| 5610 - Benzoic acid | EPA 8270D | 10186002 | NELAP | PA |
| 5630 - Benzyl alcohol | EPA 8270D | 10186002 | NELAP | PA |
| 5635 - Benzyl chloride | EPA 8270D | 10186002 | NELAP | PA |
| 5670 - Butyl benzyl phthalate | EPA 8270D | 10186002 | NELAP | PA |
| 7180 - Caprolactam | EPA 8270D | 10186002 | NELAP | PA |
| 5680 - Carbazole | EPA 8270D | 10186002 | NELAP | PA |
| 5855 - Chrysene | EPA 8270D | 10186002 | NELAP | PA |
| 6065 - Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP) | EPA 8270D | 10186002 | NELAP | PA |
| 5925 - Di-n-butyl phthalate | EPA 8270D | 10186002 | NELAP | PA |
| 6200 - Di-n-octyl phthalate | EPA 8270D | 10186002 | NELAP | PA |
| 7405 - Diallate | EPA 8270D | 10186002 | NELAP | PA |
| 5895 - Dibenz(a,h) anthracene | EPA 8270D | 10186002 | NELAP | PA |
| 5905 - Dibenzofuran | EPA 8270D | 10186002 | NELAP | PA |
| 6135 - Dimethyl phthalate | EPA 8270D | 10186002 | NELAP | PA |
| 8620 - Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP) | EPA 8270D | 10186002 | NELAP | PA |
| 6205 - Diphenylamine | EPA 8270D | 10186002 | NELAP | PA |
| 8625 - Disulfoton | EPA 8270D | 10186002 | NELAP | PA |
| 6260 - Ethyl methanesulfonate | EPA 8270D | 10186002 | NELAP | PA |
| 7580 - Famphur | EPA 8270D | 10186002 | NELAP | PA |
| 6265 - Fluoranthene | EPA 8270D | 10186002 | NELAP | PA |
| 6270 - Fluorene | EPA 8270D | 10186002 | NELAP | PA |
| 6275 - Hexachlorobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 4835 - Hexachlorobutadiene | EPA 8270D | 10186002 | NELAP | PA |
| 6285 - Hexachlorocyclopentadiene | EPA 8270D | 10186002 | NELAP | PA |
| 4840 - Hexachloroethane | EPA 8270D | 10186002 | NELAP | PA |
| 6295 - Hexachloropropene | EPA 8270D | 10186002 | NELAP | PA |
| 6315 - Indeno(1,2,3-cd) pyrene | EPA 8270D | 10186002 | NELAP | PA |
| 7725 - Isodrin | EPA 8270D | 10186002 | NELAP | PA |
| 6320 - Isophorone | EPA 8270D | 10186002 | NELAP | PA |
| 6325 - Isosafrole | EPA 8270D | 10186002 | NELAP | PA |
| 7740 - Kepone | EPA 8270D | 10186002 | NELAP | PA |
| 6345 - Methapyrilene | EPA 8270D | 10186002 | NELAP | PA |
| 6375 - Methyl methanesulfonate | EPA 8270D | 10186002 | NELAP | PA |
| 7825 - Methyl parathion (Parathion, methyl) | EPA 8270D | 10186002 | NELAP | PA |
| 5005 - Naphthalene | EPA 8270D | 10186002 | NELAP | PA |
| 5015 - Nitrobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 7955 - Parathion, ethyl | EPA 8270D | 10186002 | NELAP | PA |
| 6600 - Pentachloronitrobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 6605 - Pentachlorophenol | EPA 8270D | 10186002 | NELAP | PA |
| 6610 - Phenacetin | EPA 8270D | 10186002 | NELAP | PA |
| 6615 - Phenanthrene | EPA 8270D | 10186002 | NELAP | PA |



Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 6625 - Phenol | EPA 8270D | 10186002 | NELAP | PA |
| 7985 - Phorate | EPA 8270D | 10186002 | NELAP | PA |
| 6650 - Pronamide (Kerb) | EPA 8270D | 10186002 | NELAP | PA |
| 5095 - Pyridine | EPA 8270D | 10186002 | NELAP | PA |
| 6670 - Quinoline | EPA 8270D | 10186002 | NELAP | PA |
| 6685 - Safrole | EPA 8270D | 10186002 | NELAP | PA |
| 8155 - Sulfotepp | EPA 8270D | 10186002 | NELAP | PA |
| 8235 - Thionazin (Zinophos) | EPA 8270D | 10186002 | NELAP | PA |
| 6750 - Thiophenol (Benzenethiol) | EPA 8270D | 10186002 | NELAP | PA |
| 6125 - a-a-Dimethylphenethylamine | EPA 8270D | 10186002 | NELAP | PA |
| 5760 - bis(2-Chloroethoxy)methane | EPA 8270D | 10186002 | NELAP | PA |
| 5765 - bis(2-Chloroethyl) ether | EPA 8270D | 10186002 | NELAP | PA |
| 5780 - bis(2-Chloroisopropyl) ether | EPA 8270D | 10186002 | NELAP | PA |
| 5025 - n-Nitroso-di-n-butylamine | EPA 8270D | 10186002 | NELAP | PA |
| 6545 - n-Nitrosodi-n-propylamine | EPA 8270D | 10186002 | NELAP | PA |
| 6525 - n-Nitrosodiethylamine | EPA 8270D | 10186002 | NELAP | PA |
| 6530 - n-Nitrosodimethylamine | EPA 8270D | 10186002 | NELAP | PA |
| 6535 - n-Nitrosodiphenylamine | EPA 8270D | 10186002 | NELAP | PA |
| 6550 - n-Nitrosomethylethylamine | EPA 8270D | 10186002 | NELAP | PA |
| 6555 - n-Nitrosomorpholine | EPA 8270D | 10186002 | NELAP | PA |
| 6560 - n-Nitrosopiperidine | EPA 8270D | 10186002 | NELAP | PA |
| 6565 - n-Nitrosopyrrolidine | EPA 8270D | 10186002 | NELAP | PA |
| 8290 - o,o,o-Triethyl phosphorothioate | EPA 8270D | 10186002 | NELAP | PA |
| 8310 - tris-(2,3-Dibromopropyl) phosphate (tris-BP) | EPA 8270D | 10186002 | NELAP | PA |
| 9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD) | EPA 8290A | 10187403 | NELAP | PA |
| 9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF) | EPA 8290A | 10187403 | NELAP | PA |
| 9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd) | EPA 8290A | 10187403 | NELAP | PA |
| 9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf) | EPA 8290A | 10187403 | NELAP | PA |
| 9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf) | EPA 8290A | 10187403 | NELAP | PA |
| 9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd) | EPA 8290A | 10187403 | NELAP | PA |
| 9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf) | EPA 8290A | 10187403 | NELAP | PA |
| 9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd) | EPA 8290A | 10187403 | NELAP | PA |
| 9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf) | EPA 8290A | 10187403 | NELAP | PA |
| 9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd) | EPA 8290A | 10187403 | NELAP | PA |
| 9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf) | EPA 8290A | 10187403 | NELAP | PA |
| 9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd) | EPA 8290A | 10187403 | NELAP | PA |
| 9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf) | EPA 8290A | 10187403 | NELAP | PA |
| 9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran | EPA 8290A | 10187403 | NELAP | PA |
| 9549 - 2,3,4,7,8-Pentachlorodibenzofuran | EPA 8290A | 10187403 | NELAP | PA |
| 9612 - 2,3,7,8-Tetrachlorodibenzofuran | EPA 8290A | 10187403 | NELAP | PA |



Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 9438 - Total Hpcdd | EPA 8290A | 10187403 | NELAP | PA |
| 9444 - Total Hpcdf | EPA 8290A | 10187403 | NELAP | PA |
| 9468 - Total Hxcdd | EPA 8290A | 10187403 | NELAP | PA |
| 9483 - Total Hxcdf | EPA 8290A | 10187403 | NELAP | PA |
| 9555 - Total Pecdd | EPA 8290A | 10187403 | NELAP | PA |
| 9552 - Total Pecdf | EPA 8290A | 10187403 | NELAP | PA |
| 9609 - Total TCDD | EPA 8290A | 10187403 | NELAP | PA |
| 9615 - Total TCDF | EPA 8290A | 10187403 | NELAP | PA |
| 5500 - Acenaphthene | EPA 8310 | 10187607 | NELAP | PA |
| 5505 - Acenaphthylene | EPA 8310 | 10187607 | NELAP | PA |
| 5555 - Anthracene | EPA 8310 | 10187607 | NELAP | PA |
| 5575 - Benzo(a)anthracene | EPA 8310 | 10187607 | NELAP | PA |
| 5580 - Benzo(a)pyrene | EPA 8310 | 10187607 | NELAP | PA |
| 5585 - Benzo(b)fluoranthene | EPA 8310 | 10187607 | NELAP | PA |
| 5590 - Benzo(g,h,i)perylene | EPA 8310 | 10187607 | NELAP | PA |
| 5600 - Benzo(k)fluoranthene | EPA 8310 | 10187607 | NELAP | PA |
| 5855 - Chrysene | EPA 8310 | 10187607 | NELAP | PA |
| 5895 - Dibenz(a,h) anthracene | EPA 8310 | 10187607 | NELAP | PA |
| 6265 - Fluoranthene | EPA 8310 | 10187607 | NELAP | PA |
| 6270 - Fluorene | EPA 8310 | 10187607 | NELAP | PA |
| 6315 - Indeno(1,2,3-cd) pyrene | EPA 8310 | 10187607 | NELAP | PA |
| 5005 - Naphthalene | EPA 8310 | 10187607 | NELAP | PA |
| 6615 - Phenanthrene | EPA 8310 | 10187607 | NELAP | PA |
| 6665 - Pyrene | EPA 8310 | 10187607 | NELAP | PA |
| 6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB) | EPA 8330 | 10189807 | NELAP | PA |
| 6160 - 1,3-Dinitrobenzene (1,3-DNB) | EPA 8330 | 10189807 | NELAP | PA |
| 9651 - 2,4,6-Trinitrotoluene (2,4,6-TNT) | EPA 8330 | 10189807 | NELAP | PA |
| 6185 - 2,4-Dinitrotoluene (2,4-DNT) | EPA 8330 | 10189807 | NELAP | PA |
| 6190 - 2,6-Dinitrotoluene (2,6-DNT) | EPA 8330 | 10189807 | NELAP | PA |
| 9303 - 2-Amino-4,6-dinitrotoluene (2-am-dnt) | EPA 8330 | 10189807 | NELAP | PA |
| 9507 - 2-Nitrotoluene | EPA 8330 | 10189807 | NELAP | PA |
| 9510 - 3-Nitrotoluene | EPA 8330 | 10189807 | NELAP | PA |
| 9306 - 4-Amino-2,6-dinitrotoluene (4-am-dnt) | EPA 8330 | 10189807 | NELAP | PA |
| 9513 - 4-Nitrotoluene | EPA 8330 | 10189807 | NELAP | PA |
| 6415 - Methyl-2,4,6-trinitrophenylnitramine (tetryl) | EPA 8330 | 10189807 | NELAP | PA |
| 5015 - Nitrobenzene | EPA 8330 | 10189807 | NELAP | PA |
| 6485 - Nitroglycerin | EPA 8330 | 10189807 | NELAP | PA |
| 9522 - Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) | EPA 8330 | 10189807 | NELAP | PA |
| 9558 - Pentaerythritoltetranitrate | EPA 8330 | 10189807 | NELAP | PA |
| 9432 - RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) | EPA 8330 | 10189807 | NELAP | PA |
| 6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB) | EPA 8330A | 10190008 | NELAP | PA |
| 6160 - 1,3-Dinitrobenzene (1,3-DNB) | EPA 8330A | 10190008 | NELAP | PA |
| 9651 - 2,4,6-Trinitrotoluene (2,4,6-TNT) | EPA 8330A | 10190008 | NELAP | PA |
| 6185 - 2,4-Dinitrotoluene (2,4-DNT) | EPA 8330A | 10190008 | NELAP | PA |
| 6190 - 2,6-Dinitrotoluene (2,6-DNT) | EPA 8330A | 10190008 | NELAP | PA |
| 9303 - 2-Amino-4,6-dinitrotoluene (2-am-dnt) | EPA 8330A | 10190008 | NELAP | PA |
| 9507 - 2-Nitrotoluene | EPA 8330A | 10190008 | NELAP | PA |
| 9510 - 3-Nitrotoluene | EPA 8330A | 10190008 | NELAP | PA |
| 9306 - 4-Amino-2,6-dinitrotoluene (4-am-dnt) | EPA 8330A | 10190008 | NELAP | PA |



Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 9513 - 4-Nitrotoluene | EPA 8330A | 10190008 | NELAP | PA |
| 6415 - Methyl-2,4,6-trinitrophenylnitramine (tetryl) | EPA 8330A | 10190008 | NELAP | PA |
| 5015 - Nitrobenzene | EPA 8330A | 10190008 | NELAP | PA |
| 6485 - Nitroglycerin | EPA 8330A | 10190008 | NELAP | PA |
| 9522 - Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) | EPA 8330A | 10190008 | NELAP | PA |
| 9558 - Pentaerythritoltetranitrate | EPA 8330A | 10190008 | NELAP | PA |
| 9432 - RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) | EPA 8330A | 10190008 | NELAP | PA |
| 6485 - Nitroglycerin | EPA 8332 | 10190406 | NELAP | PA |
| 1645 - Total Cyanide | EPA 9012 | 10193201 | NELAP | PA |
| 1645 - Total Cyanide | EPA 9012A | 10193405 | NELAP | PA |
| 1900 - pH | EPA 9040B | 10197203 | NELAP | PA |
| 1625 - Corrosivity (pH) | EPA 9045 | 10197805 | NELAP | PA |
| 1900 - pH | EPA 9045 | 10197805 | NELAP | PA |
| 1610 - Conductivity | EPA 9050 | 10198604 | NELAP | PA |
| 1610 - Conductivity | EPA 9050A | 10198808 | NELAP | PA |
| 1540 - Bromide | EPA 9056 | 10199005 | NELAP | PA |
| 1575 - Chloride | EPA 9056 | 10199403 | NELAP | PA |
| 1730 - Fluoride | EPA 9056 | 10199403 | NELAP | PA |
| 1805 - Nitrate | EPA 9056 | 10199403 | NELAP | PA |
| 1835 - Nitrite | EPA 9056 | 10199403 | NELAP | PA |
| 2000 - Sulfate | EPA 9056 | 10199403 | NELAP | PA |
| 1575 - Chloride | EPA 9056A | 10199607 | NELAP | PA |
| 1730 - Fluoride | EPA 9056A | 10199607 | NELAP | PA |
| 1805 - Nitrate | EPA 9056A | 10199607 | NELAP | PA |
| 1835 - Nitrite | EPA 9056A | 10199607 | NELAP | PA |
| 1840 - Nitrite as N | EPA 9056A | 10199607 | NELAP | PA |
| 2000 - Sulfate | EPA 9056A | 10199607 | NELAP | PA |
| 2040 - Total Organic Carbon | EPA 9060 | 10200201 | NELAP | PA |
| 1905 - Total Phenolics | EPA 9066 | 10200609 | NELAP | PA |
| 4747 - Ethane | EPA RSK-175 (GC/FID) | 10212905 | NELAP | PA |
| 4926 - Methane | EPA RSK-175 (GC/FID) | 10212905 | NELAP | PA |
| 100263 - Propane | EPA RSK-175 (GC/FID) | 10212905 | NELAP | PA |
| 5029 - n-Propane | EPA RSK-175 (GC/FID) | 10212905 | NELAP | PA |
| 1095 - Mercury | EPA 1631E | 10237204 | NELAP | PA |
| 6380 - 1-Methylnaphthalene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5500 - Acenaphthene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5505 - Acenaphthylene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5555 - Anthracene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5575 - Benzo(a)anthracene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5580 - Benzo(a)pyrene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5585 - Benzo(b)fluoranthene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5590 - Benzo(g,h,i)perylene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5600 - Benzo(k)fluoranthene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5855 - Chrysene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5895 - Dibenz(a,h) anthracene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 6265 - Fluoranthene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 6270 - Fluorene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 6315 - Indeno(1,2,3-cd) pyrene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5005 - Naphthalene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 6615 - Phenanthrene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 6665 - Pyrene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 6380 - 1-Methylnaphthalene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5500 - Acenaphthene | EPA 8270D SIM | 10242509 | NELAP | PA |



Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 5505 - Acenaphthylene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5555 - Anthracene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5575 - Benzo(a)anthracene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5580 - Benzo(a)pyrene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5585 - Benzo(b)fluoranthene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5590 - Benzo(g,h,i)perylene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5600 - Benzo(k)fluoranthene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5855 - Chrysene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5895 - Dibenz(a,h) anthracene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 6265 - Fluoranthene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 6270 - Fluorene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 6315 - Indeno(1,2,3-cd) pyrene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5005 - Naphthalene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 6615 - Phenanthrene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 6665 - Pyrene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 1645 - Total Cyanide | EPA 9012B | 10243206 | NELAP | PA |
| 1900 - pH | EPA 9040C | 10244403 | NELAP | PA |
| 1575 - Chloride | EPA 300.0 | 10275408 | NELAP | PA |
| 1840 - Nitrite as N | EPA 300.0 | 10275408 | NELAP | PA |
| 2000 - Sulfate | EPA 300.0 | 10275408 | NELAP | PA |
| 1500 - Acidity, as CaCO3 | SM 2310 B, 20th ED | 20044206 | NELAP | PA |
| 100410 - Alkalinity, bicarbonate | SM 2320 B, 18th ED | 20044808 | NELAP | LA |
| 100411 - Alkalinity, carbonate | SM 2320 B, 18th ED | 20044808 | NELAP | LA |
| 1505 - Alkalinity as CaCO3 | SM 2320 B, 20th ED | 20045209 | NELAP | PA |
| 1755 - Total hardness as CaCO3 | SM 2340 B, 19th ED | 20046008 | NELAP | PA |
| 1755 - Total hardness as CaCO3 | SM 2340 B, 20th ED | 20046202 | NELAP | PA |
| 1955 - Residue-filterable (TDS) | SM 2340 C, 20th ED | 20047205 | NELAP | PA |
| 1610 - Conductivity | SM 2510 B, 20th ED | 20048208 | NELAP | PA |
| 1610 - Conductivity | SM 2510 B, 21st ED | 20048402 | NELAP | PA |
| 1950 - Residue-total | SM 2540 B, 20th ED | 20049007 | NELAP | PA |
| 1955 - Residue-filterable (TDS) | SM 2540 C, 20th ED | 20050004 | NELAP | PA |
| 1960 - Residue-nonfilterable (TSS) | SM 2540 D, 20th ED | 20050800 | NELAP | PA |
| 1965 - Residue-settleable | SM 2540 F, 20th ED | 20051803 | NELAP | PA |
| 2030 - Temperature, deg. C | SM 2550 B, 20th ED | 20052806 | NELAP | PA |
| 1575 - Chloride | SM 4500-Cl⁻ C, 20th ED | 20084804 | NELAP | PA |
| 1940 - Total residual chlorine | SM 4500-Cl⁻ F, 20th ED | 20087201 | NELAP | PA |
| 1645 - Total Cyanide | SM 4500-CN⁻ C, 20th ED | 20091605 | NELAP | PA |
| 1635 - Cyanide | SM 4500-CN⁻ E, 20th ED | 20092404 | NELAP | PA |
| 1510 - Amenable cyanide | SM 4500-CN⁻ G, 20th ED | 20093203 | NELAP | PA |
| 1730 - Fluoride | SM 4500-F⁻ B, 20th ED | 20101002 | NELAP | PA |
| 1900 - pH | SM 4500-H+ B, 20th ED | 20104807 | NELAP | PA |
| 1515 - Ammonia as N | SM 4500-NH3 B, 20th ED | 20105606 | NELAP | PA |
| 1515 - Ammonia as N | SM 4500-NH3 C, 20th ED | 20106405 | NELAP | PA |
| 1515 - Ammonia as N | SM 4500-NH3 D, 20th ED | 20109006 | NELAP | PA |
| 1880 - Oxygen, dissolved | SM 4500-O G, 20th ED | 20121204 | NELAP | PA |
| 1910 - Total Phosphorus | SM 4500-P B 5, 20th ED | 20123200 | NELAP | PA |
| 1910 - Total Phosphorus | SM 4500-P E, 20th ED | 20123802 | NELAP | PA |
| 1910 - Total Phosphorus | SM 4500-P F, 20th ED | 20124601 | NELAP | PA |
| 2005 - Sulfide | SM 4500-S2⁻ D, 20th ED | 20125400 | NELAP | PA |
| 2005 - Sulfide | SM 4500-S2⁻ F, 20th ED | 20126209 | NELAP | PA |
| 1990 - Silica as SiO2 | SM 4500-SiO2 C, 20th ED | 20128205 | NELAP | PA |
| 1530 - Biochemical oxygen demand | SM 5210 B, 20th ED | 20134809 | NELAP | PA |
| 1555 - Carbonaceous BOD, CBOD | SM 5210 B, 20th ED | 20134809 | NELAP | PA |
| 2040 - Total Organic Carbon | SM 5310 B, 20th ED | 20137400 | NELAP | PA |
| 2040 - Total Organic Carbon | SM 5310 C, 20th ED | 20138403 | NELAP | PA |
| 2025 - Surfactants - MBAS | SM 5540 C, 20th ED | 20144609 | NELAP | PA |



Uncontrolled Copy

## Non Potable Water

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 1605 - Color | SM 2120 B, 20th ED | 20224004 | NELAP | PA |
| 6385 - 2-Methylnaphthalene | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 5500 - Acenaphthene | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 5505 - Acenaphthylene | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 5555 - Anthracene | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 5575 - Benzo(a)anthracene | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 5580 - Benzo(a)pyrene | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 5585 - Benzo(b)fluoranthene | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 5590 - Benzo(g,h,i)perylene | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 5600 - Benzo(k)fluoranthene | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 5855 - Chrysene | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 5895 - Dibenz(a,h) anthracene | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 6218 - EPH Aliphatic C19-C36 | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 6222 - EPH Aliphatic C9-C18 | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 6232 - EPH Aromatic C11-C22 | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 6234 - EPH Aromatic C11-C22 Unadjusted | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 6265 - Fluoranthene | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 6270 - Fluorene | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 6315 - Indeno(1,2,3-cd) pyrene | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 5005 - Naphthalene | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 6615 - Phenanthrene | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 6665 - Pyrene | MADEP EPH, Rev.1.1 | 90017202 | NELAP | PA |
| 4375 - Benzene | MADEP VPH, Rev.1.1 | 90017406 | NELAP | PA |
| 4765 - Ethylbenzene | MADEP VPH, Rev.1.1 | 90017406 | NELAP | PA |
| 5000 - Methyl tert-butyl ether (MTBE) | MADEP VPH, Rev.1.1 | 90017406 | NELAP | PA |
| 5005 - Naphthalene | MADEP VPH, Rev.1.1 | 90017406 | NELAP | PA |
| 5140 - Toluene | MADEP VPH, Rev.1.1 | 90017406 | NELAP | PA |
| 5304 - VPH Aliphatic C5-C8 | MADEP VPH, Rev.1.1 | 90017406 | NELAP | PA |
| 5305 - VPH Aliphatic C5-C8 Unadjusted | MADEP VPH, Rev.1.1 | 90017406 | NELAP | PA |
| 5306 - VPH Aliphatic C9-C12 | MADEP VPH, Rev.1.1 | 90017406 | NELAP | PA |
| 5307 - VPH Aliphatic C9-C12 Unadjusted | MADEP VPH, Rev.1.1 | 90017406 | NELAP | PA |
| 5311 - VPH Aromatic C9-C10 | MADEP VPH, Rev.1.1 | 90017406 | NELAP | PA |
| 5240 - m+p-xylene | MADEP VPH, Rev.1.1 | 90017406 | NELAP | PA |
| 5250 - o-Xylene | MADEP VPH, Rev.1.1 | 90017406 | NELAP | PA |
| 2050 - Total Petroleum Hydrocarbons (TPH) | TNRCC 1005, Rev.3 | 90019208 | NELAP | PA |

## Solid Chemical Materials

| Analy | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 4330 - Acrylamide | EPA 8270C (extended) | 2330 | NELAP | PA |
| 5570 - Benzaldehyde | EPA 8270C (extended) | 2330 | NELAP | PA |
| 4330 - Acrylamide | EPA 8270D (extended) | 2560 | NELAP | PA |
| 5570 - Benzaldehyde | EPA 8270D (extended) | 2560 | NELAP | PA |
| 1780 - Ignitability | EPA 1010 | 10116606 | NELAP | PA |
| 1466 - Toxicity Characteristic Leaching Procedure (TCLP) | EPA 1311 | 10118806 | NELAP | PA |
| 1460 - Synthetic Precipitation Leaching Procedure | EPA 1312 | 10119003 | NELAP | PA |
| 100007 - Acid Digestion of Sediments, Sludges, and soils | EPA 3050B | 10135601 | NELAP | PA |
| 1402 - Alkaline Digestion for Hexavalent Chromium | EPA 3060A | 10136604 | NELAP | PA |
| 1444 - Separatory Funnel Liquid-liquid extraction | EPA 3510C | 10138202 | NELAP | PA |

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 1452 - Soxhlet Extraction | EPA 3540C | 10140202 | NELAP | PA |
| 1428 - Microwave Extraction | EPA 3546 | 10141205 | NELAP | PA |
| 1468 - Ultrasonic Extraction | EPA 3550C | 10142004 | NELAP | PA |
| 1456 - Sulfur Clean-Up | EPA 3660B | 10148400 | NELAP | PA |
| 2020 - Sulfuric acid/permanganate clean-up | EPA 3665 | 10148604 | NELAP | PA |
| 2020 - Sulfuric acid/permanganate clean-up | EPA 3665A | 10148808 | NELAP | PA |
| 100017 - Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples | EPA 5030 | 10153001 | NELAP | PA |
| 1406 - Purge and trap for aqueous phase samples | EPA 5030 | 10153001 | NELAP | PA |
| 100017 - Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples | EPA 5035 | 10154004 | NELAP | PA |
| 1000 - Aluminum | EPA 6010B | 10155609 | NELAP | PA |
| 1005 - Antimony | EPA 6010B | 10155609 | NELAP | PA |
| 1010 - Arsenic | EPA 6010B | 10155609 | NELAP | PA |
| 1015 - Barium | EPA 6010B | 10155609 | NELAP | PA |
| 1020 - Beryllium | EPA 6010B | 10155609 | NELAP | PA |
| 1025 - Boron | EPA 6010B | 10155609 | NELAP | PA |
| 1030 - Cadmium | EPA 6010B | 10155609 | NELAP | PA |
| 1035 - Calcium | EPA 6010B | 10155609 | NELAP | PA |
| 1040 - Chromium | EPA 6010B | 10155609 | NELAP | PA |
| 1050 - Cobalt | EPA 6010B | 10155609 | NELAP | PA |
| 1055 - Copper | EPA 6010B | 10155609 | NELAP | PA |
| 1070 - Iron | EPA 6010B | 10155609 | NELAP | PA |
| 1075 - Lead | EPA 6010B | 10155609 | NELAP | PA |
| 1080 - Lithium | EPA 6010B | 10155609 | NELAP | PA |
| 1085 - Magnesium | EPA 6010B | 10155609 | NELAP | PA |
| 1090 - Manganese | EPA 6010B | 10155609 | NELAP | PA |
| 1100 - Molybdenum | EPA 6010B | 10155609 | NELAP | PA |
| 1105 - Nickel | EPA 6010B | 10155609 | NELAP | PA |
| 1125 - Potassium | EPA 6010B | 10155609 | NELAP | PA |
| 1140 - Selenium | EPA 6010B | 10155609 | NELAP | PA |
| 1150 - Silver | EPA 6010B | 10155609 | NELAP | PA |
| 1155 - Sodium | EPA 6010B | 10155609 | NELAP | PA |
| 1160 - Strontium | EPA 6010B | 10155609 | NELAP | PA |
| 1165 - Thallium | EPA 6010B | 10155609 | NELAP | PA |
| 1175 - Tin | EPA 6010B | 10155609 | NELAP | PA |
| 1180 - Titanium | EPA 6010B | 10155609 | NELAP | PA |
| 1185 - Vanadium | EPA 6010B | 10155609 | NELAP | PA |
| 1190 - Zinc | EPA 6010B | 10155609 | NELAP | PA |
| 1000 - Aluminum | EPA 6010C | 10155803 | NELAP | PA |
| 1005 - Antimony | EPA 6010C | 10155803 | NELAP | PA |
| 1010 - Arsenic | EPA 6010C | 10155803 | NELAP | PA |
| 1015 - Barium | EPA 6010C | 10155803 | NELAP | PA |
| 1020 - Beryllium | EPA 6010C | 10155803 | NELAP | PA |
| 1025 - Boron | EPA 6010C | 10155803 | NELAP | PA |
| 1030 - Cadmium | EPA 6010C | 10155803 | NELAP | PA |
| 1035 - Calcium | EPA 6010C | 10155803 | NELAP | PA |
| 1040 - Chromium | EPA 6010C | 10155803 | NELAP | PA |
| 1050 - Cobalt | EPA 6010C | 10155803 | NELAP | PA |
| 1055 - Copper | EPA 6010C | 10155803 | NELAP | PA |
| 1070 - Iron | EPA 6010C | 10155803 | NELAP | PA |
| 1075 - Lead | EPA 6010C | 10155803 | NELAP | PA |
| 1080 - Lithium | EPA 6010C | 10155803 | NELAP | PA |

Uncontrolled Copy

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 1085 - Magnesium | EPA 6010C | 10155803 | NELAP | PA |
| 1090 - Manganese | EPA 6010C | 10155803 | NELAP | PA |
| 1100 - Molybdenum | EPA 6010C | 10155803 | NELAP | PA |
| 1105 - Nickel | EPA 6010C | 10155803 | NELAP | PA |
| 1125 - Potassium | EPA 6010C | 10155803 | NELAP | PA |
| 1140 - Selenium | EPA 6010C | 10155803 | NELAP | PA |
| 1150 - Silver | EPA 6010C | 10155803 | NELAP | PA |
| 1155 - Sodium | EPA 6010C | 10155803 | NELAP | PA |
| 1160 - Strontium | EPA 6010C | 10155803 | NELAP | PA |
| 2017 - Sulfur | EPA 6010C | 10155803 | NELAP | PA |
| 1165 - Thallium | EPA 6010C | 10155803 | NELAP | PA |
| 1175 - Tin | EPA 6010C | 10155803 | NELAP | PA |
| 1180 - Titanium | EPA 6010C | 10155803 | NELAP | PA |
| 1185 - Vanadium | EPA 6010C | 10155803 | NELAP | PA |
| 1190 - Zinc | EPA 6010C | 10155803 | NELAP | PA |
| 1000 - Aluminum | EPA 6020 | 10156000 | NELAP | PA |
| 1005 - Antimony | EPA 6020 | 10156000 | NELAP | PA |
| 1010 - Arsenic | EPA 6020 | 10156000 | NELAP | PA |
| 1015 - Barium | EPA 6020 | 10156000 | NELAP | PA |
| 1020 - Beryllium | EPA 6020 | 10156000 | NELAP | PA |
| 1030 - Cadmium | EPA 6020 | 10156000 | NELAP | PA |
| 1035 - Calcium | EPA 6020 | 10156000 | NELAP | PA |
| 1040 - Chromium | EPA 6020 | 10156000 | NELAP | PA |
| 1050 - Cobalt | EPA 6020 | 10156000 | NELAP | PA |
| 1055 - Copper | EPA 6020 | 10156000 | NELAP | PA |
| 1070 - Iron | EPA 6020 | 10156000 | NELAP | PA |
| 1075 - Lead | EPA 6020 | 10156000 | NELAP | PA |
| 1085 - Magnesium | EPA 6020 | 10156000 | NELAP | PA |
| 1090 - Manganese | EPA 6020 | 10156000 | NELAP | PA |
| 1100 - Molybdenum | EPA 6020 | 10156000 | NELAP | PA |
| 1105 - Nickel | EPA 6020 | 10156000 | NELAP | PA |
| 1125 - Potassium | EPA 6020 | 10156000 | NELAP | PA |
| 1140 - Selenium | EPA 6020 | 10156000 | NELAP | PA |
| 1150 - Silver | EPA 6020 | 10156000 | NELAP | PA |
| 1155 - Sodium | EPA 6020 | 10156000 | NELAP | PA |
| 1160 - Strontium | EPA 6020 | 10156000 | NELAP | PA |
| 1165 - Thallium | EPA 6020 | 10156000 | NELAP | PA |
| 1175 - Tin | EPA 6020 | 10156000 | NELAP | PA |
| 1185 - Vanadium | EPA 6020 | 10156000 | NELAP | PA |
| 1190 - Zinc | EPA 6020 | 10156000 | NELAP | PA |
| 1155 - Sodium | EPA 6020 | 10156204 | NELAP | PA |
| 1000 - Aluminum | EPA 6020A | 10156408 | NELAP | PA |
| 1005 - Antimony | EPA 6020A | 10156408 | NELAP | PA |
| 1010 - Arsenic | EPA 6020A | 10156408 | NELAP | PA |
| 1015 - Barium | EPA 6020A | 10156408 | NELAP | PA |
| 1020 - Beryllium | EPA 6020A | 10156408 | NELAP | PA |
| 1030 - Cadmium | EPA 6020A | 10156408 | NELAP | PA |
| 1035 - Calcium | EPA 6020A | 10156408 | NELAP | PA |
| 1040 - Chromium | EPA 6020A | 10156408 | NELAP | PA |
| 1050 - Cobalt | EPA 6020A | 10156408 | NELAP | PA |
| 1055 - Copper | EPA 6020A | 10156408 | NELAP | PA |
| 1070 - Iron | EPA 6020A | 10156408 | NELAP | PA |
| 1075 - Lead | EPA 6020A | 10156408 | NELAP | PA |
| 1085 - Magnesium | EPA 6020A | 10156408 | NELAP | PA |
| 1090 - Manganese | EPA 6020A | 10156408 | NELAP | PA |
| 1100 - Molybdenum | EPA 6020A | 10156408 | NELAP | PA |



Uncontrolled Copy

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 1105 - Nickel | EPA 6020A | 10156408 | NELAP | PA |
| 1125 - Potassium | EPA 6020A | 10156408 | NELAP | PA |
| 1140 - Selenium | EPA 6020A | 10156408 | NELAP | PA |
| 1150 - Silver | EPA 6020A | 10156408 | NELAP | PA |
| 1155 - Sodium | EPA 6020A | 10156408 | NELAP | PA |
| 1160 - Strontium | EPA 6020A | 10156408 | NELAP | PA |
| 1165 - Thallium | EPA 6020A | 10156408 | NELAP | PA |
| 1175 - Tin | EPA 6020A | 10156408 | NELAP | PA |
| 1180 - Titanium | EPA 6020A | 10156408 | NELAP | PA |
| 1185 - Vanadium | EPA 6020A | 10156408 | NELAP | PA |
| 1190 - Zinc | EPA 6020A | 10156408 | NELAP | PA |
| 1045 - Chromium VI | EPA 7196A | 10162400 | NELAP | PA |
| 1045 - Chromium VI | EPA 7199 | 10163005 | NELAP | PA |
| 1095 - Mercury | EPA 7471A | 10166208 | NELAP | PA |
| 1095 - Mercury | EPA 7471B | 10166402 | NELAP | PA |
| 9369 - Diesel range organics (DRO) | EPA 8015B | 10173601 | NELAP | PA |
| 4750 - Ethanol | EPA 8015B | 10173601 | NELAP | PA |
| 4785 - Ethylene glycol | EPA 8015B | 10173601 | NELAP | PA |
| 9408 - Gasoline range organics (GRO) | EPA 8015B | 10173601 | NELAP | PA |
| 4930 - Methanol | EPA 8015B | 10173601 | NELAP | PA |
| 9369 - Diesel range organics (DRO) | EPA 8015C | 10173805 | NELAP | PA |
| 4750 - Ethanol | EPA 8015C | 10173805 | NELAP | PA |
| 4785 - Ethylene glycol | EPA 8015C | 10173805 | NELAP | PA |
| 9408 - Gasoline range organics (GRO) | EPA 8015C | 10173805 | NELAP | PA |
| 4930 - Methanol | EPA 8015C | 10173805 | NELAP | PA |
| 4375 - Benzene | EPA 8021B | 10174808 | NELAP | PA |
| 4765 - Ethylbenzene | EPA 8021B | 10174808 | NELAP | PA |
| 4900 - Isopropylbenzene | EPA 8021B | 10174808 | NELAP | PA |
| 5000 - Methyl tert-butyl ether (MTBE) | EPA 8021B | 10174808 | NELAP | PA |
| 5005 - Naphthalene | EPA 8021B | 10174808 | NELAP | PA |
| 5140 - Toluene | EPA 8021B | 10174808 | NELAP | PA |
| 5260 - Xylene (total) | EPA 8021B | 10174808 | NELAP | PA |
| 5245 - m-Xylene | EPA 8021B | 10174808 | NELAP | PA |
| 5250 - o-Xylene | EPA 8021B | 10174808 | NELAP | PA |
| 5255 - p-Xylene | EPA 8021B | 10174808 | NELAP | PA |
| 7355 - 4,4'-DDD | EPA 8081A | 10178606 | NELAP | PA |
| 7360 - 4,4'-DDE | EPA 8081A | 10178606 | NELAP | PA |
| 7365 - 4,4'-DDT | EPA 8081A | 10178606 | NELAP | PA |
| 7025 - Aldrin | EPA 8081A | 10178606 | NELAP | PA |
| 7250 - Chlordane (tech.) | EPA 8081A | 10178606 | NELAP | PA |
| 7470 - Dieldrin | EPA 8081A | 10178606 | NELAP | PA |
| 7510 - Endosulfan I | EPA 8081A | 10178606 | NELAP | PA |
| 7515 - Endosulfan II | EPA 8081A | 10178606 | NELAP | PA |
| 7520 - Endosulfan sulfate | EPA 8081A | 10178606 | NELAP | PA |
| 7540 - Endrin | EPA 8081A | 10178606 | NELAP | PA |
| 7530 - Endrin aldehyde | EPA 8081A | 10178606 | NELAP | PA |
| 7535 - Endrin ketone | EPA 8081A | 10178606 | NELAP | PA |
| 7685 - Heptachlor | EPA 8081A | 10178606 | NELAP | PA |
| 7690 - Heptachlor epoxide | EPA 8081A | 10178606 | NELAP | PA |
| 7740 - Kepone | EPA 8081A | 10178606 | NELAP | PA |
| 7810 - Methoxychlor | EPA 8081A | 10178606 | NELAP | PA |
| 7870 - Mirex | EPA 8081A | 10178606 | NELAP | PA |
| 8250 - Toxaphene (Chlorinated camphene) | EPA 8081A | 10178606 | NELAP | PA |
| 7110 - alpha-BHC (alpha-Hexachlorocyclohexane) | EPA 8081A | 10178606 | NELAP | PA |
| 7240 - alpha-Chlordane | EPA 8081A | 10178606 | NELAP | PA |



Uncontrolled Copy

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | All |
|---|---|---|---|---|
| 7115 - beta-BHC (beta-Hexachlorocyclohexane) | EPA 8081A | 10178606 | NELAP | PA |
| 7105 - delta-BHC | EPA 8081A | 10178606 | NELAP | PA |
| 7120 - gamma-BHC (Lindane, gamma-HexachlorocyclohexanE) | EPA 8081A | 10178606 | NELAP | PA |
| 7245 - gamma-Chlordane | EPA 8081A | 10178606 | NELAP | PA |
| 7355 - 4,4'-DDD | EPA 8081B | 10178800 | NELAP | PA |
| 7360 - 4,4'-DDE | EPA 8081B | 10178800 | NELAP | PA |
| 7365 - 4,4'-DDT | EPA 8081B | 10178800 | NELAP | PA |
| 7025 - Aldrin | EPA 8081B | 10178800 | NELAP | PA |
| 7250 - Chlordane (tech.) | EPA 8081B | 10178800 | NELAP | PA |
| 7470 - Dieldrin | EPA 8081B | 10178800 | NELAP | PA |
| 7510 - Endosulfan I | EPA 8081B | 10178800 | NELAP | PA |
| 7515 - Endosulfan II | EPA 8081B | 10178800 | NELAP | PA |
| 7520 - Endosulfan sulfate | EPA 8081B | 10178800 | NELAP | PA |
| 7540 - Endrin | EPA 8081B | 10178800 | NELAP | PA |
| 7530 - Endrin aldehyde | EPA 8081B | 10178800 | NELAP | PA |
| 7535 - Endrin ketone | EPA 8081B | 10178800 | NELAP | PA |
| 7685 - Heptachlor | EPA 8081B | 10178800 | NELAP | PA |
| 7690 - Heptachlor epoxide | EPA 8081B | 10178800 | NELAP | PA |
| 7740 - Kepone | EPA 8081B | 10178800 | NELAP | PA |
| 7810 - Methoxychlor | EPA 8081B | 10178800 | NELAP | PA |
| 7870 - Mirex | EPA 8081B | 10178800 | NELAP | PA |
| 8250 - Toxaphene (Chlorinated camphene) | EPA 8081B | 10178800 | NELAP | PA |
| 7110 - alpha-BHC (alpha-Hexachlorocyclohexane) | EPA 8081B | 10178800 | NELAP | PA |
| 7240 - alpha-Chlordane | EPA 8081B | 10178800 | NELAP | PA |
| 7115 - beta-BHC (beta-Hexachlorocyclohexane) | EPA 8081B | 10178800 | NELAP | PA |
| 7105 - delta-BHC | EPA 8081B | 10178800 | NELAP | PA |
| 7120 - gamma-BHC (Lindane, gamma-HexachlorocyclohexanE) | EPA 8081B | 10178800 | NELAP | PA |
| 7245 - gamma-Chlordane | EPA 8081B | 10178800 | NELAP | PA |
| 8880 - Aroclor-1016 (PCB-1016) | EPA 8082 | 10179007 | NELAP | PA |
| 8885 - Aroclor-1221 (PCB-1221) | EPA 8082 | 10179007 | NELAP | PA |
| 8890 - Aroclor-1232 (PCB-1232) | EPA 8082 | 10179007 | NELAP | PA |
| 8895 - Aroclor-1242 (PCB-1242) | EPA 8082 | 10179007 | NELAP | PA |
| 8900 - Aroclor-1248 (PCB-1248) | EPA 8082 | 10179007 | NELAP | PA |
| 8905 - Aroclor-1254 (PCB-1254) | EPA 8082 | 10179007 | NELAP | PA |
| 8910 - Aroclor-1260 (PCB-1260) | EPA 8082 | 10179007 | NELAP | PA |
| 8912 - Aroclor-1262 (PCB-1262) | EPA 8082 | 10179007 | NELAP | PA |
| 8913 - Aroclor-1268 (PCB-1268) | EPA 8082 | 10179007 | NELAP | PA |
| 8880 - Aroclor-1016 (PCB-1016) | EPA 8082A | 10179201 | NELAP | PA |
| 8885 - Aroclor-1221 (PCB-1221) | EPA 8082A | 10179201 | NELAP | PA |
| 8890 - Aroclor-1232 (PCB-1232) | EPA 8082A | 10179201 | NELAP | PA |
| 8895 - Aroclor-1242 (PCB-1242) | EPA 8082A | 10179201 | NELAP | PA |
| 8900 - Aroclor-1248 (PCB-1248) | EPA 8082A | 10179201 | NELAP | PA |
| 8905 - Aroclor-1254 (PCB-1254) | EPA 8082A | 10179201 | NELAP | PA |
| 8910 - Aroclor-1260 (PCB-1260) | EPA 8082A | 10179201 | NELAP | PA |
| 8912 - Aroclor-1262 (PCB-1262) | EPA 8082A | 10179201 | NELAP | PA |
| 8913 - Aroclor-1268 (PCB-1268) | EPA 8082A | 10179201 | NELAP | PA |
| 7600 - Fensulfothion | EPA 8141 | 10181803 | NELAP | PA |
| 7785 - Merphos | EPA 8141 | 10181803 | NELAP | PA |
| 8140 - Stirophos | EPA 8141 | 10181803 | NELAP | PA |
| 7005 - Alachlor | EPA 8141A | 10182000 | NELAP | PA |
| 7065 - Atrazine | EPA 8141A | 10182000 | NELAP | PA |



Uncontrolled Copy

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 7075 - Azinphos-methyl (Guthion) | EPA 8141A | 10182000 | NELAP | PA |
| 7125 - Bolstar (Sulprofos) | EPA 8141A | 10182000 | NELAP | PA |
| 7300 - Chlorpyrifos | EPA 8141A | 10182000 | NELAP | PA |
| 7395 - Demeton-o | EPA 8141A | 10182000 | NELAP | PA |
| 7385 - Demeton-s | EPA 8141A | 10182000 | NELAP | PA |
| 7410 - Diazinon | EPA 8141A | 10182000 | NELAP | PA |
| 8610 - Dichlorovos (DDVP, Dichlorvos) | EPA 8141A | 10182000 | NELAP | PA |
| 8625 - Disulfoton | EPA 8141A | 10182000 | NELAP | PA |
| 7550 - EPN | EPA 8141A | 10182000 | NELAP | PA |
| 7565 - Ethion | EPA 8141A | 10182000 | NELAP | PA |
| 7570 - Ethoprop | EPA 8141A | 10182000 | NELAP | PA |
| 7580 - Famphur | EPA 8141A | 10182000 | NELAP | PA |
| 7600 - Fensulfothion | EPA 8141A | 10182000 | NELAP | PA |
| 7605 - Fenthion | EPA 8141A | 10182000 | NELAP | PA |
| 7770 - Malathion | EPA 8141A | 10182000 | NELAP | PA |
| 7785 - Merphos | EPA 8141A | 10182000 | NELAP | PA |
| 7825 - Methyl parathion (Parathion, methyl) | EPA 8141A | 10182000 | NELAP | PA |
| 7850 - Mevinphos | EPA 8141A | 10182000 | NELAP | PA |
| 7905 - Naled | EPA 8141A | 10182000 | NELAP | PA |
| 7955 - Parathion, ethyl | EPA 8141A | 10182000 | NELAP | PA |
| 7985 - Phorate | EPA 8141A | 10182000 | NELAP | PA |
| 8110 - Ronnel | EPA 8141A | 10182000 | NELAP | PA |
| 8125 - Simazine | EPA 8141A | 10182000 | NELAP | PA |
| 7005 - Alachlor | EPA 8141B | 10182204 | NELAP | PA |
| 7065 - Atrazine | EPA 8141B | 10182204 | NELAP | PA |
| 7075 - Azinphos-methyl (Guthion) | EPA 8141B | 10182204 | NELAP | PA |
| 7125 - Bolstar (Sulprofos) | EPA 8141B | 10182204 | NELAP | PA |
| 7300 - Chlorpyrifos | EPA 8141B | 10182204 | NELAP | PA |
| 7395 - Demeton-o | EPA 8141B | 10182204 | NELAP | PA |
| 7385 - Demeton-s | EPA 8141B | 10182204 | NELAP | PA |
| 7410 - Diazinon | EPA 8141B | 10182204 | NELAP | PA |
| 8610 - Dichlorovos (DDVP, Dichlorvos) | EPA 8141B | 10182204 | NELAP | PA |
| 8625 - Disulfoton | EPA 8141B | 10182204 | NELAP | PA |
| 7550 - EPN | EPA 8141B | 10182204 | NELAP | PA |
| 7565 - Ethion | EPA 8141B | 10182204 | NELAP | PA |
| 7570 - Ethoprop | EPA 8141B | 10182204 | NELAP | PA |
| 7580 - Famphur | EPA 8141B | 10182204 | NELAP | PA |
| 7600 - Fensulfothion | EPA 8141B | 10182204 | NELAP | PA |
| 7605 - Fenthion | EPA 8141B | 10182204 | NELAP | PA |
| 7770 - Malathion | EPA 8141B | 10182204 | NELAP | PA |
| 7785 - Merphos | EPA 8141B | 10182204 | NELAP | PA |
| 7825 - Methyl parathion (Parathion, methyl) | EPA 8141B | 10182204 | NELAP | PA |
| 7850 - Mevinphos | EPA 8141B | 10182204 | NELAP | PA |
| 7905 - Naled | EPA 8141B | 10182204 | NELAP | PA |
| 7955 - Parathion, ethyl | EPA 8141B | 10182204 | NELAP | PA |
| 7985 - Phorate | EPA 8141B | 10182204 | NELAP | PA |
| 8110 - Ronnel | EPA 8141B | 10182204 | NELAP | PA |
| 8125 - Simazine | EPA 8141B | 10182204 | NELAP | PA |
| 8655 - 2,4,5-T | EPA 8151 | 10183003 | NELAP | PA |
| 8545 - 2,4-D | EPA 8151 | 10183003 | NELAP | PA |
| 8560 - 2,4-DB | EPA 8151 | 10183003 | NELAP | PA |
| 8555 - Dalapon | EPA 8151 | 10183003 | NELAP | PA |
| 8595 - Dicamba | EPA 8151 | 10183003 | NELAP | PA |
| 8605 - Dichloroprop (Dichlorprop) | EPA 8151 | 10183003 | NELAP | PA |
| 8620 - Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP) | EPA 8151 | 10183003 | NELAP | PA |



Uncontrolled Copy

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | AR |
|---|---|---|---|---|
| 7775 - MCPA | EPA 8151 | 10183003 | NELAP | PA |
| 7780 - MCPP | EPA 8151 | 10183003 | NELAP | PA |
| 6605 - Pentachlorophenol | EPA 8151 | 10183003 | NELAP | PA |
| 8645 - Picloram | EPA 8151 | 10183003 | NELAP | PA |
| 8650 - Silvex (2,4,5-TP) | EPA 8151 | 10183003 | NELAP | PA |
| 8655 - 2,4,5-T | EPA 8151A | 10183207 | NELAP | PA |
| 8545 - 2,4-D | EPA 8151A | 10183207 | NELAP | PA |
| 8560 - 2,4-DB | EPA 8151A | 10183207 | NELAP | PA |
| 8555 - Dalapon | EPA 8151A | 10183207 | NELAP | PA |
| 8595 - Dicamba | EPA 8151A | 10183207 | NELAP | PA |
| 8605 - Dichloroprop (Dichlorprop) | EPA 8151A | 10183207 | NELAP | PA |
| 8620 - Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP) | EPA 8151A | 10183207 | NELAP | PA |
| 7775 - MCPA | EPA 8151A | 10183207 | NELAP | PA |
| 7780 - MCPP | EPA 8151A | 10183207 | NELAP | PA |
| 6605 - Pentachlorophenol | EPA 8151A | 10183207 | NELAP | PA |
| 8645 - Picloram | EPA 8151A | 10183207 | NELAP | PA |
| 8650 - Silvex (2,4,5-TP) | EPA 8151A | 10183207 | NELAP | PA |
| 5105 - 1,1,1,2-Tetrachloroethane | EPA 8260 | 10184404 | NELAP | PA |
| 5160 - 1,1,1-Trichloroethane | EPA 8260 | 10184404 | NELAP | PA |
| 5110 - 1,1,2,2-Tetrachloroethane | EPA 8260 | 10184404 | NELAP | PA |
| 5185 - 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113) | EPA 8260 | 10184404 | NELAP | PA |
| 5165 - 1,1,2-Trichloroethane | EPA 8260 | 10184404 | NELAP | PA |
| 4630 - 1,1-Dichloroethane | EPA 8260 | 10184404 | NELAP | PA |
| 4640 - 1,1-Dichloroethylene | EPA 8260 | 10184404 | NELAP | PA |
| 4670 - 1,1-Dichloropropene | EPA 8260 | 10184404 | NELAP | PA |
| 5150 - 1,2,3-Trichlorobenzene | EPA 8260 | 10184404 | NELAP | PA |
| 5180 - 1,2,3-Trichloropropane | EPA 8260 | 10184404 | NELAP | PA |
| 5155 - 1,2,4-Trichlorobenzene | EPA 8260 | 10184404 | NELAP | PA |
| 5210 - 1,2,4-Trimethylbenzene | EPA 8260 | 10184404 | NELAP | PA |
| 4570 - 1,2-Dibromo-3-chloropropane (DBCP) | EPA 8260 | 10184404 | NELAP | PA |
| 4585 - 1,2-Dibromoethane (EDB, Ethylene dibromide) | EPA 8260 | 10184404 | NELAP | PA |
| 4610 - 1,2-Dichlorobenzene | EPA 8260 | 10184404 | NELAP | PA |
| 4635 - 1,2-Dichloroethane (Ethylene dichloride) | EPA 8260 | 10184404 | NELAP | PA |
| 4655 - 1,2-Dichloropropane | EPA 8260 | 10184404 | NELAP | PA |
| 5215 - 1,3,5-Trimethylbenzene | EPA 8260 | 10184404 | NELAP | PA |
| 4615 - 1,3-Dichlorobenzene | EPA 8260 | 10184404 | NELAP | PA |
| 4660 - 1,3-Dichloropropane | EPA 8260 | 10184404 | NELAP | PA |
| 4620 - 1,4-Dichlorobenzene | EPA 8260 | 10184404 | NELAP | PA |
| 4735 - 1,4-Dioxane (1,4- Diethyleneoxide) | EPA 8260 | 10184404 | NELAP | PA |
| 4665 - 2,2-Dichloropropane | EPA 8260 | 10184404 | NELAP | PA |
| 4410 - 2-Butanone (Methyl ethyl ketone, MEK) | EPA 8260 | 10184404 | NELAP | PA |
| 4500 - 2-Chloroethyl vinyl ether | EPA 8260 | 10184404 | NELAP | PA |
| 4535 - 2-Chlorotoluene | EPA 8260 | 10184404 | NELAP | PA |
| 4860 - 2-Hexanone | EPA 8260 | 10184404 | NELAP | PA |
| 4540 - 4-Chlorotoluene | EPA 8260 | 10184404 | NELAP | PA |
| 4910 - 4-Isopropyltoluene (p-Cymene) | EPA 8260 | 10184404 | NELAP | PA |
| 4995 - 4-Methyl-2-pentanone (MIBK) | EPA 8260 | 10184404 | NELAP | PA |
| 4315 - Acetone | EPA 8260 | 10184404 | NELAP | PA |
| 4320 - Acetonitrile | EPA 8260 | 10184404 | NELAP | PA |
| 4325 - Acrolein (Propenal) | EPA 8260 | 10184404 | NELAP | PA |



Uncontrolled Copy

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 4340 - Acrylonitrile | EPA 8260 | 10184404 | NELAP | PA |
| 4355 - Allyl chloride (3-Chloropropene) | EPA 8260 | 10184404 | NELAP | PA |
| 4375 - Benzene | EPA 8260 | 10184404 | NELAP | PA |
| 5635 - Benzyl chloride | EPA 8260 | 10184404 | NELAP | PA |
| 4385 - Bromobenzene | EPA 8260 | 10184404 | NELAP | PA |
| 4390 - Bromochloromethane | EPA 8260 | 10184404 | NELAP | PA |
| 4395 - Bromodichloromethane | EPA 8260 | 10184404 | NELAP | PA |
| 4400 - Bromoform | EPA 8260 | 10184404 | NELAP | PA |
| 4450 - Carbon disulfide | EPA 8260 | 10184404 | NELAP | PA |
| 4455 - Carbon tetrachloride | EPA 8260 | 10184404 | NELAP | PA |
| 4475 - Chlorobenzene | EPA 8260 | 10184404 | NELAP | PA |
| 4575 - Chlorodibromomethane | EPA 8260 | 10184404 | NELAP | PA |
| 4485 - Chloroethane (Ethyl chloride) | EPA 8260 | 10184404 | NELAP | PA |
| 4505 - Chloroform | EPA 8260 | 10184404 | NELAP | PA |
| 4525 - Chloroprene (2-Chloro-1,3-butadiene) | EPA 8260 | 10184404 | NELAP | PA |
| 4555 - Cyclohexane | EPA 8260 | 10184404 | NELAP | PA |
| 9375 - Di-isopropylether (DIPE) (Isopropyl ether) | EPA 8260 | 10184404 | NELAP | PA |
| 4580 - Dibromochloropropane | EPA 8260 | 10184404 | NELAP | PA |
| 4595 - Dibromomethane (Methylene bromide) | EPA 8260 | 10184404 | NELAP | PA |
| 4625 - Dichlorodifluoromethane (Freon-12) | EPA 8260 | 10184404 | NELAP | PA |
| 4750 - Ethanol | EPA 8260 | 10184404 | NELAP | PA |
| 4755 - Ethyl acetate | EPA 8260 | 10184404 | NELAP | PA |
| 4810 - Ethyl methacrylate | EPA 8260 | 10184404 | NELAP | PA |
| 4770 - Ethyl-t-butyl ether (ETBE) (2-Ethoxy-2-methylpropane) | EPA 8260 | 10184404 | NELAP | PA |
| 4765 - Ethylbenzene | EPA 8260 | 10184404 | NELAP | PA |
| 9408 - Gasoline range organics (GRO) | EPA 8260 | 10184404 | NELAP | PA |
| 4835 - Hexachlorobutadiene | EPA 8260 | 10184404 | NELAP | PA |
| 4875 - Isobutyl alcohol (2-Methyl-1-propanol) | EPA 8260 | 10184404 | NELAP | PA |
| 4895 - Isopropyl alcohol (2-Propanol, Isopropanol) | EPA 8260 | 10184404 | NELAP | PA |
| 4900 - Isopropylbenzene | EPA 8260 | 10184404 | NELAP | PA |
| 4925 - Methacrylonitrile | EPA 8260 | 10184404 | NELAP | PA |
| 4950 - Methyl bromide (Bromomethane) | EPA 8260 | 10184404 | NELAP | PA |
| 4960 - Methyl chloride (Chloromethane) | EPA 8260 | 10184404 | NELAP | PA |
| 5000 - Methyl tert-butyl ether (MTBE) | EPA 8260 | 10184404 | NELAP | PA |
| 4965 - Methylcyclohexane | EPA 8260 | 10184404 | NELAP | PA |
| 4975 - Methylene chloride (Dichloromethane) | EPA 8260 | 10184404 | NELAP | PA |
| 5005 - Naphthalene | EPA 8260 | 10184404 | NELAP | PA |
| 5035 - Pentachloroethane | EPA 8260 | 10184404 | NELAP | PA |
| 5080 - Propionitrile (Ethyl cyanide) | EPA 8260 | 10184404 | NELAP | PA |
| 5100 - Styrene | EPA 8260 | 10184404 | NELAP | PA |
| 4370 - T-amylmethylether (TAME) | EPA 8260 | 10184404 | NELAP | PA |
| 5115 - Tetrachloroethylene (Perchloroethylene) | EPA 8260 | 10184404 | NELAP | PA |
| 5140 - Toluene | EPA 8260 | 10184404 | NELAP | PA |
| 5170 - Trichloroethene (Trichloroethylene) | EPA 8260 | 10184404 | NELAP | PA |
| 5175 - Trichlorofluoromethane (Fluorotrichloromethane, Freon 11) | EPA 8260 | 10184404 | NELAP | PA |
| 5225 - Vinyl acetate | EPA 8260 | 10184404 | NELAP | PA |
| 5235 - Vinyl chloride | EPA 8260 | 10184404 | NELAP | PA |



Uncontrolled Copy

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 5260 - Xylene (total) | EPA 8260 | 10184404 | NELAP | PA |
| 4680 - cis-1,3-Dichloropropene | EPA 8260 | 10184404 | NELAP | PA |
| 5240 - m+p-xylene | EPA 8260 | 10184404 | NELAP | PA |
| 4425 - n-Butyl alcohol (1-Butanol, n-Butanol) | EPA 8260 | 10184404 | NELAP | PA |
| 4435 - n-Butylbenzene | EPA 8260 | 10184404 | NELAP | PA |
| 5090 - n-Propylbenzene | EPA 8260 | 10184404 | NELAP | PA |
| 5250 - o-Xylene | EPA 8260 | 10184404 | NELAP | PA |
| 4440 - sec-Butylbenzene | EPA 8260 | 10184404 | NELAP | PA |
| 4420 - tert-Butyl alcohol | EPA 8260 | 10184404 | NELAP | PA |
| 4445 - tert-Butylbenzene | EPA 8260 | 10184404 | NELAP | PA |
| 4700 - trans-1,2-Dichloroethylene | EPA 8260 | 10184404 | NELAP | PA |
| 4685 - trans-1,3-Dichloropropylene | EPA 8260 | 10184404 | NELAP | PA |
| 4605 - trans-1,4-Dichloro-2-butene | EPA 8260 | 10184404 | NELAP | PA |
| 5105 - 1,1,1,2-Tetrachloroethane | EPA 8260B | 10184802 | NELAP | PA |
| 5160 - 1,1,1-Trichloroethane | EPA 8260B | 10184802 | NELAP | PA |
| 5110 - 1,1,2,2-Tetrachloroethane | EPA 8260B | 10184802 | NELAP | PA |
| 5195 - 1,1,2-Trichloro-1,2,2-trifluoroethane | EPA 8260B | 10184802 | NELAP | PA |
| 5185 - 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113) | EPA 8260B | 10184802 | NELAP | PA |
| 5165 - 1,1,2-Trichloroethane | EPA 8260B | 10184802 | NELAP | PA |
| 4630 - 1,1-Dichloroethane | EPA 8260B | 10184802 | NELAP | PA |
| 4640 - 1,1-Dichloroethylene | EPA 8260B | 10184802 | NELAP | PA |
| 4670 - 1,1-Dichloropropene | EPA 8260B | 10184802 | NELAP | PA |
| 5150 - 1,2,3-Trichlorobenzene | EPA 8260B | 10184802 | NELAP | PA |
| 5180 - 1,2,3-Trichloropropane | EPA 8260B | 10184802 | NELAP | PA |
| 5155 - 1,2,4-Trichlorobenzene | EPA 8260B | 10184802 | NELAP | PA |
| 5210 - 1,2,4-Trimethylbenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4570 - 1,2-Dibromo-3-chloropropane (DBCP) | EPA 8260B | 10184802 | NELAP | PA |
| 4585 - 1,2-Dibromoethane (EDB, Ethylene dibromide) | EPA 8260B | 10184802 | NELAP | PA |
| 4610 - 1,2-Dichlorobenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4635 - 1,2-Dichloroethane (Ethylene dichloride) | EPA 8260B | 10184802 | NELAP | PA |
| 4655 - 1,2-Dichloropropane | EPA 8260B | 10184802 | NELAP | PA |
| 5215 - 1,3,5-Trimethylbenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4615 - 1,3-Dichlorobenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4660 - 1,3-Dichloropropane | EPA 8260B | 10184802 | NELAP | PA |
| 4620 - 1,4-Dichlorobenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4735 - 1,4-Dioxane (1,4- Diethyleneoxide) | EPA 8260B | 10184802 | NELAP | PA |
| 4665 - 2,2-Dichloropropane | EPA 8260B | 10184802 | NELAP | PA |
| 4410 - 2-Butanone (Methyl ethyl ketone, MEK) | EPA 8260B | 10184802 | NELAP | PA |
| 4500 - 2-Chloroethyl vinyl ether | EPA 8260B | 10184802 | NELAP | PA |
| 4535 - 2-Chlorotoluene | EPA 8260B | 10184802 | NELAP | PA |
| 4860 - 2-Hexanone | EPA 8260B | 10184802 | NELAP | PA |
| 4368 - 2-methyl-2-butanol (tert-Amyl alcohol) | EPA 8260B | 10184802 | NELAP | PA |
| 4540 - 4-Chlorotoluene | EPA 8260B | 10184802 | NELAP | PA |
| 4910 - 4-Isopropyltoluene (p-Cymene) | EPA 8260B | 10184802 | NELAP | PA |
| 4995 - 4-Methyl-2-pentanone (MIBK) | EPA 8260B | 10184802 | NELAP | PA |
| 4315 - Acetone | EPA 8260B | 10184802 | NELAP | PA |
| 4320 - Acetonitrile | EPA 8260B | 10184802 | NELAP | PA |
| 4325 - Acrolein (Propenal) | EPA 8260B | 10184802 | NELAP | PA |
| 4340 - Acrylonitrile | EPA 8260B | 10184802 | NELAP | PA |



Uncontrolled Copy

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 4355 - Allyl chloride (3-Chloropropene) | EPA 8260B | 10184802 | NELAP | PA |
| 4375 - Benzene | EPA 8260B | 10184802 | NELAP | PA |
| 5635 - Benzyl chloride | EPA 8260B | 10184802 | NELAP | PA |
| 4380 - Bromoacetone | EPA 8260B | 10184802 | NELAP | PA |
| 4385 - Bromobenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4390 - Bromochloromethane | EPA 8260B | 10184802 | NELAP | PA |
| 4395 - Bromodichloromethane | EPA 8260B | 10184802 | NELAP | PA |
| 4400 - Bromoform | EPA 8260B | 10184802 | NELAP | PA |
| 4450 - Carbon disulfide | EPA 8260B | 10184802 | NELAP | PA |
| 4455 - Carbon tetrachloride | EPA 8260B | 10184802 | NELAP | PA |
| 4475 - Chlorobenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4575 - Chlorodibromomethane | EPA 8260B | 10184802 | NELAP | PA |
| 4485 - Chloroethane (Ethyl chloride) | EPA 8260B | 10184802 | NELAP | PA |
| 4505 - Chloroform | EPA 8260B | 10184802 | NELAP | PA |
| 4525 - Chloroprene (2-Chloro-1,3-butadiene) | EPA 8260B | 10184802 | NELAP | PA |
| 4555 - Cyclohexane | EPA 8260B | 10184802 | NELAP | PA |
| 4560 - Cyclohexanone | EPA 8260B | 10184802 | NELAP | PA |
| 9375 - Di-isopropylether (DIPE) (Isopropyl ether) | EPA 8260B | 10184802 | NELAP | PA |
| 4580 - Dibromochloropropane | EPA 8260B | 10184802 | NELAP | PA |
| 4595 - Dibromomethane (Methylene bromide) | EPA 8260B | 10184802 | NELAP | PA |
| 4625 - Dichlorodifluoromethane (Freon-12) | EPA 8260B | 10184802 | NELAP | PA |
| 4745 - Epichlorohydrin (1-Chloro-2,3-epoxypropane) | EPA 8260B | 10184802 | NELAP | PA |
| 4750 - Ethanol | EPA 8260B | 10184802 | NELAP | PA |
| 4755 - Ethyl acetate | EPA 8260B | 10184802 | NELAP | PA |
| 4810 - Ethyl methacrylate | EPA 8260B | 10184802 | NELAP | PA |
| 4770 - Ethyl-t-butyl ether (ETBE) (2-Ethoxy-2-methylpropane) | EPA 8260B | 10184802 | NELAP | PA |
| 4765 - Ethylbenzene | EPA 8260B | 10184802 | NELAP | PA |
| 9408 - Gasoline range organics (GRO) | EPA 8260B | 10184802 | NELAP | PA |
| 4835 - Hexachlorobutadiene | EPA 8260B | 10184802 | NELAP | PA |
| 4870 - Iodomethane (Methyl iodide) | EPA 8260B | 10184802 | NELAP | PA |
| 4875 - Isobutyl alcohol (2-Methyl-1-propanol) | EPA 8260B | 10184802 | NELAP | PA |
| 4895 - Isopropyl alcohol (2-Propanol, Isopropanol) | EPA 8260B | 10184802 | NELAP | PA |
| 4900 - Isopropylbenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4925 - Methacrylonitrile | EPA 8260B | 10184802 | NELAP | PA |
| 4940 - Methyl acetate | EPA 8260B | 10184802 | NELAP | PA |
| 4950 - Methyl bromide (Bromomethane) | EPA 8260B | 10184802 | NELAP | PA |
| 4960 - Methyl chloride (Chloromethane) | EPA 8260B | 10184802 | NELAP | PA |
| 5000 - Methyl tert-butyl ether (MTBE) | EPA 8260B | 10184802 | NELAP | PA |
| 4965 - Methylcyclohexane | EPA 8260B | 10184802 | NELAP | PA |
| 4975 - Methylene chloride (Dichloromethane) | EPA 8260B | 10184802 | NELAP | PA |
| 5005 - Naphthalene | EPA 8260B | 10184802 | NELAP | PA |
| 5035 - Pentachloroethane | EPA 8260B | 10184802 | NELAP | PA |
| 5080 - Propionitrile (Ethyl cyanide) | EPA 8260B | 10184802 | NELAP | PA |
| 5100 - Styrene | EPA 8260B | 10184802 | NELAP | PA |
| 4370 - T-amylmethylether (TAME) | EPA 8260B | 10184802 | NELAP | PA |
| 5115 - Tetrachloroethylene (Perchloroethylene) | EPA 8260B | 10184802 | NELAP | PA |
| 5140 - Toluene | EPA 8260B | 10184802 | NELAP | PA |



Uncontrolled Copy

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 5170 - Trichloroethene (Trichloroethylene) | EPA 8260B | 10184802 | NELAP | PA |
| 5175 - Trichlorofluoromethane (Fluorotrichloromethane, Freon 11) | EPA 8260B | 10184802 | NELAP | PA |
| 5225 - Vinyl acetate | EPA 8260B | 10184802 | NELAP | PA |
| 5235 - Vinyl chloride | EPA 8260B | 10184802 | NELAP | PA |
| 5260 - Xylene (total) | EPA 8260B | 10184802 | NELAP | PA |
| 4705 - cis & trans-1,2-Dichloroethene | EPA 8260B | 10184802 | NELAP | PA |
| 4645 - cis-1,2-Dichloroethylene | EPA 8260B | 10184802 | NELAP | PA |
| 4680 - cis-1,3-Dichloropropene | EPA 8260B | 10184802 | NELAP | PA |
| 5240 - m+p-xylene | EPA 8260B | 10184802 | NELAP | PA |
| 4425 - n-Butyl alcohol (1-Butanol, n-Butanol) | EPA 8260B | 10184802 | NELAP | PA |
| 4435 - n-Butylbenzene | EPA 8260B | 10184802 | NELAP | PA |
| 5090 - n-Propylbenzene | EPA 8260B | 10184802 | NELAP | PA |
| 5250 - o-Xylene | EPA 8260B | 10184802 | NELAP | PA |
| 4440 - sec-Butylbenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4420 - tert-Butyl alcohol | EPA 8260B | 10184802 | NELAP | PA |
| 4445 - tert-Butylbenzene | EPA 8260B | 10184802 | NELAP | PA |
| 4700 - trans-1,2-Dichloroethylene | EPA 8260B | 10184802 | NELAP | PA |
| 4685 - trans-1,3-Dichloropropylene | EPA 8260B | 10184802 | NELAP | PA |
| 4605 - trans-1,4-Dichloro-2-butene | EPA 8260B | 10184802 | NELAP | PA |
| 5510 - Acetophenone | EPA 8270 | 10185203 | NELAP | PA |
| 5560 - Aramite | EPA 8270 | 10185203 | NELAP | PA |
| 5900 - Dibenz(a, j) acridine | EPA 8270 | 10185203 | NELAP | PA |
| 5765 - bis(2-Chloroethyl) ether | EPA 8270 | 10185203 | NELAP | PA |
| 6550 - n-Nitrosomethylethylamine | EPA 8270 | 10185203 | NELAP | PA |
| 6703 - 1,1'-Biphenyl (BZ-0) | EPA 8270C | 10185805 | NELAP | PA |
| 6705 - 1,2,3,4-Tetrachlorobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 6710 - 1,2,3,5-Tetrachlorobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 6715 - 1,2,4,5-Tetrachlorobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 5155 - 1,2,4-Trichlorobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 4610 - 1,2-Dichlorobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 6155 - 1,2-Dinitrobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 6220 - 1,2-Diphenylhydrazine | EPA 8270C | 10185805 | NELAP | PA |
| 6800 - 1,3,5-Trichlorobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB) | EPA 8270C | 10185805 | NELAP | PA |
| 4615 - 1,3-Dichlorobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 6160 - 1,3-Dinitrobenzene (1,3-DNB) | EPA 8270C | 10185805 | NELAP | PA |
| 4620 - 1,4-Dichlorobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 6165 - 1,4-Dinitrobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 4735 - 1,4-Dioxane (1,4- Diethyleneoxide) | EPA 8270C | 10185805 | NELAP | PA |
| 6420 - 1,4-Naphthoquinone | EPA 8270C | 10185805 | NELAP | PA |
| 6630 - 1,4-Phenylenediamine | EPA 8270C | 10185805 | NELAP | PA |
| 5790 - 1-Chloronaphthalene | EPA 8270C | 10185805 | NELAP | PA |
| 6380 - 1-Methylnaphthalene | EPA 8270C | 10185805 | NELAP | PA |
| 6425 - 1-Naphthylamine | EPA 8270C | 10185805 | NELAP | PA |
| 6735 - 2,3,4,6-Tetrachlorophenol | EPA 8270C | 10185805 | NELAP | PA |
| 6835 - 2,4,5-Trichlorophenol | EPA 8270C | 10185805 | NELAP | PA |
| 6840 - 2,4,6-Trichlorophenol | EPA 8270C | 10185805 | NELAP | PA |
| 6000 - 2,4-Dichlorophenol | EPA 8270C | 10185805 | NELAP | PA |
| 6130 - 2,4-Dimethylphenol | EPA 8270C | 10185805 | NELAP | PA |
| 6175 - 2,4-Dinitrophenol | EPA 8270C | 10185805 | NELAP | PA |
| 6185 - 2,4-Dinitrotoluene (2,4-DNT) | EPA 8270C | 10185805 | NELAP | PA |
| 6005 - 2,6-Dichlorophenol | EPA 8270C | 10185805 | NELAP | PA |
| 6190 - 2,6-Dinitrotoluene (2,6-DNT) | EPA 8270C | 10185805 | NELAP | PA |
| 5515 - 2-Acetylaminofluorene | EPA 8270C | 10185805 | NELAP | PA |



Uncontrolled Copy

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 5795 - 2-Chloronaphthalene | EPA 8270C | 10185805 | NELAP | PA |
| 5800 - 2-Chlorophenol | EPA 8270C | 10185805 | NELAP | PA |
| 6360 - 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol) | EPA 8270C | 10185805 | NELAP | PA |
| 5145 - 2-Methylaniline (o-Toluidine) | EPA 8270C | 10185805 | NELAP | PA |
| 6385 - 2-Methylnaphthalene | EPA 8270C | 10185805 | NELAP | PA |
| 6400 - 2-Methylphenol (o-Cresol) | EPA 8270C | 10185805 | NELAP | PA |
| 6430 - 2-Naphthylamine | EPA 8270C | 10185805 | NELAP | PA |
| 6460 - 2-Nitroaniline | EPA 8270C | 10185805 | NELAP | PA |
| 6490 - 2-Nitrophenol | EPA 8270C | 10185805 | NELAP | PA |
| 5050 - 2-Picoline (2-Methylpyridine) | EPA 8270C | 10185805 | NELAP | PA |
| 5945 - 3,3'-Dichlorobenzidine | EPA 8270C | 10185805 | NELAP | PA |
| 6100 - 3,3'-Dimethoxybenzidine | EPA 8270C | 10185805 | NELAP | PA |
| 6120 - 3,3'-Dimethylbenzidine | EPA 8270C | 10185805 | NELAP | PA |
| 6355 - 3-Methylcholanthrene | EPA 8270C | 10185805 | NELAP | PA |
| 6405 - 3-Methylphenol (m-Cresol) | EPA 8270C | 10185805 | NELAP | PA |
| 6465 - 3-Nitroaniline | EPA 8270C | 10185805 | NELAP | PA |
| 6365 - 4,4'-Methylenebis(2-chloroaniline) | EPA 8270C | 10185805 | NELAP | PA |
| 5540 - 4-Aminobiphenyl | EPA 8270C | 10185805 | NELAP | PA |
| 5660 - 4-Bromophenyl phenyl ether | EPA 8270C | 10185805 | NELAP | PA |
| 5700 - 4-Chloro-3-methylphenol | EPA 8270C | 10185805 | NELAP | PA |
| 5745 - 4-Chloroaniline | EPA 8270C | 10185805 | NELAP | PA |
| 5825 - 4-Chlorophenyl phenylether | EPA 8270C | 10185805 | NELAP | PA |
| 6410 - 4-Methylphenol (p-Cresol) | EPA 8270C | 10185805 | NELAP | PA |
| 6470 - 4-Nitroaniline | EPA 8270C | 10185805 | NELAP | PA |
| 6500 - 4-Nitrophenol | EPA 8270C | 10185805 | NELAP | PA |
| 6510 - 4-Nitroquinoline 1-oxide | EPA 8270C | 10185805 | NELAP | PA |
| 6570 - 5-Nitro-o-toluidine | EPA 8270C | 10185805 | NELAP | PA |
| 6115 - 7,12-Dimethylbenz(a) anthracene | EPA 8270C | 10185805 | NELAP | PA |
| 5500 - Acenaphthene | EPA 8270C | 10185805 | NELAP | PA |
| 5505 - Acenaphthylene | EPA 8270C | 10185805 | NELAP | PA |
| 5510 - Acetophenone | EPA 8270C | 10185805 | NELAP | PA |
| 5545 - Aniline | EPA 8270C | 10185805 | NELAP | PA |
| 5555 - Anthracene | EPA 8270C | 10185805 | NELAP | PA |
| 5560 - Aramite | EPA 8270C | 10185805 | NELAP | PA |
| 7065 - Atrazine | EPA 8270C | 10185805 | NELAP | PA |
| 5570 - Benzaldehyde | EPA 8270C | 10185805 | NELAP | PA |
| 5567 - Benzenethiol | EPA 8270C | 10185805 | NELAP | PA |
| 5595 - Benzidine | EPA 8270C | 10185805 | NELAP | PA |
| 5575 - Benzo(a)anthracene | EPA 8270C | 10185805 | NELAP | PA |
| 5580 - Benzo(a)pyrene | EPA 8270C | 10185805 | NELAP | PA |
| 5585 - Benzo(b)fluoranthene | EPA 8270C | 10185805 | NELAP | PA |
| 5590 - Benzo(g,h,i)perylene | EPA 8270C | 10185805 | NELAP | PA |
| 5600 - Benzo(k)fluoranthene | EPA 8270C | 10185805 | NELAP | PA |
| 5610 - Benzoic acid | EPA 8270C | 10185805 | NELAP | PA |
| 5630 - Benzyl alcohol | EPA 8270C | 10185805 | NELAP | PA |
| 5670 - Butyl benzyl phthalate | EPA 8270C | 10185805 | NELAP | PA |
| 7180 - Caprolactam | EPA 8270C | 10185805 | NELAP | PA |
| 5680 - Carbazole | EPA 8270C | 10185805 | NELAP | PA |
| 7260 - Chlorobenzilate | EPA 8270C | 10185805 | NELAP | PA |
| 5855 - Chrysene | EPA 8270C | 10185805 | NELAP | PA |
| 6065 - Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP) | EPA 8270C | 10185805 | NELAP | PA |
| 5925 - Di-n-butyl phthalate | EPA 8270C | 10185805 | NELAP | PA |
| 6200 - Di-n-octyl phthalate | EPA 8270C | 10185805 | NELAP | PA |
| 7405 - Diallate | EPA 8270C | 10185805 | NELAP | PA |



Uncontrolled Copy

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 9354 - Dibenz(a, h) acridine | EPA 8270C | 10185805 | NELAP | PA |
| 5900 - Dibenz(a, j) acridine | EPA 8270C | 10185805 | NELAP | PA |
| 5895 - Dibenz(a,h) anthracene | EPA 8270C | 10185805 | NELAP | PA |
| 5905 - Dibenzofuran | EPA 8270C | 10185805 | NELAP | PA |
| 6070 - Diethyl phthalate | EPA 8270C | 10185805 | NELAP | PA |
| 7475 - Dimethoate | EPA 8270C | 10185805 | NELAP | PA |
| 6135 - Dimethyl phthalate | EPA 8270C | 10185805 | NELAP | PA |
| 8620 - Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP) | EPA 8270C | 10185805 | NELAP | PA |
| 6205 - Diphenylamine | EPA 8270C | 10185805 | NELAP | PA |
| 8625 - Disulfoton | EPA 8270C | 10185805 | NELAP | PA |
| 6260 - Ethyl methanesulfonate | EPA 8270C | 10185805 | NELAP | PA |
| 7580 - Famphur | EPA 8270C | 10185805 | NELAP | PA |
| 6265 - Fluoranthene | EPA 8270C | 10185805 | NELAP | PA |
| 6270 - Fluorene | EPA 8270C | 10185805 | NELAP | PA |
| 6275 - Hexachlorobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 4835 - Hexachlorobutadiene | EPA 8270C | 10185805 | NELAP | PA |
| 6285 - Hexachlorocyclopentadiene | EPA 8270C | 10185805 | NELAP | PA |
| 4840 - Hexachloroethane | EPA 8270C | 10185805 | NELAP | PA |
| 6295 - Hexachloropropene | EPA 8270C | 10185805 | NELAP | PA |
| 6312 - Indene | EPA 8270C | 10185805 | NELAP | PA |
| 6315 - Indeno(1,2,3-cd) pyrene | EPA 8270C | 10185805 | NELAP | PA |
| 7725 - Isodrin | EPA 8270C | 10185805 | NELAP | PA |
| 6320 - Isophorone | EPA 8270C | 10185805 | NELAP | PA |
| 6325 - Isosafrole | EPA 8270C | 10185805 | NELAP | PA |
| 7740 - Kepone | EPA 8270C | 10185805 | NELAP | PA |
| 6345 - Methapyrilene | EPA 8270C | 10185805 | NELAP | PA |
| 6375 - Methyl methanesulfonate | EPA 8270C | 10185805 | NELAP | PA |
| 7825 - Methyl parathion (Parathion, methyl) | EPA 8270C | 10185805 | NELAP | PA |
| 5005 - Naphthalene | EPA 8270C | 10185805 | NELAP | PA |
| 5015 - Nitrobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 7955 - Parathion, ethyl | EPA 8270C | 10185805 | NELAP | PA |
| 6590 - Pentachlorobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 6600 - Pentachloronitrobenzene | EPA 8270C | 10185805 | NELAP | PA |
| 6605 - Pentachlorophenol | EPA 8270C | 10185805 | NELAP | PA |
| 6610 - Phenacetin | EPA 8270C | 10185805 | NELAP | PA |
| 6615 - Phenanthrene | EPA 8270C | 10185805 | NELAP | PA |
| 6625 - Phenol | EPA 8270C | 10185805 | NELAP | PA |
| 7985 - Phorate | EPA 8270C | 10185805 | NELAP | PA |
| 6640 - Phthalic anhydride | EPA 8270C | 10185805 | NELAP | PA |
| 6650 - Pronamide (Kerb) | EPA 8270C | 10185805 | NELAP | PA |
| 6665 - Pyrene | EPA 8270C | 10185805 | NELAP | PA |
| 5095 - Pyridine | EPA 8270C | 10185805 | NELAP | PA |
| 6670 - Quinoline | EPA 8270C | 10185805 | NELAP | PA |
| 6685 - Safrole | EPA 8270C | 10185805 | NELAP | PA |
| 8235 - Thionazin (Zinophos) | EPA 8270C | 10185805 | NELAP | PA |
| 6125 - a-a-Dimethylphenethylamine | EPA 8270C | 10185805 | NELAP | PA |
| 5760 - bis(2-Chloroethoxy)methane | EPA 8270C | 10185805 | NELAP | PA |
| 5765 - bis(2-Chloroethyl) ether | EPA 8270C | 10185805 | NELAP | PA |
| 5780 - bis(2-Chloroisopropyl) ether | EPA 8270C | 10185805 | NELAP | PA |
| 6248 - bis(2-Ethoxyethyl) phthalate | EPA 8270C | 10185805 | NELAP | PA |
| 6062 - bis(2-Ethylhexyl)adipate | EPA 8270C | 10185805 | NELAP | PA |
| 5025 - n-Nitroso-di-n-butylamine | EPA 8270C | 10185805 | NELAP | PA |
| 6545 - n-Nitrosodi-n-propylamine | EPA 8270C | 10185805 | NELAP | PA |
| 6525 - n-Nitrosodiethylamine | EPA 8270C | 10185805 | NELAP | PA |
| 6530 - n-Nitrosodimethylamine | EPA 8270C | 10185805 | NELAP | PA |

Uncontrolled Copy

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 6535 - n-Nitrosodiphenylamine | EPA 8270C | 10185805 | NELAP | PA |
| 6550 - n-Nitrosomethylethylamine | EPA 8270C | 10185805 | NELAP | PA |
| 6555 - n-Nitrosomorpholine | EPA 8270C | 10185805 | NELAP | PA |
| 6560 - n-Nitrosopiperidine | EPA 8270C | 10185805 | NELAP | PA |
| 6565 - n-Nitrosopyrrolidine | EPA 8270C | 10185805 | NELAP | PA |
| 8290 - o,o,o-Triethyl phosphorothioate | EPA 8270C | 10185805 | NELAP | PA |
| 8310 - tris-(2,3-Dibromopropyl) phosphate (tris-BP) | EPA 8270C | 10185805 | NELAP | PA |
| 6703 - 1,1'-Biphenyl (BZ-0) | EPA 8270D | 10186002 | NELAP | PA |
| 6705 - 1,2,3,4-Tetrachlorobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 6710 - 1,2,3,5-Tetrachlorobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 6715 - 1,2,4,5-Tetrachlorobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 5155 - 1,2,4-Trichlorobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 4610 - 1,2-Dichlorobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 6155 - 1,2-Dinitrobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 6220 - 1,2-Diphenylhydrazine | EPA 8270D | 10186002 | NELAP | PA |
| 6800 - 1,3,5-Trichlorobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB) | EPA 8270D | 10186002 | NELAP | PA |
| 4615 - 1,3-Dichlorobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 6160 - 1,3-Dinitrobenzene (1,3-DNB) | EPA 8270D | 10186002 | NELAP | PA |
| 4620 - 1,4-Dichlorobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 6165 - 1,4-Dinitrobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 4735 - 1,4-Dioxane (1,4- Diethyleneoxide) | EPA 8270D | 10186002 | NELAP | PA |
| 6420 - 1,4-Naphthoquinone | EPA 8270D | 10186002 | NELAP | PA |
| 6630 - 1,4-Phenylenediamine | EPA 8270D | 10186002 | NELAP | PA |
| 5790 - 1-Chloronaphthalene | EPA 8270D | 10186002 | NELAP | PA |
| 6380 - 1-Methylnaphthalene | EPA 8270D | 10186002 | NELAP | PA |
| 6425 - 1-Naphthylamine | EPA 8270D | 10186002 | NELAP | PA |
| 6735 - 2,3,4,6-Tetrachlorophenol | EPA 8270D | 10186002 | NELAP | PA |
| 6835 - 2,4,5-Trichlorophenol | EPA 8270D | 10186002 | NELAP | PA |
| 6840 - 2,4,6-Trichlorophenol | EPA 8270D | 10186002 | NELAP | PA |
| 6000 - 2,4-Dichlorophenol | EPA 8270D | 10186002 | NELAP | PA |
| 6130 - 2,4-Dimethylphenol | EPA 8270D | 10186002 | NELAP | PA |
| 6175 - 2,4-Dinitrophenol | EPA 8270D | 10186002 | NELAP | PA |
| 6185 - 2,4-Dinitrotoluene (2,4-DNT) | EPA 8270D | 10186002 | NELAP | PA |
| 6005 - 2,6-Dichlorophenol | EPA 8270D | 10186002 | NELAP | PA |
| 6190 - 2,6-Dinitrotoluene (2,6-DNT) | EPA 8270D | 10186002 | NELAP | PA |
| 5515 - 2-Acetylaminofluorene | EPA 8270D | 10186002 | NELAP | PA |
| 5795 - 2-Chloronaphthalene | EPA 8270D | 10186002 | NELAP | PA |
| 5800 - 2-Chlorophenol | EPA 8270D | 10186002 | NELAP | PA |
| 6360 - 2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol) | EPA 8270D | 10186002 | NELAP | PA |
| 5145 - 2-Methylaniline (o-Toluidine) | EPA 8270D | 10186002 | NELAP | PA |
| 6385 - 2-Methylnaphthalene | EPA 8270D | 10186002 | NELAP | PA |
| 6400 - 2-Methylphenol (o-Cresol) | EPA 8270D | 10186002 | NELAP | PA |
| 6430 - 2-Naphthylamine | EPA 8270D | 10186002 | NELAP | PA |
| 6460 - 2-Nitroaniline | EPA 8270D | 10186002 | NELAP | PA |
| 6490 - 2-Nitrophenol | EPA 8270D | 10186002 | NELAP | PA |
| 5050 - 2-Picoline (2-Methylpyridine) | EPA 8270D | 10186002 | NELAP | PA |
| 5945 - 3,3'-Dichlorobenzidine | EPA 8270D | 10186002 | NELAP | PA |
| 6100 - 3,3'-Dimethoxybenzidine | EPA 8270D | 10186002 | NELAP | PA |
| 6120 - 3,3'-Dimethylbenzidine | EPA 8270D | 10186002 | NELAP | PA |
| 6355 - 3-Methylcholanthrene | EPA 8270D | 10186002 | NELAP | PA |
| 6405 - 3-Methylphenol (m-Cresol) | EPA 8270D | 10186002 | NELAP | PA |
| 6465 - 3-Nitroaniline | EPA 8270D | 10186002 | NELAP | PA |
| 6365 - 4,4'-Methylenebis(2-chloroaniline) | EPA 8270D | 10186002 | NELAP | PA |



Uncontrolled Copy

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 5540 - 4-Aminobiphenyl | EPA 8270D | 10186002 | NELAP | PA |
| 5660 - 4-Bromophenyl phenyl ether | EPA 8270D | 10186002 | NELAP | PA |
| 5700 - 4-Chloro-3-methylphenol | EPA 8270D | 10186002 | NELAP | PA |
| 5745 - 4-Chloroaniline | EPA 8270D | 10186002 | NELAP | PA |
| 5825 - 4-Chlorophenyl phenylether | EPA 8270D | 10186002 | NELAP | PA |
| 6410 - 4-Methylphenol (p-Cresol) | EPA 8270D | 10186002 | NELAP | PA |
| 6470 - 4-Nitroaniline | EPA 8270D | 10186002 | NELAP | PA |
| 6500 - 4-Nitrophenol | EPA 8270D | 10186002 | NELAP | PA |
| 6510 - 4-Nitroquinoline 1-oxide | EPA 8270D | 10186002 | NELAP | PA |
| 6570 - 5-Nitro-o-toluidine | EPA 8270D | 10186002 | NELAP | PA |
| 6115 - 7,12-Dimethylbenz(a) anthracene | EPA 8270D | 10186002 | NELAP | PA |
| 5500 - Acenaphthene | EPA 8270D | 10186002 | NELAP | PA |
| 5505 - Acenaphthylene | EPA 8270D | 10186002 | NELAP | PA |
| 5510 - Acetophenone | EPA 8270D | 10186002 | NELAP | PA |
| 5545 - Aniline | EPA 8270D | 10186002 | NELAP | PA |
| 5555 - Anthracene | EPA 8270D | 10186002 | NELAP | PA |
| 5560 - Aramite | EPA 8270D | 10186002 | NELAP | PA |
| 7065 - Atrazine | EPA 8270D | 10186002 | NELAP | PA |
| 5567 - Benzenethiol | EPA 8270D | 10186002 | NELAP | PA |
| 5595 - Benzidine | EPA 8270D | 10186002 | NELAP | PA |
| 5575 - Benzo(a)anthracene | EPA 8270D | 10186002 | NELAP | PA |
| 5580 - Benzo(a)pyrene | EPA 8270D | 10186002 | NELAP | PA |
| 5585 - Benzo(b)fluoranthene | EPA 8270D | 10186002 | NELAP | PA |
| 5590 - Benzo(g,h,i)perylene | EPA 8270D | 10186002 | NELAP | PA |
| 5600 - Benzo(k)fluoranthene | EPA 8270D | 10186002 | NELAP | PA |
| 5610 - Benzoic acid | EPA 8270D | 10186002 | NELAP | PA |
| 5630 - Benzyl alcohol | EPA 8270D | 10186002 | NELAP | PA |
| 5670 - Butyl benzyl phthalate | EPA 8270D | 10186002 | NELAP | PA |
| 7180 - Caprolactam | EPA 8270D | 10186002 | NELAP | PA |
| 5680 - Carbazole | EPA 8270D | 10186002 | NELAP | PA |
| 7260 - Chlorobenzilate | EPA 8270D | 10186002 | NELAP | PA |
| 5855 - Chrysene | EPA 8270D | 10186002 | NELAP | PA |
| 6065 - Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP) | EPA 8270D | 10186002 | NELAP | PA |
| 5925 - Di-n-butyl phthalate | EPA 8270D | 10186002 | NELAP | PA |
| 6200 - Di-n-octyl phthalate | EPA 8270D | 10186002 | NELAP | PA |
| 7405 - Diallate | EPA 8270D | 10186002 | NELAP | PA |
| 9354 - Dibenz(a, h) acridine | EPA 8270D | 10186002 | NELAP | PA |
| 5900 - Dibenz(a, j) acridine | EPA 8270D | 10186002 | NELAP | PA |
| 5895 - Dibenz(a,h) anthracene | EPA 8270D | 10186002 | NELAP | PA |
| 5905 - Dibenzofuran | EPA 8270D | 10186002 | NELAP | PA |
| 6070 - Diethyl phthalate | EPA 8270D | 10186002 | NELAP | PA |
| 7475 - Dimethoate | EPA 8270D | 10186002 | NELAP | PA |
| 6135 - Dimethyl phthalate | EPA 8270D | 10186002 | NELAP | PA |
| 8620 - Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP) | EPA 8270D | 10186002 | NELAP | PA |
| 6205 - Diphenylamine | EPA 8270D | 10186002 | NELAP | PA |
| 8625 - Disulfoton | EPA 8270D | 10186002 | NELAP | PA |
| 6260 - Ethyl methanesulfonate | EPA 8270D | 10186002 | NELAP | PA |
| 7580 - Famphur | EPA 8270D | 10186002 | NELAP | PA |
| 6265 - Fluoranthene | EPA 8270D | 10186002 | NELAP | PA |
| 6270 - Fluorene | EPA 8270D | 10186002 | NELAP | PA |
| 6275 - Hexachlorobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 4835 - Hexachlorobutadiene | EPA 8270D | 10186002 | NELAP | PA |
| 6285 - Hexachlorocyclopentadiene | EPA 8270D | 10186002 | NELAP | PA |
| 4840 - Hexachloroethane | EPA 8270D | 10186002 | NELAP | PA |



Uncontrolled Copy

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | All |
|---|---|---|---|---|
| 6295 - Hexachloropropene | EPA 8270D | 10186002 | NELAP | PA |
| 6312 - Indene | EPA 8270D | 10186002 | NELAP | PA |
| 6315 - Indeno(1,2,3-cd) pyrene | EPA 8270D | 10186002 | NELAP | PA |
| 6320 - Isophorone | EPA 8270D | 10186002 | NELAP | PA |
| 6325 - Isosafrole | EPA 8270D | 10186002 | NELAP | PA |
| 6345 - Methapyrilene | EPA 8270D | 10186002 | NELAP | PA |
| 6375 - Methyl methanesulfonate | EPA 8270D | 10186002 | NELAP | PA |
| 7825 - Methyl parathion (Parathion, methyl) | EPA 8270D | 10186002 | NELAP | PA |
| 5005 - Naphthalene | EPA 8270D | 10186002 | NELAP | PA |
| 5015 - Nitrobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 7955 - Parathion, ethyl | EPA 8270D | 10186002 | NELAP | PA |
| 6590 - Pentachlorobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 6600 - Pentachloronitrobenzene | EPA 8270D | 10186002 | NELAP | PA |
| 6605 - Pentachlorophenol | EPA 8270D | 10186002 | NELAP | PA |
| 6610 - Phenacetin | EPA 8270D | 10186002 | NELAP | PA |
| 6615 - Phenanthrene | EPA 8270D | 10186002 | NELAP | PA |
| 6625 - Phenol | EPA 8270D | 10186002 | NELAP | PA |
| 7985 - Phorate | EPA 8270D | 10186002 | NELAP | PA |
| 6640 - Phthalic anhydride | EPA 8270D | 10186002 | NELAP | PA |
| 6650 - Pronamide (Kerb) | EPA 8270D | 10186002 | NELAP | PA |
| 6665 - Pyrene | EPA 8270D | 10186002 | NELAP | PA |
| 5095 - Pyridine | EPA 8270D | 10186002 | NELAP | PA |
| 6670 - Quinoline | EPA 8270D | 10186002 | NELAP | PA |
| 6685 - Safrole | EPA 8270D | 10186002 | NELAP | PA |
| 8235 - Thionazin (Zinophos) | EPA 8270D | 10186002 | NELAP | PA |
| 6125 - a-a-Dimethylphenethylamine | EPA 8270D | 10186002 | NELAP | PA |
| 5760 - bis(2-Chloroethoxy)methane | EPA 8270D | 10186002 | NELAP | PA |
| 5765 - bis(2-Chloroethyl) ether | EPA 8270D | 10186002 | NELAP | PA |
| 5780 - bis(2-Chloroisopropyl) ether | EPA 8270D | 10186002 | NELAP | PA |
| 6062 - bis(2-Ethylhexyl)adipate | EPA 8270D | 10186002 | NELAP | PA |
| 5025 - n-Nitroso-di-n-butylamine | EPA 8270D | 10186002 | NELAP | PA |
| 6545 - n-Nitrosodi-n-propylamine | EPA 8270D | 10186002 | NELAP | PA |
| 6525 - n-Nitrosodiethylamine | EPA 8270D | 10186002 | NELAP | PA |
| 6530 - n-Nitrosodimethylamine | EPA 8270D | 10186002 | NELAP | PA |
| 6535 - n-Nitrosodiphenylamine | EPA 8270D | 10186002 | NELAP | PA |
| 6550 - n-Nitrosomethylethylamine | EPA 8270D | 10186002 | NELAP | PA |
| 6555 - n-Nitrosomorpholine | EPA 8270D | 10186002 | NELAP | PA |
| 6560 - n-Nitrosopiperidine | EPA 8270D | 10186002 | NELAP | PA |
| 6565 - n-Nitrosopyrrolidine | EPA 8270D | 10186002 | NELAP | PA |
| 8290 - o,o,o-Triethyl phosphorothioate | EPA 8270D | 10186002 | NELAP | PA |
| 8310 - tris-(2,3-Dibromopropyl) phosphate (tris-BP) | EPA 8270D | 10186002 | NELAP | PA |
| 9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD) | EPA 8290 | 10187209 | NELAP | PA |
| 9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF) | EPA 8290 | 10187209 | NELAP | PA |
| 9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd) | EPA 8290 | 10187209 | NELAP | PA |
| 9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf) | EPA 8290 | 10187209 | NELAP | PA |
| 9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf) | EPA 8290 | 10187209 | NELAP | PA |
| 9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd) | EPA 8290 | 10187209 | NELAP | PA |



Uncontrolled Copy

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf) | EPA 8290 | 10187209 | NELAP | PA |
| 9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd) | EPA 8290 | 10187209 | NELAP | PA |
| 9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf) | EPA 8290 | 10187209 | NELAP | PA |
| 9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd) | EPA 8290 | 10187209 | NELAP | PA |
| 9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf) | EPA 8290 | 10187209 | NELAP | PA |
| 9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd) | EPA 8290 | 10187209 | NELAP | PA |
| 9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf) | EPA 8290 | 10187209 | NELAP | PA |
| 9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran | EPA 8290 | 10187209 | NELAP | PA |
| 9549 - 2,3,4,7,8-Pentachlorodibenzofuran | EPA 8290 | 10187209 | NELAP | PA |
| 9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD) | EPA 8290 | 10187209 | NELAP | PA |
| 9612 - 2,3,7,8-Tetrachlorodibenzofuran | EPA 8290 | 10187209 | NELAP | PA |
| 9438 - Total Hpcdd | EPA 8290 | 10187209 | NELAP | PA |
| 9444 - Total Hpcdf | EPA 8290 | 10187209 | NELAP | PA |
| 9468 - Total Hxcdd | EPA 8290 | 10187209 | NELAP | PA |
| 9483 - Total Hxcdf | EPA 8290 | 10187209 | NELAP | PA |
| 9555 - Total Pecdd | EPA 8290 | 10187209 | NELAP | PA |
| 9552 - Total Pecdf | EPA 8290 | 10187209 | NELAP | PA |
| 9609 - Total TCDD | EPA 8290 | 10187209 | NELAP | PA |
| 9615 - Total TCDF | EPA 8290 | 10187209 | NELAP | PA |
| 9519 - 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD) | EPA 8290A | 10187403 | NELAP | PA |
| 9516 - 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF) | EPA 8290A | 10187403 | NELAP | PA |
| 9426 - 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd) | EPA 8290A | 10187403 | NELAP | PA |
| 9420 - 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf) | EPA 8290A | 10187403 | NELAP | PA |
| 9423 - 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf) | EPA 8290A | 10187403 | NELAP | PA |
| 9453 - 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-Hxcdd) | EPA 8290A | 10187403 | NELAP | PA |
| 9471 - 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-Hxcdf) | EPA 8290A | 10187403 | NELAP | PA |
| 9456 - 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin(1,2,3,6,7,8-Hxcdd) | EPA 8290A | 10187403 | NELAP | PA |
| 9474 - 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-Hxcdf) | EPA 8290A | 10187403 | NELAP | PA |
| 9459 - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-Hxcdd) | EPA 8290A | 10187403 | NELAP | PA |
| 9477 - 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-Hxcdf) | EPA 8290A | 10187403 | NELAP | PA |
| 9540 - 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-Pecdd) | EPA 8290A | 10187403 | NELAP | PA |
| 9543 - 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-Pecdf) | EPA 8290A | 10187403 | NELAP | PA |
| 9480 - 2,3,4,6,7,8-Hexachlorodibenzofuran | EPA 8290A | 10187403 | NELAP | PA |

Uncontrolled Copy

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 9549 - 2,3,4,7,8-Pentachlorodibenzofuran | EPA 8290A | 10187403 | NELAP | PA |
| 9618 - 2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD) | EPA 8290A | 10187403 | NELAP | PA |
| 9612 - 2,3,7,8-Tetrachlorodibenzofuran | EPA 8290A | 10187403 | NELAP | PA |
| 9438 - Total Hpcdd | EPA 8290A | 10187403 | NELAP | PA |
| 9444 - Total Hpcdf | EPA 8290A | 10187403 | NELAP | PA |
| 9468 - Total Hxcdd | EPA 8290A | 10187403 | NELAP | PA |
| 9483 - Total Hxcdf | EPA 8290A | 10187403 | NELAP | PA |
| 9555 - Total Pecdd | EPA 8290A | 10187403 | NELAP | PA |
| 9552 - Total Pecdf | EPA 8290A | 10187403 | NELAP | PA |
| 9609 - Total TCDD | EPA 8290A | 10187403 | NELAP | PA |
| 9615 - Total TCDF | EPA 8290A | 10187403 | NELAP | PA |
| 5500 - Acenaphthene | EPA 8310 | 10187607 | NELAP | PA |
| 5505 - Acenaphthylene | EPA 8310 | 10187607 | NELAP | PA |
| 5555 - Anthracene | EPA 8310 | 10187607 | NELAP | PA |
| 5575 - Benzo(a)anthracene | EPA 8310 | 10187607 | NELAP | PA |
| 5580 - Benzo(a)pyrene | EPA 8310 | 10187607 | NELAP | PA |
| 5585 - Benzo(b)fluoranthene | EPA 8310 | 10187607 | NELAP | PA |
| 5590 - Benzo(g,h,i)perylene | EPA 8310 | 10187607 | NELAP | PA |
| 5600 - Benzo(k)fluoranthene | EPA 8310 | 10187607 | NELAP | PA |
| 5855 - Chrysene | EPA 8310 | 10187607 | NELAP | PA |
| 5895 - Dibenz(a,h) anthracene | EPA 8310 | 10187607 | NELAP | PA |
| 6265 - Fluoranthene | EPA 8310 | 10187607 | NELAP | PA |
| 6270 - Fluorene | EPA 8310 | 10187607 | NELAP | PA |
| 6315 - Indeno(1,2,3-cd) pyrene | EPA 8310 | 10187607 | NELAP | PA |
| 5005 - Naphthalene | EPA 8310 | 10187607 | NELAP | PA |
| 6615 - Phenanthrene | EPA 8310 | 10187607 | NELAP | PA |
| 6665 - Pyrene | EPA 8310 | 10187607 | NELAP | PA |
| 6110 - 2,5-Dimethylbenzaldehyde | EPA 8315 | 10187801 | NELAP | PA |
| 4300 - Acetaldehyde | EPA 8315 | 10187801 | NELAP | PA |
| 4325 - Acrolein (Propenal) | EPA 8315 | 10187801 | NELAP | PA |
| 5570 - Benzaldehyde | EPA 8315 | 10187801 | NELAP | PA |
| 4430 - Butylaldehyde (Butanal) | EPA 8315 | 10187801 | NELAP | PA |
| 4545 - Crotonaldehyde | EPA 8315 | 10187801 | NELAP | PA |
| 4815 - Formaldehyde | EPA 8315 | 10187801 | NELAP | PA |
| 3825 - Hexanaldehyde (Hexanal) | EPA 8315 | 10187801 | NELAP | PA |
| 6330 - Isovaleraldehyde | EPA 8315 | 10187801 | NELAP | PA |
| 3965 - Propionaldehyde (Propanal) | EPA 8315 | 10187801 | NELAP | PA |
| 6755 - Tolualdehyde (1,2-Tolualdehyde) | EPA 8315 | 10187801 | NELAP | PA |
| 5125 - m-Tolualdehyde (1,3-Tolualdehyde) | EPA 8315 | 10187801 | NELAP | PA |
| 6760 - p-Tolualdehyde (1,4-Tolualdehyde) | EPA 8315 | 10187801 | NELAP | PA |
| 7710 - 3-Hydroxycarbofuran | EPA 8318 | 10188406 | NELAP | PA |
| 7010 - Aldicarb (Temik) | EPA 8318 | 10188406 | NELAP | PA |
| 7015 - Aldicarb sulfone | EPA 8318 | 10188406 | NELAP | PA |
| 7195 - Carbaryl (Sevin) | EPA 8318 | 10188406 | NELAP | PA |
| 7205 - Carbofuran (Furaden) | EPA 8318 | 10188406 | NELAP | PA |
| 7800 - Methiocarb (Mesurol) | EPA 8318 | 10188406 | NELAP | PA |
| 7805 - Methomyl (Lannate) | EPA 8318 | 10188406 | NELAP | PA |
| 8080 - Propoxur (Baygon) | EPA 8318 | 10188406 | NELAP | PA |
| 7710 - 3-Hydroxycarbofuran | EPA 8318A | 10188600 | NELAP | PA |
| 7010 - Aldicarb (Temik) | EPA 8318A | 10188600 | NELAP | PA |
| 7015 - Aldicarb sulfone | EPA 8318A | 10188600 | NELAP | PA |
| 7195 - Carbaryl (Sevin) | EPA 8318A | 10188600 | NELAP | PA |
| 7205 - Carbofuran (Furaden) | EPA 8318A | 10188600 | NELAP | PA |
| 7800 - Methiocarb (Mesurol) | EPA 8318A | 10188600 | NELAP | PA |
| 7805 - Methomyl (Lannate) | EPA 8318A | 10188600 | NELAP | PA |

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 8080 - Propoxur (Baygon) | EPA 8318A | 10188600 | NELAP | PA |
| 6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB) | EPA 8330 | 10189807 | NELAP | PA |
| 6160 - 1,3-Dinitrobenzene (1,3-DNB) | EPA 8330 | 10189807 | NELAP | PA |
| 9651 - 2,4,6-Trinitrotoluene (2,4,6-TNT) | EPA 8330 | 10189807 | NELAP | PA |
| 6185 - 2,4-Dinitrotoluene (2,4-DNT) | EPA 8330 | 10189807 | NELAP | PA |
| 6190 - 2,6-Dinitrotoluene (2,6-DNT) | EPA 8330 | 10189807 | NELAP | PA |
| 9303 - 2-Amino-4,6-dinitrotoluene (2-am-dnt) | EPA 8330 | 10189807 | NELAP | PA |
| 9507 - 2-Nitrotoluene | EPA 8330 | 10189807 | NELAP | PA |
| 9510 - 3-Nitrotoluene | EPA 8330 | 10189807 | NELAP | PA |
| 9306 - 4-Amino-2,6-dinitrotoluene (4-am-dnt) | EPA 8330 | 10189807 | NELAP | PA |
| 9513 - 4-Nitrotoluene | EPA 8330 | 10189807 | NELAP | PA |
| 6415 - Methyl-2,4,6-trinitrophenylnitramine (tetryl) | EPA 8330 | 10189807 | NELAP | PA |
| 5015 - Nitrobenzene | EPA 8330 | 10189807 | NELAP | PA |
| 9522 - Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) | EPA 8330 | 10189807 | NELAP | PA |
| 9558 - Pentaerythritoltetranitrate | EPA 8330 | 10189807 | NELAP | PA |
| 9432 - RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) | EPA 8330 | 10189807 | NELAP | PA |
| 6885 - 1,3,5-Trinitrobenzene (1,3,5-TNB) | EPA 8330A | 10190008 | NELAP | PA |
| 6160 - 1,3-Dinitrobenzene (1,3-DNB) | EPA 8330A | 10190008 | NELAP | PA |
| 9651 - 2,4,6-Trinitrotoluene (2,4,6-TNT) | EPA 8330A | 10190008 | NELAP | PA |
| 6185 - 2,4-Dinitrotoluene (2,4-DNT) | EPA 8330A | 10190008 | NELAP | PA |
| 6190 - 2,6-Dinitrotoluene (2,6-DNT) | EPA 8330A | 10190008 | NELAP | PA |
| 9303 - 2-Amino-4,6-dinitrotoluene (2-am-dnt) | EPA 8330A | 10190008 | NELAP | PA |
| 9507 - 2-Nitrotoluene | EPA 8330A | 10190008 | NELAP | PA |
| 9510 - 3-Nitrotoluene | EPA 8330A | 10190008 | NELAP | PA |
| 9306 - 4-Amino-2,6-dinitrotoluene (4-am-dnt) | EPA 8330A | 10190008 | NELAP | PA |
| 9513 - 4-Nitrotoluene | EPA 8330A | 10190008 | NELAP | PA |
| 6415 - Methyl-2,4,6-trinitrophenylnitramine (tetryl) | EPA 8330A | 10190008 | NELAP | PA |
| 5015 - Nitrobenzene | EPA 8330A | 10190008 | NELAP | PA |
| 9522 - Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) | EPA 8330A | 10190008 | NELAP | PA |
| 9558 - Pentaerythritoltetranitrate | EPA 8330A | 10190008 | NELAP | PA |
| 9432 - RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) | EPA 8330A | 10190008 | NELAP | PA |
| 1645 - Total Cyanide | EPA 9012A | 10193405 | NELAP | PA |
| 1615 - Corrosivity | EPA 9045C | 10198400 | NELAP | PA |
| 1900 - pH | EPA 9045C | 10198400 | NELAP | PA |
| 1610 - Conductivity | EPA 9050 | 10198604 | NELAP | PA |
| 1610 - Conductivity | EPA 9050A | 10198808 | NELAP | PA |
| 1905 - Total Phenolics | EPA 9066 | 10200609 | NELAP | PA |
| 1860 - Oil & Grease | EPA 9071B | 10201602 | NELAP | PA |
| 1560 - Cation exchange capacity | EPA 9081 | 10203404 | NELAP | PA |
| 1780 - Ignitability | EPA 1010A | 10234807 | NELAP | PA |
| 6380 - 1-Methylnaphthalene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5500 - Acenaphthene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5505 - Acenaphthylene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5555 - Anthracene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5575 - Benzo(a)anthracene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5580 - Benzo(a)pyrene | EPA 8270C SIM | 10242407 | NELAP | PA |



Uncontrolled Copy

## Solid Chemical Materials

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 5585 - Benzo(b)fluoranthene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5590 - Benzo(g,h,i)perylene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5600 - Benzo(k)fluoranthene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5855 - Chrysene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5895 - Dibenz(a,h) anthracene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 6265 - Fluoranthene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 6270 - Fluorene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 6315 - Indeno(1,2,3-cd) pyrene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 5005 - Naphthalene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 6615 - Phenanthrene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 6665 - Pyrene | EPA 8270C SIM | 10242407 | NELAP | PA |
| 6380 - 1-Methylnaphthalene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5500 - Acenaphthene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5505 - Acenaphthylene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5555 - Anthracene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5575 - Benzo(a)anthracene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5580 - Benzo(a)pyrene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5585 - Benzo(b)fluoranthene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5590 - Benzo(g,h,i)perylene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5600 - Benzo(k)fluoranthene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5855 - Chrysene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5895 - Dibenz(a,h) anthracene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 6265 - Fluoranthene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 6270 - Fluorene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 6315 - Indeno(1,2,3-cd) pyrene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 5005 - Naphthalene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 6615 - Phenanthrene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 6665 - Pyrene | EPA 8270D SIM | 10242509 | NELAP | PA |
| 1900 - pH | EPA 9040C | 10244403 | NELAP | PA |
| 4870 - Iodomethane (Methyl iodide) | EPA 8260C | 10307003 | NELAP | PA |
| 9369 - Diesel range organics (DRO) | TNRCC 1005, Rev.3 | 90019208 | NELAP | PA |

## Biological Tissue

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 1000 - Aluminum | EPA 6010 | 10155201 | NELAP | LA |
| 1005 - Antimony | EPA 6010 | 10155201 | NELAP | LA |
| 1010 - Arsenic | EPA 6010 | 10155201 | NELAP | LA |
| 1015 - Barium | EPA 6010 | 10155201 | NELAP | LA |
| 1020 - Beryllium | EPA 6010 | 10155201 | NELAP | LA |
| 1025 - Boron | EPA 6010 | 10155201 | NELAP | LA |
| 1030 - Cadmium | EPA 6010 | 10155201 | NELAP | LA |
| 1035 - Calcium | EPA 6010 | 10155201 | NELAP | LA |
| 1040 - Chromium | EPA 6010 | 10155201 | NELAP | LA |
| 1050 - Cobalt | EPA 6010 | 10155201 | NELAP | LA |
| 1055 - Copper | EPA 6010 | 10155201 | NELAP | LA |
| 1070 - Iron | EPA 6010 | 10155201 | NELAP | LA |
| 1075 - Lead | EPA 6010 | 10155201 | NELAP | LA |
| 1085 - Magnesium | EPA 6010 | 10155201 | NELAP | LA |
| 1090 - Manganese | EPA 6010 | 10155201 | NELAP | LA |
| 1100 - Molybdenum | EPA 6010 | 10155201 | NELAP | LA |
| 1105 - Nickel | EPA 6010 | 10155201 | NELAP | LA |
| 1125 - Potassium | EPA 6010 | 10155201 | NELAP | LA |
| 1140 - Selenium | EPA 6010 | 10155201 | NELAP | LA |
| 1150 - Silver | EPA 6010 | 10155201 | NELAP | LA |



Uncontrolled Copy

## Biological Tissue

| Analyte | Method Name | Method Code | Type | AB |
|---|---|---|---|---|
| 1155 - Sodium | EPA 6010 | 10155201 | NELAP | LA |
| 1160 - Strontium | EPA 6010 | 10155201 | NELAP | LA |
| 1165 - Thallium | EPA 6010 | 10155201 | NELAP | LA |
| 1175 - Tin | EPA 6010 | 10155201 | NELAP | LA |
| 1180 - Titanium | EPA 6010 | 10155201 | NELAP | LA |
| 1185 - Vanadium | EPA 6010 | 10155201 | NELAP | LA |
| 1190 - Zinc | EPA 6010 | 10155201 | NELAP | LA |
| 1005 - Antimony | EPA 6020 | 10156000 | NELAP | LA |
| 1010 - Arsenic | EPA 6020 | 10156000 | NELAP | LA |
| 1020 - Beryllium | EPA 6020 | 10156000 | NELAP | LA |
| 1030 - Cadmium | EPA 6020 | 10156000 | NELAP | LA |
| 1040 - Chromium | EPA 6020 | 10156000 | NELAP | LA |
| 1055 - Copper | EPA 6020 | 10156000 | NELAP | LA |
| 1075 - Lead | EPA 6020 | 10156000 | NELAP | LA |
| 1105 - Nickel | EPA 6020 | 10156000 | NELAP | LA |
| 1140 - Selenium | EPA 6020 | 10156000 | NELAP | LA |
| 1165 - Thallium | EPA 6020 | 10156000 | NELAP | LA |
| 1095 - Mercury | EPA 7471 | 10166004 | NELAP | LA |
| 7355 - 4,4'-DDD | EPA 8081 | 10178402 | NELAP | LA |
| 7360 - 4,4'-DDE | EPA 8081 | 10178402 | NELAP | LA |
| 7365 - 4,4'-DDT | EPA 8081 | 10178402 | NELAP | LA |
| 7025 - Aldrin | EPA 8081 | 10178402 | NELAP | LA |
| 7250 - Chlordane (tech.) | EPA 8081 | 10178402 | NELAP | LA |
| 7470 - Dieldrin | EPA 8081 | 10178402 | NELAP | LA |
| 7685 - Heptachlor | EPA 8081 | 10178402 | NELAP | LA |
| 7690 - Heptachlor epoxide | EPA 8081 | 10178402 | NELAP | LA |
| 8250 - Toxaphene (Chlorinated camphene) | EPA 8081 | 10178402 | NELAP | LA |
| 7110 - alpha-BHC (alpha-Hexachlorocyclohexane) | EPA 8081 | 10178402 | NELAP | LA |
| 7115 - beta-BHC (beta-Hexachlorocyclohexane) | EPA 8081 | 10178402 | NELAP | LA |
| 7105 - delta-BHC | EPA 8081 | 10178402 | NELAP | LA |
| 7120 - gamma-BHC (Lindane, gamma-HexachlorocyclohexanE) | EPA 8081 | 10178402 | NELAP | LA |
| 8880 - Aroclor-1016 (PCB-1016) | EPA 8082 | 10179007 | NELAP | LA |
| 8885 - Aroclor-1221 (PCB-1221) | EPA 8082 | 10179007 | NELAP | LA |
| 8890 - Aroclor-1232 (PCB-1232) | EPA 8082 | 10179007 | NELAP | LA |
| 8895 - Aroclor-1242 (PCB-1242) | EPA 8082 | 10179007 | NELAP | LA |
| 8900 - Aroclor-1248 (PCB-1248) | EPA 8082 | 10179007 | NELAP | LA |
| 8905 - Aroclor-1254 (PCB-1254) | EPA 8082 | 10179007 | NELAP | LA |
| 8910 - Aroclor-1260 (PCB-1260) | EPA 8082 | 10179007 | NELAP | LA |
| 6715 - 1,2,4,5-Tetrachlorobenzene | EPA 8270 | 10185203 | NELAP | LA |
| 6400 - 2-Methylphenol (o-Cresol) | EPA 8270 | 10185203 | NELAP | LA |
| 6405 - 3-Methylphenol (m-Cresol) | EPA 8270 | 10185203 | NELAP | LA |
| 6410 - 4-Methylphenol (p-Cresol) | EPA 8270 | 10185203 | NELAP | LA |
| 5855 - Chrysene | EPA 8270 | 10185203 | NELAP | LA |
| 6275 - Hexachlorobenzene | EPA 8270 | 10185203 | NELAP | LA |
| 4835 - Hexachlorobutadiene | EPA 8270 | 10185203 | NELAP | LA |
| 6285 - Hexachlorocyclopentadiene | EPA 8270 | 10185203 | NELAP | LA |
| 4840 - Hexachloroethane | EPA 8270 | 10185203 | NELAP | LA |
| 6290 - Hexachlorophene | EPA 8270 | 10185203 | NELAP | LA |
| 6590 - Pentachlorobenzene | EPA 8270 | 10185203 | NELAP | LA |
| 6605 - Pentachlorophenol | EPA 8270 | 10185203 | NELAP | LA |
| 5095 - Pyridine | EPA 8270 | 10185203 | NELAP | LA |
| 5025 - n-Nitroso-di-n-butylamine | EPA 8270 | 10185203 | NELAP | LA |
| 6525 - n-Nitrosodiethylamine | EPA 8270 | 10185203 | NELAP | LA |



Uncontrolled Copy

Uncontrolled Copy

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-GDL-9015387 | **Revision** | 3 |
| **Effective Date** | Aug 8, 2014 | **Status** | Effective |
| **Historical/Local Document Number** | DOD - Environmental Quality Policy Manual Appendix J | | |
| **Local Document Level** | Level 1 | | |
| **Local Document Type** | POL - Policy | | |
| **Local Document Category** | ES - Environmental Sciences | | |

| | |
|---|---|
| **Prepared by** | Kathryn Brungard |
| **Reviewed and Approved by** | Duane Luckenbill;Review;Tuesday, July 29, 2014 11:05:28 AM EDT<br>Robert Strocko;Review;Wednesday, July 30, 2014 1:06:19 PM EDT<br>Dorothy Love;Approval;Wednesday, July 30, 2014 2:18:24 PM EDT |

Uncontrolled Copy

Details on method quality control (QC) processes are provided in the individual Analytical Procedures. QC limits are maintained in the LIMS. This appendix provides an overview for representative methodology.
NOTE: This appendix is not applicable to OH VAP work. See the OH VAP approved SOPs for QC information.

| SW - 846<br>Quality Control<br>GC/MS Volatiles Method 8260 | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogates:**<br>Toluene-$d_8$<br>Bromofluorobenzene<br>1,2-Dichloroethane-$d_4$<br>Dibromofluoromethane | Each sample, MS, MSD, LCS, and blank | Reanalyze sample if outside limits; if reanalysis confirms original, document on report and/or case narrative |
| **Matrix Spikes:**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Samples:**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Reanalyze LCS and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported. |
| **Matrix Spike Duplicates (RPD):**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | Once for each 12-hour time period or ≤20 samples | Reanalyze blank and associated samples if blank outside limits |
| **Internal Standards (ISTD):**<br>Fluorobenzene<br>Chlorobenzene-$d_5$<br>1,4-Dichlorobenzene-$d_4$ | Each sample, MS, MSD, LCS, and blank | Reanalyze samples; if reanalysis confirms original, document on report or case narrative |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

**SW - 846**
**Quality Control**
**GC/MS Semivolatiles Method 8270**

| Type | Frequency | Corrective Action |
|---|---|---|
| **Surrogate:**<br>Nitrobenzene-$d_5$<br>2-Fluorobiphenyl<br>Terphenyl-$d_{14}$<br>Phenol-$d_6$<br>2-Fluorophenol<br>2,4,6-Tribromophenol | Each sample, MS, MSD, LCS, and blank | Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative |
| **Matrix Spikes:**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Sample:**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported. |
| **Matrix Spike Duplicates (RPD):**<br>Same as for matrix spikes | Each group (≤20) of samples per matrix/level | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | Once per extraction group (≤20) of samples, each matrix, level | Re-extract and reanalyze blank and associated samples |
| **Internal Standards (ISTD):**<br>1,4-Dichlorobenzene-$d_4$<br>Naphthalene-$d_8$<br>Acenaphthene-$d_{10}$<br>Phenanthrene-$d_{10}$<br>Chrysene-$d_{12}$<br>Perylene-$d_{12}$ | Each sample, MS, MSD, LCS, and blank | Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

**SW - 846**
**Quality Control**
**GC/MS Semivolatiles Method 8270 SIM**

| Type | Frequency | Corrective Action |
|---|---|---|
| **Surrogate:**<br>**1-Methylnaphthalene-d10**<br>**Fluoranthene-d10**<br>**Benzo(a)pyrene-d12** | Each sample, MS, MSD, LCS, and blank | Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative |
| **Matrix Spikes:**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Sample:**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported. |
| **Matrix Spike Duplicates (RPD):**<br>Same as for matrix spikes | Each group (≤20) of samples per matrix/level | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | Once per extraction group (≤20) of samples, each matrix, level | Re-extract and reanalyze blank and associated samples |
| **Internal Standards (ISTD):**<br>1,4-Dichlorobenzene-$d_4$<br>Naphthalene-$d_8$<br>Acenaphthene-$d_{10}$<br>Phenanthrene-$d_{10}$<br>Chrysene-$d_{12}$<br>Perylene-$d_{12}$ | Each sample, MS, MSD, LCS, and blank | Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

| SW - 846<br>Quality Control<br>Dioxins/Furans Method 8290 | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Labeled Compounds:**<br>13C Labeled Isotope of each of 17 Toxic PCDD/PCDF | Each sample, OPR, and blank | Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative |
| **Ongoing Precision and Recovery Standard (OPR):**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Reanalyze OPR and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the OPR and are ND in the samples, can be reported. |
| **Blanks:** | Once for each 12-hour time period or ≤20 samples | Reanalyze blank and associated samples if blank outside limits |
| **Internal Standards (ISTD):**<br>13C12-1234-TCDD<br>13C12-123468-HxCDD | Each sample, OPR, and blank | RT ± 15 secs of retention time in initial calibration. |

| Quality Control<br>Dioxins/Furans Method 1613B | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Labeled Compounds:**<br>13C Labeled Isotope of each of 17 Toxic PCDD/PCDF | Each sample, OPR, and blank | Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative |
| **Ongoing Precision and Recovery Standard (OPR):**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Reanalyze OPR and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the OPR and are ND in the samples, can be reported. |
| **Blanks:** | Once for each 12-hour time period or ≤20 samples | Reanalyze blank and associated samples if blank outside limits |
| **Internal Standards (ISTD):**<br>13C12-1234-TCDD<br>13C12-123468-HxCDD | Each sample, OPR, and blank | RT ± 15 secs of retention time in initial calibration. |

Uncontrolled Copy

| Quality Control<br>Congeners Method 1668 | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Labeled Compounds:**<br>13C Labeled Isotope of each of 18 Toxic PCBs | Each sample, OPR, and blank | Repeat extraction and analysis; if reanalysis confirms original, document on report and/or case narrative |
| **Ongoing Precision and Recovery Standard (OPR):**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Reanalyze OPR and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the OPR and are ND in the samples, can be reported. |
| **Blanks:** | Once for each 12-hour time period or ≤20 samples | Reanalyze blank and associated samples if blank outside limits |
| **Internal Standards (ISTD):**<br>13C12-PCB70<br>13C12-PCB111<br>13C12-PCB141<br>13C12-PCB170 | Each sample, OPR, and blank | RT ± 15 secs of retention time in initial calibration. |

Uncontrolled Copy

| SW-846<br>Quality Control<br>Pesticides/PCBs Methods 8081; 8082; 8141; 8151 | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:**<br>Organochlorine Pesticides & PCBs<br>Decachlorobiphenyl (DCB)<br>Tetrachloro-*m*-xylene (TCMX)<br><br>Herbicides:<br>Dichloroacetic acid (DCAA)<br><br>Organophosphorous Pesticides:<br>2-nitro-*m*-xylene (2NMX) | Added to each sample, MS/MSD, blank, LCS/LCSD during the extraction phase | Repeat extraction and analysis. If reanalysis confirms original result, report results and comment in case narrative |
| **Matrix Spikes:**<br>Organochlorine Pesticides:<br>Spike all compounds of interest, except PCBs, chlordane, and toxaphene<br><br>Herbicides & Organophosphorous Pesticides:<br>all compounds of interest<br><br>PCBs: Aroclor 1016 & Aroclor 1260 | Each extraction group (≤20) of samples per matrix/level | Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Sample:**<br>Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene<br><br>Herbicides & Organophosphorous Pesticides: all compounds of interest<br><br>PCBs: Aroclor 1016 & Aroclor 1260 | Each group (≤20) when MS/MSD falls outside established limits | Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported. |

uncontrolled copy

| SW-846<br>Quality Control<br>Pesticides/PCBs Methods 8081; 8082; 8141; 8151<br>(continued) | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Matrix Spike Duplicates (RPD):**<br>Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene<br><br>Herbicides & Organophosphorous Pesticides: all compounds of interest<br><br>PCBs: Aroclor 1016 & Aroclor 1260 | Each extraction group (≤20) of samples per matrix/level | Evaluated in conjunction with acceptable LCS.<br>Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Blanks:** | Once per extraction group (≤20) of samples, each matrix, level | Inject a hexane or solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be reextracted. |
| **Internal Standards (ISTD):**<br>Herbicides: 4,4'-dibromo octafluorobiphenyl (DBOB) | Each sample, MS, MSD, LCS, and blank | Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

| SW-846<br>Quality Control<br>Volatiles by GC<br>8021 | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogates:**<br>Aromatics;<br>1-Bromo-4-chlorobenzene (PID) | Each sample, MS, MSD, LCS and blank | Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident. |
| **Matrix Spikes:**<br>Spike all compounds of interest | Each group of samples (≤20) of similar matrix/level each method | Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Sample:**<br>Spike all compounds of interest | Each group (≤20); LCSD is analyzed if sufficient volume is not available for MS/MSD | Reanalyze LCS and associated samples for compounds outside of acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported. |
| **Internal Standard (ISTD):**<br>Aromatics;<br>1-chloro-3-fluorobenzene | Each sample, LCS, MS, MSD, blank, and standard | Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative. In cases where the sample matrix is elevating the ISTD recovery, a dilution and reanalysis may be performed. |
| **Matrix Spike Duplicate (RPD):**<br>Same compounds as matrix spikes | Each group (≤20) of samples per matrix/level | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | At least once per batch (≤20 samples) and once per 24 hours | Reanalyze blank and associated samples if blank is outside limits |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

| SW-846 Quality Control Petroleum Analysis | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:** α,α,α-Trifluorotoluene (PID) | Each sample, MS, MSD, LCS, and blank | Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident. |
| **Matrix Spike:** Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Sample:** Spike all compounds of interest | Each group (≤20) of samples per matrix/level. LCSD analyzed if sufficient volume is not available for MS/MSD | Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high and are ND in the samples can be reported. |
| **Matrix Spike Duplicates (RPD):** | Each group (≤20) of samples per matrix/level | Evaluated by an analyst in relationship to other QC results |
| **Blanks:** | At least once per batch (≤20 samples) and once per 24 hours | Reanalyze blank and associated samples if blank is outside limits |
| **Internal Standards (ISTD):** 1-Chloro-3-fluorobenzene (PID) | Each sample, MS, MSD, LCS, and blank analyzed on the PID | Reanalyze samples; if reanalysis confirms original result, document on report or case narrative. In cases where the sample matrix is elevating the ISTD recovery, a dilution and reanalysis may be performed. |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

| SW-846<br>Quality Control<br>TPH-DRO<br>8015B | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:**<br>*o*-Terphenyl | Added to each sample, MS/MSD, blank, LCS/LCSD during the extraction phase | Repeat extraction and analysis. If reanalysis confirms original result. report results and comment in case narrative. |
| **Matrix Spike:**<br># 2 Fuel | Each group (≤20) of samples per matrix/level | Reinject if surrogates appear low. If still out of spec, evaluate for matrix effect. If matrix effect, accept based on LCS data. If no matrix effect, repeat batch. |
| **Laboratory Control Sample:**<br># 2 Fuel | Each group (≤20) of samples per matrix/level | Reinject if surrogates appear low. If still out of spec, reextract batch. LCS that fails high and DRO is ND in the samples can be reported. |
| **Laboratory Control Duplicates (RPD):**<br># 2 Fuel | Each group (≤20) of samples per matrix/level | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | Once per extraction group (≤20) of samples, each matrix, level | Inject a solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected, if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be re-extracted. |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

| SW-846<br>Quality Control<br>TPH-GRO<br>8015B | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:**<br>Trifluorotoluene (FID) | Each sample, MS/MSD, LCS, and blank | Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident |
| **Matrix Spike:**<br>Gasoline standard | Each group of samples of similar matrix/level (≤20) each method | Evaluation in conjunction with acceptable LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD |
| **Laboratory Control Sample**<br>Gasoline standard | Each group (≤20) of samples. LCSD analyzed if sufficient volume is not available for MS/MSD. | Reanalyze LCS and associated samples. LCS that fails high and GRO is ND in the samples can be reported. |
| **Matrix Spike Duplicate (RPD):**<br>Same compounds as matrix spikes | Each group (≤20) of samples per matrix/level | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | At least one per 20 samples and at least once per 24 hours. | Reanalyze blank and associated samples if blank is outside limits |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change

| SW-846<br>Quality Control*<br>Inorganics (Metals) | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Internal Standard (ICP & ICP/MS only):** | Each sample, standard and QC (Unspiked, Dup., MS, MSD, LCS, dilution, post digestion spike and blank) | If the internal standard response falls outside the specified range, then the samples would be reanalyzed. |
| **Matrix Spikes:** | Each group of samples of similar matrix/level (≤20) each method | Analyze post-digestion spike sample |
| **Matrix Spike Duplicate (RPD):** | Each group of samples of similar matrix/level ( 20) each method | Analyze post-digestion spike sample if not already run for MS, flag the data |
| **Duplicates (RPD):** | Each group of samples of similar matrix/level (≤20) each method | Flag the data |

Uncontrolled Copy

| SW-846<br>Quality Control*<br>Inorganics (Metals) | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Blanks:**<br>Initial Calibration (ICB)<br>Continuing Calibration (CCB) | Each element immediately after calibration verification at 10% frequency or every 2 hours (beginning and end of run min.) | Correct problem, recalibrate, and rerun |
| Preparation Blank | Each SDG or batch (≤20 samples) | Redigest and reanalyze blank and associated samples if sample result is greater than the LOQ and <20× blank result |
| **Serial Dilutions (ICP, ICP/MS only):** | Each group of (≤20) of similar matrix/level | Flag the data |
| **Interference Check Sample (ICP, ICP/MS only):** | Each element after Initial Calibration Verification at beginning and end of the run or min. of 2× per 8 hour | Correct for interference, recalibrate the instrument |
| **Laboratory Control Sample:** | Each SDG or batch (≤20 samples), each method | Redigest and reanalyze LCS and associated samples. Elements in the LCS that fail high and are ND in the samples can be reported. |
| **Post Digestion Spike:** | When matrix spikes are outside 75 % - 125% range, or the statistical window (whichever is tighter). | Flag the data |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

| QC Table for SW-846 Miscellaneous Water Tests | | | |
|---|---|---|---|
| **Test** | **QC Type** | **Frequency** | **Corrective Action** |
| **Sulfide** | Blank | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze. |
| | Laboratory Control Sample | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze. LCSs that fail high (and associated samples are ND) can be reported. |
| | Duplicate | Each group of samples of similar matrix (≤20) | Ensure that LCS meets acceptance criteria. |
| | Matrix Spike/ Matrix Spike Duplicate | Each group of samples of similar matrix (≤20) | Ensure that LCS meets acceptance criteria. |
| | Blank | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze. |



Uncontrolled Copy

| | | | |
|---|---|---|---|
| **Bromide (IC)**<br>**Chloride (IC)**<br>**Cyanide (total)**<br>**Fluoride (IC)**<br>**Nitrate/Nitrite (IC)**<br>**Sulfate (IC)** | Laboratory Control Sample | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze. LCSs that fail high (and associated samples are ND) can be reported. |
| | Duplicate | Each group of samples of similar matrix (≤10) | Ensure that LCS meets acceptance criteria. |
| | Matrix Spike | Each group of samples of similar matrix (≤10) | Ensure that LCS meets acceptance criteria. |
| **Phenols**<br>**TOC Quad** | Blank | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze. |
| | Laboratory Control Sample | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze. LCSs that fail high (and associated samples are ND) can be reported. |
| | Matrix Spike/ Matrix Spike Duplicate | Each group of samples of similar matrix (≤10) | Ensure that LCS meets acceptance criteria. |
| **pH**<br>**Moisture** | Laboratory Control Sample | Each group of samples of similar matrix (≤20) | Re-analyze samples. |
| | Duplicate | Each group of samples of similar matrix (≤10) | Ensure that LCS meets acceptance criteria. |
| **Microbiology** | Organism control | Each lot of media (minimum of one per month) | Investigate cause |
| | Negative control | Each lot of media (minimum of one per month) | Investigate cause |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

| Drinking Water Quality Control Inorganics (Metals) | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Internal Standard (ICP & ICP/MS only):** | Each sample, standard and QC (Unspiked, Dup., MS, LFB, Post Digestion Spike, dilution and blank) | If the internal standard response falls outside the specified range, then the samples would be reanalyzed. |
| **Matrix Spikes:** | Each group of samples of similar matrix/level (≤10) each method | Analyze post-digestion spike sample |
| **Duplicates (RPD):** | Each group of samples of similar matrix/level (≤10) each method | Flag the data |
| **Blanks:**<br>Initial Calibration (ICB)<br>Continuing Calibration (CCB) | Each wavelength immediately after calibration verification at 10% frequency | Correct problem, recalibrate, and rerun |
| Preparation Blank | Each batch (≤10 samples) | Redigest and reanalyze blank and associated samples if sample result <10 times blank result or >LOQ |
| **Laboratory Fortified Blank (LFB):** | Each batch (≤10 samples) | Redigest and reanalyze LFB and associated samples. Elements that fail high in the LFB and are ND in the samples can be reported. |
| **Post Digestion Spike:** | When matrix spikes are outside range | Flag the data |

Uncontrolled Copy

| Drinking Water<br>EPA Method 525.2<br>Quality Control | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Lab Reagent Blank (LRB):** | One per extraction batch of (≤20) samples | Re-extract and reanalyze blank and associated samples |
| **Lab Fortified Blank (LFB):**<br>Spike all compounds of interest | One per extraction batch of (≤20) samples | Re-extract and reanalyze LFB and associated samples for compounds outside acceptance limits. Compounds that fail high in the LFB and are ND in the samples can be reported. |
| **Matrix Spike/Matrix Spike Duplicate (MS/MSD):**<br>Spike all compounds of interest | One per extraction batch of (≤20) samples | Recoveries for LFB must be within criteria. If there is insufficient sample for MSD, then a duplicate (extraction and analysis) of another sample in the batch must be performed. |
| **Surrogates:**<br>1,3-Dimethyl-2-nitrobenzene<br>Perylene-$d_{12}$<br>Triphenylphosphate | Each sample, LFB, MS, MSD, and blank | Re-extract and reanalyze the sample |
| **Internal Standards (ISTD):**<br>Acenaphthene-$d_{10}$<br>Phenanthrene-$d_{10}$<br>Chrysene-$d_{12}$ | Each sample, LFB, MS, MSD, and blank | Reanalyze samples |

Uncontrolled Copy

| QC Table for Miscellaneous Water Tests | | | |
|---|---|---|---|
| **Test** | **QC Type** | **Frequency** | **Corrective Action** |
| **Alkalinity**<br>**Ammonia (ISE)**<br>**Ammonia (Distill)**<br>**Dissolved Solids**<br>**Fluoride (ISE)**<br>**Hardness**<br>**Sulfate (TURB)**<br>**Sulfide**<br>**Total Solids**<br>**Turbidity** | Blank | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze. |
| | Laboratory Fortified Blank | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze.* |
| | Duplicate | Each group of samples of similar matrix (≤20)<br>Alkalinity, Dissolved Solids, Total Solids, Turbidity each group of similar matrix (≤10) | Ensure that LFB meets acceptance criteria. |
| | Matrix Spike/<br>Matrix Spike Duplicate | Each group of samples of similar matrix (≤20)<br><br>(not for Turbidity) | Ensure that LFB meets acceptance criteria. |
| **Bromide (IC)**<br>**Chloride (IC)**<br>**Cyanide (total & free )**<br>**Fluoride (IC)**<br>**Nitrogen (TKN)**<br>**Nitrate/Nitrite**<br>**Sulfate (IC)**<br>**Total Phosphorus**<br>**TOC** | Blank | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze. |
| | Laboratory Fortified Blank | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze.* |
| | Duplicate | Each group of samples of similar matrix (≤10) | Ensure that LFB meets acceptance criteria. |
| | Matrix Spike | Each group of samples of similar matrix (≤10) | Ensure that LFB meets acceptance criteria. |
| **Phenols** | Blank | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze. |
| | Laboratory Fortified Blank/Laboratory Control Sample | Each group of samples of similar matrix (≤20) | Prepare the entire batch again and re-analyze.* |
| | Matrix Spike/<br>Matrix Spike Duplicate | Each group of samples of similar matrix (≤10) | Ensure that LFB meets acceptance criteria. |
| **pH**<br>**Moisture** | Laboratory Fortified Blank | Each group of samples of similar matrix (≤20) | Re-analyze samples. |
| | Duplicate | Each group of samples of similar matrix (≤10) | Ensure that LFB meets acceptance criteria. |
| **Microbiology** | Organism control ( + ) | Each lot of media (minimum of one per month) | Investigate cause |
| | Negative control ( - ) | Each lot of media (minimum of one per month) | Investigate cause |

*LFBs that fail high and associated samples are ND can be reported.

Uncontrolled Copy

| QC Table for Drinking Water Methods: 507, 508, 515.1, 531.1 | | |
|---|---|---|
| **Type of QC** | **Frequency** | **Corrective Action** |
| **Blank** | Each batch of (≤20) samples | Inject a solvent blank to check for analytical system contamination. Re-inject the blank. If the re-injected blank is acceptable then any samples with positive results must be re-injected. If the re-injected blank is unacceptable, all associated samples must be re-extracted. |
| **Surrogate**<br>507 – 2-NMX<br>508 – DCB<br>515 – DCAA<br>531 – BDMC | Added to each field and QC sample during the extraction. | Recovery must be within specifications unless matrix-related problems are evident, in which case report results and comment. |
| **Matrix Spike/Matrix Spike Duplicate**<br>Spike all compounds of interest, except multipeak compounds | Each batch (≤20) of samples if sample volume is available. | Evaluate in conjunction with the LFB. |
| **Laboratory Fortified Blank (LFB)**<br>Spike all compounds of interest, rotate multipeak compounds | Each batch of (≤20) samples. LCSD may be used if insufficient sample for MS/MSD is submitted. | If LFB compounds are outside of acceptance limits, re-extract and re-analyze the batch. Compounds that fail high in the LFB and are ND in the samples can be reported. |

Uncontrolled Copy

| QC Table for Drinking Water Method: 524.2 | | |
|---|---|---|
| **Type of QC** | **Frequency** | **Corrective Action** |
| **Blank** | One blank for each 12-hour period or batch of ≤20 samples | Reanalyze blank and associated samples if blank is unacceptable. |
| **Surrogate**<br>4-Bromofluorobenzene<br>1,2-Dichlorobenzene-$d_4$ | Added to each field and QC sample prior to analysis | Reanalyze sample if outside limits. If reanalysis confirms original, document on report. |
| **Matrix Spike/Matrix Spike Duplicate**<br>Spike all compounds of interest | At client request. | Evaluate in conjunction with the LFB. |
| **Laboratory Fortified Blank (LFB)**<br>Spike all compounds of interest | One LFB for each 12 hour period. | If target compounds are outside of acceptance limits, re-analyze the LFB. If second LFB fails, recalibrate instrument, re-analyze LFB and any associated samples. Compounds that fail high in the LFB and are ND in the samples can be reported. |
| **Internal standard (ISTD)**<br>Fluorobenzene | Added to each field and QC sample prior to analysis | Reanalyze sample if outside limits. If reanalysis confirms original, document on report. |

Uncontrolled Copy

| EPA 624<br>Quality Control<br>GC/MS Volatiles | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogates:**<br>4-Bromofluorobenzene<br>1,2-Dichloroethane-$d_4$<br>Fluorobenzene | Each sample, MS, MSD, LCS, and blank | Reanalyze sample if outside limits; if reanalysis is within limits, the reanalysis data is reported. If surrogates confirm original, document on report and/or case narrative |
| **Matrix Spikes:**<br>Spike all compounds of interest | Each batch (≤20) of samples | Evaluated by analyst in conjunction with the LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Samples:**<br>Spike all compounds of interest | Each batch (≤20) of samples | Reanalyze LCS and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits. Compounds that fail high in the LCS and are ND in the samples can be reported. |
| **Matrix Spike Duplicates (RPD):**<br>Spike all compounds of interest | Each batch (≤20) of samples | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | Once every 24-hour tune period and/or 20 samples, which ever comes first | Reanalyze blank and associated samples if blank outside QC limits |
| **Internal Standards (ISTD):**<br>Bromochloromethane<br>2-Bromo-1-chloropropane<br>1,4-Difluorobenzene | Each sample, MS, MSD, LCS, and blank | Reanalyze sample if outside limits; if reanalysis is within limits, the reanalysis data is reported. If internals confirm original, document on report and/or case narrative |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

| EPA 625<br>Quality Control<br>GC/MS Semivolatiles | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:**<br>Nitrobenzene-$d_5$<br>2-Fluorobiphenyl<br>Terphenyl-$d_{14}$<br>Phenol-$d_6$<br>2-Fluorophenol<br>2,4,6-Tribromophenol | Each sample, MS, MSD, LCS, and blank | Re-extract and reanalyze if more than one surrogate out per fraction (acid/base) or any recovery <10%; if re-extraction and reanalysis confirms originals, document on report and/or case narrative |
| **Matrix Spikes:**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Evaluate in conjunction with the LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Sample:**<br>Spike all compounds of interest | Each group (≤20) of samples per matrix/level | Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits.<br>Compounds that fail high in the LCS and are ND in the samples can be reported. |
| **Matrix Spike Duplicates (RPD):**<br>Same as for matrix spikes | Each group (≤20) of samples per matrix/level | Evaluated by analyst in relationship to other QC results |
| **Blanks:** | Once per extraction group (≤20) of samples, each matrix, level, instrument | Re-extract and reanalyze blank and associated samples |
| **Internal Standards (ISTD):**<br>1,4-Dichlorobenzene-$d_4$<br>2-Fluoronaphthalene<br>Acenaphthene-$d_{10}$<br>Phenanthrene-$d_{10}$<br>Chrysene-$d_{12}$<br>Perylene-$d_{12}$ | Each sample, MS, MSD, LCS, and blank | Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

| EPA 608<br>Quality Control<br>Pesticides/PCBs | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:**<br>Organochlorine Pesticides & PCBs<br><br>DCB<br>TCMX | Each sample, MS, MSD, LCS, and blank | Repeat extraction and analysis if reanalysis confirms original report results and comment in case narrative |
| **Matrix Spikes:**<br>Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene<br>PCBs: Aroclor 1016 and Aroclor 1260 | Each batch (≤20) of samples | Evaluate in conjunction with LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Matrix Spike Duplicates (RPD):**<br>Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene<br>PCBs: Aroclor 1016 and Aroclor 1260 | Each batch (≤20) of samples | Evaluated by analyst in relationship to other QC results |
| **Laboratory Control Sample:**<br>Organochlorine Pesticides: Spike all compounds of interest, except PCBs, chlordane, and toxaphene<br>PCBs: Aroclor 1016 and Aroclor 1260 | Each batch (≤20) of samples | Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds in the LCS that fail high and are ND in the samples can be reported. |
| **Blanks:** | Each batch (≤20) of samples | Inject a hexane or solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be reextracted. |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

| EPA Method 602<br>Petroleum Analysis<br>Acceptance Criteria | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Surrogate:**<br>α,α,α-Trifluorotoluene (PID) | Each sample, MS, MSD, LCS, and blank | Reanalyze if the surrogate recovery is outside the limits unless matrix-related problems are evident. |
| **Matrix Spike:**<br>Spike all compounds of interest | Each group (≤20) of samples | Evaluate in conjunction with LCS. Acceptable LCS would be indicative of matrix effects on the MS/MSD. |
| **Laboratory Control Sample:**<br>Spike all compounds of interest | Each group (≤20) of samples. LCSD analyzed if sufficient volume is not available for MS/MSD | Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds in the LCS that fail high and are ND in the samples can be reported. |
| **Matrix Spike Duplicates (RPD):**<br>Same compounds as the matrix spike | Each group (≤20) of samples | Evaluated by an analyst in relationship to other QC results |
| **Blanks:** | At least once per 24 hours | Reanalyze blank and associated samples if blank is outside limits |
| **Internal Standards (ISTD):**<br>1-Chloro-3-fluorobenzene (PID) | Each sample, MS, MSD, LCS, and blank | Reanalyze samples; if reanalysis confirms original result, document on report or case narrative. In cases where the sample matrix is elevating the ISTD recovery, a dilution and reanalysis may be performed. |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change

Uncontrolled Copy

| EPA Method 600 Series (Method 200.8 for ICP/MS)<br>Quality Control<br>Inorganics (Metals) | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Internal Standard:** | Each sample, standard and QC (Unspiked, Dup., MS, LCS, dilution, Post Digestion Spike and blank) | If the internal standard response falls outside the specified range, then the samples would be reanalyzed. |
| **Matrix Spikes:** | Each group of samples of similar matrix/level (≤10) each method | Analyze post-digestion spike sample |
| **Matrix Spike Duplicate (RPD):** | Not required | N/A |
| **Duplicates (RPD):** | Each group of samples of similar matrix/level (≤10) each method | Flag the data |
| **Blanks:**<br>Initial Calibration (ICB)<br>Continuing Calibration (CCB)<br><br>Preparation Blank | Each wavelength immediately after calibration verification at 10% frequency or every 2 hours (beginning and end of run min.)<br><br>Each SDG or batch (≤10 samples) | Correct problem, recalibrate, and rerun<br><br>Redigest and reanalyze blank and associated samples if sample result is greater than the LOQ and <10× blank result |
| **Serial Dilutions:** | Each group of (≤10) of similar matrix/level | Flag the data |
| **Interference Check Sample:** | Each wavelength after Initial Calibration Verification at beginning and end of the run or min. of 2 times per 8 hour | Correct for interference, recalibrate the instrument |
| **Laboratory Control Sample:** | Each SDG or batch (≤10 samples), each method | Redigest and reanalyze LCS and associated samples. Elements in the LCS that fail high and are ND in the samples can be reported. |
| **Post Digestion Spike:** | When matrix spikes are outside 70% to 130% range or within the statistical window (whichever is tighter) | Flag the data |
| **Analytical Spike:** | One per 10 field samples | ICP-MS – flag the data |

Uncontrolled Copy

| Quality Control for Miscellaneous 600 Series Water Tests | | | |
|---|---|---|---|
| **Test** | **QC Type** | **Frequency** | **Corrective Action** |
| **Alkalinity**<br>**Ammonia (ISE)**<br>**Ammonia (Distill.)**<br>**Dissolved Solids**<br>**Fluoride (ISE)**<br>**Hardness**<br>**Sulfate (turb)**<br>**Sulfide**<br>**Total Solids**<br>**Turbidity** | Blank | Each batch (≤20) of samples | Prepare the entire batch again and re-analyze. |
| | Laboratory Control Sample | Each batch (≤20) of samples | Prepare the entire batch again and re-analyze.* |
| | Duplicate | Each batch (≤20) of samples | Ensure that LCS meets acceptance criteria. |
| | Matrix Spike/<br>Matrix Spike Duplicate | Each batch (≤20) of samples<br><br>(not for turbidity) | Ensure that LCS meets acceptance criteria. |
| **Bromide (IC)**<br>**Chloride (IC)**<br>**Sulfate (IC)**<br>**Cyanide (total & free)**<br>**Fluoride (IC)**<br>**Nitrogen (TKN)**<br>**Nitrate/Nitrite**<br>**Total Phosphorus**<br>**TOC** | Blank | Each batch (≤20) of samples | Prepare the entire batch again and re-analyze. |
| | Laboratory Control Sample | Each batch (≤20) of samples | Prepare the entire batch again and re-analyze.* |
| | Duplicate | Each batch (≤10) of samples | Ensure that LCS meets acceptance criteria. |
| | Matrix Spike | Each batch (≤10) of samples | Ensure that LCS meets acceptance criteria. |
| **Phenols** | Blank | Each batch (≤20) of samples | Prepare the entire batch again and re-analyze. |
| | Laboratory Control Sample | Each batch (≤20) of samples | Prepare the entire batch again and re-analyze.* |
| | Matrix Spike/<br>Matrix Spike Duplicate | Each batch (≤10) of samples | Ensure that LCS meets acceptance criteria. |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

*LCSs that fail high and associated samples are ND can be reported.

Uncontrolled Copy

| TO-15 Volatile Organics in Air | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Laboratory Control Sample:** Spike all compounds of interest | Each group (≤20) of samples | Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported. |
| **Blanks:** | Once for each 24-hour time period or ≤20 samples | Reanalyze blank and associated samples if blank outside limits |
| **Internal Standards (ISTD):** Bromochloromethane 1,4-Difluorobenzene Chlorobenzene-$d_5$ | Each sample, LCS, and blank | Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

| TO-14A Volatile Organics in Air | | |
|---|---|---|
| **Type** | **Frequency** | **Corrective Action** |
| **Laboratory Control Sample:** Spike all compounds of interest | Each group (≤20) of samples | Reanalyze LCS and associated samples for compounds outside acceptance limits. Compounds that fail high in the LCS and are ND in the samples, can be reported. |
| **Blanks:** | Once for each 24-hour time period or ≤20 samples | Reanalyze blank and associated samples if blank outside limits |
| **Internal Standards (ISTD):** Bromochloromethane 1,4-Difluorobenzene Chlorobenzene-$d_5$ | Each sample, LCS, and blank | Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative |

Acceptance limits are based on statistical evaluation of laboratory data and are subject to change.

Uncontrolled Copy

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-GDL-9015388 | **Revision** | 3 |
| **Effective Date** | Jan 13, 2015 | **Status** | Effective |
| **Historical/Local Document Number** | DOD - Environmental Quality Policy Manual Appendix K | | |
| **Local Document Level** | Level 1 | | |
| **Local Document Type** | POL - Policy | | |
| **Local Document Category** | ES - Environmental Sciences | | |

| | |
|---|---|
| **Prepared by** | Barbara F. Reedy |
| **Reviewed and Approved by** | Robert Strocko;Review;Tuesday, December 30, 2014 10:09:14 AM EST<br>Duane Luckenbill;Review;Tuesday, December 30, 2014 12:59:11 PM EST<br>Dorothy Love;Approval;Tuesday, December 30, 2014 1:18:10 PM EST |

Uncontrolled Copy

**MICROBIOLOGICAL TESTING**

# 1. MICROBIOLOGICAL SAMPLE HANDLING

## 1.1. Microbiological Sample Collection

The containers for environmental microbiology are typically sterile, screw-cap plastic bottles. A minimum of 100 mL of sample is required. The sampling containers are purchased with a sterility certification. The sterility, absence of autofluoresence, and volume of each purchased lot of containers is verified by randomly selecting a container from each purchased lot and inoculating it with approximately 100 mL of sterile tryptic soy broth and placing it in incubation for 24 hours at 35° ± 0.5°C. Each lot of bottles is also checked for absence of autofluoresence with a 366-nm UV light with a 6-Watt bulb. The 100-mL calibration line on the container is verified using a 100-mL Class A graduated cylinder to 2.5% tolerance.

Samples collected for microbiological analyses must follow a specific protocol:

- The sampling taps are to be free of aerators, strainers, hose attachments, and purification devices; they should not be mixing type faucets, and avoid leaky faucets.
- Maintain a steady water flow for 3 to 5 minutes before collecting the sample.
- Using aseptic techniques, fill the container to just above the 100-mL mark on the container. This will allow for mixing and chlorine residual analysis.
- Do not overfill the container.
- If another environmental microbial analysis is required, or if the water is discolored (to act as a color standard), a separate container will be required.

## 1.2. Microbiological Sample Storage

Because sample integrity can be compromised by improper storage, the environmental microbiology samples are refrigerated with the temperature monitored until requested by the microbiologist for analysis.

Holding times for samples are monitored and analysis is scheduled accordingly. For Safe Drinking Water Act (SDWA) compliance purposes, no sample (for total coliform analysis) with over 30 hours elapsed time from collection will be analyzed. HPC samples from SDWA surface water systems must be tested within 8 hours of collection. Fecal coliform tests on effluents for National Pollutant Discharge Elimination System (NPDES) compliance purposes must be transported to the laboratory within 6 hours of collection. Samples that arrive past 6 hours of when they were collected cannot be tested. Whenever possible, the sample should be tested within 2 hours of receipt.

### 1.3. Microbiological Sample Return/Disposal

All solid wastes generated from the microbiological analyses are disposed of in bags designated as "BioHazard", sterilized via autoclave and disposed of by incineration. The laboratory uses a sophisticated, laboratory information management system (LIMS), which includes programming to assist in the identification of hazardous wastes at time of discard. In most cases, a sample for coliform testing is collected in a container that will also be the test vessel. When this occurs, samples are discarded in the laboratory immediately after analysis is completed. When samples are not tested in the sample container, the sample containers are returned to sample storage for disposal.

## 2. MICROBIOLOGICAL TECHNICAL REQUIREMENTS AND TRACEABILITY OF MEASUREMENTS

### 2.1. Media

- Within the microbiology laboratory, procedures are in place to address preparation, labeling, storage, expiration, documentation, and quality/sterility evaluation requirements for these materials. Only commercially prepared or manufactured dehydrated media is used for SDWA water work. Media may not be formulated from basic ingredients. Each new lot of dehydrated or commercially prepared medium is checked against positive and negative culture controls. Each purchased lot of MMO-MUG media is tested for performance using *E. coli*, *K. pneumoniae*, and *Ps. aeruginosa*, or equivalent organisms following a standard operating procedure. The positive/negative organism check is performed on each new lot of purchased or prepared media for QC purposes.

- Each analytical method includes a list of media needed for the test. These are fully described, including name, purity, and description of preparation. Where applicable, shelf life and storage conditions are also listed.

- The Microbiology Department is responsible for maintaining an inventory of the media needed. New supplies of media are checked by the Purchasing Department to ensure that they match the purchase order. The laboratory is responsible for checking that new supplies meet the method requirements.

- In addition to the name and concentration, the media containers are labeled with the storage conditions, the date opened, and an expiration or re-evaluation date. Subsequent media preparations at the laboratory are fully documented in a logbook and are traceable to, or labeled to include:

    1. Name of media
    2. Concentration, as appropriate
    3. Date prepared
    4. Name of analyst preparing or reference to logbook
    5. Storage conditions
    6. Expiration/re-evaluation date
    7. Manufacturer name and lot #
    8. Sterilization time and temperature
    9. Final pH, where required
    10. Sterility check result

Uncontrolled Copy

### 2.2. Microbiological Standard Sources, Calibration, and Preparation

Microbial Control Species - Where required, laboratory cultures are obtained from the American Type Culture Collection (ATCC). Cultures used in testing are no more than five transfers from ATCC freeze-dried cultures.

### 2.3. Microbiological Equipment Maintenance

Equipment maintenance and calibration is addressed in instrument-specific Operation, Maintenance, and Calibration Procedures (OMC) or instrument-specific instruction manuals located within the department.

The general process for sterilization procedures are outlined below:

2.3.1. All autoclaving is done at 121° ± 1°C, with times as specified below (in minutes):

| | |
|---|---|
| Carbohydrate media | 25 |
| Rinse water | 60 |
| Contaminated materials | minimum of 70 |

2.3.2. Sterile disposable single use membrane filter units or sterile glass filter funnels are used for methods that require filtration.

### 2.4. Microbiological Labware Cleaning

Sterile disposable plastic ware is primarily used for microbiological analysis. However, procedures are in place to outline the washing process for each type of labware used in the laboratory. Most glassware is machine-washed. Labware that is washed by hand is either air dried or dried in specifically designed ovens and sterilized appropriately. Each new lot, or at least annually, of detergents used to wash glassware for Environmental Microbiology labware, is tested using the Inhibitory Residue Test, as outlined in SM20 9020.B.4.a.2).

## MICROBIOLOGICAL INTERNAL QUALITY CONTROL CHECKS

### 2.5. Microbiological Laboratory Quality Control Samples and Acceptance Criteria

Quality control (QC) samples are analyzed with each batch of samples or new lot of reagents, as required by the referenced methods, to demonstrate that all aspects of the analysis are in control within established limits of precision and accuracy. Chromofluorogenic media QC tests are lot-specific and performed on each newly received lot.

Each laboratory analytical method specifies (or includes cross-references to) the type of QC sample, frequency of analysis, acceptance criteria for QC sample results, and corrective action to be taken if QC sample results fall outside of the acceptance range. The handling of QC data is described in section 9.2 of the Environmental Quality Policy Manual. The types of QC samples and the information each provides are discussed in the following paragraphs.

Uncontrolled Copy

2.5.1. Negative System Control - The QC on this is method specific and can be found in 1-P-QM-PRO-9018209, Quality Control/Quality Assurance Procedure for Environmental Microbiology.

2.5.2. Positive and Negative Organism Controls - Each lot/batch of media is tested using positive and negative organism controls.

2.5.3. Duplicate Counting (Test Variability/Reproducibility) - duplicate counting is performed monthly on HPC and fecal MF plates. Each analyst who counted samples for a month, counts the plates and their results are evaluated. Counts must be within 10% difference of the total average for all analysts to be acceptable.

2.5.4. Duplicates - For heterotrophic plate count samples, a duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test. The plate counts are averaged.

2.5.5. Serial Dilutions - Fecal coliform, biosolids analyses, and heterotrophic plate counts may require serial dilution of the sample.

## 2.6. Microbiological Quality Control Sample Frequency and Corrective Action

Each analytical method defines the frequency for the required QC samples, where appropriate. The corrective action required when a QC result fails to meet the acceptance criteria is also given, where appropriate.

The QC acceptance criteria are available to analysts in the laboratory. If the results are not within the acceptance criteria, corrective action suitable to the situation must be taken. This may include, but is not limited to, checking calculations, examining other quality control analyzed with the same batch of samples, qualifying results with a comment stating the observed deviation, and invalidating results. It should be noted that resampling may be required in the case of invalidated results for SDWA, Environmental Protection Agency (EPA), Pennsylvania Department of Environmental Protection (PADEP), or Pennsylvania Department of Health (DOH) compliance samples due to the short hold-times in microbiological analysis.

## 2.7. Microbiological Water Systems

Laboratory Reagent Water Suitability Testing - On an annual basis, a sample is sent to a PADEP certified laboratory for suitability analyses. These serve as confirmation of our analyses, as well as to supply additional data on the water suitability.

## 2.8. Microbiological Reporting Limits

For microbiological analysis, the limits are method-specified and/or project-specific. This information is programmed into the LIMS for reporting purposes.

Uncontrolled Copy

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-WI -9014165 | **Revision** | 9 |
| **Effective Date** | Aug 18, 2014 | **Status** | Effective |
| **Historical/Local Document Number** | Analysis 7103, 11601, 11604 | | |
| **Local Document Level** | Level 3 | | |
| **Local Document Type** | TEST - Testing Document | | |
| **Local Document Category** | ANALYSIS-ES - Analysis-Environmental Science | | |

| | |
|---|---|
| **Prepared by** | Michele Graham |
| **Reviewed and Approved by** | Erik Frederiksen;Review;Wednesday, August 13, 2014 10:55:05 AM EDT<br>Christiane Sweigart;Approval;Thursday, August 14, 2014 3:45:49 PM EDT |

## Revision Log:

| Revision: 9 | Effective Date: This version | |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Document Title | Clarification | Add 63 (reapproved 2007) to the method |
| Reference 1. | Clarification | Added 63 (reapproved 2007) |
| Cross Reference | No longer referenced in procedure | Deleted Analysis #1443, 6569, 1-P-QM-QMA-9015389 and 1-P-QM-QMA-9021767 |
| Personnel Training and Qualifications | Requirement | Added requirement of documenting observation of analyst |
| Sample Collection, Preservation, Handling | Requirement | Added no hold time and sample storage temp |
| Procedure B. NOTE | Reflect current process | Took out reference to check hydrometer annually |

| Revision: 8 | Effective Date: Jan 3, 2013 | |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Throughout Document | Reflect re-identification of documents in EtQ<br><br>Clarification | Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers<br><br>Updated all reference to deionized water to reagent water |
| Calibration | Reflect current practice | Added balances must be calibrated |
| Quality Assurance/Quality Control | Reflect current practice | Added batch size limited to 20 samples or less |

## Reference:

1. ASTM D422-63 (reapproved 2007), Standard Test Method for Particle-Size Analysis of Soil

2. ASTM D421 - 85, *Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants.*

3. ASTM E868 - 82, "*Conducting Performance Tests on Mechanical Conveying Equipment Used in Resource Recovery Systems*," Sec 9.9 (modified), "*Measuring Bulk Density of Material*."

4. Method 160.3, *EPA Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020, (modified).

5. *Chemical Hygiene Plan*, current version.

## Cross Reference:

| Document | Document Title |
|---|---|
| Analysis #0111, 6111, 7611, 11624, 12845 | Moisture (Gravimetric) |
| 1-P-QM-FOR-9008039 | #7103 Particle Size Distribution / #11604 Grain Size Classification |
| 1-P-QM-PRO-9015418 | ETM System Probe Calibration |
| 1-P-QM-PRO-9015422 | Equipment Muffle Furnaces and Ovens |
| 1-P-QM-QMA-9015389 | Balance, Syringe, Pipette Verification |
| 1-P-QM-QMA-9017328 | Reagents and Standards |

## Scope:

This procedure is applicable to the determination of the distribution of particle sizes in soils and solids. Particle sizes in the range 75 to 0.075 mm are determined by sieving. Distribution of particle sizes smaller than 0.075 mm is determined by a sedimentation process using a hydrometer.

## Basic Principles:

The process determines the particle sizes and distribution in a soil/solid sample. The sample is dried, ground, and sieved using sieves of different sizes. Particle sizes in the range 75 to 0.075 mm are determined by sieving. Distribution of particle sizes smaller than 0.075 mm is determined by a sedimentation process using a hydrometer.

## Interferences:

When high levels of organic material are present in the soil (material with a specific gravity less than one), the hydrometer readings are subject to error. After air-drying the sample, remove as much of the organic material (leaves, roots, sticks, etc.) as possible.

## Safety Precautions and Waste Handling:

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Use caution when handling any chemicals, solvents or reagents. Avoid inhalation and skin contact. Standard safe laboratory procedure must be followed.

## Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP. Also, documented observation of the analyst's accurate performance of the procedure by another trained employee is required.

## Sample Collection, Preservation, and Handling:

There is no holding time for this analysis. Samples are stored at 0 to 6°C; not frozen.

1. Place the sample as received in a glass, baking dish. Allow to air dry at room temperature for approximately 24 hours or until thoroughly dried. Use enough sample so that the material needed to pass through the No. 8 sieve is approximately 100 g or more.

2. Break and grind the dried sample using the rubber-covered pestle. Continue to do so until the sample is reduced to a fine material. **Do not break rocks that are part of the sample matrix as this is likely to affect the sample sedimentation process.**

   All information needs to be recorded on Form 1-P-QM-FOR-9008039 as soon as the sample preparation is started.

**Apparatus and Equipment:**

1. Analytical balance, pan balance, or equivalent; refer to 1-P-QM-QMA-9015389

2. Mechanically operated sieving device

3. Mechanically operated stirring device

4. Hydrometer - graduated to read in specific gravity of the suspension

5. Sedimentation cylinder – 1000-mL

6. Thermometer - accurate to 0.5°C; refer to 1-P-QM-PRO-9015418

7. Sieves - Numbers 4, 6, 8, 16, 30, 50, 100, 200, 0.75", 1.5", and 3"

8. Sieve pan

9. Rubber covered pestle, or equivalent

10. Beakers – 150-mL and 250-mL

11. Specimen collection cups (120-mL), or equivalent

12. Glass baking dishes, or equivalent

13. Glass stir rod, or equivalent

14. Oven maintained at 110° ± 5°C; adjust as needed to stay in this range; refer to 1-P-QM-PRO-9015422

15. Whatman Grade 3 filter paper - 6 micron pore size

16. Buchner funnel

**Reagents and Standards:**

Alternate weights may be used as long as the final concentrations remain the same. Refer to 1-P-QM-QMA-9017328 for the proper labeling and documentation of reagents preparations.

1. Sodium hexametaphosphate solution - Dissolve 40 g of sodium hexametaphosphate in reagent water and dilute to 1 liter. Prepare fresh monthly. Store at room temperature in a glass or plastic container.

2. n-hexane – 85% purity, 99.0% min. saturated $C_6$ isomers, purchased. See container for shelf life and storage information.

**Calibration:**

Balances must be calibrated each day before use. Refer to 1-P-QM-QMA-9015389.

**Procedure:**

**NOTE: When sample contains oil, extract using procedure F.**

A. The sieved analysis of the portion retained on the No. 8 sieve.

Check to be sure that the balance has been calibrated each day before use.

1. Tare the sieving pan, No. 8, No. 6, No. 4, 0.75", 1.5", and the 3" sieved consecutively (to 0.01 g) using a pan balance.

2. Using the prepared sample, place the sample in the tared sieves and begin the sieving operation using the mechanical sieving device. Agitate for approximately one minute. Continue sieving until no more than 1% of the residue on each sieve passes that sieve during 1 minute of sieving.

   **NOTE:** If sample particle size is too great to pass through the sieve, continue to break and grind as needed. Do not break stones or rocks that are part of the sample matrix.

3. Determine the mass retained (Mr) on the 3" sieve. Weigh on the balance and record the combined sieve and sample weight. Continue sieving with the remaining sieves recording all determined sample masses on the sieves.

   To calculate the mass retained:

   *Mr = Tare + sample weight value – the tare weight value*

4. Retain the sample collected in the sieving pan after weighing.

   a. Weigh approximately 50 g of sample into a 250-mL beaker.

   b. Place approximately 30 g or more of the remaining sample into a specimen cup, for use when performing the moisture and bulk density analyses.

B. Hydrometer analysis

**NOTE:** The hydrometer must be visually inspected for any cracks or breaks before each use.

1. Using the sample in the 250-mL beaker add 125 mL of sodium hexametaphosphate solution. Stir the soil-water slurry until it is thoroughly moistened. Cover and label beaker with sample number. Allow this slurry to soak for at least 16 hours, but not to exceed 24 hours.

2. At the end of the soaking period, transfer the soil-water slurry into a dispersion cup using room temperature reagent water. Be sure to rinse all residue from the beaker into the dispersion cup.

   **NOTE:** Extra care needs to be taken when rinsing the sample into another container or when using any apparatus. **All particles need to be rinsed into the new container or a loss in sample weight is possible to occur.**

3. Stir for one minute using the stirring apparatus. **Rinse stirring apparatus well into dispersion cup to prevent loss of sample.**

4. Transfer the soil-water slurry into a glass sedimentation cylinder, rinsing well. Add room temperature reagent water until the total volume is 1000 mL.

5. Cover the open end of the cylinder with parafilm, then placing the palm of the hand over the end, invert the cylinder and agitate for a period of one minute. Place the cylinder in a location where it will not be disturbed or moved during the sedimentation readings (for 24 hours).

6. Remove the parafilm and immediately begin the hydrometer readings, recording the temperature reading after each suspension. Record the readings at the following intervals (measured from the beginning of sedimentation): 2, 5,15, 30, 60, 250, and 1440 minutes. Insert the hydrometer about 20 to 25 seconds before the reading is due to the approximate depth. Clean the hydrometer between readings by placing it into reagent water and twisting with a spinning motion.

**NOTE:** The basic temperature to be maintained for the hydrometer test is 68°F (20°C). Small variations of temperature do not introduce differences that are of practical significance.

C. Final sieving analysis of the portion of sample passing the No. 8 sieve.

1. After taking the final hydrometer reading, pour the suspension through a No. 200 sieve and rinse with reagent water until the wash water is clear.

2. Transfer the remaining sample from the sieve into a 150-mL beaker, rinsing well with room temperature reagent water and dry in an oven at 110° ± 5°C for at the least 12 hours or longer.

3. After the sample has dried and no liquid is remaining. Remove from the oven and allow to cool. When the sample has reached room temperature use a glass stir rod to scrape the beaker and crush the harden residue into fine particles.

4. Tare the collection pan, the No. 200, No. 100, No. 50, No. 30, and No. 6 sieves consecutively (to 0.01 g) using a pan balance.

5. Place the oven-dried sample into the sieves and cover. The sieves need to be covered at this point of agitation due to the fine and lightweight particle sizes. Agitate for approximately 5 minutes to allow the fine particles to pass within the sieves.

6. Determine the mass retained (Mr) on each sieve by weighing and recording the combined weight of the sieve and the sample.

D. Moisture analysis

Using approximately 5 g of sample from the specimen collection cup (Procedure: Section A.4.b.) Perform a moisture analysis according to the Lancaster Laboratories analysis 0111. Record all information on 1-P-QM-FOR-9008039.

E. Bulk density analysis

1. Weigh out approximately 15 g of sample from the specimen collection cup (Procedure A.4.b.).

2. Tare a 100 mL volumetric flask and record data on 1-P-QM-FOR-9008039.

3. Add sample to tared flask.

4. Add approximately 50 mL reagent water and agitate flask until soil is thoroughly mixed.

5. Remove air bubbles by inserting a vacuum tube inside the neck of flask being careful not touch the contents of the flask.

6. Once air bubbles are removed, bring mixture to a final volume of 100 mL using reagent water.

7. Reweigh the flask and its contents and record the reading on the data sheet (form 3606).

   **NOTE:** When sample contains oil, extract using procedure F.

F. Extraction procedure for soil samples containing oil (Analysis #11601)

1. The samples are allowed to air dry in a dish.

2. After air-drying, if the sample exhibits an oil/organic nature that would prohibit proceeding with the procedures of ASTM D 422, the following steps will be employed.

3. Add enough n-hexane is added to the sample so the sample is totally submerged. Allow to soak for at least 10 minutes.

4. In a Hood, assemble a Buchner funnel fitted with Whatman Grade 3 filter paper (6 micron pore size) to a vacuum.

5. Using a glass rod agitate the sample to promote the dissolving of the oil.

6. Pour the hexane filtrate onto the Buchner funnel and allow it to filter through.

7. Discard the oil/hexane filtrate in a solvent container.

8. Inspect the solids that are left in the dish for oil. If oil is visible repeat the process as needed starting at step # 3.

9. After all the oil has been removed from the sample pour the entire solid onto a fresh filter and allow to dry under vacuum for about five minutes.

10. Transfer solids back to drying dish, proceed with additional air-drying as needed and grind as per ASTMD 422.

11. After extraction procedure sample follows normal procedure.

G. Grain Size Classification (analysis #11604)

To report the % Gravel, % Sand, % Silt, and % Clay fractions electronically, a separate grain size classification scan with the % passing at each type as a separate piece will be determined and recorded on 1-P-QM-FOR-9008039. See below for further information on % classification. For sediments that do not have sufficient sample volume to perform the hydrometer portion of the test, the sum of the % Silt and Clay can be reported as one aggregate value. The classifications are entered as Analysis #11604.

1. % Gravel – determined by the amount of particles passing 3-in. and retained on No. 4 sieve (size 4.75-mm).

2. % Sand - determined by the amount of particles passing No. 4 sieve (size 4.75-mm) and retained on No. 200 sieve (size 0.075-mm).

3. % Silt – determined by the amount of particles passing 0.074 to 0.005-mm.

4. % Clay – determined by the amount of particles smaller than 0.005-mm.

**Calculations:**

A spreadsheet using Excel, or an equivalent, has been prepared to facilitate the calculation of data, the plotting of the graph, and the interpolation of the hydrometer results from the graph. It is possible for data to be reported directly from the spreadsheets; however, the plotted hydrometer data may be more accurate than the computer interpolations. Refer to this spreadsheet for the appropriate tables to hand calculate data.

Use the mass retained (Mr) values recorder for each sieve as Mr8, Mr6, Mr4, etc. to determine the percent passing each sieve.

To calculate the mass retained:

*Mr = Tare + sample weight value – the tare weight value*

A. Sieve analysis values for the portion coarser than the No. 8 sieve

1. $Mt = Mc + Mf$

**Where:**

Mt = total mass

Mc = mass of the coarse material

Mf = mass of the fine material

2. $P8 = Mf/Mt \times 100$

**Where:**

P8 = percentage passing No. 8 sieve

3. $$P6 = \frac{Mf + Mr8}{Mt} \times 100$$

**Where:**

P6 = percentage passing No. 6 sieve

Mr8 = mass retained on No. 8 sieve

4. $$P4 = \frac{Mf + Mr8 + Mr6}{Mt} \times 100$$

**Where:**

Mr6 = mass retained on the No. 6 sieve

P4 = percentage passing No. 4 sieve

5. Continue calculations as above for the 0.75", 1.5", and 3" sieves.

B. Percentages of soil in suspension

1. $Hf = Os/As$

Hygroscopic moisture correction factor

**Where:**

Hf = hygroscopic moisture correction factor

As = air dry mass of the soil

Os = oven dry mass of the soil = (oven dry weight minus the tare weight)

2. Percentages of soil in suspension

a. Calculate the oven dry mass of soil used in the hydrometer analysis by multiplying the air-dry mass of the soil used in the hydrometer analysis by the moisture correction factor.

b. $$W = \frac{oven\ dry\ mass\ in\ hydrometer}{P8} \times 100$$

**Where:**

W = oven dry mass of soil in a total test sample represented by the mass of the soil dispersed, in grams

P8 = percentage passing the No. 8 sieve (from calculation A.2.)

c. $$P = \left[(100{,}000/W) \times G/(G - G1)\right] \times (R - G1)$$

**Where:**

G = specific gravity of the soil

G1 = specific gravity of the liquid in which the soil was suspended (use 1)

W = oven dry mass of soil in a total test sample represented by the mass of the soil dispersed, in grams

P = percentage of soil remaining in suspension at the level at which the hydrometer measures the density of the suspension

R = Hydrometer reading with composite correction applied

d. $$D = K\sqrt{L/T}$$

**Where:**

D = diameter of the particle (in mm)

K = constant using the temperature of the suspension and the specific gravity of the soil particles (see the Excel spreadsheet or equivalent for the Analysis #7103, for the specific "K" values to use)

L = distance from the surface of the suspension to the level at which the density of the suspension is being measured (the effective depth from Table I)

T = interval of time from the beginning of sedimentation to the taking of the reading in minutes

C. Sieve analysis values of the portion finer than the No. 8 sieve

1. Calculate the percentage of particles retained on the No. 8 sieve as follows:

$$Pr8 = 100 - P8$$

**Where:**

Pr8 = percentage of particles retained on the No. 8 sieve

P8 = percentage of particles passing the No.8 sieve (from calculation A.2.)

2. Calculate the mass retained on the No. 8 sieve represented by the sample volume used in the hydrometer analysis as follows:

$$Mf8 = \frac{Pr8 \times W}{100}$$

**Where:**

Mf8 = mass retained on the No. 8 sieve represented by the sample volume used in the hydrometer analysis

W = oven dry mass of the soil in a total test sample represented by the mass of the soil dispersed (as calculated in B.2.b.)

3. Calculate the mass passing the No. 200 sieve as follows:

$$Mp200 = W - (Mr200 + Mr100 + Mr50 + Mr30 + Mr16 + Mf8)$$

**Where:**

Mp200 = mass passing the No. 200 sieve

Mr200, 100, 50, etc. = mass retained on the sieves used for the portion finer than the No. 8 sieve

Mf8 = mass retained on the No. 8 sieve represented by the mass of the soil used in the hydrometer analysis

W = oven dry mass of the soil in a total test sample represented by the mass of the soil dispersed (as calculated in B.2.b.)

4. $$P200 = \frac{Mp200}{W} \times 100$$

**Where:**

P200 = percentage passing the No. 200 sieve

Mp200 = mass passing the No. 200 sieve (use calculation from C.3.)

W = oven dry mass of the soil in a total test sample represented by the mass of the soil dispersed (as calculated in B.2.b.)

5. $$P100 = \frac{Mp200 + Mr200}{W} \times 100$$

**Where:**

P100 = percentage passing the No. 100 sieve

Mr200 = mass retained on the No. 200 sieve

Mp200 = mass passing the No. 200 sieve (use calculation from C.3.)

W = oven dry mass of the soil in a total test sample represented by the mass of the soil dispersed (as calculated in B.2.b.)

6. $$P50 = \frac{Mp200 + Mr200 + Mr100}{W} \times 100$$

**Where:**

P50 = percentage passing the No. 50 sieve

Mr100 = mass retained on the No. 100 sieve

Mp200 = mass passing the No. 200 sieve

Mr200 = mass retained on the No. 200 sieve

W = oven dry mass of the soil in a total test sample represented by the mass of the soil dispersed (as calculated in B.2.b.)

7. Continue calculations as above for the No. 30 and No. 16 sieves.

D. Prepare a graph of the test results on a logarithmic scale, plotting the diameter of the particles as the abscissa and the percentages smaller than the corresponding diameters as the ordinate. Report (from the graph or directly from the tabulated data) the percentage of particles passing the 3", 1.5", 0.75", No. 4, No. 6, No. 8, No. 16, No. 30, No. 50, No. 100, and No. 200 sieves. Report the hydrometer results (from the graph) as the percentage passing 0.050 mm, 0.020 mm, 0.005 mm, 0.002 mm, and 0.001 mm.

**Statistical Information/Method Performance:**

Not applicable to this procedure.

**Quality Assurance/Quality Control:**

When possible, perform duplicate analyses for particle size on a routine basis.

Batch size is limited to 20 samples or less.

## Table I

## Values of Effective Depth Based on Hydrometer and Sedimentation Cylinder of Specific Sizes[A]

| Hydrometer 151H | |
|---|---|
| Actual Hydrometer Reading | Effective Depth, L, cm |
| 1.000 | 16.3 |
| 1.001 | 16.0 |
| 1.002 | 15.8 |
| 1.003 | 15.5 |
| 1.004 | 15.2 |
| 1.005 | 15.0 |
| 1.006 | 14.7 |
| 1.007 | 14.4 |
| 1.008 | 14.2 |
| 1.009 | 13.9 |
| 1.010 | 13.7 |
| 1.011 | 13.4 |
| 1.012 | 13.1 |
| 1.013 | 12.9 |
| 1.014 | 12.6 |
| 1.015 | 12.3 |
| 1.016 | 12.1 |
| 1.017 | 11.8 |
| 1.018 | 11.5 |
| 1.019 | 11.3 |
| 1.020 | 11.0 |
| 1.021 | 10.7 |
| 1.022 | 10.5 |
| 1.023 | 10.2 |
| 1.024 | 10.0 |
| 1.025 | 9.7 |
| 1.026 | 9.4 |
| 1.027 | 9.2 |
| 1.028 | 8.9 |
| 1.029 | 8.6 |
| 1.030 | 8.4 |
| 1.031 | 8.1 |
| 1.032 | 7.8 |
| 1.033 | 7.6 |
| 1.034 | 7.3 |
| 1.035 | 7.0 |
| 1.036 | 6.8 |
| 1.037 | 6.5 |
| 1.038 | 6.2 |

[A]Values of effective depth are calculated from the equation:

$$L = L1 + \tfrac{1}{2} \times \left[ L2 - \left( \frac{V_B}{A} \right) \right]$$

**Where:**

L = effective depth, cm

L1 = distance along the stem of the hydrometer from the top of the bulb to the mark for a hydrometer reading, cm

$L_2$ = overall length of the hydrometer bulb, cm

$V_B$ = volume of hydrometer bulb, $cm^3$, and

A = cross-sectional area of sedimentation cylinder, $cm^2$

Values used in calculating the values in Table I are as follows:

For hydrometer 151H:

$L_2$= 14.0 cm

$V_b$ = 67.0 $cm^3$

A = 27.8 $cm^2$

L1 = 10.5 cm for a reading of 1.000

= 2.3 cm for a reading of 1.031

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-WI -9015133 | **Revision** | 16 |
| **Effective Date** | Dec 3, 2014 | **Status** | Effective |
| **Historical/Local Document Number** | Analysis DOD - 1848, 10635 | | |
| **Local Document Level** | Level 3 | | |
| **Local Document Type** | TEST - Testing Document | | |
| **Local Document Category** | ANALYSIS-ES - Analysis-Environmental Science | | |

| | |
|---|---|
| **Prepared by** | Debra Bryan |
| **Reviewed and Approved by** | Robert Strocko;Review;Wednesday, November 19, 2014 1:11:31 PM EST<br>Barbara Reedy;Approval;Wednesday, November 19, 2014 1:15:26 PM EST |

## Revision Log:

| Revision: 16 | Effective Date: This version | |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Historical/Local Document Number | No longer part of current procedure | Removed 5720 |
| Reference | No longer part of current procedure | Removed CLP ILM02.1, ILM04.0, ILM05.2 |
| Scope | No longer part of current procedure | Removed reference to CLP |
| Apparatus and Equipment | Reflect current procedure | Included DEENA to item 6. |
| Procedure A | No longer part of current procedure | Removed Analysis 5720 (CLP) entire section |
| Procedure B | Clarification<br><br>No longer part of current procedure | NOTE: Reworded text pertaining to the preparation of the PB and LCS for soluble metals analysis<br><br>Removed Analysis 5720 (CLP) |
| Procedure C | Reflect current procedure | Included analysis 10635 (SW-846) |
| Procedure C.2 | Reflect current procedure | Added DEENA temperature 90° to 95°C |
| Procedure C.5 | Updated to current procedure | Replaced DI water with reagent water. |
| Quality Assurance/Quality Control | No longer part of current procedure | Removed reference to CLP digestion 5720 batch. |

| Revision: 15 | Effective Date: Nov 27, 2013 | |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Throughout Document | Reflect re-identification of documents in EtQ | Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers |
| Sample Collection, Preservation, and Handling | Process change | Changed sample storage temperature from 4° ± 2°C to 0° to 6° C but not frozen, prior to digestion. |
| Procedure A | Reflect current procedure | Added text, to NOTE, pertaining to the blank and LCS must also be filtered if any samples are filtered due to insoluble matter present in the digested sample.<br>Added NOTE, pertaining to using a smaller aliquot of the sample and bring sample to final volume, if contains high solids<br>Added NOTE, pertaining to filtering unpreserved sample and preparing the blank and spiked LCS using filtered reagent water, for soluble metals analysis |
| Procedure A.1.a | Clarification | Added text pertaining to adding spike solution, after the sample has been poured. |
| Procedure A.2.a | Clarification | Added text pertaining to adding spike solution, after the sample has been poured. |
| Procedure A.2.a | Reflect current procedure | Added reference to Analysis 6966, 1643……<br>Deleted reference to SOP SOP-IO-014 |
| Procedure A.2 | Reflect current procedure | Added 2nd NOTE pertaining to Lab filtering. |

| Revision: 15 | Effective Date: Nov 27, 2013 | |
|---|---|---|
| Procedure B | Reflect current procedure | Added text, to NOTE, pertaining to the blank and LCS must also be filtered if any samples are filtered due to insoluble matter present in the digested sample.<br>Added NOTE, pertaining to filtering unpreserved sample and preparing the blank and spiked LCS using filtered reagent water, for soluble metals analysis<br>Added NOTE, pertaining to using a smaller aliquot of the sample and bring sample to final volume, if contains high solids. |
| Procedure B.1.a | Clarification | Added text pertaining to adding spike solution, after the sample has been poured. |
| Procedure B.2 | Reflect current procedure | Added NOTE pertaining to Lab filtering. |
| Procedure B.2.a | Clarification | Added text pertaining to adding spike solution, after the sample has been poured. |
| Procedure C | New equipment in use | Added entire section pertaining to DEENA Auto-digester. |
| Procedure C | Reflect current procedure | Added NOTE, pertaining to using a smaller aliquot of the sample and bring sample to final volume, if contains high solids.<br>Added NOTE, pertaining to filtering sample, prep blank, and LCS if insoluble matter is present in the digested sample, or allow to settle by gravity.<br>Added NOTE, pertaining to filtering unpreserved sample and preparing the blank and spiked LCS using filtered reagent water, for soluble metals analysis |
| Block Digester Instruction | Reflect current procedure | Clarified instruction steps.<br>Deleted text pertaining to the difference between sample temperature and display temperature. |
| Quality Assurance/Quality Control | Reflect current procedure | Added reference to SOP 6966, 1643…for batch quality control requirements. |

**Reference:**

1. *Test Methods for Evaluating Solid Waste*, SW-846 Method 3005A, July 1992

2. *Chemical Hygiene Plan*, current version

**Cross Reference:**

| Document | Document Title |
|---|---|
| Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961,10145, 6955, 6944, 6936, 6969, 7968, … | Metals by Inductively Coupled Plasma Atomic Emissions Spectroscopy for SW-846 Methods 6010A/B/C (aqueous, solid, tissue), CLP 2.1(water/solid/tissue), CLP 4.0(water/solid/tissue), CLP 5.2 (water/solid/tissue) and EPA 200.7(aqueous) |
| 1-P-QM-FOR-9009182 | Working Instructions for Prep Solutions and Standards |
| 1-P-QM-QMA-9015390 | Demonstrations of Capability |

**Scope:**

This acid digestion procedure is used by the Metals Department of the Environmental Sciences Division at Lancaster Laboratories to prepare wastewater, surface water, and groundwater samples for measurement of total recoverable metals by inductively coupled plasma optical emission spectroscopy (ICP-OES) following SW-846 protocol.

This method is used whenever SW-846 Method 3010 is not requested or required for total metals.

**Basic Principles:**

Samples are heated with nitric and hydrochloric acids with a substantial reduction in volume during digestion to dissolve metals.

**Reference Modifications:**

1. A 50-mL sample aliquot and final volume is used instead of 100 mL to improve digestion throughput, conserve sample usage, and limit waste generation. Because all reagents are also adjusted so that concentrations are equivalent to a 100-mL aliquot, there is no impact on the data.

2. Ribbed watch glasses or reflux caps are not used during evaporation; samples are heated without watch glasses in non-metallic hoods to speed evaporation. No contamination trends have been observed in prep blanks evaporated without using watch glasses.

3. Samples are heated at 90° to 95°C on hotplates or Hotblocks, not 92° to 95°C as stated in ILMO4.0; hotplates cannot be maintained within 3°C range.

**Definitions:**

1. ACS – American Chemical Society

2. D – Sample Duplicate

3. DOC – Demonstration of Capability

4. IDOC – Initial Demonstration of Capability

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

6. LCSW– Laboratory Control Sample Water

7. LLENS - the computer program that integrates a PC with an analytical balance to collect data directly from the balance. The program organizes the data and transmits the readings to the LIMS.

8. LIMS – Laboratory Information Management Systems

9. LLI Sample ID – unique 7-digit number assigned to a client sample.

10. LOQ – Limit of Quantitation

11. MDL – Method Detection Limit

12. MS (R) – Matrix Spike

13. MSD (M) – Matrix spike duplicate

14. PB/PBW–Preparation Blank/ Preparation Blank Water

15. QC – Quality Control

16. Method Blank - equivalent to a Preparation Blank. A designated sample designed to monitor for sample contamination during the analysis process. A volume of reagent laboratory water is typically used to monitor water sample analysis, while solids blanks consist of a purified solid matrix or just the reagents used in the test. The blank demonstrates that no artifacts were introduced during the analysis process.

17. SOP- Standard Operating Procedure

18. U or US – unspiked background sample

**Interferences:**

Not applicable to this procedure

**Safety Precautions and Waste Handling:**

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

**Nitric acid ($HNO_3$)** – This acid can cause skin burns. Add nitric acid to samples in a hood to avoid exposure to toxic fumes or use the designated dispensing equipment.

**Hydrochloric acid (HCl)** – This acid can cause skin burns. Never mix HCl with concentrated $H_2SO_4$ to avoid a violent reaction. Always use in a fume hood or use the designated dispensing equipment.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds.

Samples that contain dust may be hazardous. Open in a fume hood.

When a hazardous flag is added indicating possible cyanide, special precautions are required to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

**Personnel Training and Qualifications:**

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability for this or an equivalent procedure.

Initially, each employee performing this digestion procedure must work with an experienced employee for a period of time until they can independently set up batches and perform the necessary steps outlined in this procedure. Proficiency is measured through documentation of the critical steps in this procedure, over checking of data as well as an IDOC.

The IDOC and the DOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Refer to1-P-QM-QMA-9015390, for specific requirements. A DOC is performed annually and is maintained in the analyst's training records.

**Sample Collection, Preservation, and Handling:**

Samples are collected in plastic containers and preserved to a pH of <2 with $HNO_3$. (Samples to be analyzed for soluble metals requiring filtration at the lab must be submitted unpreserved. The sample is run through a 0.45 micron filter within 5 days of receipt and then preserved.) The pH is checked upon receipt and adjusted as necessary by Sample Support; samples that are pH adjusted at the lab must not be digested for a minimum of 24 hours. If samples fail to maintain a pH of < 2 the Client Service Representative is notified for further direction. Samples are stored at 0° to 6°C, but not frozen, prior to digestion. Samples must be digested within 6 months of collection. Digested samples are stored in plastic at room temperature and have a 6 month holding time.

**Apparatus and Equipment:**

1. Polypropylene containers (digestion vessels) – certified clean and Class A equivalent

2. 250-mL beakers, 400-mL beakers (or other volumes as appropriate)

3. 100-mL graduated cylinders (or other volumes as appropriate)

4. 100-mL Class A volumetric flasks (or other volumes as appropriate)

5. 125-mL Nalgene bottles (or other volumes as appropriate)

6. Hot plates, Hotblocks, or DEENA, adjustable and capable of maintaining a temperature of 90° to 95°C

**Reagents and Standards:**

For reagent preparation, shelf life, and storage conditions, see Form 1-P-QM-FOR-9009182.

1. Nitric acid, $HNO_3$ - Fisher, Trace Metal Grade, or equivalent. Store at room temperature and reevaluate annually.

2. Hydrochloric acid, HCl - Fisher, Trace Metals Grade, or equivalent. Store at room temperature and reevaluate annually.

3. Nitric acid (1:1) – Add 500 mL of $HNO_3$ to 500 mL of reagent water. Store at room temperature. Expires in 6 months.

4. Hydrochloric acid (1:1) – Add 500 mL of HCl to 500 mL of reagent water. Store at room temperature. Expires in 6 months.

**NOTE:** It is acceptable to prepare solutions using multiples of indicated volumes if exact ratios are maintained.

**Calibration:**

Not applicable to this method.

**Procedure:**

**This SOP has been set up to outline the procedures for hotblock, hot plate, and auto-digester (see below). Choose the procedure that corresponds to the sample heating technique being used for sample digestion.**

A. Hotblocks

**NOTE:** It is acceptable to reduce the volume of sample being analyzed as long as the sample reagent ratios are maintained.

**NOTE:** If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

**NOTE:** When insoluble matter is present after digestion, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the prep blank and LCS must also be filtered.

**NOTE:** For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The prep blank and spiked LCS must also be prepared with filtered reagent water.

See Hotblock Control Point Temperature Logbook to obtain control point temperature setting for the Hotblock being used for digestion. If necessary, adjust control point temperature to the proper setting as instructed below.

Analyses 1848 and 10635 (SW-846):

**NOTE:** The procedures for analysis 1848 and 10635 are equivalent as outlined below. Analysis 10635 is used only for SW-846 Update IV. When entering the batch number in the LIMS the "1" is omitted (i.e. use YYDDD0635###, where YY is the year, DDD is the julian day, and ### is the digest number).

1. Shake sample well. Transfer 50-mL of well-mixed sample into a 68-mL digestion vessel. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see form 1-P-QM-FOR-9009182. For sample batch quality control requirements see SOP Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961,10145, 6955, 6944, 6936, 6969, 7968, ...

2. Add 2 mL of (1:1) HNO3 and 5 mL of (1:1) HCl.

3. Heat the solution in a Hotblock at about 90° to 95°C until sample volume is reduced to between 15 and 20 mL, making certain the sample does not boil.

4. Allow to cool.

5. Adjust volume to the 50-mL mark on the digestion vessel with reagent water, cap and mix.

6. The sample is now ready for analysis.

B. Hot Plates:

**NOTE:** If boron (B) is requested on a sample, use Teflon vessels.

**NOTE:** It is acceptable to reduce the volume of sample being analyzed as long as the sample reagent ratios are maintained.

**NOTE:** When insoluble matter is present in the digested sample, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the prep blank and LCS must also be filtered.

**NOTE:** For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The prep blank and spiked LCS must also be prepared with filtered reagent water.

**NOTE:** If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

Analyses 1848 and 10635 (SW-846):

1. Shake sample well. Using a 50-mL graduated cylinder, transfer 50 mL of well-mixed sample into a 250-mL beaker. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see form 1-P-QM-FOR-9009182. For sample batch quality control requirements see SOP Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961,10145, 6955, 6944, 6936, 6969, 7968, …

2. Add 2 mL of (1:1) $HNO_3$ and 5 mL of (1:1) HCl.

3. Heat the solution on a hot plate at 90° to 95°C until sample volume is reduced to between 15 and 20 mL, making certain the sample does not boil.

4. Allow to cool.

5. Transfer the solution to a 50-mL volumetric flask. Adjust volume to the 50-mL mark with reagent water and mix.

6. Transfer the solution to a 125-mL Nalgene container and cap.

7. The sample is now ready for analysis.

C. DEENA Auto-digester

**NOTE:** If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

**NOTE:** When insoluble matter is present after digestion, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the prep blank and LCS must also be filtered.

**NOTE:** For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The prep blank and spiked LCS must also be prepared with filtered reagent water.

Analysis 1848 and 10635 (SW-846):

1. Shake sample well. Transfer 50-mL of well mixed sample into a 68-mL digestion vessel. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see form 1-P-QM-FOR-9009182. For sample batch quality control requirements see. SOP Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961,10145, 6955, 6944, 6936, 6969, 7968, …

2. Verify the DEENA temperature is 90° to 95°C

3. Place samples into 20 position sample trays starting in position one. Place the trays into the DEENA.

4. Open the DEENA software. Click the Rack Definition button and input the total number of samples to be run.

5. Make sure all reagents have sufficient volume and that the transfer tubes are in the appropriate reagent. Make sure the waste beaker is clean and has 5-10 mL of reagent water in it.

6. Press the Green traingle (GO) button.

## Block Digestor Instructions:

1. Turn block digestor on by pressing rocker switch located on the cord.

2. Wait about 8 seconds until controller display indicates current block temperature.

3. PRESS and hold STAR (*) key.

4. The display shows the Set Point Temperature.

5. The digits can be changed to the desired value by pressing the up and down arrows keys while holding the (*) key.

6. Confirm Control Point temperature is set to the block temperature that provides 90° to 95°C.

   **NOTE:** See HotBlock Control Point Temperature Logbook to obtain control point temperature setting for the HotBlock being used for digestion. If necessary, adjust Control Point temperature to the proper setting.

   **NOTE:** Polypropylene containers must not be heated above 130°C.

## Calculations:

Not applicable to this procedure.

## Statistical Information/Method Performance:

Not applicable to this procedure.

## Quality Assurance/Quality Control:

A method blank, sample duplicate, sample matrix spike, sample matrix spike duplicate, and laboratory control sample must be performed for every SW-846 digestion batch (analysis 1848 or 10635). A batch is 20 samples or less.

A method blank, sample duplicate, sample matrix spike, and laboratory control sample must be performed every CLP digestion batch (analysis 5720). A batch is 20 samples or less.

Each piece of batch QC is digested following the procedures in this SOP.

For sample batch quality control requirements see Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961,10145, 6955, 6944, 6936, 6969, 7968, ...

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-WI -9018442 | **Revision** | 8 |
| **Effective Date** | Jan 28, 2015 | **Status** | Effective |
| **Historical/Local Document Number** | Analysis 6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961,10145, 6955, 6944, 6936, 6969, 7968, … | | |
| **Local Document Level** | Level 3 | | |
| **Local Document Type** | TEST - Testing Document | | |
| **Local Document Category** | ANALYSIS-ES - Analysis-Environmental Science | | |

| | |
|---|---|
| **Prepared by** | Nina Haller |
| **Reviewed and Approved by** | Robert Strocko;Review;Wednesday, January 28, 2015 8:31:26 AM EST<br>Barbara Reedy;Approval;Wednesday, January 28, 2015 8:48:44 AM EST |

## Table of Contents

Revision Log: ..... 3
Reference: ..... 4
Cross Reference: ..... 4
Purpose: ..... 4
Scope: ..... 5
Routine Method: ..... 5
Basic Principles: ..... 6
Definitions: ..... 7
Interferences: ..... 11
Safety Precautions and Waste Handling: ..... 11
Personnel Training and Qualifications: ..... 12
Sample Collection, Preservation, and Handling: ..... 13
Apparatus and Equipment: ..... 14
Reagents and Standards: ..... 16
Calibration: ..... 17
Procedure: ..... 18
A. Setting up an ICP run ..... 18
B. Pouring an ICP run ..... 21
Instrument Operations: ..... 23
Routine Maintenance for the ICAP™ 6000 Duo Analyzer: ..... 29
Calculations: ..... 33
Statistical Information/Method Performance: ..... 36
Quality Assurance/Quality Control: ..... 36
Figure I: ..... 42
Table I (QC for SW-846 6010B, and 6010C): ..... 43
Table II (QC for EPA-600/R-94/111 (PW,EW,WW): ..... 47
Appendix I: ..... 50

## Revision Log:

| Revision: 8 | Effective Date: This version | |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Throughout Document | Reflects re-identification of documents in EtQ | Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers |
| Routine Methods | Correction | Removed highlight from Te, Th, W wavelengths |
| Quality Assurance/ Quality Control D.2. | Correction | Removed reference to table III |

| Revision: 7 | Effective Date: Nov 21, 2014 | |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Throughout Document | Reflects re-identification of documents in EtQ<br><br>No longer applicable<br><br>Updated to current procedure | Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers<br><br>Deleted references to CLP and SW846 6010A.<br><br>Minor clarifications |
| Routine Methods | Updated to current procedure | Added Thorium, Tungsten, and Tellurium |
| Calculations | Updated to current procedure | Included information for 1-point MSA. |

**Reference:**

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 6010B, December 1996

2. Method 200.7 (rev. 4.4), Determination of Metals and Trace Metals in Water and Wastes by Inductively Coupled Plasma-Atomic Emission Spectrometry, USEPA 600/R-94/111 May 1994.

3. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 6010C, February 2007

4. ICAP™ 6000 Series ICP-OES Spectrometer Operator Manual, 2005/2006.

5. *Chemical Hygiene Plan*, current version.

**Cross Reference:**

| Document | Document Title |
|---|---|
| 1-P-QM-FOR-9008385 | ICP LOQs (mg/L) |
| 1-P-QM-FOR-9008807 | MSA Prep for Samples with MS/MSD <50% |
| 1-P-QM-FOR-9008905 | MSA Prep for Samples within TCLP Limits |
| 1-P-QM-FOR-9009067 | Working Instructions for Preparation of ICP Solutions and Standards |
| 1-P-QM-FOR-9009182 | Working Instructions for Prep Solutions and Standards |
| 1-P-QM-PRO-9015403 | Fixed-Volume Hand-Held Pipettes |
| 1-P-QM-PRO-9015511 | Liquid Sample Preservation |
| 1-P-QM-QMA-9017309 | Determining Method Detection Limits and Limits of Quantitation |
| 1-P-QM-QMA-9017313 | Establishing Control Limits |
| 1-P-QM-QMA-9017325 | Instrument and Equipment Maintenance and Calibration |

**Purpose:**

The purpose of this SOP is to describe the proper analysis of aqueous and solid samples for metals by ICP. This SOP also outlines the proper operation and maintenance of the ICP instrumentation and provides consistent guidelines for the evaluation of ICP data.

**Scope:**

This procedure applies to analyses performed in Environmental Sciences using ICP for identification and quantitation of metallic constituents.

LOQs are based on annual statistical evaluation of laboratory data and are subject to change. The current MDLs and LOQs are maintained in the LIMS.

Limits of Quantitation are subject to change without notification.

**Routine Methods:**

Elements routinely analyzed on the Thermo Scientific iCAP 6000 Series Analyzer include Eurofins Lancaster Laboratories Environmental, LLC (ELLE) analyses:

| Element | Waters Analysis # | Solids Analysis # | Wavelength (nm) |
|---|---|---|---|
| Ag | 7066 | 6966 | 328.06 |
| Al | 1743 | 1643 | 308.21 |
| As | 7035 | 6935 | 189.04 |
| Au | 11762 | 11761 | 242.80 |
| B | 8014 | 7914 | 249.67 |
| Ba | 7046 | 6946 | 455.40 |
| Be | 7047 | 6947 | 313.04 |
| Ca | 1750 | 1650 | 317.93 |
| Cd | 7049 | 6949 | 226.50 |
| Co | 7052 | 6952 | 228.62 |
| Cr | 7051 | 6951 | 267.72 |
| Cu | 7053 | 6953 | 327.40 |
| Fe | 1754 | 1654 | 261.19 |
| K | 1762 | 1662 | 766.49 |
| Li | 1756 | 1656 | 670.78 |
| Mg | 1757 | 1657 | 285.21 |
| Mn | 7058 | 6958 | 257.61 |
| Mo | 7060 | 6960 | 202.03 |
| Na | 1767 | 1667 | 589.59 |
| Ni | 7061 | 6961 | 231.60 |
| P | 10143 | 10145 | 177.49 |
| Pb | 7055 | 6955 | 220.35 |
| S | 12004 | 12003 | 182.03 |
| Sb | 7044 | 6944 | 206.83 |
| Se | 7036 | 6936 | 196.09 |
| Si | 1765 | 12763 | 251.60 |
| Sn | 7069 | 6969 | 189.99 |
| Sr | 8068 | 7968 | 421.55 |
| Te | 13494 | 13498 | 214.281 |
| Th | 13495 | 13499 | 401.913 |
| Ti | 7070 | 6970 | 334.94 |
| Tl | 7022 | 6925 | 190.86 |
| V | 7071 | 6971 | 292.40 |
| W | 13496 | 13500 | 207.911 |
| Zn | 7072 | 6972 | 213.86 |
| Zr | 10144 | 10146 | 339.19 |

## Basic Principles:

An instrument run sheet is prepared using the information provided on the sample batch sheet received from the prep area. Appropriate standards, check standards and interference check standards are added. Standards and samples are poured as needed to be analyzed on the instrument.

Samples are received from the prep area in Nalgene containers. The samples are analyzed directly on the instrument, with the exception of the spiked sample and a serial dilution of the same background sample. The spiked and serial dilution sample is prepared in a volumetric flask or directly into the graduated plastic digestion tube that is placed on the autosampler for instrument analysis. Any sample that requires a dilution is prepared in the same fashion. Standards and samples are entered in to a sequence file on the instrument in the same order as on the ICP run sheet.

Water and soil samples are treated with acids and heated to solubilize the metals present. These digestates are then analyzed for trace metals by an atomic emission spectroscopic technique. Samples are transported to a nebulizer via an autosampler and peristaltic pump. The nebulizer introduces an aerosol into a spray chamber; the resulting mist is then transported to an argon plasma torch where excitation of atoms occurs. Characteristic atomic-line emission spectra are produced by a radio-frequency (R.F.) inductively coupled plasma. The spectra are dispersed by a diffraction grating and the intensities of the light at each wavelength are monitored by a photosensitive device. The signals from the photosensitive device are processed by a computer. A background correction technique is required to compensate for variable background contribution to the spectra of trace elements.

The Quality Control requirements for accurately reviewing and verifying a sample data run are listed in this SOP.

**Definitions:**

Batch and instrument QC

1. Analytical Batch – A group of field samples that are digested and analyzed together. A batch consists of no more than 10 samples for EPA 600 methods or no more than 20 samples for other methods.

2. Analytical Samples – Analytical sample is defined as any solution introduced into an instrument on which an analysis is performed, excluding instrument calibration, ICV, ICB, CCV, and CCB. Analytical samples include undiluted and diluted samples, matrix spike samples, duplicate samples, serial dilution samples, analytical spike samples, post-digestion spike samples, ICSs, LLCs, PBs, LCSs, and PEs.

3. Background Sample (U) – The original sample from which the batch QC is derived. The background sample is either site specific or randomly selected.

4. Continuing Calibration Blank (CCB) – A reagent blank run immediately after every CCV. This is used to monitor the stability of the low end of the calibration.

5. Continuing Calibration Verification (CCV) – A mid-range standard run at a frequency of 10% (every ten samples) throughout the run. This is used to monitor instrument drift.

6. Duplicate Sample (D) – A replicate of the original sample, processed in parallel. This sample is used to provide a measure of the in-lab repeatability (precision) of the analytical process. The duplicate sample is either site specific or randomly selected.

7. Initial Calibration Verification (ICV) – This is a standard near the middle of the calibration range, prepared from a different source than the calibration standards. It is used to prove that the instrument is calibrated correctly at the start of the run.

8. Initial Calibration Blank (ICB) – This is a standard reagent blank, used to prove that the low end of the calibration is acceptable. It must be run immediately after the ICV.

9. Interelement Correction Standard-A (ICSA) – A standard containing high concentrations of commonly interfering elements. It is used to assess the spectral interferences due to matrix elements that are normally expected to be found in a sample.

10. Interelement Correction Standard-AB (ICSAB) – A standard containing both interfering elements and target analytes, run immediately after the ICSA. It is used to demonstrate the effectiveness of the interelement correction factors in use.

11. Instrument detection limit (IDL)

    EPA SW846 and EPA 600 Analyses – A value determined for the purpose of evaluating the ICB/CCBs for data package samples. It is determined by calculating the standard deviation on 7 standard solutions at a concentration 3× to 5× the anticipated IDL. This standard deviation is then multiplied by the student's t value to obtain the MDL. This value is obtained quarterly on each instrument used for an analyte.

12. Laboratory Control Sample (LCS) – A spiked reagent blank of known composition carried through the digestion process. It is used to judge efficiency of the digestion procedure, as measured by the % recovery of the analytes.

13. Laboratory Control Sample Duplicate (LCSD) – This is a duplicate of the LCS. It is used to judge efficiency of the digestion procedure, as measured by the % recovery of the analytes. It is also used as a measure of the precision of the analytical process.

14. Limit of Quantitation (LOQ) – The level above which quantitative results are obtained with a specified degree of confidence. It is based on a value 3× to 5× the MDL.

15. Low Level Check Standard (LLC) – A low-level standard used to monitor the performance of the instrument near the detection limit.

16. Matrix Spike Sample (R) – A replicate of the original sample spiked with a known amount of analyte. This sample is used to determine if there are any matrix effects that could influence analyte recovery during the digestion procedure. The matrix spike sample is either site specific or randomly selected.

17. Matrix Spike Duplicate (M) – A duplicate of the Matrix Spike Sample (R) which is a replicate of the original sample spiked with a known amount of analyte. This sample is used to determine if there are any matrix effects that could influence analyte recovery during the digestion procedure. It is also used as a measure of the precision of the analytical process. The matrix spike duplicate sample is either site specific or randomly selected.

18. Method Detection Limit (MDL) – The minimum concentration of a substance reportable with 99% confidence that the analyte concentration is greater than 0. It is determined by calculating the standard deviation on 7 digested standards at an estimated concentration 2.5× to 5× the signal/noise ratio. This standard deviation is then multiplied by the student's t value to obtain the MDL. MDLs are performed on all instruments used to determine each analyte. MDLs are not listed in this SOP. They can be found in the LIMS system due to the fact that they change on a regular basis.

19. Post Digestion Spike (PDS) – This sample is a spike of the Background Sample prepared after digestion, at the time of analysis. It is used to determine if out-of-specification spike recoveries are due to problems in the digestion or are matrix related.

20. Preparation Blank (PB) – This is a reagent blank carried through the entire digestion procedure. It is used to determine if contamination has occurred during the digestion procedure.

21. Serial Dilution (SD) – This sample is a 1:4 (5×) dilution of the background sample, prepared after the digestion. It is used to indicate the presence of any matrix effects that could cause a nonlinear response at the instrument.

22. Linear Range (LR) – This is the highest sample concentration that can be analyzed by the method with criteria of ±5% of the true value. Sample results must be < 90% of the true value of the linear range.

23. Analytical Value – Analytical reading obtained by the average of three instruments replicates.

**Interferences:**

Spectral interferences are caused by background emission, stray light from high concentration elements or overlap from a spectral line from another element. Spectral interferences are compensated for by the use of background points, alternate wavelengths and interelement corrections.

Physical interferences caused by the change in sample matrix affecting sample transport and/or nebulization must be compensated for by using internal standardization.

Memory interference, or carryover, is the contribution of analyte signal from a previous sample onto the next sample analysis. Adequate rinse time of the autosampler tubing overcomes any memory interference.

**Safety Precautions and Waste Handling:**

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

**Nitric acid ($HNO_3$)** – This acid can cause skin burns. Add nitric acid to samples in a hood to avoid exposure to toxic fumes.

**Hydrochloric acid (HCl)** – This acid can cause skin burns. Never mix HCl with concentrated H2SO4 to avoid a violent reaction. Always use in a fume hood.

**Hydrogen Peroxide 30% ($H_2O_2$)** - This oxidizer can cause skin burns. Always use in a fume hood.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

**Personnel Training and Qualifications:**

1. All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

2. Initially, each analyst performing the instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the sequence editor to set up the run, perform calculations, interpret raw data, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an IDOC (Initial Demonstration of Capability).

3. The IDOC and the DOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

**Sample Collection, Preservation, and Handling:**

A. Aqueous samples

1. Samples are collected in plastic or glass containers.

2. Samples are preserved with nitric acid and stored at 0°to 6°C, not frozen.

3. Samples must be digested within 180 days of collection for all methods.

B. Solid samples

1. Samples are collected in glass containers and stored at 0° to 6°C, not frozen.

2. Samples must be digested within 180 days of collection.

3. Solid samples require no chemical preservation.

C. pH Adjustment

1. Upon receipt at the laboratory, Sample Storage personnel check the pH of water samples. If the pH is greater than 2, the pH of the sample is adjusted to a pH less than 2 following the protocol outlined in 1-P-QM-PRO-9015511.

2. Drinking water samples require pH check immediately before digestion and analysis. .If the pH is greater than 2, the client service representative (CSR) is notified. The CSR must notify the client for direction on how to proceed with the sample (i.e. proceed as is or add more acid.)

3. Dissolved Metals

   a. Samples to be analyzed for metals requiring filtration at the lab must be submitted unpreserved.

   b. The sample is run through a 0.45 micron filter within 5 days of receipt.

   c. Samples are filtered into containers and preserved to a pH of <2 with $HNO_3$.

D. Storage - Store sample digestates in plastic bottles at room temperature. Store standards and digestates separately.

E. Sample Discard - The general practice in the metals group is to discard the digestions after all the required metals from a batch of samples have been analyzed and verified in the LIMS. Samples which require the digestate to be held for long term storage are periodically evaluated for discard.

**Apparatus and Equipment:**

The following is a list of the hardware and apparatus necessary for ICP analysis. More detailed hardware information is located in the *Operator's Manuals*.

1. Test tube racks

2. 15-mL graduated polypropylene screw cap tubes (certified ±1%)

3. 16-mL polystyrene tubes

4. Filter paper – Whatman No. 540, 90-mm ashless

5. FilterMate filtration device with 0.45-µm PTFE fiber filter and insertion tool

6. 1 × 100 10-mL sterile disposable syringes

7. 25-mm syringe filters, PTFE, 0.45-µm

8. 30-mL polypropylene medicine cups

9. Adjustable electronic and fixed volume hand-held pipettes and tips (10 – 5000 µL) - FisherBrand or equivalent.

   **NOTE:** For routine operation, calibration, and maintenance of FisherBrand (or equivalent) electronic or fixed volume hand-held pipettes, see 1-P-QM-PRO-9015403.

10. Spectrometer

    The Thermo Scientific iCAP™ 6000 series Trace Analyzer utilizes a high performance solid state Charge Injection Device (CID) camera system to deliver high contrast/low noise imaging and quantification of all wavelengths in the analytical range. With the entire spectrometer and foreoptics purged with either Argon or Nitrogen, it features a 52.91 grooves/mm grating and dual-view detector.

11. Auto-sampler – The ESI SC-14 auto-sampler and integrated "FAST" system offer increased capacity and reduce sample introduction times. The parameters for each automated run are entered into the auto-sampler table in the iTEVA™ software as described in Instrument Operation, Section A of this SOP.

12. Peristaltic pump – The peristaltic pump regulates the flow of the following: sample, internal standard, instrument rinse and spray chamber waste. Special care must be taken to ensure that all pump tubing is connected properly. The Teflon concentric and glass V-groove nebulizers have a natural uptake, but a peristaltic pump is used to compensate for differences in sample viscosity. After traveling through the peristaltic pump, the sample and internal standard tubing are combined by a "Y" connector, and then allowed to mix in a mixing coil before entering the nebulizer.

13. R.F. generator –The iCAP™ 6000 series Trace Analyzer utilizes an internal solid state RF Generator at 27.12MHz with a power efficiency greater than 78%.

14. Coolflow –The ThermoFlex™ 900 cooling device for the iCAP™ 6000 series Trace Analyzer operates at 17°C.

15. Personal computer – The iCAP™ 6000 series Trace Analyzer is controlled by PCs.

**Reagents and Standards:**

Reagent and standard information and the preparation of the following standard and solution sections are located in 1-P-QM-FOR-9009067.

A. ICP Standards

B. ICP Initial and Continuing Calibration

C. ICP LOQ Check Standard Solutions (LLC)

D. Interference Check Solutions

E. Rinse/Carrier and Profile Solutions

F. Internal Standard Solution

G. IDL and MDL Solutions

H. Matrix Matched Standards Table

**Calibration:**

A. Initial Calibration.

1. For the preparation and concentrations of calibration blanks and calibration standards see 1-P-QM-FOR-9009067.

2. For the frequency, acceptance criteria and corrective action see Tables I and II.

B. Initial Calibration Verification (ICV).

1. For the preparation and concentrations of ICV standard see 1-P-QM-FOR-9009067.

2. For the frequency, acceptance criteria and corrective action see Tables I and II.

C. Continuing Calibration Verification (CCV).

1. For the preparation and concentrations of CCV standard see 1-P-QM-FOR-9009067.

2. For the frequency, acceptance criteria and corrective action see Tables I and II.

D. Low Level Check Standard (LLC)

1. For the preparation and concentrations of the LLC standard see 1-P-QM-FOR-9009067.

2. For the frequency, acceptance criteria and corrective action see Tables I and II.

E. ICSA/ICSAB

1. For the preparation and concentrations of ICSA/ICSAB standards see 1-P-QM-FOR-9009067.

2. For the frequency, acceptance criteria and corrective action see Tables I and II.

**Procedure:**

A. Setting up an ICP run

1. Determine the batches to be analyzed and determine any special requirements by viewing lab notes and/or project notes that are with the batch paperwork delivered from the metals prep area.

2. Assign an ICP metals storage location and document the location on the batch sheet(s) and on the sample lid for the Prep Blank of each batch.

3. Log in to Parallax and select Sequence Editor from the IDAT menu. In the Sequence Editor window, select the appropriate batch digest type (EPA or SW-846).

4. Choose the appropriate digest from the list, and click on “Get Batches”

5. Select a batch from the list to display the incomplete samples in that batch.

6. Select the appropriate template (pre-designed with the correct QC standards and auto-sampler locations) from the template list; a blank form is opened. If that batch has been previously documented, the existing sequence file is also loaded.

7. Add all required samples into the form, either by choosing "Add batch" for all samples, or by "dragging" individual samples into the field.

   a. Sample names include:

      (1) PBW – Prep blank (water)

      (2) LCSW – Laboratory control sample (water)

      (3) LCSDW – Laboratory control sample duplicate (water)

      (4) PBS – Prep blank (solid)

      (5) LCSS – Laboratory control sample (solid)

      (6) LCSDS – Laboratory control sample duplicate (solid)

      (7) Lancaster Laboratories' sample number

      (8) CCV – Continuing calibration verification

      (9) CCB – Continuing calibration blank

      (10) LLC – Low level check

      (11) ICSA – Interelement correction standard – A

      (12) ICSAB – Interelement correction standard - AB

   b. Batches with only field blanks or equipment blanks do not need a post-digest spike or a serial dilution.

   c. "As Received" samples must be run with a blank and LCS, LCSD (prepared and documented in LLENS by the analyst).

8. Edit dilution factors (DF), protocols, and auto-sampler locations as needed. Consult the Incomplete List sheet to determine the analysis requirements for each sample.

9. Remove all unnecessary QC standards by clicking on the "QC" button. Unnecessary lines are removed by selecting individual lines and clicking on the red "X" button.

10. Save the sequence file. Click "OK" to acknowledge that the file has been saved and the cover sheet document has been created. The document opens automatically.

11. Edit the cover sheet document as needed, including batch location information and any additional comments or instructions.

12. When setting up a run, Batch QC (the order of the batch QC is typically PB, LCS, (LCSD), Bkg, PDS, DUP, MS, (MSD), SD.) must be placed in the same block of ten or fewer samples. If there are two LCSs, they must be placed one after the other.

    a. ICV/ICB must be analyzed immediately after the calibration curve.

    b. CCV/CCB must be analyzed after every ten analytical samples.

    c. LLC, ICSA, ICSAB, CCV, CCB must immediately follow the ICV/ICB and must conclude each run.

       **NOTE:** As of 10/11/2012 for all DOD protocols, it is not necessary to analyze the ending ICSA/ICSAB and LLC check samples. This is for DOD only!

    d. Any deviations from protocol must be noted in the Comments Section of the cover page.

e. Any unused portion of the run sheet must be "Z'd" out with initial and date.

B. Pouring an ICP run

It is important to minimize any chance of contamination, both of yourself and the samples. Keep your hands and the work area clean at all times. Do not re-use any pipette tips.

**NOTE:** Run QC standards are prepared separately, and kept in separate auto-sampler racks to be obtained at the time of analysis.

1. Use the batch location information on the selected run sheet to locate the corresponding batch(es). In the "Poured by:" section of the header, record: initials, employee number, and the date.

2. Carefully examine the batch to ensure there are no discrepancies between the Batch Preparation Sheet, run cover sheet, and the physical placement of samples in the batch.

**NOTE:** In most instances, samples are analyzed in their digestion vessels, in a foam storage rack.

3. Obtain and label all required test tubes, and place them in test tube racks. Any poured sample that does not require a graduated test tube is to be poured into a polystyrene tube.

4. Prepare and label the PDS required for each new batch (sample volume permitting).

   a. A PDS is prepared using 0.2 mL of a custom-ordered PDS solution into 9.8 mL of background sample.

   b. Equivalent amounts of the custom PDS must be used if decreasing sample volume.

c. Record preparation details in the comments column of the ICP run sheet.

5. Prepare a serial dilution by diluting the background sample by 5×.

   a. If the background sample chosen for serial dilution has been diluted due to matrix interference or to bring the concentration into the linear range of the instrument, the serial dilution must also be diluted by 5 times the dilution factor of the background (i.e., if Bkg = DF5, S.D. must = DF25).

   b. Document preparation details in the comment section.

6. Using Whitman No. 540 filter paper or the Filter Mate filtration device, filter those samples that are cloudy or contain particulate.

   a. If the filtrate remains cloudy, filter again.

   b. Samples with limited sample volume must be filtered using a 10-mL sterile disposable syringe fitted with a 0.45 µm PTFE syringe filter.

   c. If any samples are filtered, the prep blank must also be filtered.

   d. Document all filtrations on the run cover sheet and mark each sample lid with an “F” to indicate that it was filtered.

7. For TCLP samples that requires method of standard additions, refer to 1-P-QM-FOR-9008905 or 1-P-QM-FOR-9008807 for instructions.

8. Perform any additional spiking or dilutions and document preparation details in the comment section.

9. Cover the samples with lids or with plastic wrap to prevent contamination.

10. Place the poured batch on the bench top to await analysis, or return samples to their ICP sample storage location.

**NOTE:** A post-digest spike and a serial dilution must be performed on one sample in each digestion batch. Typically, the background sample is chosen. If the batch QC is split between two samples, the post-digest spike is performed on the background sample accompanied by a matrix spike; the serial dilution is performed on the background sample accompanied by a matrix duplicate. If sample volume is limited, it is acceptable to use the duplicate for the PDS and SD.

**NOTE:** Analysis information, including standard lot numbers, run number, rinse time, method, analyst and date of analysis, are documented on the cover sheet at the time of analysis.

**NOTE:** Documentation is of utmost importance. Double check all entries.

**NOTE:** Dilute samples when necessary to yield a response that falls within the calibration range. Report the results for the least dilute sample where the concentration measured is within the acceptable calibration range.

**NOTE:** If a batch requires re-analysis, it is acceptable to re-use dilutions and/or spiked samples that were prepared for the previous analysis. A "P" in the comments section is used to indicate that a previously poured test tube is being re-used.

**Instrument Operations:**

A. iTEVA™ software: The Thermo Scientific iCAP™ 6000 series instrument is operated through iTEVA™ software. From the Start menu, select "iTEVA™ Control Center" to start the software.

1. Plasma ignition of the iCAP™ 6000

   a. Open the plasma status window by clicking on the icon at the bottom of the screen.

   b. Verify that all parameters are within acceptable range for ignition as indicated by a green light.

c. Ensure that the drain tubing for the spray chamber is properly connected to the peristaltic pump and positioned to drain into a waste carboy.

d. Select "Ignite plasma". After the plasma has ignited, the instrument automatically performs optimization of the nebulizer gas pressure, and then starts the on-board peristaltic pump.

e. If the plasma does not light, repeat steps b-d.

f. Once the plasma operating parameters have engaged, exit the Plasma status window by clicking on Close.

g. If the plasma has been off for more than 15 minutes let the instrument warm up for 30 minutes. If the plasma has been off less than 15 minutes, let the instrument warm up 5 to 10 minutes.

2. Automated analysis using the iTEVA™ software

a. Open the Analyst window from the Control Center by clicking on the Analyst icon. When prompted, select the appropriate method.

b. In the Analyst window, click on the Sequence tab at the bottom of the screen.

c. From the Auto-session menu, select Open new session.

d. The "New auto-session" window opens. Choose the appropriate autosampler configuration set.

e. Click on "New" to add a sequence and the "Add sequence" window appears.

f. Click on the "Import comma delimited text file" option and choose an appropriate template or previously prepared run sequence from the drop-down menu for the run to be entered. Click OK to close this window and continue.

g. Change the sequence name to reflect the run number, but do not change the method revision number.

h. Click OK at the bottom of the "New auto-session" window to continue.

i. The sequence template is loaded. When prompted, click OK to choose the "Use positions" option, then Yes to accept duplicate positions.

j. Edit the table as needed to include sample number, class, dilution factor, batch number and protocol for each sample.

k. Additional samples and QC are added using the "Add sample" and "Add QC" icons, respectively, at the top of the screen. Unused rows are removed by selecting the entire row(s) and using the "remove sample" icon at the top of the screen.

l. Right-click on the calibration standards list and select "Auto-locate" to have autosampler positions automatically assigned.

m. Verify that the sample list begins and ends at the correct tube numbers, and check all entries for errors.

n. Click on the "Initialize Autosampler" icon to initialize the autosampler for the current configuration.

o. Click on the printer icon and choose to print page 1 only. This printout is kept with the run cover sheet.

p. Carefully examine the batch to ensure there are no discrepancies between the run cover sheet, auto-sampler sequence table and the physical placement of samples in the batch.

q. Click on the "Start automated run" icon to start the run sequence. If a run sequence is to be started at a sample or standard other than the initial calibration, right-click on the appropriate sample and choose "Start Auto-Session Run at this Sample" and elect not to run the "start actions."

3. Running an AutoPeak in iTEVA™

a. In an open autosampler session (autosampler must be initialized), right-click on the location of the AutoPeak solution, and choose "Go to..."

b. Click on the Analysis tab to open the Analysis window.

c. From the Instrument menu, select Perform AutoPeak.

d. Click on All elements, then OK.

e. When prompted to aspirate the high standard, click OK. The AutoPeak is now performed.

f. When the AutoPeak has finished, click on Done.

4. Manual analysis in iTEVA™

a. In an open autosampler session (autosampler must be initialized), add sample(s) to be analyzed to a new or existing sequence as detailed in section A.2 of this SOP.

b. To start analysis, right-click on the appropriate sample and choose "Start Auto-Session Run at this Sample" and elect not to run the "start actions."

c. When analysis is complete, results can be printed from the Analysis tab by right-clicking on the sample name and selecting "Print Sample..."

5. Performing an interelement correction (IEC) in iTEVA™

a. Prepare a solution of the interfering element at the linear range of the instrument. Perform manual analysis according to section A.4 of this SOP.

b. Note results of elements with a known interference that are greater than the limit of quantitation.

c. Divide the result of each interfered element by that of the interfering element. These values represent the amount the current IECs need to be adjusted.

d. In the Method window, click on Elements to expand the list of elements in the method.

e. Click on the targeted element to view the settings for that element.

f. Click on the IECs tab to view the current IECs for that element.

g. Add each calculated result to the correction factors currently in the first column corresponding to each pair of elements.

h. Enter the new correction factors in the table.

i. Repeat steps d-f as needed.

j. Click on the Save method icon to save the method.

B. Import and QC review of run data

Importing run data

a. Open the iCAP Data Reprocessor.

b. Ensure the correct database is listed.

c. Click on “Get run name list”.

d. Select the appropriate run.

e. Click on “Reprocess”.

f. Start the Parallax LIMS software and log in.

g. Select Import from the IDAT menu.

h. Open the appropriate run file.

i. If prompted, enter the storage location of batch(es) requested.

j. Verify that the following information is accurate: sample number, standard name, class, batch number, matrix, protocol, method reference, LCS ID, initial volume, final volume and dilution factor. Make corrections as needed.

k. Enter the correct rinse time.

l. Enter the appropriate analyst number.

m. Click on Check/Save.

n. When the confirmation screen appears, verify that the file name and run number are the same. Choose to either Exit or Import another run and the run is imported and printed.

**Routine Maintenance for the ICAP™ 6000 Duo Analyzer:**

A. Sample introduction system removal and cleaning: Remove and clean the sample introduction system when instrument performance declines (See **Figure 1**). Any adjustment to an instrument (replacement of parts, etc.) must be documented in the appropriate instrument logbook.

1. Remove spray chamber and nebulizer.

   a. Unclamp spray chamber from spray chamber adapter by gently squeezing clamp with one hand while supporting the spray chamber with the other hand.

   b. Gently remove the nebulizer from the spray chamber by pulling it out.

   c. Disconnect the argon and sample tubing from the nebulizer by pinching the Luer lock and pulling the tubing off the nebulizer.

   d. Clean the spray chamber if residue is observed coating the sides. If cleaning is necessary, remove the drain tubing from the spray chamber.

2. Remove and disassemble the torch

   a. Gently pull the spray chamber adapter out of the torch assembly.

   b. Unlock the torch assembly by turning it clockwise and remove it from the instrument.

   c. Turn the injector tip assembly clockwise to separate it from the torch housing.

d. Gently pull the center tube out of housing to clean.

3. Prepare ultrasonic bath. Make sure the bath is at least ½ full with clean reagent water.

4. Clean torch, injector tip, and nebulizer.

   a. Invert the torch in a 250-mL vacuum flask of 50% HCl and place in the sonicator for 10 minutes. After sonication, rinse the torch with reagent water. (Be careful not to get a lot of water down into the base of the torch.) Carefully dry the torch with a paper towel.

   b. Place the injector tip in 50% HCl for 10 minutes. Rinse the injector tip with reagent water and carefully dry with a paper towel.

   c. For a glass nebulizer, place the nebulizer in 50% HCl for 10 minutes. (Do not place nebulizer in the sonicator.) If there is a visible clog, carefully insert 0.13 diameter fishing line through the tip of the nebulizer to assist in removing the clog. Force the 50% HCl solution through the argon and sample inlets in the nebulizer and rinse with reagent water when finished. (Make sure all of the water is out of the argon cavity of nebulizer.) For a plastic nebulizer, use a syringe to force the 50% HCl solution through the nebulizer to clean and/or remove any clogs.

   d. If the spray chamber needs to be cleaned, place it in the sonicator for approximately 5 minutes, and then rinse it out with matrix B rinse, followed by reagent water.

B. Reassemble the sample introduction system: (See **Figure 1**)

1. Reassemble the torch.

   a. The o-rings on the metal torch mount must be inspected and replaced if any wear or damage is visible.

b. The quartz torch is pushed fully into the metal torch mount with a gently twisting pressure.

c. The circular "target" design on the torch **MUST** align with the circular notch on the torch mount.

d. Insert the injector tip fully into the center tube holder.

e. Insert the center tube assembly into the torch mount and rotate it counter-clockwise to lock it in position.

f. Mount the torch assembly back into the instrument by inserting it straight through the torch hole and coil, being careful not to disturb the quartz bonnet above the radial view lens.

g. Turn the assembly counter-clockwise to lock it into position.

h. Gently push the spray chamber adapter into the back of the center tube assembly.

2. Reassemble the spray chamber and nebulizer.

a. If removed for spray chamber cleaning, reattach the drain tube to the spray chamber.

b. With a twisting motion, insert the nebulizer into the spray chamber so that the collar is a tight fit.

c. Attach the sample and nebulizer gas tubing to the nebulizer.

d. Clamp the spray chamber to the spray chamber adapter.

3. Ignite the plasma.

C. Changing the pump tubing: Change pump tubing on the peristaltic pump when the tubing shows wear. Inspect all tubing to insure that it is secure and in good condition.

D. Documentation for instrument/analysis tag out and return to service.

**NOTE:** The following information is taken from 1-P-QM-QMA-9017325: In the event of an equipment failure, the following must be performed:

1. Document the nature of the failure in the maintenance logbook

2. Document how and when the defect was discovered

3. Notification of supervisor or responsible person who can decide on appropriate action to take

4. The instrument must be clearly tagged as *Out of Service*. The tag must contain the following information:

   a. Date taken out of service

   b. Employee who took the instrument out of service

   c. Reason for tagout

   Form 1-P-QM-FOR-9007909 is used for "tagging out".

5. The date taken out of service and the date returned to service must be documented in the logbook.

6. Document any corrective action that was taken to bring the equipment back into service.

7. Results of the corrective action (i.e., system calibration within specifications, etc.)

8. Supervisory personnel must perform a documented evaluation and review of instrumentation/equipment where a major or uncommon failure has occurred to assess the potential impact the failure could have on the calibration and/or qualification of the instrument. This is done on a case-by-case basis.

9. After repair, document whether the function has been fixed. Then determine if calibration or verification activities need to be performed before the instrumentation is put back into service.

**Calculations:**

1. Final result

   a. Water sample

$$\text{Instrument Reading} \times \frac{\text{Dilution Volume}}{\text{Aliquot Volume}} \times \frac{\text{Final Volume}}{\text{Sample Volume}}$$

   b. Solid sample (mg/kg)

$$\text{Instrument Reading} \times \frac{\text{Dilution Volume}}{\text{Aliquot Volume}} \times \frac{\text{Final Volume}}{\text{Sample Weight (grams)}}$$

All dilution factors must be recorded and used in the calculation. [To enter dilution data into the LIMS when multiple dilutions are used, a factor must be formed (Ex. 1), which contains no more than three figures for the volume or the aliquot (Ex. 2).]

Ex. 1. 50/.5 × 10/1 = 500/.5

Ex. 2. 50/.5 × 25/.5 = 1250/.25 = 125/.025

**NOTE:** The default units are µg/L

2. Relative percent different (RPD)

$$RPD = \frac{S - D}{(S + D)/2} \times 100$$

**Where:**

S = first sample value

D = duplicate sample value

3. Spike recovery

$$\%\ Recovery = \frac{SSR - SR}{SA} \times 100$$

**Where:**

SSR = spiked sample result

SR = sample result

SA = spike added

4. Correlation Coefficient

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{(\sum X^2 - \frac{(\sum X)^2}{N})(\sum Y^2 - \frac{(\sum Y)^2}{N})}}$$

**Where :**

X = the known concentration

Y = the instrument response

N = the total number of data points

5. Serial Dilution

$$\% \, Difference = \frac{(5 \times SDR) - SR}{SR} \times 100$$

**Where:**

SDR = serial dilution result

SR = sample result

6. Methods of standard additions (MSA)

Take either 4 identical aliquots (for 3 point MSA) or 2 identical aliquots (for one point MSA) of the same sample. Leave one unspiked. Spike the other 3 aliquots with different levels of a standard solution (for 3 point MSA) and spike the other aliquot at approximately the indigenous concentration of the sample (for one point MSA). Add blank solution to sample aliquots so that the final volume is the same for all. Use small volumes of spiking solution to avoid diluting the sample more than 10%. Analyze the 4 aliquots or 2 aliquots and record the instrument readings in absorbance. Use the readings and spike values to find the slope and x- and y- intercepts. The x- intercept is the result.

Slope = m = $\dfrac{\sum x_i y_i - (\sum x_i \sum y_i)/n}{\sum x_i^2 - (\sum x_i)^2 / n}$

Y-Intercept = b = $\bar{y} - m\bar{x}$

Result = $-\dfrac{b}{m}$

Correlation Coefficient = r = $\dfrac{\sum\{(x_i - \bar{x})(y_i - \bar{y})\}}{\sqrt{\left[\sum (x_i - \bar{x})^2\right]\left[\sum (y_i - \bar{y})^2\right]}}$

The correlation coefficient (r) for the least squares fit must be ≥0.995. If the r value is <0.995, the MSA must be repeated at the same dilution. If the r value is again low, the result with the higher r value is verified and both are flagged with a "+" in the data package. If the r value is <0.990, the sample is run at an interference dilution to overcome matrix effects. This usually requires a raised limit of quantitation. If a client requests a particular limit of quantitation that prohibits further dilution, then the sample is repeated at the same dilution and the best of the two results is verified.

**Statistical Information/Method Performance:**

Generate MDLs and LOQs according to 1-P-QM-QMA-9017309. Perform an MDL study on each instrument used for the analysis. Determine the MDL by taking seven spiked replicates through the entire digestion and analysis procedure. Compare and pool results to determine the final reporting MDL. The department supervisor maintains annual study data. The department supervisor requests that a Quality Assurance Specialist update to the LIMS as needed. Update the department database via a download from the LIMS.

Each analyst training to perform a new analysis must complete an IDOC that meets the requirements for accuracy and precision before working independently on that test method. Typically, this is accomplished by the successful analysis of four known samples or one blind sample. Maintain copies of the IDOC in the analyst's training records.

**Quality Assurance/Quality Control:**

A. For 6010B, and 6010C, each digestion batch (up to 20 samples) must contain a method blank, LCS, and either an U, D, MS, MSD or an LCS/LCSD.

B. For 200.7, each digestion batch (up to 10 samples) must contain a method blank, LCS, and either an U, D, MS or an LCS/LCSD.

C. QC limits for MS/MSD, and LCS/LCSD are established through statistical analysis of historical data.

1. The limits are maintained in the LIMS for the metals analysis numbers.

2. The limits are evaluated every 6 months and updated as needed.

3. The limits are subject to change without notification.

D. Batch Quality Control

1. For the preparation and concentrations of Batch Quality Control see 1-P-QM-FOR-9009067

2. For the frequency, acceptance criteria and corrective action see tables I and II.

E. Raw data quality checks

1. Confirm that the batch and cover sheets are correctly labeled, dated, and signed where necessary. Review the batch sheet, project notes and lab notes with the incomplete list for special comments and due dates. Check that the run protocol has been selected correctly.

2. Check to see that the autosampler table printout is with the run and has a review signature from the analyst and run importer.

3. Refer to the calculation section of this SOP for calculations used for ICP analysis.

4. Refer to Tables I, and II for run and batch calibration and QC frequency, acceptance criteria and corrective action. For information on statistical limits refer to 1-P-QM-QMA-9017313.

5. Each analytical run must have a QC review attached. All samples on the run must be listed on the QC review with notation as to whether the sample was verified or needed to be redigested/reanalyzed. The verifier must document on the QC review if any sample(s) were selected/deselected.

6. For spike levels of run QC see 1-P-QM-FOR-9009067

7. Spike levels of batch QC are available in the LIMS and on 1-P-QM-FOR-9009182.

8. LOQs are available in the LIMS and on 1-P-QM-FOR-9008385.

9. Check to make sure that all results are below 90% of the linear range. If a sample reading is above 90% of the linear range, then reread the sample at an appropriate dilution. Verifiers footnote the coversheet indicating that all dilutions were performed correctly by comparing to the previous undiluted sample data.

10. Check that the **absolute** value of all nondetected analytes is less than the LOQ. A technical decision must be made as to whether a reread is warranted for readings <(-LOQ). Comments are added during verification to any non-detect sample readings that were diluted due to <(-LOQ).

11. For SPLP and TCLP samples, an MSA (method of standard additions) is required if:

    a. The sample concentration falls between 80% to 100% of the regulatory limits.

    b. If the SPLP or TCLP Matrix Spike (QA) recovers < 20%, all samples in the leachate batch must be reanalyzed using the method of standard additions for that analyte.

12. For all EW samples (samples from public drinking water sources); check the results against the MCL (maximum contaminant level). If an analyte **exceeds** the MCL, notify a verifier at once. An automated email is sent to the Client Service Representative and the state for the analytes listed below with the exception of lead and copper which follow the 90$^{th}$ percentile rule (the CSR tracks the lead and copper and notifies the supplier when necessary). Suppliers must be notified within 24 hours.

| Analyte | MCL (mg/L) |
|---|---|
| Sb | 0.006 |
| As | 0.01 |
| Ba | 2 (1)** |
| Be | 0.004 |
| Cd | 0.005 |
| Cr | 0.1 (0.05)** |
| Se | 0.05 (0.01)** |
| Tl | 0.002 |
| Al* | 0.2 |
| Cu | 1.0 |
| Fe* | 0.3 |
| Mn* | 0.05 |
| Ag* | 0.1 (0.05)** |
| Zn* | 5.0 |

*Secondary regulated contaminants

**The federal MCLs for these analytes are greater than Pennsylvania MCLs. The numbers in parentheses are the MCLs effective in Pennsylvania.

13. Check the internal standard (Yttrium) level for the entire run. If the Yttrium reading for any sample is < 50% or >130% of the reading for S0, then reread the sample at a dilution.

    **NOTE:** The internal standard is added in equal concentration to all of the samples and standards via a dedicated line on the peristaltic pump. The analytical lines referenced to an internal standard report a corrected concentration value based on the ratio of analyte to internal standard intensities. All of the calculations for determining concentration are based off of Intensity Ratio (IR). The IR is defined as the background corrected intensity signal of the analyte line (Ia) divided by the internal standard value (Iis). IR = Ia/Iis

14. For EPA600 series samples, an ICV2 is analyzed immediately after the initial ICV. The average of the six total replicates is used with a requirement of ±5% accuracy and an RSD of <3%.

15. Check for high concentrations of interfering elements. Analytes must be flagged for possible interference if any interfering element concentration is greater than the level used for semi-annual IECs. Comments must be added during verification to any samples reading under the reporting limit that were

diluted due to possible interference(s). For the iCAP 6000 series instrument (T70, #11016; T71, #16315; T72, #16417, T73, #18255 ) Si is monitored due to an interference on Pb. Pb data must be reread if Si is not within ±10% in CCVs.

**NOTE:** All samples requiring postspikes must be postspiked at 2 times the CRQL or approximately 2 times the indigenous level of the sample.

F. When raw data checks are complete, check the following:

1. All samples requiring reread/redigestion are listed on the reread/redigestion schedule forms. Any dilutions required have been calculated correctly and added to the reread/redigestion form. Specific instrument has been noted for client requirements if necessary.

2. Data for samples following Good Laboratory Practices (GLP) must be retained as permanent storage.

3. The data are uploaded to Parallax via IDAT by the reviewer and are verified from Parallax by the verifier.

G. Instrument detection limits are performed on a quarterly basis and method detection limits are performed on a yearly basis for each analytical instrument.

H. Verification process

1. Confirm that all required pieces of QC have been uploaded to Parallax and are within specification. If there is partial QC on the current run and the samples have been analyzed more than once, check to see if there are associated runs in the hold bin waiting on additional QC to be verified.

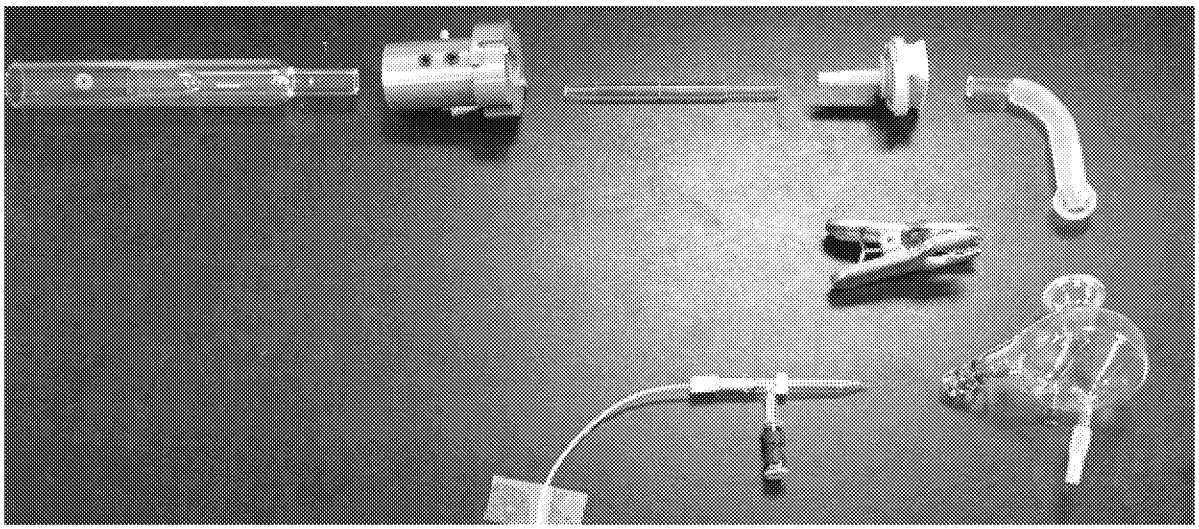
2. In Parallax, choose method of verification. (Metals verification by run, or verify by individual element.)

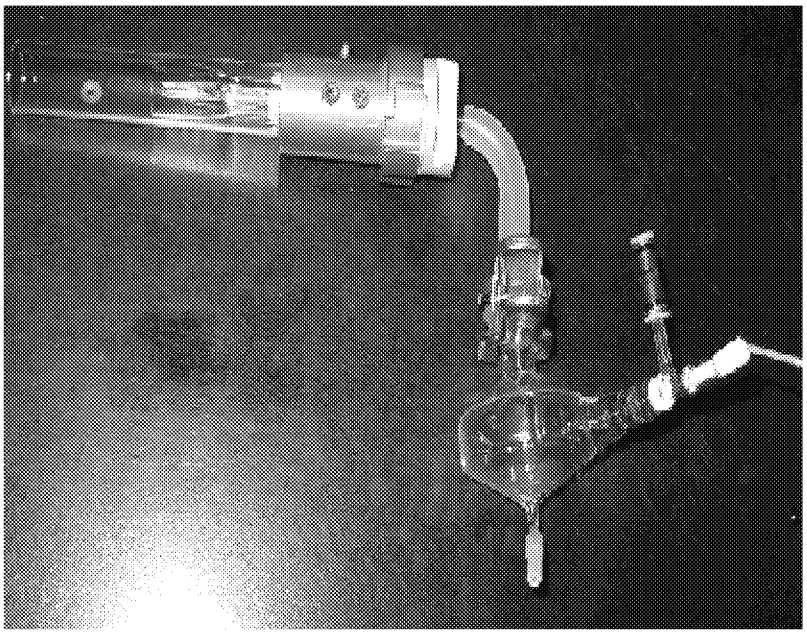
3. Ensure that all lab notes and project notes were followed.

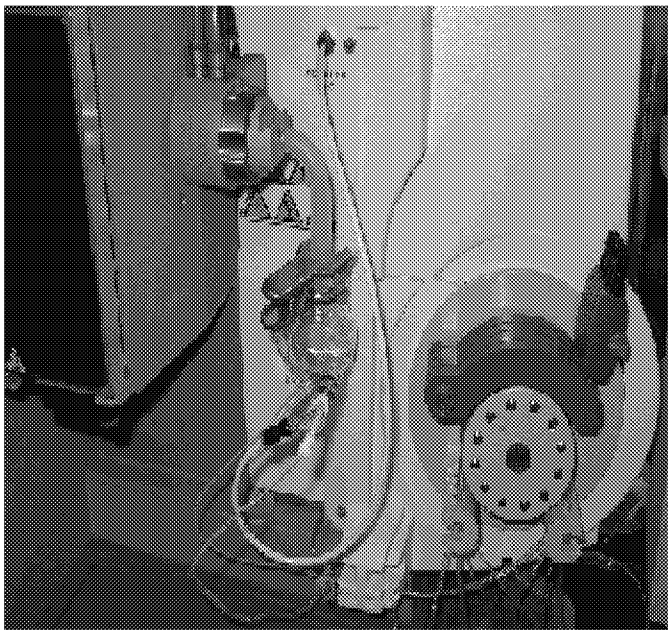
4. Non-compliant data can be reported only after all required corrective actions have been taken. Document the nonconformance using Form 1-P-QM-FOR-9007858.

5. When all of the elements are verified for a digest, verify the digest number. Associated tracking numbers and suite numbers are routinely auto-verified within hours of verifying all of the elements and digests on each sample.

## Figure 1







# Table I
## QC requirements for SW-846 6010B and 6010C (ICP Metals)

| | Frequency | Acceptance | Corrective Action |
|---|---|---|---|
| Calibration | The calibration contains a blank and 1 standard. | | |
| Initial Calibration Verification (ICV) | Must be analyzed immediately following Calibration Standards. | ±10% of the true value.<br><br>RSD must be <5% (6010B, 6010C). | If the ICV is out of specification high for an analyte and the result is not < - LOQ, accept results that report as non-detect for affected analyte. Results for the affected analyte(s) > or = to the reporting limit must not be reported from the run (reanalyze). |
| Initial Calibration Blank (ICB) | Must be analyzed immediately following the ICV. | \|ICB\| must be <3× IDL (6010B, 6010C)<br><br>If ICB is Out of Specification positive (+), accept results that are > 10X the ICB, or < reporting limit. If ICB is Out of Specification negative (-), only accept results that are > 10X ICB. (6010B, 6010C). | Data for that analyte cannot be reported from the run for the affected samples (reanalyze the affected samples for that analyte) (6010B, 6010C). |
| Low Level Check (LLC) | Must be analyzed at the beginning and end of each run and before the ICSA and ICSAB. | 6010B: ±50% of True Value.<br>Not applicable if sample concentrations are >10× the true value of the LLC. For LLC results >the high limit, samples <reporting limit can be accepted.<br><br>6010C:+/-30% of True Value. Not applicable if sample concentrations are < LOQ, or if sample concentrations are greater than the CCV (CCV must be within specification). | Data for that analyte cannot be reported from the run for the affected samples. |
| Interference Check Standard A and AB (ICSA/ICSAB) | The ICSA must be analyzed at the beginning and end of each run immediately following the LLC.<br>The ICSAB must be analyzed at the beginning and end of each run immediately following the ICSA. | ±20% of the true value for analytes that are spiked.<br>\|ICS\| or \|ICSAB\| must be <2× LOQ for analytes that are not spiked. | Data for that analyte cannot be reported from the run (reanalyze all samples requiring that element). |

## Table I (Continued)

| | Frequency | Acceptance | Corrective Action |
|---|---|---|---|
| Continuing Calibration Verification (CCV) | Must be analyzed immediately following the ICSAB and at a frequency of every 10 samples. | ±10% of the true value.<br><br>RSD must be <5% (6010B, 6010C) | If the CCV is out of specification high for an analyte and the result is not < - LOQ, accept results that report as non-detect for affected analyte. Results for the affected analyte(s) > or = to the reporting limit must not be reported from the run (reanalyze). |
| Continuing Calibration Blank (CCB) | Must be analyzed immediately following CCV's at a frequency of every 10 samples | \|CCB\| must be <3× IDL (6010B, 6010C)<br><br>If CCB is Out of Specification positive (+), accept results that are > 10X the CCB, or < reporting limit. If CCB is Out of Specification negative (-), only accept results that are > 10X CCB. (6010B, 6010C). | Data bracketing the CCB for that analyte cannot be reported for the affected samples (reanalyze the affected samples in the bracketing blocks for that analyte) (6010B, 6010C). |
| Preparation Blank (PB) | Must be prepped at a frequency of 1 per analytical batch of 20 samples or less. | \|PB\| must be <1/2 LOQ.<br>For 6010B: Not applicable if analyte reading in the sample is > 20× the PB reading or <LOQ.<br>For 6010C: Not applicable if analyte reading in the sample is > 10× the PB reading or <LOQ. | Redigest all associated samples. |
| Laboratory Control Standard (LCS) | Must be prepped at a frequency of 1 per analytical batch of 20 samples or less. | Use statistical limits or the method limit of ±20%, as indicated by the client requirement.<br><br>If the LCS is out of specification high and the sample result is less than the LOQ the data can be taken. | Redigest all associated samples if the LCS is out of specification low.<br><br>If the LCS is out of specification high redigest samples that are greater than the LOQ. |

## Table I (Continued)

| | Frequency | Acceptance | Corrective Action |
|---|---|---|---|
| Laboratory Control Standard Duplicate (LCSD) | If insufficient sample volume is submitted to perform batch QC then a LCSD is prepped at a frequency of 1 per analytical batch of 20 samples or less. | Use statistical limits or the method limit of ±20%, as indicated by the client requirement<br><br>If the LCS is out of specification high and the sample result is less than the LOQ the data can be taken.<br><br>RPD must be < 20%. | Redigest all associated samples if the LCS is out of specification low.<br><br>If the LCS is out of specification high redigest samples that are greater than the LOQ.<br><br>Redigest samples if RPD is out of specification |
| Matrix Spike/ Matrix Spike Duplicate (MS/MSD) | Must be prepped at a frequency of 1 per analytical batch of 20 samples or less. | Use statistical limits or the method limit of ±25% (6010B, 6010C), as indicated by the client requirement.<br>RPD must be <20%. | Data is flagged in the QC Summary and/or in the data package.<br>If sample concentration <4× the spike added a PDS must be performed.<br><br>Flagged in the Data Package and in the QC summary. |
| Duplicate (D) | Must be prepped at a frequency of 1 per analytical batch of 20 samples or less. | If the samples are >5× the LOQ the RPD must be <20%.<br>If either the sample or duplicate is <5× the LOQ the difference between the two values must be <LOQ.<br>Not applicable if both samples are <LOQ. | Data is flagged in the QC Summary and/or in the data package. |
| Post Digestion Spike (PDS) | Must be prepared with each background sample.<br>Evaluated when matrix spike(s) are not within specification. | ±25% of the true value. | The data is reported in the data package. |
| Serial Dilution | Must be prepared with each background sample.<br>Evaluated only when analyte concentrations are >50× the MDL. | The percent difference must be <10%. | The data is flagged in the data package. |

## Table I (Continued)

| | Frequency | Acceptance | Corrective Action |
|---|---|---|---|
| Samples | | Results must be < 90% of the linear dynamic range, >-LOQ.<br><br>RSD must be <20% for results >2x LOQ.<br><br>Elements reported as non-detect are accepted if the ICV/CCV is out of specification high, and the sample is not < - LOQ. | Sample is diluted and reanalyzed.<br><br>Sample is reanalyzed.<br><br>Reanalyze for elements that do not meet this criteria. |
| Linear Range Standard (LRS) | LRS not evaluated on all runs. Use as needed. | ±10% of the true value | Samples reading greater than 90% of the calibration range must be reanalyzed. |
| Internal Standard | Added to samples in line by use of a mixing T. | Must be 50% -130% of the calibration blank. | Reanalyze at a dilution. |

# Table II
## QC requirements EPA-600/R-94/111 (PW, EW, WW) ICP Metals

| | Frequency | Acceptance | Corrective Action |
|---|---|---|---|
| Calibration | The calibration contains a blank and 1 standard. | | |
| Initial Calibration Verification (ICV)<br><br>ICV2 | Must be analyzed immediately following calibration.<br><br>ICV2 must be analyzed immediately after the ICV to attain the average of six replicates. | Avg of ICV and ICV2 must be ±5% of the true value.<br><br>RSD for 6 replicates must be <3%. | If the ICV is out of specification high for an analyte and the result is not < - LOQ, accept results that report as non-detect for affected analyte. Results for the affected analyte(s) > or = to the reporting limit must not be reported from the run (reanalyze). |
| Initial Calibration Blank (ICB) | Must be analyzed immediately following the ICV. | \|ICB\| must be < 3x IDL<br><br>If ICB is Out of Specification positive (+), accept results that are > 10X the ICB, or < reporting limit. If ICB is Out of Specification negative (-), only accept results that are > 10X ICB. | Data for that analyte cannot be reported from the run (reanalyze all samples requiring that analyte). |
| Low Level Check (LLC) | Must be analyzed at the beginning and end of each run and before the ICSA and ICSAB. | Use statistical limits. Not applicable if sample concentrations are >10× the true value of the LLC. For LLC results >the high limit, samples <reporting limit can be accepted. | Data for that analyte cannot be reported from the sample. |
| Interference Check Standard A and AB (ICSA/ICSAB) | The ICSA must be analyzed at the beginning and end of each run immediately following the LLC.<br>The ICSAB must be analyzed at the beginning and end of each run immediately following the ICSA. | ± 20% of the true value for analytes that are spiked.<br>\|ICSA\| or \|ICSAB\| must be <2× LOQ for analytes that are not spiked. | Data for that analyte cannot be reported from the run (reanalyze all samples requiring that element). |

## Table II (Continued)

| | Frequency | Acceptance | Corrective Action |
|---|---|---|---|
| Continuing Calibration Verification (CCV) | Must be analyzed immediately following the ICSAB and at a frequency of every 10 samples. | ±10% of the true value. | If the CCV is out of specification high for an analyte and the result is not < - LOQ, accept results that report as non-detect for affected analyte. Results for the affected analyte(s) > or = to the reporting limit must not be reported from the run (reanalyze). |
| Continuing Calibration Blank (CCB) | Must be analyzed immediately following CCV's at a frequency of every 10 samples. | \|CCB\| must be <3x IDL<br><br>If CCB is Out of Specification positive (+), accept results that are > 10X the CCB, or < reporting limit. If CCB is Out of Specification negative (-), only accept results that are > 10X CCB. | Data bracketing the CCB for the affected analyte cannot be reported (reanalyze all samples in the bracketing blocks for that element). |
| Preparation Blank (PB) | Must be prepped at a frequency of 1 per analytical batch of 10 samples or less. | \|PB\| must be <1/2 LOQ. Not applicable if analyte reading in the sample is >10× the PB reading or <LOQ. | Redigest all associated samples. |
| Laboratory Control Standard (LCS) | Must be prepped at a frequency of 1 per analytical batch of 10 samples or less. | Use statistical limits or the method limit of ±15% (PW, EW)/ 20%(WW) ,as indicated by the client requirement.<br>If the LCS is out of specification high and the sample result is less than the LOQ the data can be taken. | Redigest all associated samples if the LCS is out of specification low.<br><br>If the LCS is out of specification high redigest samples that are greater than the LOQ. |
| Laboratory Control Standard Duplicate (LCSD) | If insufficient sample volume is submitted to perform batch QC then a LCSD is prepped at a frequency of 1 per analytical batch of 10 samples or less. | Use statistical limits or the method limit of ±15%(PW, EW)/ 20%(WW) ,as indicated by the client requirement.<br>If the LCS is out of specification high and the sample result is less than the LOQ the data can be taken.<br><br>RPD must be < 20%. | Redigest all associated samples if the LCS is out of specification low.<br><br>If the LCS is out of specification high redigest samples that are greater than the LOQ.<br><br>Redigest samples if RPD is out of specification |

## Table II (Continued)

| | Frequency | Acceptance | Corrective Action |
|---|---|---|---|
| Matrix Spike (MS) | Must be prepped at a frequency of 1 per analytical batch of 10 samples or less. | Use statistical limits or the method limit of ±30%, as indicated by the client requirement. | Data is flagged in the QC Summary and/or in the data package.<br>If sample concentration <4× the spike added a PDS must be performed. |
| Duplicate (D) | Must be prepped at a frequency of 1 per analytical batch of 10 samples or less. | If the samples are >5× the LOQ the RPD must be <20%.<br>If either the sample or duplicate is <5× the LOQ the difference between the two values must be <LOQ.<br>Not applicable if both samples are <LOQ. | Data is flagged in the QC Summary and/or in the data package. |
| Post Digestion Spike (PDS) | Must be prepared with each background sample. Evaluated when matrix spike is not within specification. | ±15% of the true value. | Data is reported in the data package. |
| Serial Dilution | Must be prepared with each background sample. Evaluated only when analyte concentrations are >50× IDL. | The percent difference must be <10%. | Data is flagged in the data package. |
| Samples | | Results must be < 90% of the linear dynamic range, >-LOQ.<br><br>RSD must be <20% for results > 2xLOQ.<br><br>Elements reported as non-detect are accepted if the ICV/CCV is out of specification high and the sample is not < - LOQ. | Sample is diluted and reanalyzed.<br><br>Sample is reanalyzed.<br><br>Reanalyze for elements that do not meet this criteria. |
| Linear Range Standard (LRS) | LRS not evaluated on all runs. Use as needed. | ±10% of the true value | Samples reading greater than 90% of the calibration range must be reanalyzed. |
| Internal Standard | Added to samples in line by use of a mixing T. | Must be 50% -130% of the calibration blank. | Reanalyze at a dilution. |

## Appendix I

Definitions and explanations of the codes and symbols used on the raw data

A. Sample table information

1. The run number.
2. The page number.
3. The tube number.
4. The sample number.
5. The first and second of four asterisks denote whether the sample is a background (U*), duplicate (D*), spike (R*), MSD (M*), post-digestion spike (UP), serial dilution (UL), or not a QC sample (**).
6. The weight to volume or volume to volume digestion ratio, consisting of the initial quantity of sample used and the final digest volume.
7. The dilution factor – Indicating if the digest solution was diluted prior to analysis. An undiluted sample is labeled DF1.
8. Digestion batch number – Assigned when designated samples are scheduled for preparation, this number is used to track samples and QC prepared together.
9. The protocol by which the data is reviewed (SW-846, EPA-600).

## Appendix I (Continued)

10. Date and time of the sample injection into the instrument.

11. The ICAP identification number.

B. The ICP scans all of the method elements simultaneously during the analysis. The QC review lists all the samples on the run. The QC review lists elements verified, good phantom, and elements/phantom that are bad (need to be reread for run or batch QC). The reviewer or verifier documents on the QC review if any element(s)/sample(s) were selected/deselected.

C. The following are error codes in the iTEVA™ software .

1. S = Saturation – The concentration of the element is more than the detector can quantify.

2. K = The Elements Affected by a Saturated Element – The concentration listed is not accurate, and a more accurate result can be obtained by running the sample at a dilution.

D. Along with the average concentration (in ppm), the average intensity, %RSD and all three replicates are shown for each analyte. Internal standard values are intensities (cts/s).

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-WI -9011630 | **Revision** | 13 |
| **Effective Date** | Jul 28, 2015 | **Status** | Effective |
| **Historical/Local Document Number** | Analysis 0212 | | |
| **Local Document Level** | Level 3 | | |
| **Local Document Type** | TEST - Testing Document | | |
| **Local Document Category** | ANALYSIS-ES - Analysis-Environmental Science | | |

| | |
|---|---|
| **Prepared by** | Susan Hibner |
| **Reviewed and Approved by** | Erik Frederiksen;Review;Friday, July 24, 2015 4:26:47 PM EDT<br>Kathryn Brungard;Approval;Monday, July 27, 2015 7:39:57 AM EDT |

## Revision Log:

| Revision: 13 | Effective Date: This version | |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Historical/Local Document Number | Reflects combination of documents | Added Analysis 6649 |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Throughout Document | Combine and streamline procedures | Content taken from 1-P-QM-WI-9014026.06 Effective Mar 13, 2015 which will be made Obsolete |
| Reference | Current edition of SM | Added SM22 |
| Scope | Consolidation of procedures | Explained differences between Analyses 0212 and 6649 |
| Apparatus and Equipment | Reflects appropriate equipment | Added hot plate |
| Procedure 7. | Enhancement | Moved QC preparation from the Quality Assurance/ Quality Control section |
| Procedure 14. | Reflects appropriate equipment | Added hot plate |
| Procedure 16. | Consolidation of procedures | Added drying requirement for PA samples |
| Procedure 21. | Consolidation of procedures | Added weight requirement for PA samples |
| Quality Assurance/ Quality Control | Clarification | Expanded on batch size limits |

| Revision: 12 | Effective Date: Dec 30, 2014 | |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Cross Reference | Reflect current documents referenced in procedures | Replaced 1-P-QM-QMA-9017363 with 1-P-QM-QMA-9015389<br>Replaced 1-P-QM-QMA-9017372 with 1-P-QM-QMA-21767<br>Added 1-P-QM-QMA-9017309 and 1-P-QM-QMA-9017313 |
| Sample Collection, Handling and Preservation | Reflect current practice | Updated 4° ± 2°C with 0° to 6°C, not frozen |

## Reference:

1. *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998, Method 2540 C-1997.

2. Standard Methods for the Examination of Water and Wastewater, 22nd Edition, 2012, Method 2540 C-1997

3. Method 160.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.

4. *Chemical Hygiene Plan*, current version.

## Cross Reference:

| Document | Document Title |
|---|---|
| 1-P-QM-PRO-9015422 | Equipment Muffle Furnaces and Ovens |
| 1-P-QM-PRO-9015424 | Maintenance of Desiccators |
| 1-P-QM-PRO-9015533 | Instructions for Collecting Data on the LLENS System |
| 1-P-QM-PRO-9015535 | Quality Control Data for Wet Chemistry |
| 1-P-QM-QMA-9015389 | Balance, Syringe, Pipette Verification |
| 1-P-QM-QMA-9015390 | Demonstrations of Capability |
| 1-P-QM-QMA-9017309 | Determining Method Detection Limits and Limits of Quantitation |
| 1-P-QM-QMA-9017313 | Establishing Control Limits |
| 1-P-QM-QMA-9017328 | Reagents and Standards |
| 1-P-QM-QMA-9021767 | Laboratory Notebooks, Logbooks, and Documentation for Environmental Testing |

## Scope:

This method is applicable for the determination of total dissolved solids (TDS) in potable, surface, and saline waters, as well as domestic and industrial wastewaters in a range up to 20,000 mg/L.

Analysis #0212 applies to all non-Pennsylvania samples.

Analysis #6649 is applicable specifically for the determination of dissolved solids in all waters for the state of Pennsylvania. The state of Pennsylvania requires only one weight after a 16 hour drying cycle

The maximum contaminant level for compliance samples, designated as EW, is 500 mg/L. All potable waters, designated as PW (from New Jersey), follow the same criteria as compliance samples (EW).

The limit of quantitation (LOQ) for this analysis varies with the sample volume. This method uses glass beakers in place of porcelain evaporating dishes for sample drying.

**Basic Principles:**

A well-mixed sample is filtered through a glass fiber filter. The filtrate is placed in a tared beaker and evaporated to dryness on a steam bath or equivalent. The beaker is then dried to constant weight in an oven at 180° ± 2°C. The increase in dish weight represents the total dissolved solids (TDS).

**Reference Modifications:**

The differences between SM 2540 C and EPA 160.1 are that SM 2540 C has a ten-minute filtration time limit and samples that do not maintain a homogeneous state after shaking are magnetically stirred while the aliquot is taken.

**Interferences:**

Highly mineralized samples with a significant concentration of calcium, magnesium, chloride, and/or sulfate may require prolonged drying. Samples with a high concentration of bicarbonate may also require prolonged drying to convert the bicarbonate to carbonate.

Waters with excessive residue may form a water entrapping crust therefore; residue should be limited to no more than 0.2 g.

**Safety Precautions and Waste Handling:**

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

**Personnel Training and Qualifications:**

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Proficiency is measured through an Initial Demonstration of Capability (IDOC) that consists of four laboratory control samples (LCS) that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four LCS's or one blind sample. Refer to 1-P-QM-QMA-9015390 for more guidance on these options.

**Sample Collection, Preservation, and Handling:**

Samples for total dissolved solids must be unpreserved, collected in glass or plastic containers and refrigerated at 0° to 6°C, not frozen. Analyze within 7 days of collection to minimize microbiological decomposition of the solids.

**Apparatus and Equipment:**

1. Glass fiber filters
2. Filtration apparatus:
    a. Suction flask (500-mL capacity) or equivalent
    b. Filter holder
    c. Buchner funnel or equivalent
3. 250-mL glass beakers or equivalent

4. Steam bath or hot plate

5. Desiccators or equivalent. Refer to 1-P-QM-PRO-9015424.

6. Oven maintained at 180° ± 2°C. Adjust as needed to stay in this range. Refer to 1-P-QM-PRO-9015422.

7. Analytical balance

8. LLENS - an electronic notebook that integrates a PC with an analytical balance to collect data directly from the balance. It also organizes the data, performs calculations and transmits the final results to the central computer system.

**Reagents and Standards:**

Alternate weights and volumes are acceptable as long as final concentrations remain the same.

Refer to 1-P-QM-QMA-9017328 for the proper labeling and documentation of reagent preparations.

1. TDS/TS stock standard (4000 mg/L)

    a. Dry KCl for at least 1 hour in oven at 104° ± 1°C.

    b. Desiccate approximately 1 hour.

    c. Dissolve 4.0 ± 0.05 g KCl in reagent water and dilute to 1000 mL in volumetric flask.

    d. Store at 0° to 6°C, not frozen. Stable 6 months.

    e. Use as prepared for spiking solution.

2. TDS/TS working standard (200 mg/L)

    a. Pipette 50 mL of TDS/TS stock standard into a volumetric flask

    b. Dilute to 1000 mL with reagent water.

    c. Store at 0° to 6°C, not frozen.

    d. Stable 6 months from preparation date of TDS/TS stock standard.

    e. Use as prepared for LCS.

**Calibration:**

Balances must be calibrated each day before use. Refer to 1-P-QM-QMA-9015389.

**Procedure:**

Use LLENS for TDS whenever possible to facilitate data transfers according to the most recent version of 1-P-QM-PRO-9015533. If it is necessary to record data in a raw data logbook, follow instructions in 1-P-QM-QMA-9021767 for documentation.

1. Place clean beakers in oven for 1 hour at 180° ± 2°C.

2. Cool the beakers in a desiccator for at least 1 hour.

    **NOTE:** Check desiccant to be sure that the indicator crystals are still blue and not pink.

3. Check to make sure the balance has been calibrated each day before use.

4. Use tongs to place beaker on a zeroed balance. Record beaker designation and tare weight, along with other requested information.

5. Store beakers in a clean, dry environment until needed.

6. Assemble filtration apparatus.

   a. Place a glass fiber filter in the bottom of a Buchner funnel.

   b. Apply vacuum and wash with at least three 20-mL portions of reagent water.

   c. Continue suction to remove all traces of water.

   d. Discard washings and rinse suction flask with reagent water.

   e. Reassemble filtration apparatus and apply vacuum.

7. Required QC sample preparation.

   a. Analyze a method blank which is 200 mL of reagent water.

   b. Analyze the LCS and/or LCSD using 100 mL of the 200 mg/L TDS/TS working standard.

   c. Prepare and analyze a matrix spike (MS) and/or matrix spike duplicate (MSD) by measuring equal portions of sample and spiking one portion with 10 mL of spiking solution (4000mg/L TDS/TS stock solution). If the sample aliquot is 10 mL then 20 mL of spiking solution must be used.

   d. Prepare duplicates by analyzing equal portions of sample.

8. Shake sample vigorously. (**NOTE**: If the sample does not maintain a homogeneous state until the aliquot is taken, then magnetically stir the sample while pipetting the appropriate aliquot onto the filter.)

9. Using a Class A graduated cylinder or wide-mouth pipette, measure 200 mL of sample or a smaller portion if the sample matrix dictates. An appropriate aliquot should be sufficient to contain between 0.0025 and 0.2 g total dissolved solids.

10. Rapidly transfer the aliquot to the Buchner funnel.

11. Still under vacuum, filter the sample.

    a. Wash the filter with at least three 10-mL portions of reagent water when the sample matrix allows (rinsing inside of the graduated cylinder and funnel).

    b. If complete filtration takes more than 10 minutes, decrease the sample volume or increase size of the filter.

    c. Allow complete drainage between washings.

    d. Continue suction at least 3 minutes after filtration is complete.

    **NOTE:** This step is important to ensure that dissolved solids are rinsed through, and not left behind in the filter.

12. Transfer the total filtrate with washings to a tared beaker.

    a. Rinse suction flask with two small portions of reagent water

    b. Transfer each rinse to the beaker.

13. Record sample aliquot volume and beaker designation, along with other requested information, on the batch worksheet.

14. Evaporate the sample to dryness on a steam bath or hot plate.

15. When evaporation is complete, place the beaker containing the sample residue in an oven.

16. Dry at least 1 hour or longer at 180° ± 2°C. For samples from PA, dry the sample for at least 16 hours.

17. Use tongs to remove the beaker containing dried residue from the oven.

18. Cool the beaker containing dried residue in a desiccator for at least 1 hour.

    **NOTE:** Check desiccant to be sure that the indicator crystals are still blue and not pink.

19. Again, check to make sure that the balance has been calibrated each day before use.

20. Using tongs, place the beaker containing dried residue on a zeroed balance.

21. Record the weight. Samples from PA require only one weight after a 16-hour drying cycle

22. Return beaker to oven and dry at least 1 hour or longer at 180° ± 2°C. Use tongs to remove the beaker containing dried residue from the oven. Cool beaker in a desiccator for at least 1 hour.

23. Using tongs, place beaker containing dried residue on a zeroed balance. Record the weight. Repeat this drying, desiccating, and reweighing cycle until weight loss is ≤0.0005 g. Use the lowest weight as the final weight for the calculation.

24. If an inappropriate aliquot was selected, repeat process using more or less sample volume. Minimum volume should be at least 10 mL to ensure analysis of a representative sample. Maximum volume is 200 mL.

    **NOTE:** If ever unable to weigh beakers promptly after desiccation, return beakers to oven at 180° ± 2°C for at least 1 hour before removing for desiccating and weighing.

## Calculations:

$$mg\ total\ dissolved\ solids/L = \frac{(A - B) \times 1000 \times 1000}{Sample\ Volume\ (mL)}$$

**Where:**

A = Weight of residue and beaker or dish (in grams) after drying

B = Tare weight of empty beaker or dish (in grams)

**NOTE:** Occasionally, weight gain is exhibited during the analysis due to oxidation of the sample.

## Statistical Information/Method Performance:

Generate the method detection limit (MDL) and limit of quantitation (LOQ) annually by following the procedure in 1-P-QM-QMA-9017309. The department maintains annual study data and updates to LIMS are made as needed by the QA department.

Generate the quality control acceptance windows by following the procedure outlined in 1-P-QM-QMA-9017313. The limits are evaluated annually and updated as needed. These limits are maintained in LIMS for the relevant analysis number(s).

## Quality Assurance/Quality Control:

Batch size is limited to 20 samples or less.

If an Analysis #0212 batch contains Analysis #6649 samples, they are included as part of the 20 sample limit.

One method blank and a 200 mg/L LCS must be analyzed with each batch.

A MS must be analyzed with each batch. A sample matrix duplicate must be analyzed with each group of not more than 10 samples.

When sample volume does not permit the analysis of either the MS or the required duplicates, then an LCSD must be analyzed to demonstrate method precision.

Samples from West Virginia require a usable precision measurement for each batch. Analyzing one of the following on a batch containing a West Virginia sample fulfills this requirement: an MS/MSD, a non-program deleted duplicate or an LCSD.

If the residue weight of a sample is less than 0.0025 gram and sample volume permits, repeat the sample using up to 1000 mL of sample. Samples from the state of South Carolina have a minimum limit of 0.01 gram.

The maximum residue limit is 0.2 gram

See LIMS for current quality control (QC) acceptance windows. Follow guidelines in 1-P-QM-PRO-9015535 for outlier QC data.

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-WI -9013418 | **Revision** | 15 |
| **Effective Date** | Oct 30, 2013 | **Status** | Effective |
| **Historical/Local Document Number** | Analysis 2079, 0383, 6623, 10065, 11356, 11763 | | |
| **Local Document Level** | Level 3 | | |
| **Local Document Type** | TEST - Testing Document | | |
| **Local Document Category** | ANALYSIS-ES - Analysis-Environmental Science | | |

| | |
|---|---|
| **Prepared by** | Nicole Kepley |
| **Reviewed and Approved by** | Erik Frederiksen;Review;Tuesday, October 29, 2013 3:05:46 PM EDT<br>Barbara Reedy;Approval;Wednesday, October 30, 2013 7:53:17 AM EDT |

## Revision Log:

| Revision: 15 | Effective Date: This version | |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Throughout Document | Reflect re-identification of documents in EtQ | Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers |
| Scope | Method update | Added analysis 11356, TIC Calculation |
| Calculations | Method update | Added the Total Inorganic Carbon (TIC) calculation. |

| Revision: 14 | Effective Date: Jan 24, 2012 | |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirements per LOM-SOP-LAB-201 | Removed revision logs up to the previous version. |
| Reagents and Standards | Clarification | Added TC/TOC QC stock preparation |
| Calibration | Clarification | Changed CCV instructions |
| Procedure 11 | Clarification | Noted to record drying time/temperature |
| Quality Assurance/Quality Control | Enhancement | Clarified TC LCSS |

## Reference:

1. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 5310B Modified

2. *Method 415.1 (modified), Methods for Chemical Analysis of Water and Wastes USEPA 600.*

3. *Test Methods for Evaluating Solid Wastes, SW-846 Method 9060 Modified, September 1986.*

4. Test Methods for Evaluating Solid Wastes, SW-846 Method 9060A Modified, November 2004

5. *Solids Module Operators Manual*, O.I. Analytical.

6. *WinTOC Solids Operators Manual*, O.I. Analytical.

7. *Determination of Total Organic Carbon in Sediment*, U. S. EPA, Region II, July 27, 1988. ("Lloyd Kahn Method.").

8. *Chemical Hygiene Plan*, current version.

## Cross Reference:

| Document | Document Title |
|---|---|
| 1-P-QM-QMA-9017309 | Determining Method Detection Limits and Limits of Quantitation |
| 1-P-QM-QMA-9017313 | Establishing Control Limits |
| 1-P-QM-QMA-9017328 | Reagents and Standards |

## Scope:

This method is applicable for the determination of total organic carbon (TOC) in soils and other samples not easily analyzed by the TOC waters method. The limit of quantitation (LOQ) for this method can be found in the analysis information file. Quantitative TOC results up to 1,000,000 mg/kg may be obtained by this method. Analysis 0383 is used for samples referencing the Lloyd Kahn Method.

Analysis 6623 is used for TOC in solids by triplicate analysis. The procedure is identical to analysis 2079 except that samples are analyzed in triplicate and the average is reported. The QC associated with these samples is still a single measurement.

Analysis 10065 is used for the determination of Total Carbon in solids. This procedure does not eliminate the inorganic carbon by acidification prior to analysis.

Analysis 11763 is used for TOC for account 12935 and has a 14 day holding time, and client specific quality control acceptance windows.

Analysis 11356 is a calculation to determine the TIC result. TIC is the calculation subtracting the TOC soil result from the result obtained when analyzing the TC.

## Basic Principles:

TOC is determined by acidifying a sample and heating it to remove the TIC. An aliquot of sample (1. mg to 1. g) is weighed into a sample cup. The sample is then heated to 900°C for combustion of the remaining TOC. The resulting carbon dioxide from the TOC is detected by a nondispersive infrared (NDIR) detector that has been calibrated to directly display the mass of carbon dioxide detected. The mass is proportional to the mass of TOC in the sample. Samples analyzed by this method include solids such as soils or sediments, slurries, sludges, brines, and corrosives.

The Total Carbon measurement is identical to the TOC measurement, with the exception that there is not an acidification and heating step to remove the TIC.

TIC is the calculation subtracting the TOC soil result from the result obtained when analyzing the TC.

**Reference Modifications:**

This method deviates from Sections 9.2 and 9.3 of the referenced "Lloyd Kahn" method. A matrix duplicate sample is analyzed at a 10% frequency, but a quadruplicate determination is not performed.

There is no referenced method for the determination of Total Carbon in solids. Analysis 10065 references a modified TOC method. The calibration standards, QC standards, and LCS employed for this analysis are composed of only organic sources of carbon (Sucrose for the calibration and QC standards, and a purchased standard for the LCS solid). Therefore, the Total Organic Carbon content is equal to the Total Carbon content in these standards.

**Interferences:**

Carbon is ubiquitous in nature. Therefore, extra care must be taken to avoid contamination of reagents, glassware, and any other materials that come in contact with the sample. Samples which are light in weight may need to be analyzed at smaller aliquots to fit within a sample cup. These samples are reported with an elevated LOQ.

**Safety Precautions and Waste Handling:**

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

1. Normal laboratory practices for safety must be followed.

2. Extreme caution must be used when handling sample cups after they have been analyzed.

3. Discard acid waste in acid waste containers.

4. See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

**Personnel Training and Qualifications:**

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

Analysts are considered proficient when they have successfully completed a Demonstration of Capability for the analysis. A Demonstration of Capability consists of four laboratory control standards that are carried through all steps of the analysis and that meet the acceptance criteria for the LCS and LCSD. Documentation for these studies are in each individual's training records.

**Sample Collection, Preservation, and Handling:**

Samples must be collected and stored in glass containers. Samples must be stored under refrigeration at 0° to 6°C, not frozen. The holding time for samples is 28 days. Because very small amounts (1. mg to 1 g) of sample are used for the analysis, the sample must be as homogeneous as possible. The holding time for analysis by the Lloyd Kahn method (analysis 0383) and TOC by 11763 is 14 days.

**Apparatus and Equipment:**

1. O.I. analytical solids combustion module

2. Pentium 90 PC compatible computer with WinTOC hardware and printer

3. 2-stage gas regulator (two required)

4. Sample cups

5. Fiber quartz wool

6. Analytical balance, capable of accurately weighing to 1. mg

7. Glassware – General laboratory glassware as needed for preparing reagents and standards

8. Microliter syringe, various volumes

**Reagents and Standards:**

**NOTE:** All chemical used must be ACS reagent grade unless otherwise noted.

Different volumes or weights may be used provided the ratios remain equivalent.

See 1-P-QM-QMA-9017328, for the appropriate labeling and documentation of reagent and standard preparation.

1. Ultra pure nitrogen gas (60 psi)

2. Ultra pure oxygen gas (60 psi)

3. Hydrochloric acid, concentrated (HCl) – Purchased. Store at room temperature.

4. 1+1 Phosphoric acid

| | |
|---|---|
| Phosphoric acid ($H_3PO_4$) | 50 mL |
| Reagent water | 50 mL |

Take 50 mL of $H_3PO_4$ and add slowly while swirling to a 100-mL volumetric flask containing 50 mL reagent water. Store at room temperature. Prepare fresh every 6 months.

5. TOC stock calibration standard (30% carbon), purchased. See label for expiration date. Store at room temperature.

6. TOC LCS standard, purchased. See label for expiration date, and the certified concentration. Store at room temperature.

7. TC/TOC QC Stock solution 15,000 mg/L.

   Potassium Hydrogen Phthalate (KHP) 15.945 g ± 0.005 g

   Phosphoric Acid, concentrated, 10 drops.

   Add 10 drops of Phosphoric acid to a 500 ml volumetric flask containing approximately 250 ml of reagent water. Add 15.945 g ± 0.005 g of KHP to the flask, dissolve and bring to full volume with reagent water. Store in an amber glass bottle at 0° to 6°C, not frozen. Prepare every 30 days.

**Sample Cup Preparation:**

Sample cups must be conditioned prior to analysis. This is achieved by heating the cups to 900°C for a period of 2 to 5 minutes.

**Calibration:**

1. Working standards for calibration

   Pipette a volume of the TOC stock calibration standard into the sample cups as follows:

| Working Std. (mg C) | Vol. Stock TOC (µL) |
|---|---|
| 0.30 | 1.0 |
| 0.90 | 3.0 |
| 3.0 | 10.0 |
| 6.0 | 20.0 |

   Prepare fresh daily. Store at room temperature.

2. Continuing calibration verification standard (CCV)

| CCV (mg C) | Vol. QC Stock TOC (mL) |
|---|---|
| 3.0 | 0.20 |

Pipette directly onto glass wool in a quartz cup.

Prepare fresh daily. Store at room temperature.

**Procedure:**

1. Turn on nitrogen to 60 psig.
2. Turn on oxygen to 60 psig.
3. Add water and a drop of HCl to the scrubber.
4. Measure the carrier gas (oxygen) flow rate and adjust to 200 mL/min.
5. Measure the dryer gas (nitrogen) flow rate and adjust to 160 to 300 mL/min.
6. Power up instrument.
7. Program in a sequence file.
8. Analyze 3 blank replicates and then run the calibration sequence as follows: 0.30, 0.90, 3.0, and 6.0 mg C (Performed monthly).
9. The instrument automatically calculates the $R^2$ and list the calibration data.
10. Samples must now be analyzed along with the appropriate laboratory control standard and preparation blank. A check standard (CCV) of 3.0 mg C and a continuing calibration blank (CCB) must be run after every ten samples.

11. Weigh samples into sample cups (up to 1000 mg). Add 1+1 $H_3PO_4$ drop wise until effervescence stops. Heat at 75°C for 15 minutes. Record the oven ID, time and temperature of this step in the log book.

    **NOTE:** This procedure will convert inorganic carbonates and bicarbonates to carbon dioxide and eliminate it from the sample. The addition of $H_3PO_4$ and the heating to 75°C is not performed for analysis 10065.

12. Analyze the residue according to the instrument manufacturer's instructions for the remaining TOC result.

**Calculations:**

1. To determine mg/kg TOC or TC

$$mg/kg = (Raw\ result\ in\ mg\ C) \times (1000/weight\ in\ mg) \times (1000)$$

2. To determine LOQ/MDL factors

$$Factor = \frac{Maximum\ sample\ aliquot\ weight\ (1000.mg)}{weight\ of\ sample\ (mg)}$$

3. To determine Total Inorganic Carbon (TIC)

TIC = Total Carbon (TC) – Total Organic Carbon (TOC)

**Statistical Information/Method Performance:**

1. The method detection limit (MDL) is determined annually by following the procedure outlined in 1-P-QM-QMA-9017309.

2. The quality control acceptance windows are generated annually by following the procedure outlined in 1-P-QM-QMA-9017313.

## Quality Assurance/Quality Control:

1. A calibration must be performed every 30 days. The acceptable range for the calibration is R = 0.995 or greater. If this criteria is not met, the instrument must be recalibrated.

2. A batch must contain no more than 20 field samples.

3. A batch blank (PBS) must be analyzed every batch or each day samples are prepared (not to exceed 20 samples). An acceptable result is < the limit of quantitation. If the PBS does not meet this criterion, it must be rerun twice. If either of the two additional trials do not meet the acceptance criterion, all samples in the batch must be repeated.

4. A laboratory control standard (LCSS) must be analyzed every batch or each day samples are analyzed (not to exceed 20 field samples). For TOC this is a purchased standard and the acceptable range is specified by the manufacturer. For TOC by 11763, the acceptance range for the LCS is 80% to 120%. For Total Carbon, spike 0.2 ml of the TC QC Stock solution onto glass wool. Assuming the nominal full volume of 1000 mg, the TC LCSS true value is 3000 mg/kg. The LCSS should undergo the same steps as the samples. If the LCSS does not meet the acceptable criterion, it must be repeated twice. If either of the two additional trials do not meet the acceptance criterion, all samples in the batch must be reanalyzed.

5. Based upon client requirements, a laboratory control standard duplicate (LCSSD) may need prepared and analyzed under the same conditions as the LCSS. The acceptance criterion for the LCSSD is the same as that of the LCSS. The relative percent difference between the LCSS and the LCSSD is calculated statistically.

6. A duplicate must be analyzed every 10 samples. The acceptable relative percent difference is statistically determined. For TOC by 11763, the duplicate RPD is 40%. The duplicate relative percent differences must be tracked to continually monitor method performance.

7. A spike must be analyzed for every batch. The acceptance range is determined statistically. For TOC by 11763, the acceptance range is 75% to 125%. The spike recoveries must be tracked to continually monitor method performance.

8. Based upon client requirements, a matrix spike duplicate (MSD) may need prepared and analyzed under the same conditions as the MS. The acceptance criterion for the MSD is the same as that of the MS. The relative percent difference between the MS and the MSD is calculated statistically. For TOC by 11763, the MS/MSD RPD is 40%.

9. A check standard (CCV) and blank (CCB) must be run after every ten injections (including blanks and standards). The acceptable range for the CCV is ±10% of the true value. An acceptable CCB result is < the limit of quantitation. If either, or both, of these injections do not meet the acceptance criterion, the unacceptable original must be repeated twice. If either of the two additional trials do not meet the acceptance criterion, all samples since the last compliant CCV/CCB must be reanalyzed.

10. A CCV and CCB shall be analyzed at the beginning and the end of each run. At any time when the instrument has been idle for a period of 4 hours or more, a CCV and CCB must be analyzed. If either of these parameters cannot meet specifications, the instrument must be recalibrated.

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-WI -9011651 | **Revision** | 15 |
| **Effective Date** | May 22, 2015 | **Status** | Effective |
| **Historical/Local Document Number** | Analysis 0273, 6090, 7547 | | |
| **Local Document Level** | Level 3 | | |
| **Local Document Type** | TEST - Testing Document | | |
| **Local Document Category** | ANALYSIS-ES - Analysis-Environmental Science | | |

| | |
|---|---|
| **Prepared by** | Nicole Veety |
| **Reviewed and Approved by** | Erik Frederiksen;Review;Thursday, May 21, 2015 1:06:30 PM EDT<br>Barbara Reedy;Approval;Thursday, May 21, 2015 3:07:05 PM EDT |

## Revision Log:

| Revision: 15 | Effective Date: This version | |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Calculations | Method update | Clarified using the average of the duplicate injections, not the higher of the two. |
| Quality Assurance/Quality Control 14 | Not a necessary check | Removed entire step |

| Revision: 14 | Effective Date: Dec 20, 2013 | |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Throughout Document | Reflect re-identification of documents in EtQ<br><br>Method Update | Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers<br><br>Updated temperature to 0°to 6°C not frozen. |
| Statistical Information/Method Performance | Method Update | MDL replicates to be performed over a period of 3 days. |
| Quality Assurance/Quality Control | Method Update | Added method blank requirement to ½ the RL.<br>Added required reporting limit check. |

## Reference:

1. Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005, Method 5310 C-2000

2. Method 415.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.

3. *Model 1030 Total Organic Carbon Analyzer Operating Procedures and Service Manual,* O.I. Corporation, 2005.

4. *Chemical Hygiene Plan*, current version.

## Cross Reference:

| Document | Document Title |
|---|---|
| 1-P-QM-QMA-9017309 | Determining Method Detection Limits and Limits of Quantitation |
| 1-P-QM-QMA-9017313 | Establishing Control Limits |
| 1-P-QM-QMA-9017328 | Reagents and Standards |

## Scope:

This method is applicable for the determination of total organic carbon in water and wastewaters. The procedure outlined in this method pertains to the O.I. Model 1030 analyzer. This model uses the persulfate oxidation technique and references SM 5310C. The limit of quantitation (LOQ) for this analysis can be found in the sample information file.

Analysis 7547 is used for analysis of dissolved organic carbon. These samples are passed through a 0.45-µ membrane filter prior to analysis. Analysis 6090 is used for the determination of total inorganic carbon. It can be performed by calculating the difference between total carbon and TOC.

## Basic Principles:

A sample aliquot of water or wastewater is injected into a reaction vessel at 100°C where metered amounts of phosphoric acid are added. The sample is purged with ultrapure nitrogen gas to remove inorganic carbon as carbon dioxide and any purgeable organic carbon (POC). Following the purging of the inorganic fraction, a metered amount of sodium persulfate is added to the reaction vessel, and the sample is heated. The persulfate oxidizes any organic carbon to carbon dioxide. Following the completion of the persulfate digestion, the carbon dioxide is carried to the IR detector by the nitrogen stream.

## Reference Modifications:

There are no procedural differences between EPA 415.1 and SM20 5310C.

## Interferences:

This method is generally free of interferences when normal wastewater and water samples are analyzed. However, high concentrations of chloride can interfere and several other problems can arise from certain sample matrices. These are listed below.

1. Chloride can react with the persulfate, which can cause erroneously low TOC results. Samples high in chloride may require that extra persulfate be added and the reaction time extended. The chlorine gas that is produced is also damaging to the molecular sieve. For these reasons, samples must not be preserved with hydrochloric acid.

2. Samples with high levels of inorganic carbon may require extra acid and longer purge time to ensure all the carbonates and bicarbonates are removed from the sample. A smaller sample volume may also be used.

3. Samples with high levels of organic carbon may require that extra sodium persulfate be added and that the reaction time is extended to ensure that all the organic carbon is oxidized by the persulfate. A smaller sample volume may also be used. Spiking the sample with a known amount of carbon and calculating recovery can be used to verify the oxidation efficiency.

4. When sequentially analyzing samples, carryover may occur when a sample high in carbon is followed by a sample low in carbon. This will produce erroneously high results for low-level TOC samples. This is caused by adsorption of organic carbon on the Teflon™ tubes and overloading of the molecular sieve. If an excessively high-level sample is accidentally introduced into the system, it may be necessary to clean the digestion vessel with reagent water before analyzing any more samples. This is accomplished by cycling reagent water and the reagents through the system until TOC values drop to less than the normal detection limit.

**Safety Precautions and Waste Handling:**

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Normal laboratory safety practices must be followed when performing this method. Extra care must be taken when handling the persulfate reagent (which is a strong oxidant) and unknown samples that could contain toxic or carcinogenic chemicals. Inspect all glassware before use. Discard or send for repair any glassware that is chipped, flawed, or broken.

**Personnel Training and Qualifications:**

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

Demonstration of Capability consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. This is performed annually and is maintained in the analyst's training records.

**Sample Collection, Preservation, and Handling:**

All samples must be collected in glass containers and stored at 0°to 6°C not frozen. Samples for TOC must be acidified with concentrated phosphoric acid to a pH <2. The holding time for these samples is 28 days.

**Apparatus and Equipment:**

1. O.I. Corporation Model 1030 TOC analyzer
2. O.I. Corporation Model 1088 Rotary Autosampler
3. Printer
4. 2-stage gas regulator
5. Analytical balance capable of accurately weighing to 0.0001 g
6. Automatic pipettes
7. Glassware – general laboratory glassware is needed for preparing reagents, standards, sample dilutions, etc.

**Reagents and Standards:**

**NOTE:** All chemicals used must be ACS reagent grade unless otherwise noted.

Different volumes or weights may be used provided the ratios remain equivalent.

See 1-P-QM-QMA-9017328 for the appropriate labeling and documentation of reagent and standard preparation.

1. Ultra-pure nitrogen gas (30 psi)

2. Oxidizing reagent

   Sodium persulfate ($Na_2S_2O_8$) 100 g

   a. Dissolve 100 ± 1 g of sodium persulfate in approximately 500 mL of reagent water in a 1000-mL volumetric flask.

   b. Dilute to volume with reagent water.

   c. Purge with nitrogen gas for 1 hour to release inorganic carbon present in reagent.

   d. This solution is stable for 6 months and is stored at room temperature in a plastic container.

3. Phosphoric acid (5% w/w)

   Phosphoric acid, 85% ($H_3PO_4$) 59 mL

   a. Add 59 mL of 85% $H_3PO_4$ to about 500 mL of reagent water in a 1000-mL volumetric flask.

   b. Mix thoroughly and dilute to volume with reagent water.

   c. This solution is stable for 6 months and is stored at room temperature in a plastic container.

4. Total Inorganic Standard (500 mg/L)

   Sodium bicarbonate ($NaHCO_3$) 0.1750 g ±0.0005 g

   Sodium carbonate ($Na_2CO_3$) 0.2209 g ±0.0005 g

a. Dissolve above reagents in a 100-mL volumetric flask containing about 50 mL of reagent water.

b. Dilute to volume with reagent water.

c. Prepare monthly. Do not acidify. Store in the flask at 0°to 6°C not frozen.

**Calibration:**

1. TOC stock calibration standard (500 mg C/L)

   Potassium hydrogen phthalate (KHP) 1.063 ± 0.005 g

   Phosphoric acid, concentrated ($H_3PO_4$) 20 drops

   a. Add 20 drops of concentrated phosphoric acid ($H_3PO_4$) to a 1000-mL volumetric flask containing about 500 mL of reagent water.

   b. Dissolve 1.063 ± 0.005 g of KHP to the flask and dilute to volume with reagent water.

   c. Prepare every 30 days. Store in an amber glass bottle at 0°to 6°C not frozen.

2. TOC stock QC standard (500 mg C/L)

   Prepare identically to TOC stock calibration standard using KHP from a different source.

3. Working standards for calibration and QC

   Pipette a volume of TOC stock standard into the appropriate volumetric flask that contains reagent water and three drops of concentrated phosphoric acid. Dilute to volume with reagent water. Prepare daily, as needed, according to the following table:

| Volume Stock CAL Standard (mL) | Standard Concentration (mg/L) | Final Volume (mL) |
|---|---|---|
| 20 | 100 | 100 |
| 10 | 50 | 100 |
| 10 | 25 | 200 |
| 2.0 | 10 | 100 |
| 3.0 | 7.5 | 200 |
| 0.2 | 1.0 | 100 |
| | | |
| Volume Stock QC Standard (mL) | Standard Concentration (mg/L) | Final Volume (mL) |
| 10.0 | 25 –CCV2/LCSW | 200 |

**Procedure:**

General (more detailed instructions for each step can be found in the instrument manual)

Start up the instrument in the following manner:

1. Turn on the power switch located at the back of the instrument. The system loads the startup screen and User Login dialog box. Turn on the nitrogen gas flow.

2. Prime the syringe and all reagents by following the manufacturer's instructions located in the instrument manual.

3. Load the active sequence.

4. Each sample is injected in duplicate. The RPD of the duplicate injections must be <10% when the concentrations are greater than five times the LOQ.

5. For Dissolved Organic Carbon, the samples and all quality control samples are filtered through a 0.45 micron filter that has been rinsed two times with reagent water. There is no subtraction of the filter blank in the calculation for DOC.

6. Load samples onto the autosampler trays.

7. Press Start.

**Calculations:**

The TOC result (in mg/L) is performed as below using the average of the two injections:

*raw result (mg/L from instrument) × dilution factor = final TOC result (mg/L)*

**Statistical Information/Method Performance:**

1. The method detection limit (MDL) is determined annually by following the procedure outlined in 1-P-QM-QMA-9017309. The 7 replicates must be analyzed over a period of at least 3 days.

2. The quality control acceptance windows are generated annually by following the procedure outlined in 1-P-QM-QMA-9017313.

**Quality Assurance/Quality Control:**

1. A calibration of 6 standards and a reagent water blank must be run monthly as the instrument calibration. The correlation coefficient of the curve must be ≥0.995.

2. An initial calibration blank (ICB) and an initial calibration verification standard (ICV) must be run after every calibration. The acceptable result is < the LOQ for the ICB and +/- 10% for the ICV.

3. A CCV and CCB must be analyzed after every 10 injections. The acceptable range for the CCV is ±10% of the true value. An acceptable CCB result is < the LOQ. If a CCV or CCB does not meet the acceptance criterion, all samples since the last compliant CCV and CCB and all samples before the next compliant CCV and CCB must be reanalyzed.

4. Sample results must not exceed the concentration of the highest standard. If a sample result falls above this value, the sample must be diluted and run again.

5. A batch must contain no more than 20 samples.

6. A batch blank (PBW) must be analyzed every batch. An acceptable result is less than ½ the LOQ. If the batch blank does not meet this criterion, corrective action must be taken, documented, and the PBW rerun twice. If the blank result is still greater than ½ the LOQ, any samples associated with the unacceptable PBW must be reanalyzed with an acceptable PBW once the analysis is back in control.

   **NOTE:** The batch blank analyzed is a reagent water blank.

7. A laboratory control standard (LCSW) must be analyzed every batch. The LCSW is the 25 mg/L CCV2 standard. The acceptable range for this standard is statistical. See LIMS for current acceptance range. If the LCSW does not fall within the acceptable range, corrective action must be taken, documented, and the LCSW rerun twice. If the LCSW result is still unacceptable, any samples associated with the unacceptable LCSW must be reanalyzed with an acceptable LCSW.

8. Based upon client requirements, a laboratory control standard duplicate (LCSWD) is prepared and analyzed under the same conditions as the LCSW. The acceptance criterion for the LCSWD is the same as that of the LCSW. The relative percent difference between the LCSW and LCSWD is calculated by the LIMS statistical program. If the RPD is outside of specifications, see your group leader to determine if a reanalysis is required.

9. A duplicate must be analyzed every batch at a frequency of 1 duplicate per 10 samples. The acceptance criterion is calculated by the LIMS statistical program. If the relative percent difference falls outside of the acceptance criteria, see your group leader to determine if reanalysis is needed.

10. A matrix spike must be analyzed at a frequency of 1 spike per 10 samples. This spike must be prepared at a concentration level that is at least four times greater than the concentration of the unspiked sample. See LIMS for current quality control acceptance criteria. If the recovery is outside of the acceptance criteria, consult your group leader to determine if reanalysis is necessary.

11. Based upon client requirements, a MSD is prepared and analyzed under the same conditions as the MS. The acceptance criteria and corrective action are the same as the MS. The relative percent difference between the MS and MSD is statistical and can be found in the LIMS. If the RPD is outside of these criteria, consult your group leader to determine if reanalysis is necessary.

12. The instrument must be calibrated at least every 30 days, or whenever acceptable check standards can no longer be obtained. At any point where the instrument has been idle for a period of 4 hours or more, a CCB and CCV must be analyzed. If either of these parameters is not within specifications, the instrument must be recalibrated and a new run started.

13. A Total Inorganic Carbon (TIC) check standard must be prepared daily to determine the efficiency of inorganic carbon removal when performing the total organic carbon analysis. The LCSW sample must be spiked with the same level of TIC and analyzed with each run. The acceptable range for this spike is 80%-120%.

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-WI -9012778 | **Revision** | 8 |
| **Effective Date** | Aug 4, 2015 | **Status** | Effective |
| **Historical/Local Document Number** | Analysis 10457 | | |
| **Local Document Level** | Level 3 | | |
| **Local Document Type** | TEST - Testing Document | | |
| **Local Document Category** | ANALYSIS-ES - Analysis-Environmental Science | | |

| | |
|---|---|
| **Prepared by** | Susan Hibner |
| **Reviewed and Approved by** | Erik Frederiksen;Review;Monday, July 20, 2015 3:47:48 PM EDT<br>Kathryn Brungard;Approval;Tuesday, July 21, 2015 7:39:32 AM EDT |

## Revision Log:

| Revision: 8 | Effective Date: This version | |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Historical/ Local Document Number | Added to the procedure | Add LIMS scan 13858 |
| Scope | The one-weight after 16-hour drying cycle applies to PA water samples only. | Added statement for differences between the 2 analyses |
| Procedure 14. | Addition of Analysis #13858 | Added drying requirement for PA samples |
| Procedure 16. | Addition of Analysis #13858 | Added weight requirement for PA samples |
| Quality Assurance/Quality Control | Clarification | Expanded on batch size limits |

| Revision: 7 | Effective Date: Jun 3, 2015 | |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Throughout Document | Updated references | Replaced 1-P-QM-QMA-9017363 with 1-P-QM-QMA-9015389<br>Replaced 1-P-QM-QMA-9017372 with 1-P-QM-QMA-9021767 |
| Reference 1. | Update to current regulatory method | Added SM 22 |

## Reference:

1. *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998, Method 2540 D-1997.

2. *Standard Methods for the Examination of Water and Wastewater*, 22nd Edition, 2012, Method 2540 D-1997.

3. *Chemical Hygiene Plan*, current version.

## Cross Reference:

| Document | Document Title |
|---|---|
| Analysis #0207, 0208 | Fixed Suspended Solids (Gravimetric) (#207) Volatile Suspended Solids (Gravimetric) (#208) by SM 2540 E - 1997 |
| 1-P-QM-PRO-9015422 | Equipment Muffle Furnaces and Ovens |
| 1-P-QM-PRO-9015424 | Maintenance of Desiccators |
| 1-P-QM-PRO-9015533 | Instructions for Collecting Data on the LLENS System |
| 1-P-QM-PRO-9015535 | Quality Control Data for Wet Chemistry |
| 1-P-QM-QMA-9015389 | Balance, Syringe, Pipette Verification |
| 1-P-QM-QMA-9015390 | Demonstrations of Capability |
| 1-P-QM-QMA-9017309 | Determining Method Detection Limits and Limits of Quantitation |
| 1-P-QM-QMA-9017313 | Establishing Control Limits |
| 1-P-QM-QMA-9017328 | Reagents and Standards |
| 1-P-QM-QMA-9021767 | Laboratory Notebooks, Logbooks, and Documentation for Environmental Testing |

## Scope:

This method is used for the determination of total suspended solids (TSS) in potable, surface and saline water, domestic and industrial wastewater in a range up to 20,000 mg/L.

Analysis #10457 applies to all non-Pennsylvania samples.

Analysis #13858 is applicable specifically for the determination of suspended solids in all waters for the state of Pennsylvania. The state of Pennsylvania requires only one weight after a 16 hour drying cycle.

The reporting limit for this analysis varies with the sample volume. LIMS may round the reporting limit during the calculation routine.

**Basic Principles:**

A well-mixed sample is filtered through a glass fiber filter and the residue on the filter is dried in an oven at 103° to 105°C. The increase in weight of the filter represents the TSS.

**Interferences:**

Samples high in dissolved solids may yield positive interferences.

**Safety Precautions and Waste Handling:**

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

**Personnel Training and Qualifications:**

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Proficiency is measured through an Initial Demonstration of Capability (IDOC) that consists of four laboratory control samples (LCS) that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four LCS's or one blind sample. Refer to 1-P-QM-QMA-9015390 for more guidance on these options.

## Sample Collection, Preservation, and Handling:

Samples for TSS must be unpreserved, collected in glass or plastic containers and refrigerated at 0° to 6°C, not frozen. Analyze within 7 days of collection to minimize microbiological decomposition of the solids.

Exclude non-representative, nonhomogeneous materials, such as leaves and sticks, from the analysis if their inclusion is not desired in the final result.

## Apparatus and Equipment:

1. ProWeigh Filters from Environmental Express – pre-weighed 47 mm glass fiber filters

2. ProWeigh Filters from Environmental Express – pre-weighed **volatile** 47 mm glass fiber filters or equivalent

3. Filtration apparatus

4. Desiccators, or equivalent. Refer to 1-P-QM-PRO-9015424.

5. Oven maintained at 104° ± 1°C. Adjust as needed to stay in this range. Refer to 1-P-QM-PRO-9015422.

6. Analytical balance.

7. LLENS - computer program that integrates a PC with an analytical balance to collect data directly from the balance. It also organizes the data, performs calculations and transmits the final results to LIMS.

**Reagents and Standards:**

Alternate weights and volumes are acceptable as long as final concentrations remain the same.

Refer to 1-P-QM-QMA-9017328 for the proper labeling and documentation of reagent preparation.

A. TSS Working Standard (150 mg/L)

1. Dry Naphthalimide for approximately 1 hour at 104° ± 1°C.
2. Desiccate approximately 1 hour.
3. Dissolve 0.1500 ± 0.005 g Naphthalimide in approximately 700-mL of reagent water in a 1000-mL volumetric flask.
4. Mix very well.
5. Dilute to 1000 mL with reagent water.
6. Store at room temperature.
7. Stable 30 days.
8. Naphthalimide can be weighed out and stored prior to use.

**Calibration:**

Balances must be calibrated each day before use. Refer to 1-P-QM-QMA-9015389.

**Procedure:**

LLENS must be used for TSS whenever possible to facilitate data transfers according to the most recent version of 1-P-QM-PRO-9015533. If it is necessary to record data in a raw data logbook, follow instructions in 1-P-QM-QMA-9021767 for documentation.

1. Batch samples for analysis in the LLENS system.

2. Assemble filtration apparatus.

3. Assign a pre-washed, pre-weighed filter to each client sample and each QC sample on the batch. If fixed or volatile suspended solids are to be performed use a pre-weighed **volatile** filter and follow instructions in Analysis #0207, 0208.

4. Remove the assigned filter from its aluminum carrying dish and place on the filtration unit.

5. Apply vacuum to the filtration apparatus.

6. Wet filter with small amount of reagent water to seat it.

7. Quality Control samples preparation

    a. Analyze the method blank by using 1000 mL of reagent water.

    b. Analyze the LCS/LCSD using 1000 mL each of the 150 mg/L TSS working standard.

    c. Prepare duplicates by analyzing equal portions of sample.

8. Sample analysis

   a. Shake sample vigorously.

      **NOTE:** If the sample does not maintain a homogeneous state until the aliquot is taken, then magnetically stir the sample while pipetting the appropriate aliquot onto the filter.

   b. Using a graduated cylinder or wide mouth pipette, measure 1000 mL of sample or a smaller portion if the sample matrix dictates.

   c. Rapidly transfer the aliquot to the filtration unit.

   d. Still under vacuum, filter the sample.

   e. Wash the filter with at least three 10 mL portions of reagent water when the sample matrix allows, rinsing inside the graduated cylinder.

   f. If the entire volume of the sample was used for the analysis, then rinse the inside of the sample container with at least three 10-mL portions of reagent water and transfer the rinses to the filtration apparatus. Rinse sufficiently to ensure all of the solids inside the bottle are transferred to the filtration apparatus.

   g. Allow complete drainage between washings. If complete filtration takes more than 10 minutes, decrease sample volume.

   h. Alternate measuring technique:

      (1) Mark the water meniscus on the sample bottle. The entire sample volume is used for the analysis. Shake the bottle and pour the entire contents into the filtration unit. Follow steps 8.d. to 8.g.

(2) After the sample bottle is flushed, fill the bottle with water to the meniscus mark and then measure the sample volume using a graduated cylinder.

9. If necessary, perform a final rinse to remove any residue from the sides of the filtration unit.

10. Continue suction at least 3 minutes after filtration is complete.

    **NOTE:** This step is important to ensure that dissolved solids are rinsed through, and not dried in the filter.

11. Record the sample volume on the datasheet.

12. Transfer the filter back into its aluminum carrying dish and place in an oven maintained at 104° ± 1°C.

13. Record the oven temperature on the worksheet.

14. Dry the filter for at least one hour. For samples from Pennsylvania, dry the filter for at least 16 hours.

15. After the drying time, transfer the aluminum dish into a desiccator for at least 30 minutes.

16. After cooling, record the oven dried weight of the filter. Samples from Pennsylvania require only one weight after a 16-hour drying cycle.

17. Repeat this drying dessicating and weighing cycle until weight loss is ≤ 0.0005g.

## Calculations:

$$mg\ Total\ Suspended\ Solids\ /\ L = \frac{(A - B) \times 1000 \times 1000}{Sample\ Volume\ (mL)}$$

**Where:**

A = Weight of filter, (in grams) after drying

B = Tare weight of filter (in grams)

## Statistical Information/Method Performance:

Generate the method detection limit (MDL) and limit of quantitation (LOQ) annually by following the procedure in 1-P-QM-QMA-9017309. The department maintains annual study data and updates to LIMS are made as needed by the QA department.

Generate the quality control acceptance windows by following the procedure outlined in 1-P-QM-QMA-9017313. The limits are evaluated annually and updated as needed. These limits are maintained in LIMS for the relevant analysis number(s).

## Quality Assurance/Quality Control:

Batch size is limited to 20 samples or less.

If an Analysis #10457 batch contains Analysis #13858 samples, they are included as part of the 20 sample limit.

One method blank and one 150-mg/L LCS must be analyzed with each batch.

A sample matrix duplicate must be analyzed with each group of not more than 10 samples.

When sample volume does not permit the analysis of the required duplicate(s), then a 150 mg/L LCSD must be analyzed to demonstrate method precision.

The maximum residue limit is 0.2 gram.

Samples from West Virginia require a usable precision measurement for each batch. Analyzing one of the following on a batch containing a West Virginia sample fulfills this requirement: a non-program deleted duplicate or an LCSD.

See LIMS for current quality control (QC) acceptance windows. Follow guidelines in 1-P-QM-PRO-9015535 for outlier QC data.

| | | | |
|---|---|---|---|
| **Eurofins Document Reference** | 1-P-QM-WI -9013112 | **Revision** | 8 |
| **Effective Date** | Jun 12, 2015 | **Status** | Effective |
| **Historical/Local Document Number** | Analysis 12145, 12146, 12147, 12148, 12149, 12150, 12151, 12152, 12677, 12678, 12679 | | |
| **Local Document Level** | Level 3 | | |
| **Local Document Type** | TEST - Testing Document | | |
| **Local Document Category** | ANALYSIS-ES - Analysis-Environmental Science | | |

| | |
|---|---|
| **Prepared by** | Michele Graham |
| **Reviewed and Approved by** | Erik Frederiksen;Review;Wednesday, June 10, 2015 12:31:41 PM EDT<br>Barbara Reedy;Approval;Wednesday, June 10, 2015 2:05:08 PM EDT |

**Table of Contents**

Revision Log: ..... 4
Reference: ..... 5
Cross Reference: ..... 9
Scope: ..... 10
Basic Principles: ..... 11
Reference Modifications: ..... 11
Interferences: ..... 12
Safety Precautions and Waste Handling: ..... 13
Personnel Training and Qualifications: ..... 13
Sample Collection, Preservation, and Handling: ..... 14
Apparatus and Equipment: ..... 14
For Manual Method: ..... 15
Reagents and Standards: ..... 19
Calibration: ..... 27
Procedure: ..... 38
Manual Procedures: ..... 38
A. Analysis #12145, Turbidity ..... 38
B. Analysis #12146, Specific Conductance ..... 39
C. Analysis #12147, Total Hardness ..... 40
D. Option #1 - Analysis #12707, Alkalinity to pH 8.3 (titrimetric) and Analysis #12150, Alkalinity to pH 4.5 (titrimetric) ..... 40
E. Option #2 – Autotitrator Procedure - Analysis #12707, Alkalinity to pH 8.3 (titrimetric) and Analysis #12150, Alkalinity to pH 4.5 (titrimetric) ..... 42
F. Analysis #12148, 12149, and 1456 Carbonate, Bicarbonate and Hydorxide Alkalinity ..... 46
G. Analysis #12151 and 12152, Temperature of pH and pH ..... 46
H. Analysis #12678 and 2200 Fluroride and Distilled Fluoride ..... 46
I. Analysis #12677, Ammonia – Nitrogen in Water By Ion-Selected Method (ISE) ..... 48
J. Analysis #12679, Ammonia – Nitrogen by Ion-Selective Electrode Method (ISE), Analysis #4219, Ammonia Distillation & Analysis #2593, Un-ionized Ammonia ..... 49

K. Option #1 - Analysis #4530, Total Acidity ..... 51

L. Option #2 – Autotitrator Procedure – Analysis #4530, Total Acidity ..... 52

M. Option #3 – Analysis #13414 – Prep (for use with ManTech Analysis #4530) ..... 53

N. Option #1 – Analysis #0475, 0476, Acidity to pH 3.7 and pH 8.3 (Titrimetric) ..... 53

O. Option # 2 – Autotitrator Procedure – Analysis 0475, 0756, Acidity to pH 3.7 and pH 8.3..... 54

ManTech Procedure (automated method):..... 55

A. Introduction to the procedure for the operation of the ManTech Multi-purpose instrument..... 55

B. Performing daily calibration:..... 55

C. Analyzing samples:..... 56

D. Routine Maintenance of ManTech multi-parameter system..... 57

E. Maintenance of all other systems:..... 61

F. Retrieving Historical Raw Data on ManTech:..... 61

Calculations:..... 61

Statistical Information/Method Performance:..... 65

Quality Assurance/Quality Control: ..... 65

Table I (Analysis Name and Number/CCV Barcodes/Concentrations):..... 67

## Revision Log:

| Revision: 8 | Effective Date: This version | |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Reagents and Standards | Clarify and reflect current procedure | Added 10 mg/L fluoride working standard<br>Added 4000 NTU for value of Turbidity Standard<br>Added different source needed for Turbidity standard for curve and LCS/CCVs |
| Calibration A.1 and A.2 | Clarify and reflect current procedure | Added to refer to 1-P-QM-PRO-9015423 for preparation instructions for turbidity curve standards. Added different source needed for Turbidity standard for curve and LCS/CCVs |

| Revision: 7 | Effective Date: Nov 17, 2014 | |
|---|---|---|
| **Section** | **Justification** | **Changes** |
| Revision Log | Formatting requirement per 1-P-QM-QMA-9017356 | Removed revision logs up to the previous version |
| Throughout entire document | Updated procedure to include additional analyses | Added analyses 4530/13414 and 0475,0476 to SOP |

**Reference:**

1. Analysis 12145-Turbidity

    a. Method 180.1 (1993), Methods for Chemical Analysis of Water and Wastes USEPA 600.

    b. Method 180.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.

    c. Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005, Method 2130 B-2001.

2. Analysis 12146-Specific Conductance

    a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2510 B-1997

    b. Method 120.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.

    c. Test Methods for Evaluating Solid Wastes, SW-846 Method 9050A, December 1996.

3. Analysis 12147-Total Hardness

    a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2340 C-1997

    b. Method 130.2 (modified), Methods for Chemical Analysis of Water and Wastes USEPA 600.

4. Analysis 12148-Carbonate Alkalinity

   Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2320 B-1997

5. Analysis 12149-Bicarbonate Alkalinity

   Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2320 B-1997

6. Analysis 12150-Alkalinity

   a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2320 B-1997

   b. Method 310.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.

7. Analysis 12151-Temperature of pH

   Temperature EPA 170.1 Methods for Chemical Analysis of Water and Wastes USEPA 600.

8. Analysis 12152-pH

   a. Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005, Method 4500 H/B-2000

   b. Method 150.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.

   c. Test Methods for Evaluating Solid Wastes, SW-846 Method 9040B.

   d. Test Methods for Evaluating Solid Wastes, SW-846 Method 9040C.

9. Analysis 12677-Ammonia-Nitrogen

    a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500 NH3 D-1997

    b. Method 350.3, Methods for Chemical Analysis of Water and Wastes USEPA 600.

10. Analysis 12678-Fluoride

    a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500-F C-1997

    b. Method 340.2, Methods for Chemical Analysis of Water and Wastes USEPA 600.

11. Analysis 12679-Ammonia-Nitrogen Distilled

    a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500 NH3 D-1997

    b. Method 350.3, Methods for Chemical Analysis of Water and Wastes USEPA 600.

12. Analysis 12707-Phenolphthalein Alkalinity

    a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2320 B-1997

    b. Method 310.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.

13. Analysis 4219-Ammonia Distillation

    Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500 NH3 B-1997

14. Analysis 2593-Unionized Ammonia

    Standard Methods for the Examination of Water and Wastewater, 20th Editions, 8010 F-1997

15. Analysis 238-Free Carbon Dioxide

    Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500-CO2 D-1997

16. Analysis 1456-Hydroxide Alkalinity

    Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2320 B-1997

17. Analysis 2200-Fluoride (Distilled)

    a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500-F C

    b. Method 340.2, Methods for Chemical Analysis of Water and Wastes USEPA 600.

    c. Test Methods for Evaluating Solid Wastes, SW-846 Method 9214, December 1996.

18. Analysis 4530-Total Acidity

    a. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 2310 B-1997.

    b. Method 305.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.

19. Analysis #0475, 0476 – Acidity to pH 3.7 and pH 8.3 (Titrimetric)

    a. Method 305.2, Methods for Chemical Analysis of Water and Wastes USEPA 600.

    b. Orion 960 Autochemistry System Instruction Manual, Orion Research, 1991.

20. ManTech Associates, Inc. PC-Titration Plus Instruction and Operation manual, January 25 2000.

21. *Chemical Hygiene Plan*, current version.

**Cross Reference:**

| Document | Document Title |
|---|---|
| Analysis #1448 | Bellack Distillation for Fluoride in Waters and Solids by SM 4500 F B–1997 or EPA 340.1 Procedure 6.1 |
| 1-P-QM-PRO-9015419 | Accumet Model AB30 pH/Ion/Conductivity Meters |
| 1-P-QM-PRO-9015421 | pH Probes and Meters |
| 1-P-QM-PRO-9015423 | Calibration of Hach 2100AN Turbidimeter |
| 1-P-QM-PRO-9015425 | Fixed Volume Hand-Held Pipettes |
| 1-P-QM-PRO-9015426 | Adjustable Volume Handheld Pipettes |
| 1-P-QM-PRO-9015428 | Orion 960 Autotitration System |
| 1-P-QM-PRO-9015530 | Standardization of 0.02 and 0.1 Normal Sulfuric Acid |
| 1-P-QM-PRO-9015535 | Quality Control Data for Wet Chemistry |
| 1-P-QM-QMA-9015389 | Balance, Syringe, Pipette Verification |
| 1-P-QM-QMA-9017309 | Determining Method Detection Limits and Limits of Quantitation |
| 1-P-QM-QMA-9017313 | Establishing Control Limits |
| 1-P-QM-QMA-9017328 | Reagents and Standards |
| 1-P-QM-QMA-9021767 | Laboratory Notebooks, Logbooks, and Documentation for Environmental Testing |

**Scope:**

**This SOP covers two options for analyzing samples for certain analytes (see table below for complete list). Option one is listed as a manual method and option two is listed as an automated method.**

**The automated method uses an instrument called the ManTech multi-parameter system.** The manual method and the ManTech multi-parameter system (automated) method are used for the determination of the following analytes (see table below) in drinking waters, surface waters, and wastewater samples.

The table below lists the name and number of the analyses that are included in this SOP and the method references associated with each.

**Table of Analyses and Reference Methods**

| Analysis Name and Number | Analysis Method |
|---|---|
| Turbidity, 12145 | EPA 180.1 (1993)<br>EPA 180.1 |
| Specific Conductance, 12146 | SM 2510B-1997,<br>EPA 120.1,<br>SW-846 9050A |
| Total Hardness, 12147 | SM 2340C-1997,<br>EPA 130.2 modified |
| Carbonate Alkalinity, 12148 | SM 2320B-1997 |
| Bicarbonate Alkalinity, 12149 | SM 2320B-1997 |
| Total Alkalinity, 12150 | SM 2320B-1997,<br>EPA 310.1 |
| Temperature of pH, 12151 | EPA 170.1 |
| pH, 12152 | SM 4500-H+B-2000,<br>EPA 150.1,<br>SW-846 9040B,<br>SW-846 9040C |
| Ammonia-Nitrogen, 12677 | SM 4500-NH3D-1997,<br>EPA 350.3 |
| Fluoride, 12678 | SM 4500-F C-1997,<br>EPA 340.2 |
| Ammonia-Nitrogen Distilled, 12679 | SM 4500-NH3D-1997,<br>EPA 350.3 |
| Phenolphthalein Alkalinity 12707 | SM 2320B-1997,<br>EPA 310.1 |

| Analysis Name and Number | Analysis Method |
|---|---|
| Ammonia Distillation, 04219 | SM 4500-NH3 B-1997 |
| Unionized Ammonia, 02593 | SM 8010 F-1997 |
| Free Carbon Dioxide, 00238 | SM 4500-CO2 D-1997 |
| Hydroxide Alkalinity, 01456 | SM 2320 B-1997 |
| Fluoride (distilled), 02200 | SM 4500-F C-1997, EPA 340.2, SW-846 9214 |
| Total Acidity, 04530 | SM 2310-B-1997, EPA 305.1 |
| Acidity to pH 3.7 and pH 8.3 (titrimetric) | EPA 305.2 |

**Basic Principles:**

If necessary, samples can be analyzed using a manual method.

Samples are analyzed using the ManTech multi-parameter system, which has been designed to test for specific analytes. The system is able to be configured in different ways to optimize sample volumes required, and analysis times. The ManTech system is able to analyze for one parameter or multi-parameters at the same time.

**Reference Modifications:**

The following analyses have reference modifications:

1. Analysis #12147-Total Hardness:

    a. The procedures listed in SM 2340C and Method 130.2 are modified by using potassium cyanide (KCN) as the inhibitor instead of sodium cyanide (NaCN).

    b. SM2340C and EPA 130.2 state to dilute 25 mL of sample to 50 mL with reagent water prior to titration. This procedure uses 50 mL sample.

2. Analysis #12152 –pH

   EPA 150.1 states to repeat measurement on successive volumes of sample until values differ by less than 0.1 pH units. However, SM 4500 H+ B does not require multiple readings.

3. Analysis #12678, 2200 – Fluoride and Distilled Fluoride

   a. The differences between SM 4500-F- C and EPA 340.2 are that SM 4500-F-C states that the electrodes are inserted before stirring the sample. For EPA 340.2 begin stirring the sample before the electrodes are inserted.

   b. This method uses less buffer than suggested by the manufacturer. The concentration ratio of sample to total ionic strength adjustment buffer (TISAB) is the same as EPA Method 340.2.

4. Analysis #12677, 12679– Ammonia-Nitrogen and Distilled Ammonia-Nitrogen

   Instead of using NaOH in order to pH adjust the samples during the 12677 and 12679 ammonia analysis, this procedure uses alkaline reagent. Alkaline reagent is a purchased reagent containing NaOH that is currently recommended by the manufacturer of the ammonia electrode.

**Interferences:**

Sample matrix is likely to be the largest cause of interference for each analysis.

Samples containing oily layers, soaps, suspended solids, or precipitates may impede the electrode response. The electrode must be cleaned according to the manufacturer's instructions.

Total Hardness – excessive amounts of heavy metals can interfere, causing a faded or indistinct endpoint by the stoichiometric consumption of EDTA. If this interference is not resolved after multiple dilutions on the ManTech automated procedure, then the sample must be analyzed using the manual procedure. See SM 2340C for more discussion on interferences and how to treat them.

Turbidity – the presence of floating debris and coarse sediments, which settle out rapidly, will give low turbidity readings. Finely divided air bubbles will affect the results in a positive manner.

Ammonia Nitrogen – volatile amines are a positive interference. Mercury and Silver also interfere with this procedure. Electrode responds slowly at levels <1 mg $NH_3$-N/L; use longer electrode immersion times.

Fluoride – several polyvalent cations, notably aluminum, iron and silicon interfere by forming complexes with fluoride. Adding TISABIII provides a uniform ionic strength background, adjusts pH and breaks up complexes so that the fluoride ion activity can be measured. Fluoborates are widely used in industrial processes. At concentrated levels, as in electroplating wastes, fluoborates do not hydrolyze to release fluoride without using the Bellack distillation (Analysis #1448) prior to analyzing the sample distillate by ISE.

**Safety Precautions and Waste Handling:**

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

**Personnel Training and Qualifications:**

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

Analysts are considered proficient when they have successfully completed a documented Demonstration of Capability. This consists of four laboratory control samples that are carried through all steps of the analysis and that meet the acceptance criteria for the LCS. Demonstration of Capability is performed annually and documentation is in each individual's training records.

**Sample Collection, Preservation, and Handling:**

Samples for pH, Temperature of pH, Specific Conductance, Turbidity, Fluoride, Total Alkalinity, Total Acidity, and Acidity to pH 3.7 and pH 8.3 are to be collected in unpreserved glass or plastic containers. Analyze Total Alkalinity, Total Acidity, and Acidity to pH 3.7 and pH 8.3 within 14 days of collection. Analyze Fluoride within 28 days of collection. All other analyses mentioned above are to be analyzed as soon as possible upon receipt at the laboratory.

Samples for Ammonia must be collected in a glass container, preserved with concentrated sulfuric acid to a pH < 2. Analyze within 28 days of collection.

Samples for Total Hardness must be collected in a glass or plastic container, preserved with nitric acid to a pH < 2. Analyze within 6 months of collection.

All samples must be stored at 0° to 6°C, not frozen. Prior to analysis, samples must be brought to room temperature.

**Apparatus and Equipment:**

1. pH Electrode
2. Fluoride ion selective electrode
3. Interface
4. Burivar I/2 (25 mL burette)

5. TitraRinse pump

6. TitraRinse slow speed reagent addition pump

7. Turbidity meter – white light turbidity meter option

8. Reversible Peri-Max pump

9. Man-Tech photometric detector with a 620nm filter

10. Conductivity/TDS Meter, Model 4510

11. Ammonia electrode

12. Autosampler - MEGA, 197 sample locations

13. Analytical balance or equivalent. Refer to 1-P-QM-QMA-9015389

**For Manual Methods:**

A. Analyisis #4219 Distillation Apparatus and Equipment

1. Kjeldahl distillation rack

2. Refrigerated recirculator (Coolflow) with a recirculating pressure set at 20 psi and the temperature adjustment set at 10°C, or equivalent.

*Each distillation setup requires the following

3. Glass distillation apparatus with connector and 800 mL Kjeldahl flask

4. pH indicator strips, purchased

5. Porous boiling chips, purchased

B. Analysis #12677, 12679 ISE Apparatus and Equipment:

1. Analytical balance, or equivalent. Refer to 1-P-QM-QMA-9015389
2. pH meter with expanded millivolt scale, or equivalent
3. Ammonia selective electrode (Thermo Orion 95-12) or equivalent
4. Stir plate with magnetic stirrer with Teflon-coated stirring bar, or equivalent
5. 100-mL class A graduated cylinder, or equivalent
6. Automatic pipette capable of dispensing 1 mL of liquid, or equivalent. Refer to 1-P-QM-PRO-9015425 and 1-P-QM-PRO-9015426

C. Analysis #12147-Total Hardness

1. Class A buret with buret stand, or equivalent
2. 125-mL Erlenmeyer flasks, or equivalent
3. Analytical balance or pan balance, or equivalent. Refer to 1-P-QM-QMA-9015389.
4. Adjustable hand-held automatic pipette, or equivalent. Refer to 1-P-QM-PRO-9015426

D. Analysis #12146-Specific Conductance

Conductivity meter (Accumet Model AB30)

E. Analysis #12150, 12707 - Alkalinity

1. pH meter that reads to 0.05 pH units, with automatic temperature compensation and a glass electrode or equivalent. Refer to 1-P-QM-PRO-9015421.

2. Orion 960 Autotitration System or equivalent. Refer to 1-P-QM-PRO-9015428. (Automated Procedure only).

3. Microburet with reservoir or equivalent (Manual Procedure only).

4. Analytical balance, or pan balance, or equivalent.

F. Analysis #12678, #2200 –Fluoride and Distilled Fluoride

1. pH meter with expanded millivolt scale, or equivalent. Refer to pH meter manufacturer's Instruction Manual.

2. Fluoride electrode (Orion 94-09-00), or equivalent

   If the fluoride electrode's performance degrades, consult the manufacturer's *User Guide* for cleaning and maintenance instructions. If performance does not improve after cleaning, then the electrode must be replaced.

   The expected lifespan of a fluoride electrode is 3 years. Refer to the electrode's identification tag for in-service date.

3. Reference electrode (Ag/AgCl), or equivalent

4. Stir plate with magnetic stirrer

5. Timer

6. Class A graduated cylinder, or equivalent

7. Analytical balance, or equivalent.

8. Assorted automatic pipettes, or equivalent. Refer to 1-P-QM-PRO-9015425 and 1-P-QM-PRO-9015426

G. Analysis #12152-pH

1. pH meter with automated temperature compensator (ATC) probe

2. Combination electrodes or equivalent

3. Stir bar and stir plate

H. Analysis #12145-Turbidity

1. Turbidimeter – Hach Model 2100AN or equivalent

2. Silicone oil and oiling cloth

3. Sample tubes, clear colorless glass

I. Analysis #4530/#13414 -Total Acidity/Prep

1. pH meter that uses a glass electrode and reads to .05 pH units

2. Magnetic stir bar and stir plate

3. Hot plate

4. 150-mL glass beakers and plastic cups

5. 10-mL microburet with reservoir

6. Analytical balance capable of weighing to .0001g

7. Orion 960 Autotitrator system

J. Analysis #0475,0476 – Acidity to pH 3.7 and pH 8.3

1. pH meter that uses a glass electrode and is able to be read to 0.05 pH units. If automatic temperature compensation is not provided, make titration at 25° ±2°C.

2. Magnetic stirrer and stir plate

3. 100, 150 and 250-mL beakers

4. 10-mL microburet

5. Analytical balance capable of weighing to .0001 g. Refer to 1-P-QM-QMA-9017363

6. Orion 960 autotitration system

**Reagents and Standards:**

Alternative weights and volumes are acceptable as long as final concentrations remain the same. Refer to 1-P-QM-QMA-9017328 for proper labeling and documentation of reagent preparations.

A. Reagents and Standards needed for Manual and ManTech methods

1. Sulfuric acid, 0.02 N

   a. Dilute 0.6 mL of concentrated sulfuric acid to 1000 mL with reagent water.

   b. Store at room temperature in glass or plastic container and re-evaluate yearly.

c. Standardize according to 1-P-QM-PRO-9015530.

d. Re-standardize titrant before use if more than 30 days have passed since the last standardization date.

2. Total alkalinity standard (9400 mg/L as $CaCO_3$)

a. Dry sodium carbonate ($Na_2CO_3$) for at least 4 hours at approximately 250°C.

b. Desiccate approximately 2 hours.

c. Dissolve 9.954g ± 0.002g $Na_2CO_3$ in reagent water and dilute to 1000 mL in a volumetric flask.

d. Stable 3 months.

e. Store in a glass container at 0º to 6ºC, not frozen.

f. Dilute for other concentrations.

3. pH 4, 7, and 10 buffer solutions- purchased; see container for shelf life information.

**NOTE: A second source 7.00 pH buffer solution that is from ISO 17025 approved vendor must be purchased; see container for shelf life information. This is to be used for analysis 12152 LCS. It is also to be used for analysis 12152 and 12150 CCV's.**

4. Turbidity standard; 4000 NTU – purchased; see container for shelf life information.

**NOTE**: The Turbidity standard used to prepare the calibration curve must be prepared using a **different source Primary Formazin Standard than that used for LCS/CCVs**.

5. Total Ionic Strength Adjustment Buffer (TISAB) –purchased; see container for shelf life information.

6. 10N Sodium hydroxide (NaOH) - Purchased; see shelf life for information. Or prepare:

   a. Prepared - Dissolve 400 g NaOH pellets in 1000 mL volumetric flask containing approximately 800 mL reagent water. Solution becomes very warm.

   b. Cool to room temperature and dilute to 1000 mL with reagent water.

   c. Store at room temperature in plastic or glass container and re-evaluate yearly.

7. 0.1 M KCl (12,900 µhoms/cm)

   a. In a 1 L glass volumetric flask, dissolve 7.4555 ± .0001 g predried KCl (2 hours at 105° ± 2°C) in approximately 500 mL reagent water.

   b. Dilute to volume with reagent water.

   c. Stable 3 months.

   d. Store at room temperature in a glass container.

   e. Dilute for other concentrations.

8. 5 umhos/cm low-level check standard

    a. In a 1 L glass volumetric flask, containing approximately 500 mL reagent water, dissolve 0.0025 g of NaCL.

    b. Prepare fresh before use.

9. Fluoride standard stock solution (100 mg/L)

    a. Dissolve 0.2210 ± .0005 g of anhydrous sodium fluoride (NaF) in reagent water and dilute to 1000 mL in a volumetric flask.

    b. Stable for 6 months.

    c. Store in a plastic container at room temperature.

    d. Dilute for other concentrations.

10. Fluoride working standard (10 mg/L)

    a. Pipette 10 mL of Fluoride stock solution (100 mg/L) into a 100 mL volumetric flask.

    b. Dilute to volume using reagent water.

    c. Prepare daily each day calibration curve is analyzed.

    **NOTE:** A separate standard fluoride stock solution must be prepared using a **different source of NaF** when preparing a calibration curve.

10. Ammonia nitrogen standard (100 m/L $NH_3$-N)

    a. Dry ammonium chloride ($NH_4Cl$) at 103°C to 105°C for approximately 2 hours.

b. Desiccate approximately 1 hour.

c. Dissolve 0.3819 ± 0.0002 g $NH_4Cl$ in approximately 800 mL reagent water.

d. Once dissolved, preserve the solution with concentrated sulfuric acid to a pH < 2. Dilute to 1000 mL in a volumetric flask.

e. Stable for 6 months.

f. Store at 0º - 6º C, not frozen in a glass or plastic container.

g. Dilute as needed for other concentrations.

**NOTE**: The Ammonia nitrogen standard used to prepare the calibration curve must be prepared using a **different source** of $NH_4Cl$.

11. Ammonia electrode storage solutions

a. Storage between runs – mix 1ppm ammonium chloride solution with pH 4 buffer 1:1.

b. Overnight storage – mix 10 ppm ammonium chloride solution with pH 4 buffer 1:1.

12. Standard EDTA titrant (0.02N) - Purchased; see container for shelf life information. Or prepare:

a. Dissolve 3.723 g ± 0.005 g of disodium EDTA in reagent water and dilute to 1000 mL with reagent water in a volumetric flask.

b. Stable for 3 months.

c. Store at room temperature in plastic bottle.

d. Standardize daily before use. Refer to Analysis #12147 for instructions for standardizing.

13. pH 10 hardness buffer solution – purchased; see container for shelf life information. Or prepare:

    a. Dissolve 16.9 g ammonia chloride ($NH_4Cl$) in 143 mL of concentrated ammonium hydroxide ($NH_4OH$).

    b. Separately, dissolve 1.179 ± 0.0005 g of disodium EDTA and 0.78 ± 0.005 g of ($MgSO_4 \cdot 7\ H_2O$) in 50 mL of reagent water (this solution becomes turbid).

    c. Combine the above two solutions and dilute to 250 mL with reagent water in a volumetric flask.

    d. Solution is stable 30 days.

    e. Store at room temperature in plastic container.

14. Calmagite indicator solution (0.1 % w/v) – Purchased; Store at room temperature. See manufacturer's label for expiration date.

15. Calcium reference standard (1000 mg/L Ca = 2497 mg/L $CaCO_3$) – Purchased; store at room temperature. See manufacturer's label for expiration date.

16. 1000 mg/L $CaCO_3$ intermediate calcium standard

    a. Pipette 20.0 mL of purchased reference standard into 50 mL volumetric flask and dilute to volume with reagent water.

    b. Stable for 6 months.

c. Store at room temperature in glass or plastic container.

17. 15% Sodium Acetate Solution – dissolve 15.0 g of sodium acetate anhydrous in 85 mL of reagent water in a 150 mL beaker. Prepare fresh before use.

18. Total acidity standard (5000 mg/L as $CaCO_3$)

    a. In a 1-L glass volumetric flask containing approximately 500 mL of reagent water; add 20.4000 ± .0005 g potassium hydrogen phthalate.

    b. Allow to dissolve and dilute solution to volume.

    c. Store at 0°to 6°C, not frozen, in a glass container.

    d. Solution expires 6 months from the date of preparation.

19. Sodium hydroxide, 1 N

    a. In a 1-L glass volumetric flask containing approximately 500 mL reagent water, dissolve 40.00 ±.05 g NaOH.

    b. Cool and dilute to volume.

    c. Store in a plastic bottle at room temperature.

    d. Solution expires 1 year from date of preparation.

20. Standardized sodium hydroxide, 0.02 N

    a. In a 1-L glass volumetric flask, add approximately 500 mL reagent water.

    b. Add 20 mL of 1 N NaOH to the flask and dilute to volume with reagent water.

c. Re-standardize titrant before use if more than 30 days have passed since the last standardization date. Standardize using instructions as per 1-P-QM-PRO-9015531.

d. Store at room temperature in a plastic or glass container.

e. Solution expires 1 year from the date of preparation.

21. Hydrogen peroxide ($H_2O_2$, 30% solution) – purchased. Store at room temperature. See label for expiration date.

22. pH 8.00 buffer Solution; purchased. Store at room temperature. See container for shelf life information.

B. Reagents needed for 4219 analysis:

1. Borate buffer solution – Dissolve 19.0 $\pm$ 0.1 g sodium borate, 10-hydrate ($Na_2B_4O_7 \cdot 10\ H_2O$) in approximately 1000 mL of reagent water. Add 176 mL of 0.1N NaOH to the solution and dilute to 2000 mL with reagent water in a volumetric flask. Store at room temperature in a glass container. Solution stable for 6 months.

2. 0.1N $H_2SO_4$ – Dilute 3.0 mL of concentrated sulfuric acid to 1000 mL with reagent water in a volumetric flask. Store at room temperature in a glass or plastic container and re-evaluate yearly.

3. 4% $H_2SO_4$ Solution – Dilute 380 mL of 0.1N $H_2SO_4$ to 1000 mL with reagent water in a volumetric flask. Store at room temperature in a plastic container and re-evaluate yearly.

4. Antifoam B (purchased). Store at room temperature. See manufacturer's label for expiration date.

5. Sodium hydroxide, 5N – Dissolve 200 ± 0.5 g sodium hydroxide (NaOH) pellets in approximately 800 mL of reagent water. Solution becomes very warm. Cool to room temperature and dilute to 1000 mL with reagent water in a volumetric flask. Store at room temperature in plastic container and re-evaluate yearly. (This is used to pH adjust samples.)

6. Sodium hydroxide, 0.1N – Dilute 40 mL of 5N NaOH solution to 2000 mL with reagent water in a volumetric flask. Store at room temperature in a plastic container and re-evaluate yearly. (This is used in borate buffer solution.)

7. Dilute Hydrochloric (HCl) acid – To prepare, add 50 mL of concentrated HCl to approximately 3.5 liters of reagent water. Slowly invert. Store at room temperature in a plastic container. (This is used to rinse tubing prior to steam cleaning the distillation apparatus.)

8. Ammonia-nitrogen standard, 500 mg/L NH3-N – In a 1 L volumetric flask containing approximately 500 mL reagent water, dissolve 1.9095 ± .0002 g NH4Cl (which has been dried at 105° ± 2°C for at least 2 hours). Dilute to 1 L using reagent water. Preserve the solution with concentrated sulfuric acid to a pH <2. Store the standard at 0º to 6ºC, not frozen in a glass or plastic container. Standard expires 6 months from the date of preparation.

**Calibration:**

Calibration is preformed daily. It is only necessary to calibrate for analyses that will be performed on that day.

**A manual calibration and automated calibration section is given for each analysis**.

Balances must be calibrated each day before use. Refer to 1-P-QM-QMA-9015389.

**NOTE:** When Calibrating using ManTech : For all calibrations, 50 mL of standard is poured into a sample tube. For each analysis, a predetermined and programmed sample volume is used (to be taken from the 50 mL in the sample tube).

**NOTE:** Recalibration is necessary for each analysis if acceptance criteria is not met.

A. Analysis #12145 Turbidity Calibration

1. Manual Calibration:

   a. Quarterly Calibration of turbidimeter – Every 90 days prepare a series of calibration standards covering the range 0 to 4000 NTU. Prepare the calibration standards as per instructions in 1-P-QM-PRO-9015423. If the standards are purchased no preparation is necessary. The Turbidity standard used to prepare the calibration curve must be prepared using a different source Formazin Primary standard than that used for the LCS/CCVs. Calibrate the instrument as per the instructions in 1-P-QM-PRO-9015423.

   b. Daily Calilbration of turbiditimeter- Read the Gelex secondary turbidity standards including a stray light standard, as per the instructions in 1-P-QM-PRO-9015423 each day the analysis is performed. Record the values in the maintenance logbook for the Hach 2100AN Turbidimeter.

2. Automated Calibration:

   **NOTE: The Turbidity standard used to prepare the calibration curve must be prepared using a different source Formazin Primary standard than that used for the LCS/CCVs.**

   a. Dilute the 4000 NTU stock standard to obtain the following concentrations (1.0, 2.5, 5.0, 10.0, 20.0 NTU) and place calibration standards in ascending order in autosampler rack.

b. Sampler moves to rinse station and reagent water is pumped through flow cell to rinse tubing and cell.

c. Sampler moves into first standard and 25 mL of standard is pumped through flow cell.

d. Turbidity meter stabilizes for 60 seconds and turbidity reading recorded.

e. Sample is pumped back into tube and sampler moves to rinse station to rinse flow cell and tubing.

f. Steps b. – e. are repeated for remaining calibration standards.

g. Acceptance criteria: Correlation coefficient of curve must be ≥ 0.995.

B. Analysis #12146 Conductivity Calibration – determining cell constant; daily.

1. Manual Calibration:

a. Determine cell constant daily, according to 1-P-QM-PRO-9015419.

b. Conductivity Meter Linearity Check:

(1) Linearity check of the conductivity meter must be performed on the instrument at least once per year using the following concentrations below. Refer to 1-P-QM-PRO-9015419 for preparation instructions.

.0001M, .0005M, .001M, .005M, .01M, .02M, .05M, .1M

(2) Correlation Coefficient must be ≥ .995. If this acceptance criteria is not met, the linearity check must be repeated.

2 Automated Calibration:

a. Determine cell constant daily:

(1) Place 1413 µhoms/cm calibration standard into autosampler rack.

(2) The conductivity cell is rinsed with reagent water in the rinse station.

(3) The cell moves to the 1413 µhoms/cm standard and is dipped 3 times in the solution, remaining fully immersed on the third dip.

(4) Solution stabilizes for 25 seconds. The meter prompts to press calibration key twice.

(5) The cell constant is displayed. Record cell constant in maintenance logbook.

b. Conductivity Meter Linearity Check:

(1) Linearity check of the conductivity meter must be performed on the instrument at least once per year using the following concentrations below. Refer to 1-P-QM-PRO-9015419 for preparation instructions.

.0001M, .0005M, .001M, .005M, .01M, .02M, .05M, .1M

(2) Correlation Coefficient must be ≥ .995. If this acceptance criteria is not met, the linearity check must be repeated.

C. Analysis #12147, Total Hardness Calibration:

1. Manual Calibration:

*Standardization of EDTA Titrant:

a. Weigh 1.000 ± 0.0005 g $CaCO_3$ and transfer to a 500-mL Erlenmeyer flask.

b. Add 1 + 1 HCl gradually until the $CaCO_3$ dissolves.

c. Add 200 mL reagent water and boil for a few minutes to expel $CO_2$.

d. Allow the flask to cool.

e. Add a few drops of methyl red indicator and adjust to an intermediate orange color with 3 N $NH_4OH$ or 1 + 1 HCl, as needed.

f. Dilute to 1000 mL with reagent water in a volumetric flask. (This solution is 1000 mg/L $CaCO_3$.)

g. Dilute 5.0 mL (pipette) of this solution to 50 mL and titrate to a blue endpoint following the steps in the Procedure Section of this analysis.

h. Perform duplicate trials. Use the average of two trials to calculate the constant.

$$\textbf{EDTA constant} = \frac{5mL\ CaCO_3}{mL\ of\ EDTA\ titrant}$$

2. Automated Calibration: Not Applicable to this analysis

D. Analysis #12707, 12150: Alkalinity Calibration:

1. Manual Calibration:

The pH meter must be calibrated each day before use. Refer to 1-P-QM-PRO-9015421 for manual calibration instructions.

2. Automated Calibration:

   The pH meter must be calibrated each day before use. See Section E2. under Calibration section

E. Analysis # 12152: pH Calibration:

1. Manual Calibration:

   The pH meter must be calibrated each day before use. Refer to 1-P-QM-PRO-9015421 for manual calibration instructions.

2. Automated Calibration:

   a. Place pH 4, 7, and 10 buffers into autosampler rack and run a schedule to calibrate pH probe.

   b. Sampler moves to rinse station where the sample transfer line and Titrasip vessel are rinsed with reagent water.

   c. Sampler moves to pH 4 buffer position and sample transfer line is primed with pH 4 buffer solution.

   d. 10 mL of buffer solution is pumped into Titrasip cell and stirrer is turned on.

   e. pH of buffer solution is measured and recorded.

   f. Steps b. to e. are repeated for pH buffers 7 and 10.

   g. Acceptance criteria: Slope of pH calibration must be within the range of -65 to -53.

F. Analysis #12678, 2200 Fluoride Calibration:

1. Manual Calibration:

a. Meter Calibration

Each day that samples are analyzed for fluoride, the meter must be zeroed prior to use with a 2.0-mg/L calibration standard.

Record data in a raw data logbook following instructions in 1-P-QM-QMA-9021767.

(1) Connect fluoride electrode and reference electrode to the pH meter.

**NOTE:** The current pH meter in use with an expanded millivolt scale is a VWR pH meter (SB301). The following meter instructions are for it.

(2) Turn on the power. Press the mode key until “RmV” is displayed

(3) Place 20 mL of a 2-mg/L calibration standard into a 50-mL plastic beaker.

(4) Add 2 mL of TISAB III and place electrodes under the surface of the sample.

(5) Begin stirring at a slow, steady rate.

(6) Wait while the standard stirs for 3 minutes.

(7) **After at least 3 minutes**, press the “cal” key. When the reading is stable the display will flash “ready.”

(8) Press the "OK" key to set the meter to zero.

(9) Withdraw the electrodes and rinse with reagent water.

(10) **Gently** blot electrodes with clean, dry tissues between readings.

(11) Place 20 mL of the 0.5 mg/L CCV into a 50-mL plastic beaker.

(12) Add 2 mL of TISAB III buffer and place electrodes under the surface of the sample.

(13) Begin stirring at a slow, steady rate.

(14) Stir solution for at least 3 minutes.

(15) When the mV reading is stable, record the mV reading.

(16) On each batch, at least one 0.5-mg/L CCV must be analyzed to validate the curve.

b. Curve:

(1) Using the fluoride concentrations listed below, analyze a new calibration curve every 3 months **or** when a bottle having a new lot number of TISAB III is opened.

(2) After analyzing, plot calibration curve of $F^-$ concentration vs. Rel mV under log plot using statistics program in LIMS.

(3) The calibration curve must have a correlation coefficient of ≥ 0.995.

(4) When analyzing samples from the state of North Carolina, each analyst performing the analytical procedure must produce a standard curve (Ref 15A NCAC 2H .0805 (a) (7) (l)).

| Concentration (mg/L) | mL Working Standard (10 mg/L) | Final Volume (mL) |
|---|---|---|
| 2.00 | 20 | 100 |
| 1.50 | 15 | 100 |
| 1.00 | 10 | 100 |
| 0.50 | 5 | 100 |
| 0.10 | 1 | 100 |

2. Automated Calibration:

**NOTE:** Before analyzing for analysis 2200, add 1 mL of 15% of Sodium Acetate to all curve standards.

a. Dilute Stock standard to obtain the following concentrations: concentrations of 2.0, 1.5, 1.0, 0.5, 0.1 mg/L and place calibration standards into autosampler rack in ascending order and run a schedule to calibrate fluoride probe.

b. Sampler moves to rinse station where sample transfer line and Titrasip vessel are rinsed with reagent water.

c. Sampler moves to first standard position.

d. Sample transfer line is primed with standard solution.

e. 30 mL of standard and 3 mL of TISAB is pumped into the Titrasip vessel, and stirrer is turned on.

f. Fluoride concentration is measured and recorded.

g. Steps b. – f. are repeated for remaining standards.

h. Acceptance criteria: Correlation coefficient of curve must be ≥ 0.995.

G. Analysis #12677, 12679 Ammonia Calibration

1. Manual Calibration:

Curve:

Prepare a calibration curve daily using the concentrations listed below. (Dilute 100 mg NH3-N /L stock solution with reagent water in 100-mL volumetric flasks.) After analyzing, plot calibration curve of mg NH3-N /L vs. Rel mV using the log plot program in LIMS. The correlation coefficient of the curve must be ≥ .995 and the slope of the curve must range from 54 to 60 mV. The curve must be analyst specific.

| Conc. (mg/L $NH_3$-N) | mL 100 mg/L → 100 mL |
|---|---|
| 0.1 | 0.1 |
| 0.5 | 0.5 |
| 2.5 | 2.5 |
| 5.0 | 5.0 |
| 10.0 | 10.0 |

Refer to Procedure I or J for instructions on analyzing curve.

2. Automated Calibration:

a. Ensure electrode is filled to line with appropriate fill solution ($NH_4Cl$).

b. Dilute stock standard to obtain the following concentrations: 0.1, 0.5, 2.5, 5.0, 10.0 mg/L and place calibration standards into the sampler rack in ascending order, and pH 4 buffer into dip rinse (second rinse) position.

c. Sampler moves to flowing rinse station where electrode is rinsed with reagent water.

d. Sampler moves to dip station and electrode remains immersed in pH 4 buffer for 15 seconds.

e. Sampler moves to flowing rinse station where electrode is rinsed again with reagent water.

f. Sampler moves to first calibration standard position and stirrer is turned on.

g. 0.45 mL of ISA (10 N NaOH) is added to sample to adjust pH to 11 or greater, ensuring all $NH_4$ is converted to $NH_3$.

h. Ammonia electrode is allowed to stabilize and reading is recorded.

i. Steps c. - h. are repeated for remaining calibration standards.

j. Acceptance criteria: The slope of the curve must range from -55 to -63 mV and the correlation coefficient of the curve must be ≥0.995.

H. Analysis #4530/#13414 - Total Acidity/Prep

1. Manual Calibration:

   The pH meter must be calibrated each day before use. Refer to 1-P-QM-PRO-9015421 for manual calibration instructions.

2. Automated Calibration:

   The pH meter must be calibrated each day before use. See Section E2. under Calibration section.

I. Analysis #0475, 0476 - Acidity to pH 3.7 and pH 8.3

1. Manual Calibration:

   The pH meter must be calibrated each day before use. Refer to 1-P-QM-PRO-9015421 for manual calibration instructions.

2. Automated Calibration:

   The pH meter must be calibrated each day before use. See Section E2. under Calibration section.

**Procedure:**

**I. Manual Procedures:**

A. Analysis #12145, Turbidity

1. Turn on the instrument and allow at least ½ hour for warm up.

2. Install the USEPA filter module.

3. Select NTU units by pressing the Units key.

4. Read the Gelex secondary turbidity standards including a stray light standard, as per the instructions in 1-P-QM-PRO-9015423 each day the analysis is performed. Record the values in the maintenance logbook for the Hach 2100AN Turbidimeter.

5. Analyze blank, standard, or sample by filling the sample cell to the line, wipe to remove any water or fingerprints, and apply a thin layer of silicone oil to the sample cell.

6. Place the sample cell in the instrument compartment and close the lid.

7. Select automatic ranging by pressing the Range key.

8. Enable ratio on by pressing the RATIO key until a green light appears next to the Ratio key.

9. Read and record the results.

10. Dilute the sample with deionized water if the NTU reading is greater than 40 NTU.

B. Analysis #12146, Specific Conductance

1. Turn meter on.

2. Determine cell constant daily, according to 1-P-QM-PRO-9015419.

3. Rinse probe with reagent water and place probe in a reagent water blank sample.

4. Read and record the conductivity value when the meter stabilizes.

5. Repeat steps 3 and 4 with a LCS, check standards, samples and CCV recording the final value for each.

6. If the sample exceeds 12.9 mS/cm, then the appropriate dilution must be made so that the reading falls within the verifiable range of the electrode.

C. Analysis #12147, Total Hardness

Record data in a raw data logbook following instructions in 1-P-QM-QMA-9021767.

1. Place 50 mL of sample into a 125-mL Erlenmeyer flask, or equivalent (low hardness samples).

   **NOTE:** If greater than 10 mL of EDTA titrant is needed, re-analyze the sample using a smaller aliquot of sample diluted to 50 mL with reagent water.

2. Add **2 mL** of buffer solution to achieve a pH of 10.0 ± 0.1.

3. Add **1 mL** of Calmagite indicator solution. The solution color changes to wine red indicating the pH is in the range of 10.0 ± 0.1.

4. Titrate slowly with continuous stirring with standardized EDTA titrant until the last reddish tint disappears. The solution is normally blue at the endpoint. Complete the titration within 5 minutes of adding the buffer.

5. If the endpoint is not sharp, re-analyze the sample. Add approximately 0.66 ± 0.05 g KCN inhibitor per 50 mL of sample **after adding the buffer solution** and follow steps 3 and 4 in the procedure section.

   **NOTE:** Add additional buffer if needed to achieve the pH 10.0 ± 0.1.

D. Option #1 - Analysis #12707, Alkalinity to pH 8.3 (titrimetric) and Analysis #12150, Alkalinity to pH 4.5 (titrimetric)

Record data in a raw data logbook following instructions in 1-P-QM-QMA-9021767.

1. Calibrate the pH meter each day before use.

2. Analyze a CCV to confirm meter calibration.

3. Measure 50 mL of well-mixed sample or a smaller portion diluted to 50 mL if the sample matrix dictates. Pour into a beaker containing a stir bar.

   The blank is prepared by measuring 140 mL of reagent water. Analyze using the low alkalinity method (Procedure D.11.)

   The LCS is prepared by pipetting 1 mL of the 9400 mg/L stock into a 150 mL beaker and diluting to 50 mL with reagent water.

   The MS is prepared by adding an appropriate volume of the 9400 mg/L stock to an aliquot of field sample.

   **NOTE:** Although this method is suitable for all concentration ranges of alkalinity, use appropriate aliquots to avoid a titration volume >50 mL.

4. Rinse electrodes with reagent water and gently blot dry with clean tissues between each use.

5. Place beaker on stir plate. Immerse electrode in liquid and gently stir at a constant rate. Do not let the stir bar bump the electrode.

6. **Record pH of sample**. If pH is >8.3, titrate with 0.02 N or 0.1 N sulfuric acid to a pH of 8.30 ± 0.02. Record the volume of titrant used (analysis 12707).

7. After 8.30 ± 0.02 endpoint is reached, <u>continue</u> titrating to a pH of 4.50 ± 0.02. Record the <u>total volume of titrant</u> used to reach second endpoint (analysis 12150).

8. When initial pH is ≤8.3, titrate with 0.02 N or 0.1 N sulfuric acid to a pH of 4.50 ± 0.02. Record the volume of titrant used (analysis 12150).

9. As each endpoint is approached, add smaller amounts of titrant and confirm that pH equilibrium is reached before adding more titrant.

10. For 50 mL of sample, if the need for a large volume of 0.02 N sulfuric acid titrant is anticipated, analyze the sample using 0.1 N sulfuric acid titrant. Avoid using >50 mL of titrant to reach the pH 4.5 endpoint.

11. For 50 mL of sample, if the total volume of 0.02 N sulfuric acid titrant used to reach the pH 4.5 endpoint is <1 mL (i.e., <20 mg/L total alkalinity), repeat titration using the following steps. **(Low Alkalinity Method).**

    a. Measure 140 mL of well-mixed sample.

    b. Titrate with 0.02 N sulfuric acid to a pH of 4.50 ± 0.02.

    c. Record the volume of titrant used in the comment section of the raw data logbook as "A".

    d. Carefully <u>continue</u> titrating to a pH of 4.20 ± 0.02.

    e. Record the <u>total volume of titrant</u> used to reach second endpoint in the comment section as "B".

    f. Calculate the total alkalinity titrant volume as (2A-B), record this calculated value as the titrant volume in the appropriate column in the raw data logbook and use this same calculated value as the "Total mL of titrant" in the pH to 4.5 alkalinity calculation on page 11.

12. Analyze a CCV after every 10 samples and at the end of a batch to confirm meter calibration.

E. Option #2: Autotitrator Procedure - Analysis #12707, Alkalinity to pH 8.3 (titrimetric) and Analysis #12150, Alkalinity to pH 4.5 (titrimetric)

1. The pH meter must be calibrated each day before use.

2. Before beginning the analysis, flush the dispenser with the appropriate titrant, following the cleaning instructions in 1-P-QM-PRO-9015428.

3. Under "Analyze," at the "Autosample Standby" prompt, press <YES>.

| Display Reads | Action |
|---|---|
| 1: Chan 1 2: Chan 2<br>3: No Cal | Press < 3 > |
| 1: Methods<br>2: Sequences | Press < 1 or 2> |
| 1: Different<br>2: Same method | Press < 1 or 2 > |
| Use method 1? | Enter Method #,<br>and then press <YES> |
| 2 beaker wash? | Press <YES> |
| 10 sec wash? | Press <YES> |
| After analysis, keep electrode in beaker? | Press <YES> |
| Samples = 13? | Enter number of samples,<br>and then press <YES> |
| Start with Beaker 1? | Press <YES> |
| Use Sequence 1 for Beaker 1? | Press <YES> |
| Sample ID # = ? | Enter Sample ID #,<br>and press <YES> |
| Begin analysis? | Press <YES> |

4. Analyze a CCV to confirm meter calibration using stored *Method #1.*

5. Measure 50 mL of well-mixed sample. Initially, analyze all samples at 50 mL volume on Sequence #2.

   The LCS is prepared by pipetting 1 mL of the 9400 mg/L stock to into a 150 mL beaker and diluting to 50 mL with reagent water.

   The MS is prepared by adding an appropriate volume of the 9400 mg/L stock to an aliquot of field sample.

6. Pour into a 150-mL beaker and place in the sample carousel.

7. Using stored Method #1, analyze a CCV after every 10 samples and at the end of a batch to confirm meter calibration.

8. Determine if the sample must be reanalyzed.

   a. For 50 mL of sample, if the total volume of 0.02 N sulfuric acid titrant used to reach the pH 4.5 endpoint is <1 mL (i.e., <20 mg/L total alkalinity), repeat titration using 140 mL of sample and stored Sequence #1. See Step E.9.

   b. Any sample using more than 50 mL of 0.02N titrant must be reanalyzed using 0.1N titrant. See Step E.10.

9. Low Alkalinity Sequence

   a. Measure 140 mL of well-mixed sample.

      The blank is analyzed using this sequence. Prepare by measuring 140 ml of reagent water.

   b. Follow Steps E.3. – E.7. using stored Sequence #1 instead of stored Method #1.

10. 0.1 N Titrant Sequence

    a. Reprogram the auto titrator Sequence #1. See 1-P-QM-PRO-9015428.

    b. Analyze a CCV and a check LCS

    c. Measure 50 mL of well-mixed sample and pour into a 150-mL beaker placed in the sample carousel.

d. Analyze samples using Sequence #1.

e. Using stored Method #1, analyze a CCV after every 10 samples and at the end of a batch to confirm meter calibration.

11. After completing the analysis, flush the dispenser with reagent water following the cleaning instructions in 1-P-QM-PRO-9015428.

**NOTE:** The Orion 960 autotitrator system presently has three stored methods for alkalinity and one stored method for pH.

*Method #1* – This method is programmed to take the pH of the sample.

*Method #2* – This method is programmed for 0.02 N acid titrant and 50 mL of sample and the programmed endpoints are pH 8.3 and 4.5

*Method #3* – This method is programmed for 0.1 N acid titrant and 50 mL of sample and the programmed endpoints are 8.3 and 4.5

*Method #4* – This method is programmed for 0.02 N acid titrant and 140 mL of sample and the programmed endpoints are pH 4.5 and 4.2

The Orion 960 autotitrator system presently has two stored sequences for alkalinity.

*Sequence #1* – This sequence is programmed to run *Method #1* followed by *Method #4.*

*Sequence #2* – This sequence is programmed to run *Method #1* followed by *Method #2.*

*Sequence #1* can be re-programmed to run *Method #1* followed *by Method #3*, as needed using steps in the manufacturer's instruction manual.

F. Analysis #12148, 12149, and 1456 Carbonate, Bicarbonate and Hydroxide Alkalinity

Refer to Calculations section

G. Analysis #12151 and 12152, Temperature of pH and pH

1. 40 CFR Part 136 states that water pH is to be analyzed within 15 minutes or less of collection. Samples are analyzed as soon as possible after the sample is received in the laboratory.

2. Place enough sample in a clean beaker to immerse the sensing elements of the electrodes (approximately 30 mL).

3. Rinse and shake off any water on the electrode. Immerse the calibrated electrode in the sample and stir at a constant rate, being careful not to let the stir bar bump the electrode.

4. When the meter has stabilized, obtain the pH reading and temperature of the sample. Record each reading and temperature in the Laboratory Data Notebook.

   **NOTE**: If pH reading is < 4.00 or >10.00, then the pH result will be reported with a qualifying flag.

5. Analyze a CCV after every 10 samples and at the end of the batch.

H. Analysis #12678 and 2200 Fluoride and Distilled Fluoride

**NOTE:** Analysis 2200 is applicable for the determination of fluoride in liquid and solid samples that have been previously distilled using Analysis #1448. Analysis #1448 is required for NPDES monitoring prior to analyzing by ISE.

1. Allow samples to equilibrate to room temperature prior to analysis.

2. Calibrate the meter. See Meter Calibration in Calibration section

3. Pipette sample volumes or measure using a Class A graduated cylinder.

4. Place 20 mL or a suitable portion diluted to 20 mL in a 50-mL plastic beaker.

5. Add 2 mL of TISAB III buffer and place electrodes under the surface of the sample.

6. Begin stirring at a slow, steady rate.

   For samples referencing EPA Method 340.2, analyze as in procedural step 5, except begin stirring the sample before the electrodes are inserted.

7. Stir the solution for at least 3 minutes.

8. When the mV reading is stable, record the mV reading.

   **NOTE: The 3-minute guide is a minimum time limit** — record the mV reading when a stable reading is observed. This statement is applicable to mV readings above the limit of quantitation (LOQ) because samples with fluoride concentrations less than the LOQ may have continued slight fluctuation.

9. Withdraw the electrodes and rinse with reagent water.

   **Gently** blot electrodes with clean, dry tissues between readings.

**NOTE:** If the mV reading drops below 0.0 (a negative Rel mV reading), immediately withdraw the electrodes from the sample, rinse with reagent water and store electrodes in a reagent blank while a sample dilution is made. Prior to re-analyzing the sample at a higher dilution, analyze a continuing calibration verification (CCV) standard to insure calibration was not lost. If necessary, recalibrate and begin again by analyzing another CCV prior to the sample.

I. Analysis #12677, Ammonia - Nitrogen in Water by Ion-Selective Electrode Method (ISE)

Record data in raw data logbook following instructions in LOM-SOP-LAB-220.

1. Connect ammonia electrode to pH/ISE meter.

2. Place 100 mL aliquot of sample (or a suitable portion diluted to 100-mL with reagent water) into a 150-mL glass beaker.

3. Rinse electrode with reagent water. Immerse electrode into liquid and mix gently with a magnetic stirrer. Stir at a slow, steady rate so air bubbles do not become trapped on the electrode membrane surface. Continue stirring during analysis.

4. Add **1 mL** alkaline reagent to raise pH to above 11. Add the alkaline reagent down the side of the glass beaker (into the sample) very slowly in order to minimize the formation of air bubbles. Document that the pH of the sample is greater than 11 in the raw data logbook.

5. Keep electrode in solution until a stable millivolt reading is obtained.

   **NOTE:** Do not add alkaline reagent before immersing the electrode; it is possible to lose ammonia from a basic solution.

**NOTE:** If necessary, allow standards and samples containing ≤1 mg $NH_3$-N/L additional time for stabilization.

**NOTE:** Dilute samples with reagent water if they are more concentrated than the highest standard on the curve.

6. Record the stabilized mV reading of each sample in a raw data logbook and convert the reading to the ammonia concentration using the standard curve.

7. Dip the electrode into the pH 4.0 buffer solution and then rinse the electrode with reagent water.

J. Analysis #12679, Ammonia – Nitrogen by Ion-Selective Electrode Method (ISE), Analysis #4219, Ammonia Distillation and Analysis #2593, Un-ionized Ammonia

1. Analysis 4219 Distillation Procedure:

   Record data in raw data logbook following instructions in 1-P-QM-QMA-9021767.

   a. Before each distillation, rinse tubes with dilute HCl. Add approximately 500 mL of reagent water to an 800-mL Kjeldahl flask to steam clean the distillation apparatus.

   b. Connect Kjeldahl flask to glass adapter and hose. Turn on the Coolflow. Turn on the temperature control and distill until approximately 150 mL of water is collected in the beaker at the bottom of the setup. Remove distillate from delivery tube immediately after turning off heat source to avoid back wash during the cool-down phase.

   c. Measure 500 mL of sample (or an aliquot diluted to 500 mL with reagent water) using a Class A graduated cylinder. Pour into a beaker and adjust the pH of the sample to 9.5 to 12 with 5N NaOH. Check pH with purchased pH strips, and then add 25 mL of borate buffer solution.

d. Transfer the solution to an 800-mL Kjeldahl flask. Add a pinch of boiling chips and approximately 5 mL of antifoam B to the solution. Connect flask to glass adapter and hose. Turn on the Coolflow.

e. Measure 50 mL of 4% $H_2SO_4$ solution into a 400-mL beaker. Make sure the delivery tube is below the level of the 4% $H_2SO_4$ solution (receiving solution).

f. Begin heating. Collect approximately 220 mL of distillate. Turn off heat and immediately remove the distillate beakers from the delivery tube. Turn off the Coolflow.

g. Pour the distillate into a 500-mL Class A graduated cylinder and dilute to final volume of 500 mL with reagent water. Store distillate at 0°C - 6°C; not frozen, prior to analyzing

h. Analyze distillate for $NH_3$-N according to Analysis #12679 procedure.

2. Analysis 12679 ISE Procedure:

Record data in raw data logbook following instructions in 1-P-QM-QMA-9021767.

a. Connect ammonia electrode to pH/ISE meter.

b. Place 100 mL aliquot of sample (or a suitable portion diluted to 100-mL with reagent water) into a 150-mL glass beaker.

c. Rinse electrode with reagent water. Immerse electrode into liquid and mix gently with a magnetic stirrer. Stir at a slow, steady rate so air bubbles do not become trapped on the electrode membrane surface. Continue stirring during analysis.

d. Add **1 mL** alkaline reagent to raise pH above 11. Add the alkaline reagent down the side of the glass beaker (into the sample) very slowly in order to minimize the formation of air bubbles. Document that the pH of the sample is above 11 in the raw data logbook.

e. Keep electrode in solution until a stable millivolt reading is obtained.

**NOTE:** Do not add alkaline reagent before immersing the electrode; ammonia is lost from a basic solution.

**NOTE:** Standards and samples containing ≤1 mg $NH_3$-N/L require extra time for stabilization.

**NOTE:** Dilute samples with reagent water if they are more concentrated than the highest standard on the curve.

f. Record the stabilized mV reading of each sample in a raw data logbook and convert the reading to the ammonia concentration using the standard curve.

g. Dip the electrode into the pH 4.0 buffer solution and then rinse the electrode with reagent water.

K. Option #1 – Analysis #4530 - Total Acidity

1. Calibrate the pH electrode by following the directions under 1-P-QM-PRO-9015421.

2. Pour 50 mL of the sample into a 150-mL beaker. Read the initial pH of the sample and record the result in the laboratory data notebook.

3. If the pH is above 4.0, add standard sulfuric acid in 5.0-mL increments to lower the pH to 4.0 or less. If initial pH is less than 4.0, addition of sulfuric acid is not required.

4. Add 5 drops of $H_2O_2$ (in hood).

5. Heat the sample to boiling and boil for 2 to 4 minutes.

6. Cool the sample to room temperature and titrate with standardized sodium hydroxide to pH 8.3. If more than 50 mL of titrant is used, repeat procedure using less sample.

L. Option #2: Autotitrator Procedure – Analysis #4530 - Total Acidity

This method utilizes the Orion 960 autotitrator system.

1. Calibrate the pH electrode by following the directions under 1-P-QM-PRO-9015421.

2. Place 50 mL of each standard or sample in a 150-mL beaker and place in sample carousel.

3. In order to record the initial pH of the blank, standard, or sample, at the "Autosample Standby" prompt, press <YES>.

| Display Reads | Action |
|---|---|
| 1: Chan1 2: Chan2 | Press 3 |
| 3: No Cal | |
| 1: Methods | Press 1 |
| 2: Sequences | |
| 1: Different Methods | Press 2 |
| 2: Same Method | |
| Use Method 1? | Enter Method 1and press yes |
| 2 beaker wash? | Press yes |
| 10 sec wash? | Press yes |
| After analysis, keep electrode In beaker? | Press yes |
| Samples = 13? | Enter # of samples Press yes |
| Sample ID # = ? | Enter sample # and Press yes |
| Begin analysis? | Press yes |

4. In order to lower the initial pH of the blank, standard, or sample below a pH of 4.0 or less, repeat the steps above (starting with…"at the autosample standby press <YES>") using standardized $H_2SO_4$. When prompted to enter a method number, instead of entering method 1 enter method 8.

5. When the cycle is complete remove blank, standard, or sample from carousel and add three drops of hydrogen peroxide. Boil for 2 to 4 minutes. After cooling, bring the pH of the blank, standard or sample to 8.3 using the standardized NaOH and the autotitrator system. Repeat the steps in #3 under Option #2, beginning with pressing <YES> at the autosample standby. When prompted for a method number, enter method 9 instead of method 8.

M. Option #3 – Analysis #13414 Prep (for use with ManTech analysis #4530)

1. Calibrate the pH electrode by following the directions under 1-P-QM-PRO-9015421.

2. Pour 100 mL of the sample into a 150-mL beaker. Read the initial pH of the sample and record the result in the laboratory data notebook.

3. If the pH is above 4.0, add standard sulfuric acid in 5.0-mL increments to lower the pH to 4.0 or less. If initial pH is less than 4.0, addition of sulfuric acid is not required.

4. Add 5 drops of $H_2O_2$ .

5. Heat the sample to boiling and boil for 2 to 4 minutes.

6. Cool the sample to room temperature. Proceed to ManTech Procedure.

N. Option #1, Analysis #0475, 0476 – Acidity to pH 3.7 and pH 8.3

1. Calibrate the pH electrode by following the directions under 1-P-QM-PRO-9015421.

2. Pour 50 mL of sample into a 100-mL beaker. Read the initial pH of the sample and record the result in the Laboratory Data Notebook.

3. Titrate to pH 3.7 with 0.02 N NaOH. As endpoint is approached, use smaller additions of titrant and allow electrode to equilibrate between each addition. Record amount of titrant. Titrate to pH 8.3 with 0.02 N NaOH. As endpoint is approached, use smaller additions of titrant and allow electrode to equilibrate between each addition.

4. Record total amount of titrant. If more than 50 mL of titrant is used, repeat using less sample or a dilution.

O. Option #2: Autotitrator Procedure – Analysis #0475, 0476 – Acidity to pH 3.7 and pH 8.3

This method utilizes the Orion 960 autotitrator system.

1. Calibrate the pH electrode by following the directions under 1-P-QM-PRO-9015421.

2. Place 50 mL of each standard or sample in a 150-mL beaker and place in sample carousel.

3. At the "Autosample Standby" prompt, press <YES>.

| Display Reads | Action |
|---|---|
| 1: Chan 1<br>2: Chan2<br>3: No Cal | Press 3 |
| 1: Methods<br>2: Sequences | Press 2 |
| Use Sequence 1? | Enter Sequence 3 and press YES |
| 2 beaker wash? | Press YES |
| 10 sec wash? | Press YES |
| After analysis, keep electrode in beaker? | Press YES |
| Samples = 13? | Enter number of samples and press YES |
| Sample ID # = ? | Enter sample # and press YES |
| Begin analysis? | Press YES |

4. If more than 50 mL of titrant is used, repeat using less sample.

## II. ManTech Procedure (automated method):

A. Introduction to the procedure for the operation of the ManTech Multi-purpose instrument.

The instrument is equipped with systems to analyze for pH, temperature of pH, alkalinity, conductivity, turbidity, fluoride, ammonia and total hardness. The methods for each procedure is pre programmed and the analyst will not need to make any adjustments.

Each test can be performed individually or in tandem with others. The analyst will determine the combination of analyses for each run. Before operating the instruments, the analyst must ensure that all required reagents needed for each test is in adequate supply and are not expired.

To operate the instrument, open the PC-titrate software menu from the computer desktop.

Each day before any analysis is performed; the daily calibration associated with each analysis must be completed and evaluated to ensure that the acceptance criteria are met. (See the calibration section for the required concentrations and acceptance criteria for each calibration). Daily calibration schedules are created and saved. If a specific analysis is not being performed that day, the calibration can be removed from the schedule for that day.

B. Performing daily calibration:

Open the daily start up tab and load the standards according to the schedule for each calibration. Click on the start button and the instrument will proceed with the calibration. Once the calibration is complete the calibration data is automatically sent to the assign printer and is printed. Ensure the calibration data meets requirements before proceeding. See the calibration section for the required concentrations and acceptance criteria for each calibration.

C. Analyzing samples:

**NOTE**: Prior to starting the ManTech system, make sure all required reagent containers and reagent water containers have sufficient sample volume.

**NOTE**: Before analyzing for analysis 2200, add 1 mL of 15% of Sodium Acetate to all standards (including the curve), samples, and Blank.

**NOTE:** Before analyzing for analysis 4530, samples need to be prepared following steps outlined under Manual Procedure M; analysis #13414.

To analyze samples, select "Run titration" from the PC-titrate menu. A blank schedule will appear.

1. Click on the add row buttons to add the required number of rows for that run.

2. Double click on the blank space under the schedule header. The menu of analyses will appear. Select the analyses to be preformed and click ok.

3. When completing the schedule, each analysis must be bracketed by its own CCV of alternating concentrations and a CCB (see QA section). The CCV's and CCB's ID's are pre–programmed and are to be scanned in from the charts provided at each instrument. Barcodes are provided for each CCV and CCB. See Table I.

4. The LCS for each analysis is pre-programmed and is to be scanned in from the charts provided at each instrument. See Table I.

5. Sample numbers can be typed in; however each instrument is equipped with a scanner which is used to scan the sample numbers directly from the label of the container (scan barcodes on label).

   The batch information for each Method Blank, LCS, CCV, CCB and samples must be completed using the example below:

Sample/ bottle code is scanned in and then a ";" followed by the batch designation "1a" followed by a ";" and then "u","d","r", or "m" for the QC Type (u-background, d-duplicate, r-matrix spike, m-matrix spike duplicate). .

For example, for a background QC sample having a sample number of 6515514 and a bottle code of 005A the correct batch information would be: 6515514005A;1a;u

If a sample is analyzed at a dilution the dilution factor is then entered at the very end of the batch information with a ";" placed before it.

For example: If the same sample as used above was analyzed at a 10X dilution then the batch information for that sample would be entered as: 6515514005A;1a;u;10

6. Fill the sample tube with Method Blank, LCS, each CCV, CCB and samples. Ensure the sample tubes are loaded according to the order on the schedule.

7. Click on the auto-generate order number to add the order number to the schedule.

8. Once the schedule is completed, click start and the instrument will proceed with the analysis until the entire schedule of samples is complete.

9. The data is saved automatically and sent to the PC –Titrate export file before it is imported to the LIMS system.

D. Routine Maintenance of ManTech multi-parameter system

1. Calibration of Titrasip Pumps: Flow Rate Check:

   a. Manual Control of Autosampler

(1) From the PC-Titrate main menu, click on Titrator, then on Manual Control (autosampler tab)

(2) Next, click on Load Tray From Folder button and then double click on Automax 197 Tube Sampler file

(3) Then, under Zone select tubes. Under Tubes select tube position and place a tube in that position on the autosampler tray.

(4) Click on Home Sampler

(5) Click on Go To This Location XYZ button. The autosampler will then move to the tube position.

(6) Click OK button in order to get back to the PC-Titrate main menu

b. Flow Rate Check:

(1) From the PC-Titrate menu select the pump to be calibrated (Click on Pump Cal button) and follow the prompts.

(2) Calibration must be performed monthly and documented in the maintenance logbook.

**NOTE:** When completed, Home sampler (follow instructions under II. ManTech Procedure D1a. steps 1-4)

2. Calibration of Zero and Span for the Hardness detector:

**NOTE:** Turn on Hardness Detector in order for the detector to warm up before calibration.

**NOTE:** Ensure reagent water is in titration vessel cup containing the photo cell

a. Accessing Zero and Span Check screen and set-up:

(1) From the PC-Titrate main menu, click on Titrator, then on Manual Control

(2) Click on Analog

(3) Click on Scan Analog, making sure the continuous button is checked

(4) The Hardness Detector is on Monitor Electrode # 4

b. Zero Check/Calibration:

(1) Unscrew the Zero (careful not to look directly into the bright light). The Zero must be as close as possible to 0 mV.

(2) If not, adjust the screw for Zero on the hardness detector until reading is as close as possible to 0 mV.

(3) Check/Calibration must be performed monthly and documented in the maintenance logbook.

c. Span Check/Calibration:

(1) The Span reading must be -400 mV ± 25 mV.

(2) If not, adjust the screw for Span on the hardness detector until reading is within range.

(3) Check/Calibration must be performed monthly and documented in the maintenance logbook.

3. Changing and Entering Acid Normalities on ManTech :

   a. Changing Titrant –Purging titrant:

      **NOTE:** Disconnect acid titrant bottle from dispenser line

      (1) Click on PC-Titrate, Titrator, Manual Control, Serial Devices

      (2) Click on Burivar II TIS1 tab; Titrasip pump#1/Burette #1

      (3) Purge Buret one time (empty cup-use manual button on side of pump #1 at the top of cup)

      (4) Fill titrant bottle with new standardized 0.02N $H_2SO_4$ titrant and connect dispenser line to bottle

      (5) Purge system two more times

      (6) Click OK

   b. Entering Acid Normalities:

      (1) Click on PC-Titrate, Set-up, Titration Method, Load

      (2) Click Alkalinity

      (3) Under Titrant Information-Concentration, change Normality to current value.

      (4) Click Save

      (5) Click Alkalinity-Low and follow steps above

E. Maintenance of all other systems:

1. Maintenance of the Ammonia Ion-Selective Electrode – See manufactures instruction manual for maintenance and operation of electrode

2. Maintenance of pH electrodes- refer to 1-P-QM-PRO-9015421 for maintence of pH electrodes

3. Perform Maintenance on all other systems as needed.

F. Retrieving Historical Raw Data on ManTech :

1. Find run number of sample in question- Go into sample number in Parallax; copy and paste run number

2. Open PC-titrate software menu from computer desktop

3. Click on Titrator, Replay Titration, Load, Sort by order and sample name

4. Click on sample (go by time), Select, Print, Equation Result Report (rplyeqn.srw), Print.

**Calculations:**

A. Fluoride, pH, Temperature of pH, Conductivity, Turbidity and Ammonia are measured directly and therefore no calculations are needed.

B. Alkalinity:

To pH of 8.3:

*Alkalinity, mg/L* $CaCO_3$ *= (mL of titrant (pH 8.3) x Normality x 50,000)/ mL of sample*

To pH of 4.5:

*Alkalinity, mg/L $CaCO_3$ = (Total mL of titrant x Normality x 50,000)/ mL of sample*

C. Carbonate, Bicarbonate, and Hydroxide Alkalinity are direct calculations from the total alkalinity result.

The computer chooses the appropriate calculation from the # 12707 and # 12150 alkalinity data:

Analysis #12149:

| | |
|---|---|
| If 12707 result is < MDL | Bicarbonate = 12150 result |
| If 12707 result is < 1/2 of 12150 result | Bicarbonate = 12150 result - (2 x 12707 result) |
| If 12707 result is = 1/2 of 12150 result | Bicarbonate = < MDL |
| If 12707 result is > I/2 of 12150 result | Bicarbonate = < MDL |
| If 12707 result is = 12150 result | Bicarbonate = < MDL |

Analysis #12148:

| | |
|---|---|
| If 12707 result is < MDL | Carbonate = < MDL |
| If 12707 result is < % of 12150 result | Carbonate = 2 x 12707 result |
| If 12707 result is = % of 12150 result | Carbonate = 2 x 12707 result |
| If 12707 result is > % of 12150 result | Carbonate = 2 x (12150 result - 12707 result) |
| If 12707 result is = 12150 result | Carbonate = < MDL |

Analysis #1456:

| | |
|---|---|
| If 12707 result is < MDL | Hydroxide = < MDL |
| If 12707 result is < % of 12150 result | Hydroxide = < MDL |
| If 12707 result is = % of 12150 result | Hydroxide = < MDL |
| If 12707 result is > % of 12150 result | Hydroxide = (2 x 12707 result) - 12150 result |
| If 12707 result is = 12150 result | Hydroxide = 12150 result |

D. Free Carbon Dioxide Calculation (analysis #238)

The calculation assumes that the total alkalinity of the sample is due almost entirely to hydroxides, carbonates or bicarbonates.

The total dissolved solids of the sample may not be greater than 500 mg/L for this calculation.

$$mg/L\ CO_2 = 2.0 \times B \times 10^{(6-pH)}$$

**Where:**

B = bicarbonate alkalinity (from analysis #12149)

**NOTE**: Total carbon dioxide can be calculated, if requested, according to the calculations found in Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Method 4500 $CO_2$ D-1997.

E. Total Hardness:

$$Hardness\ (mg/L\ as\ CaCO_3) = [(mL\ EDTA\ used \times 1000)/\ mL\ of\ sample] \times EDTA\ Constant$$

F. Analysis #2593 Un-ionized Ammonia Calculation:

$$mg\ \ un\text{-}ionized\ ammonia/L = (ammonia\ nitrogen\ (6914)\ raw\ result\ mg/L) \times (\%\ un-ionized\ ammonia\ at\ a\ given\ pH\ and\ temperature)$$

Refer to table below for % un-ionized ammonia:

**Table 8010: VI.**
**Percentage of Ammonia Un-ionized in Distilled Water***

| Temp °C | Percentage Un-ionized at a given pH* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 6.0 | 6.5 | 7.0 | 7.5 | 8.0 | 8.5 | 9.0 | 9.5 | 10.0 |
| 5 | 0.01 | 0.04 | 0.11 | 0.40 | 1.1 | 3.6 | 10 | 27 | 54 |
| 10 | 0.02 | 0.06 | 0.18 | 0.57 | 1.8 | 5.4 | 15 | 36 | 64 |
| 15 | 0.03 | 0.08 | 0.26 | 0.83 | 2.6 | 7.7 | 21 | 45 | 72 |
| 20 | 0.04 | 0.12 | 0.37 | 1.2 | 3.7 | 11 | 28 | 55 | 80 |
| 25 | 0.05 | 0.17 | 0.51 | 1.7 | 5.1 | 14 | 35 | 63 | 84 |
| 30 | 0.07 | 0.23 | 0.70 | 2.3 | 7.0 | 19 | 43 | 70 | 88 |

*Prepared from data given in Sillen and Martell.

G. Analysis #4530 - Total Acidity

$$\text{Acidity as mg / mL } CaCO_3 \quad \frac{[(A \times B) - (C \times D)] \times 50{,}000}{\text{mL of sample}}$$

**Where:**

A = Vol. of std. NaOH used in titration

B = Normality of std. NaOH

C = Vol. of std. H2SO4 used to reduce pH to less than 4

D = Normality of std. $H_2SO_4$

H. Analysis #0475, 0476 – Acidity to pH 3.7 and pH 8.3

$$mg/L \text{ as } CaCO_3 = \frac{Normality \times 50{,}000 \times mL of\ titrant}{samplevolume, mL}$$

**Statistical Information/Method Performance:**

The method detection limit (MDL) is determined annually by following the procedure outlined in 1-P-QM-QMA-9017309.

The quality control acceptance windows are generated annually by following the procedure outlined in 1-P-QM-QMA-9017313.

**Quality Assurance/Quality Control:**

The batch size is limited to 20 samples or less. For analyses with more than 10 samples on a batch, two duplicates are needed (excluding ammonia and fluoride – only one duplicate is needed per batch 20 samples –unless a batch contains an NPDES sample(s) from South Carolina and the batch contains more than 10 samples, then two duplicates are needed.).

A Laboratory Control Standard (LCS) must be analyzed for each analysis. See Table I for each analysis LCS concentration.

For alkalinity, Total Acidity and total hardness one matrix spike (MS) must be analyzed per batch of 20 samples or less.

For ammonia, fluoride and Acidity to pH 3.7 and 8.3 (total acidity spikes only), a matrix spike (MS) and a matrix spike duplicate (MSD) must be analyzed per batch of 20 samples or less.

When sample volume does not permit the analysis of either a sample matrix duplicate or an MS and MSD, then a LCSD must be analyzed to demonstrate method precision.

Samples from West Virginia require a usable precision measurement for each batch. Analyzing one of the following on a batch containing a West Virginia sample fulfills this requirement: an MS/MSD, a non-program deleted duplicate, or an LCSD.

For Specific Conductance, if the batch contains samples from the state of North Carolina a low-level check standard of 5 umhos/cm NaCl must be analyzed.

For Total Hardness, samples that are designated NPDES require digestion. Confirm whether this analysis is appropriate for samples designated NPDES.

For each analysis, a continuing calibration verification (CCV) standard must be analyzed at the beginning of each batch, after every 10 samples and at the end of each batch. The concentration of the CCV must alternate in a repeating wave pattern. All CCVs have an acceptance criteria of 90% to 110%. If any CCV's are outside this range, then the samples bracketed by the out of specification CCV must be repeated. Refer to Table I for CCV concentrations for each analysis.

A continuing calibration verification blank (CCB – a reagent water blank) must be analyzed after each CCV standard on the batch. The CCB must be less than the LOQ for the analysis.

See LIMS for current quality control (QC) acceptance windows. Follow guidelines in 1-P-QM-PRO-9015535 for outlier QC data.

## Table I

| Analysis Name and Number | CCV Barcodes/Concentrations |
|---|---|
| Total Alkalinity (12150)<br>Carbonate (12148)<br>Bicarbonate (12149) | CCVPH2 = 7.00 pH buffer<br>LCSAK = 188 mg/L<br>LCSPH = 7.00 pH buffer<br>PBW = Method Blank<br>CCB = reagent water blank |
| Total Acidity (4530) | CCVPH8 = 8.00 pH buffer<br>LCSTACD = 500 mg/L<br>PBW = Method Blank<br>CCB = reagent water blank |
| Acidity to pH 3.7 and pH 8.3 (0475, 0476) | CCVPH8 = 8.00 pH buffer<br>LCSACD = 250 mg/L<br>PBW = Method Blank<br>CCB = reagent water blank |
| pH (12152)<br>Temperature of pH (12151) | CCVPH2 = 7.00 pH buffer<br>LCSPH = 7.00 pH buffer<br>CCB = reagent water blank |
| Specific Conductance (12146) | CCVSC1 = 147 uhoms/cm<br>CCVSC2 = 1413 umhos/cm<br>CCVSC3 = 12,900 umhos/cm<br>LCSSC = 147 umhos/cm<br>PBW = Method Blank<br>CCB = reagent water blank |
| Fluoride (12678) | CCVFL1 = 0.5 mg/L<br>CCVFL2 = 1.0 mg/L<br>CCVFL3 = 1.5 mg/L<br>LCSFL = 1.0 mg/L<br>PBW = Method Blank<br>CCB = reagent water blank |
| Turbidity (12145) | CCVTB1 = 10 NTU<br>CCVTB2 = 20 NTU<br>CCVTB3 = 30 NTU<br>LCSTB = 10 NTU<br>PBW = Method Blank<br>CCB = reagent water blank |
| Ammonia (12677)<br>Distilled Ammonia (12679) | CCVNH1 = 1.0 mg/L<br>CCVNH2 = 2.5 mg/L<br>CCVNH3 = 7.5 mg/L<br>LCSNH = 5 mg/L<br>PBWNH = Method Blank (12679-distilled)<br>PBW = Method Blank (12677)<br>CCB = reagent water blank |
| Total Hardness (12147) | CCVTH1 = 20 mg/L<br>CCVTH2 = 40 mg/L<br>CCVTH3 = 60 mg/L<br>LCSTH = 40 mg/L<br>PBWTH = Method Blank<br>CCB = reagent water blank |

# APPENDIX B

## FIELD SAMPLING PLAN

# APPENDIX B
# FIELD SAMPLING PLAN

## Perfluoroalkyl Compounds Work Plan

*Prepared for*
**Solvay Specialty Polymers USA, LLC**
10 Leonard Lane
West Deptford, NJ 08086

*Prepared by*
integral consulting inc.
200 Harry S. Truman Pkwy.
Suite 330
Annapolis, MD 21401

September 21, 2015

# CONTENTS

**LIST OF FIGURES** ..... **iii**

**LIST OF TABLES** ..... **iv**

**ACRONYMS AND ABBREVIATIONS** ..... **v**

**1 INTRODUCTION** ..... **1-1**

1.1 OVERVIEW ..... 1-1
1.2 DOCUMENT ORGANIZATION ..... 1-2

**2 SAMPLING PROCEDURES** ..... **2-1**

2.1 SCHEDULE ..... 2-1
2.2 FIELD EQUIPMENT AND SUPPLIES ..... 2-1
2.3 STATION/LOCATION POSITIONING ..... 2-2
2.4 SAMPLING VESSEL ..... 2-2
2.5 WEATHER ..... 2-2
2.6 SPECIAL SAMPLING CONCERNS ..... 2-3
2.7 EQUIPMENT DECONTAMINATION ..... 2-3
2.7.1 Groundwater ..... 2-3
2.7.2 Surface Water ..... 2-4
2.7.3 Sediment ..... 2-4
2.7.4 Soil ..... 2-5
2.8 GROUNDWATER SAMPLING ..... 2-5
2.8.1 Stabilization Parameters ..... 2-6
2.9 SURFACE WATER SAMPLING ..... 2-7
2.9.1 Sample Handling ..... 2-7
2.9.2 Water Quality Measurements ..... 2-8
2.10 SEDIMENT SAMPLING ..... 2-8
2.10.1 Surface Sediment Sampling ..... 2-8
2.10.2 Subsurface Sediment Sampling ..... 2-10
2.11 SOIL SAMPLING ..... 2-12
2.11.1 Field Quality Control ..... 2-13
2.11.2 Groundwater ..... 2-13
2.11.3 Surface Water ..... 2-14
2.11.4 Sediment ..... 2-15
2.11.5 Soil ..... 2-16



ED_004850_00001502-00831

2.12 SAMPLE PACKAGING AND TRANSPORT ..... 2-16
2.13 STUDY DERIVED WASTES ..... 2-17

**3 FIELD DOCUMENTATION ..... 3-1**

3.1 FIELD LOGBOOK ..... 3-1
3.2 CHAIN-OF-CUSTODY PROCEDURES ..... 3-3
3.3 WELL AND SAMPLE LOCATION NUMBERING ..... 3-4
3.4 SAMPLE IDENTIFIERS ..... 3-5

**4 FIELD DATA MANAGEMENT AND REPORTING PROCEDURES ..... 4-1**

**5 REFERENCES ..... 5-1**

Attachment B1. Standard Operating Procedures

Attachment B2. Field Forms



ED_004850_00001502-00832

# LIST OF FIGURES

Figure B-1. Location Map

Figure B-2. Proposed Monitoring Well Sampling Locations

Figure B-3. Proposed Monitoring Well Locations and Areas to be Canvassed for Existing Monitoring Wells

Figure B-4. Surface Water and Sediment Sample Locations

Figure B-5. Proposed Soil Boring Locations



ED_004850_00001502-00833

# LIST OF TABLES

Table B-1. Chemicals of Interest

Table B-2. Sample Containers, Preservation, and Holding Time Requirements

Table B-3. Field Sample Collection Matrix for Groundwater (Onsite and Offsite Wells)

Table B-4. Field Sample Collection Matrix for Surface Water from Little Mantua Creek and the Main Ditch

Table B-5. Field Sample Collection Matrix for Surface and Subsurface Sediment from Little Mantua Creek and the Main Ditch

Table B-6. Field Sample Collection Matrix for Soil

Table B-7. Geographic Coordinates of Proposed Sampling Locations for the Field Investigation

Table B-8. Solvay Site Wells



ED_004850_00001502-00834

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AXYS | AXYS Analytical Services Ltd. |
| bgs | below ground surface |
| COC | chain-of-custody |
| DGPS | differential global positioning system |
| EPA | U.S. Environmental Protection Agency |
| Eurofins | Eurofins Lancaster Laboratories Environmental, LLC |
| FSP | field sampling plan |
| GPS | global positioning system |
| HSP | health and safety plan |
| Integral | Integral Consulting Inc. |
| LDPE | low–density polyethylene |
| NAD83 | North American Datum of 1983 |
| NJDEP | New Jersey Department of Environmental Protection |
| NOAA | National Oceanic and Atmospheric Administration |
| NWIS | National Water Information System |
| PFC | perfluoroalkyl compound |
| PVC | polyvinyl chloride |
| PWS | public water system |
| QA/QC | quality assurance/quality control |
| QAPP | quality assurance project plan |
| Site | West Deptford, New Jersey, Plant |
| Solvay | Solvay Specialty Polymers USA, LLC |
| SOP | standard operating procedure |
| TOC | total organic carbon |
| USGS | U.S. Geological Survey |
| VOC | volatile organic compound |
| WGS84 | World Geodetic System of 1984 |



ED_004850_00001502-00835

# 1 INTRODUCTION

This document presents the field sampling plan (FSP) that has been prepared on behalf of Solvay Specialty Polymers USA, LLC (Solvay) to study perfluoroalkyl compounds (PFCs) at the West Deptford, New Jersey, Plant site (the Site). Additional information on the Site history and a summary of existing data are provided in the work plan.

The 234-acre Site is located at 10 Leonard Lane in West Deptford Township, Gloucester County, New Jersey, on the Delaware River across from the Philadelphia Airport (Figure B-1). Active plant operations occur on approximately 34 acres of the property, with the remainder either in a natural state or used for agriculture. The far northern area of the Site contains dredge spoils placed there by the U.S. Army Corps of Engineers in the 1960s (ERM 2013). The western edge of the property borders Little Mantua Creek, with undeveloped property located to the east, and a rail line to the south.

Prior to 1970, the property was used for agriculture. Fluorocarbon manufacturing began when Pennwalt constructed a facility in 1970. Manufacturing ceased in 1977 and a new facility was constructed from 1983 to 1985; production of vinylidene fluoride monomers and polymers using PFCs in the manufacturing process started in 1985 (ERM 2013). The facility was purchased by Elf Atochem in 1989 and operated until it was sold to Ausimont USA, Inc. in 1990. The Solvay Group acquired the holding of the parent company of Ausimont in May 2002, and changed the name to Solvay Solexis, Inc. on January 1, 2003. The company and facility name were then changed to Solvay Specialty Polymers USA, LLC on October 31, 2012 (ERM 2013).

The primary objective of the work plan is to determine if PFCs are present in Site groundwater, soils, and/or surface water and sediments in the Delaware River.

To execute this investigation, Integral Consulting Inc. (Integral) will conduct the fieldwork and data analysis outlined in this FSP and in the quality assurance project plan (QAPP). The names and quality assurance responsibilities of key project personnel for Integral who will be involved in sampling and analysis activities are provided in Figure A-1 of the QAPP.

## 1.1 OVERVIEW

The sampling design as provided in the work plan incorporates a number of different components and sampling media. The sampling design can be summarized as follows:

- **Groundwater**—Groundwater samples will be collected at 45 well locations from monitoring wells installed by Solvay as part of the volatile organic compound (VOC) investigation program (this count does not include wells that will be installed or



ED_004850_00001502-00836

sampled as part of canvass efforts - Phase II and III of the work plan). Groundwater samples will be tested for the analytes presented in Table B-1.

- **Surface Water**—Surface water samples will be collected from 7 locations. Four samples will be collected from Little Mantua Creek and 3 samples will be collected from the Main Ditch. Surface water samples will be tested for the analytes presented in Table B-1.
- **Sediment**—Surface and subsurface sediment will be collected from 7 locations. Four samples will be collected from Little Mantua Creek and 3 samples will be collected from the Main Ditch. Where applicable, surface water and sediment locations will be co-located. Surface water samples will be collected prior to any sediment collection activities at any of the co-located locations. Sediment samples will be tested for the analytes presented in Table B-1.
- **Soil**—Soil samples will be collected from 18 soil borings at the Site. Soil samples will be tested for the analytes presented in Table B-1

## 1.2 DOCUMENT ORGANIZATION

This FSP describes the field methods that will be used to collect samples to meet the objectives of the work plan. The background, rationale, data quality objectives, and overall study design are described in detail in the QAPP. Section 2 of this FSP describes the field procedures and sample packaging and shipping requirements that will be followed by the technical team during the field study. Section 3 summarizes field documentation and chain-of-custody (COC) procedures. Field data reporting and field custody procedures are discussed in Section 4.

The following documents are provided as attachments to this FSP:

- Standard Operating Procedures (SOPs). The SOPs describe the procedures that will be used to collect groundwater, surface water, and surface and subsurface sediments (Attachment B1).
- Field Forms. This attachment contains examples of various forms that will be used during field sampling, including a corrective action record, a field change request form, and a COC form (Attachment B2).

The Site Health and Safety Plan (HSP) has been updated to address additional field activities. This document describes the specific requirements and procedures that will be implemented to minimize the safety risk to personnel who carry out the field study program for groundwater, surface water, and sediment collection.



ED_004850_00001502-00837

# 2 SAMPLING PROCEDURES

The following sections describe the detailed procedures and methods that will be used during the proposed field sampling events, including sampling procedures, recordkeeping, sample handling, storage, and field quality control procedures. Sample collection and processing will be conducted in accordance with the SOPs provided in Attachment B2. Depending on field conditions, procedures specified in the referenced SOPs may be modified if necessary. All field activities will be conducted in accordance with the HSP prepared for the project.

## 2.1 SCHEDULE

Onsite soil sampling, groundwater sampling, well installation, and surface water and sediment sampling in Little Mantua Creek and the Main Ditch are pending New Jersey Department of Environmental Protection (NJDEP) approval of the work plan. The anticipated schedule is presented as Figure A-2 of the QAPP (Attachment A of the workplan).

## 2.2 FIELD EQUIPMENT AND SUPPLIES

Field equipment and supplies include sampling equipment, decontamination supplies, sample containers, coolers, shipping containers, log books and forms, personal protection equipment, and personal gear. Protective wear (e.g., gloves) is required to minimize the possibility of cross-contamination between locations. Additional information on protective wear required for this project is provided in the HSP prepared for the site.

Sample jars, preservatives, distilled/deionized water, coolers, and packaging material for the samples will be supplied by the analytical laboratory. Pursuant to the NJDEP sampling guidance (NJDEP 2005) and where practicable, sample containers will not be held for more than 4 days between sample container shipment from the testing laboratory and sample shipment back to the laboratory for analysis. Details on the numbers and type of sample containers are provided in the QAPP and in Table B-2 of this FSP. The field lead and field personnel in charge of sample handling in the field will use a sample matrix table (Tables B-3, B-4, B-5, and B-6) as a quality control check to ensure that all samples have been collected at a given station. These tables include the total number and type of sample jars required for each analysis at each sampling station.

Commercially available, pre-cleaned jars will be used for the samples, and the testing laboratories will maintain a record of certification from the suppliers. The bottle shipment documentation will include batch numbers. With this documentation, jars can be traced to the supplier, and bottle-wash analysis results can be reviewed. The bottle-wash certificate documentation will be archived in Integral's project file.



ED_004850_00001502-00838

Sample containers will be clearly labeled at the time of sampling. Labels will include the task name, sample number, sampler's initials, analyses to be performed, and sample date and time. Sample numbering and identification procedures are described in detail in Sections 3.3 and 3.4.

## 2.3 STATION/LOCATION POSITIONING

Latitude and longitude coordinates will be obtained at each sample location where samples are collected on Little Mantua Creek and the Main Ditch. A differential global positioning system (DGPS) will be used to document the actual location where samples were collected. The standard projection method to be used during field activities is New Jersey state plane feet (the North American Datum of 1983; NAD83); coordinates will be collected in the field using World Geodetic System of 1984 (WGS84). The positioning objective is to accurately determine and record the positions of all sampling locations to within ±2 m. Proposed well and sample location coordinates are provided in Table B-7.

The DGPS unit consists of a global positioning system (GPS) receiver and a differential receiver located at a horizontal control point. At the control point, the GPS-derived position is compared with the known horizontal location, offsets or biases are calculated, and the correction factors are telemetered to the GPS receiver. Positioning accuracies on the order of ±1 to 3 m can be achieved by avoiding the few minutes per day when the satellites are not providing the appropriate quality of signal (SOP AP-06, Attachment B2). The GPS unit provides the operator with a listing of the time intervals during the day when accuracies are decreased.

## 2.4 SAMPLING VESSEL

If necessary, surface water and sediment samples will be collected from a sampling vessel. The sampling boat or barge will have enough space to process the sediment cores onboard and accommodate a minimum of five people—three sampling team members, the vessel's operator, and one NJDEP oversight individual (if required)—and the following gear: hydraulic (or similar) winch and cable capable of deploying a vibracorer and van Veen grab sampler (or similar equipment) for sediment collection, sample collection and compositing equipment, sample coolers, and multiple sampling equipment boxes containing sample jars and other ancillary equipment. The vessels used for sampling will have navigational lights, anchors, and basic sonar (e.g., fathometer). The vessel operator will be thoroughly familiar with the area of the river/creek to be navigated.

## 2.5 WEATHER

During sampling activities, weather will be monitored using the following web site:



ED_004850_00001502-00839

Weather conditions and forecasts: National Oceanic and Atmospheric Administration (NOAA) site for the Philadelphia area http://graphical.weather.gov/sectors/phi.php#tabs.

## 2.6 SPECIAL SAMPLING CONCERNS

Because PFCs are also found in numerous everyday items, the following special precautions will be taken during all sampling activities:

- No use of Teflon®-containing materials (e.g., Teflon® tubing, bailers, tape, sample jar lid liners, plumbing paste)
- No Tyvek® clothing will be worn onsite
- Clothes treated with stain- or rain-resistant coatings will be avoided or go through several washings prior to use onsite
- No Post-It® notes will be brought onsite
- No fast food wrappers, disposable cups, or microwave popcorn will be brought onsite
- After handling any of the above items, field personnel will wash their hands thoroughly with soap and water prior to any sampling activities
- No use of chemical (blue) ice packs or foil will be allowed
- Any insect repellant or sunscreen used during PFC sampling should not contain any chemicals containing "fluor" in the ingredients list. Any insect repellant or sunscreen used during the sampling events will be applied downwind and well away from sample containers and sample collection equipment.

Nitrile gloves will be worn during all sample collection activities.

## 2.7 EQUIPMENT DECONTAMINATION

### 2.7.1 Groundwater

Prior to pump installation and collection of the each groundwater sample, the pump will be decontaminated and fitted with new ¼-in. polyethylene tubing, eliminating the need for field decontamination of the tubing.

Pump decontamination procedures are as follows:

1. Disassemble pump and dispose of used bladder
2. Tap water rinse



ED_004850_00001502-00840

3. Vigorously scrub all parts with brush and laboratory-grade standard detergent (e.g., Alconox®) and tap water
4. Generous rinse with tap water or store-purchased distilled/deionized water
5. Acetone rinse and air dry followed by rinse with laboratory-grade distilled/deionized water
6. Air dry
7. Install new bladder in the pump
8. Reassemble pump.

Water level measuring tapes and the flow-through cell will be decontaminated following above procedures in steps 2 through 6.

### 2.7.2 Surface Water

Dedicated ¼-in. low-density polyethylene (LDPE) tubing and polycarbonate mixing containers that will be used for collection of surface water samples will be supplied by the analytical laboratory. Therefore, there will be no decontamination of surface water sampling equipment in the field, except for the cleaning of the surface area of the work area and water sampler polyvinyl chloride (PVC) structures with a soapy solution (e.g., Alconox®) and rinsed with deionized water and water from the sample locations, respectively, prior to sampling.

### 2.7.3 Sediment

Before surface sediment sampling begins at a station, the grab sampler will be scrubbed with a standard detergent (e.g., Alconox®), rinsed with water (river, tap, or deionized water), air-dried, and rinsed with river water. Equipment used for compositing the sediment samples (i.e., stainless-steel pot, bowls, and spoons) will follow the same basic decontamination sequence, except that the final rinse will be with laboratory-grade distilled/deionized water. After cleaning, the decontaminated stainless-steel spoon will be placed inside the decontaminated stainless-steel pot and will be covered with the stainless-steel lid for the pot to protect it from possible contamination. The sediment sample collection equipment will be decontaminated immediately before it is used. Decontaminated equipment will not be stored prior to use.

Prior to subsurface sampling, all core liners will be washed in sequence with a standard detergent (e.g., Alconox®) rinsed with laboratory grade distilled/deionized water, and then air-dried. During storage and transport, decontaminated core liners will be capped at both ends to prevent contamination.

All non-dedicated sampling equipment that comes into contact with the sediment samples (e.g., core catchers, grab samplers, core liners, stainless-steel bowls, pots, and spoons) will be



ED_004850_00001502-00841

decontaminated prior to use and between samples. Non-dedicated sampling equipment will be decontaminated following procedures in SOP SD-01 (Attachment B2), except that no solvent rinse will be used.

### 2.7.4 Soil

Decontamination procedures for soil sampling are generally similar to those used for sediment sampling, except that equipment rinses will be conducted with deionized/distilled water and tap water. Soil samples will be collected from a 6-in. discrete interval from the disposable acetate liner using a decontaminated stainless-steel spoon and placed into laboratory-provided sampling containers.

All stainless steel macrocores will be decontaminated between intervals in sequence with a standard detergent and rinsed with laboratory grade distilled/deionized water.

Sampling spoons used to transfer core into laboratory-provided containers will be decontaminated before use and between samples. The sampling spoon will be decontaminated by scrubbing with standard detergent and tap water, rinsing with tap water, and rinsing with distilled water. Any other non-dedicated sampling equipment that comes into contact with the soil samples ore core liners will be decontaminated prior to use and between samples following procedures in SOP SD-01 (Attachment B2), except that no solvent rinse will be used.

## 2.8 GROUNDWATER SAMPLING

As discussed previously in Section 1.1, groundwater samples will be collected from selected Site wells for onsite sampling at the Solvay facility; wells identified as part of canvassing, and from new wells proposed to be installed as part of the work plan (Figure B-2 and Figure B-3, respectively). Samples will be collected directly into bottles provided by the certified contract laboratory from the sample port on the flow-through cell.

Low-flow purging and sampling methods will be employed to collect groundwater samples from Site wells identified in Table B-8. This method was selected based on prior use at the Site to collect VOC samples, reduced production of purge water, and limited disruption to groundwater conditions during sampling. Field procedures are to follow NJDEP and U.S. Environmental Protection Agency (EPA) guidance (NJDEP 2005; USEPA 2010). Unlike prior sampling events, no Teflon® disposable bladders or Teflon®-lined tubing will be used to minimize risk of PFC contamination from the sampling equipment. Easy to disassemble and clean low-flow bladder pumps with disposable polyethylene bladders will be employed for sample collection (e.g., Solinst 407 Integra). Dedicated or disposable ¼-in. polyethylene tubing will be used to avoid the need for decontamination of tubing.



ED_004850_00001502-00842

Pump intakes will be placed at the midpoint of the well screens and pumps will be secured with non-Teflon® coated cord.

### 2.8.1 Stabilization Parameters

As per NJDEP guidance, stabilization parameters will be monitored during purging to determine if well stability has been achieved prior to sampling. Purging will continue until respective measurements fall within the ranges stated below for three consecutive measurements or 4 hours have elapsed, at which time a sample will be collected and the attempts to reach stabilization documented. Measurements will be collected every 5–6 minutes.

| | |
|---|---|
| Drawdown | <0.3ft |
| pH | ±0.1 unit |
| Specific conductance | ±3% |
| Temperature | ±3% |
| Dissolved oxygen | ±10% |
| Turbidity | ±10% for values >1 NTU |
| ORP/Eh | ±10 millivolts. |

Care will be taken to minimize the length of tubing between the top of the well casing and the flow-through chamber. A low volume transparent flow-through cell will be used to allow visual observation of water conditions during purging. The flow-through cell will be connected such that water enters the bottom of the cell and exits the top.

Prior to connection of the flow-through cell, tubing will be flushed for up to 10 minutes while initial drawdown measurements are made. Probes used in the flow-through cell will be calibrated in the field prior to the day's sampling event by personnel certified for the collection of stabilization parameters in New Jersey.

Water level measurements will be recorded prior to pump installation. Following pump installation the water level probe will be suspended in the well at the point representing 0.3-ft drawdown. Water level readings will be recorded every 5 minutes at the time stabilization parameters are measured.

Pump installation will occur following initial water level measurements. Prior to installation, the pump will be properly decontaminated and fitted with appropriate tubing. Once the pump is prepared for installation, the pump will be lowered in a manner to minimize any disturbance to the well by slowly lowering the pump to the target sampling interval.

The purge rate will be set initially within a range of 100 mL/min to 500 mL/min. The initial few minutes of purge water will be discharge to the waste water container prior to connection to the flow-through cell. Tubing will be connected to the cell with the pump continuing to operate. If drawdown measurements indicate greater than 0.3 ft of drawdown, the pumping rate will be



ED_004850_00001502-00843

decreased, but not to less than 100 mL/min. Due to the highly permeable nature of the aquifer being sampled, it is not anticipated that drawdown to the well screen will occur. Following initial adjustments to the pumping rate, stabilization parameters will begin to be recorded.

## 2.9 SURFACE WATER SAMPLING

Surface water samples will be collected from 7 locations, 4 on Little Mantua Creek and 3 from the Main Ditch (See Figure B-4). Surface water samples will be collected prior to sediment sample collection at any given station. Surface water samples will be collected outside the main channel and from a single mid-depth interval at each sampling location. Prior to sampling, the water column length will be measured with a lead line from the boat deck or with a fathometer mounted on the research vessel's hull or by hand. Surface water samples will be collected using either a water collection bottle without Teflon® lining or by using a peristaltic pump and dedicated tubing that will be extended to the desired sampling depths (the depth of the channel and conditions of the surface water body at the time of sampling will dictate the sampling method.

To obtain the representative volume for sampling, the samples will be compositing in a mixing container and the appropriate sample bottles will be filled using a peristaltic pump, with the outflow directed into the sample bottle. Laboratory bottles will be pre-cleaned and any required preservatives will be placed in the specific bottles by the testing laboratory prior to shipping.

As stated above, the sample matrix table (Table B-2) shows the total number of sample jars for each analysis needed at each sampling station. Integral's field lead and field personnel in charge of sample handling will use this table as a quality control check to ensure that all samples at a given station are collected and that the appropriate sample container is used for each sample.

### 2.9.1 Sample Handling

Gloved hands are required for sample collection and handling, as described above. Field staff will wear appropriate non-contaminating, disposable, powderless nitrile gloves during the entire sampling operation. The field sampling team will change gloves frequently and before each surface water sample is collected.

Gloved hands are required for all operations that involve equipment that comes into contact with the surface water sample, including the following activities:

- Handling the sample bottle
- Handling the discharge end of the water collection bottle or sample tubing.



ED_004850_00001502-00844

The surface water samples will be placed in labeled, laboratory-cleaned sample containers (Table B-2). Each sample container will be clearly labeled with the task name, sample number, type of analysis to be performed, date and time, and initials of person(s) preparing the sample. Immediately after sample containers are filled, the samples will be stored on wet ice (4 ± 2°C) or as specified by the method; no chemical (blue) ice packs will be used during the sampling event. The sampling team leader is responsible for maintaining sample integrity throughout the sampling event.

### 2.9.2 Water Quality Measurements

In addition to surface water collection, general water quality parameters (i.e., water temperature, pH, dissolved oxygen, salinity, oxidation-reduction potential, turbidity, and conductivity) will be measured *in situ* at all sampling locations using a multi-probe (e.g., YSI 650/6600 or 6920 V2).

The multi-probe will be calibrated at the beginning of every day according to manufacturer specifications (see user manual). The name(s) of the person(s) performing the calibration will be recorded in the field logbook that is used during the sampling event. Calibration records must be kept so the results of the water quality monitoring are traceable. Information and general instructions for field measurement of water quality parameters are provided in SOP SW-06 (Attachment B2).

## 2.10 SEDIMENT SAMPLING

As discussed previously in Section 1.1, surface and subsurface sediment chemistry samples will be collected from Little Mantua Creek and the Main Ditch (see Figure B-4). In addition, sediments will also be collected for pore water sample extraction. Sediment samples will be collected outside the main channel. The following sections describe the sampling equipment, sampling methods, sample handling, and shipping for sediments.

### 2.10.1 Surface Sediment Sampling

Surficial sediment samples (0–6 in.; 0–15 cm) will be collected at the 7 proposed locations with a stainless-steel van Veen grab sampler (or equivalent type of equipment) depending upon the conditions encountered in the field. Sediment samples will be collected in accordance with standard methods used by USEPA (1997). Methods for surface sediment sampling are provided in SOPs SD-04 and SD-13 (Attachment B2).

One surface sediment sample will be collected at each station. The holding time requirements for the sediment samples following field collection are specified in Table B-2. The samples will



ED_004850_00001502-00845

be analyzed for the target analytes listed in Table B-1. Additional sediment from each station will be archived and stored at the laboratory for possible future analysis, if necessary.

At each co-located surface sediment and surface water station, additional sediment will also be collected for pore water analysis. This bulk sediment sample will be sent to Eurofins Lancaster for pore water extraction and analysis following their SOP. An aliquot of the pore water volume will be transferred into an appropriate sample container and analyzed for the parameters presented on Table B-1. An aliquot of the pore water will be shipped to AXYS for the analysis of PFCs. In addition a fraction of the volume may be archived for future analysis.

Material collected with the grab sampling device will be evaluated by the Integral field lead for acceptability using the following criteria:

- The sampler is not overfilled
- Overlying water may be present
- The overlying water (if present) is not excessively turbid
- The sediment surface is relatively undisturbed
- An adequate penetration depth is attained (i.e., to enable sampling of the undisturbed surface sediment).

If a sample fails to meet any of the above criteria, it will be rejected and discarded away from the station. Removal of material from the sample will be documented in the field log book.

After a sediment sample is judged to be acceptable, any overlying water will be siphoned off and the upper 6 in. (15 cm) of sediment will be collected in accordance with guidelines (USEPA 1997). Decontaminated stainless-steel spoons will be used to collect the sediment from the grab sampler. A stainless-steel ruler will be used to ensure that the sampling criterion for adequate penetration depth has been met and that the correct amount (i.e., 6 in. [15 cm]) of sediment has been removed from the grab sampler.

Surface sediments from the grab samples will be placed into a decontaminated, stainless-steel bowl and homogenized using a stainless-steel spoon or other stainless-steel mixing implement until the sediment attains a visually uniform color and texture. The sediment sample in the bowl will be covered with the lid until a sufficient volume of sediment (approximately 1 L per sample location) is collected. Sediment subsamples will then be removed for the various kinds of laboratory analyses and for archiving.

The composite surface sediment samples will be placed in labeled, laboratory-cleaned sample containers without Teflon®-lined lids (Table B-2). Each sample container will be clearly labeled with the task name, sample number, type of analysis to be performed, date and time, and initials of person(s) preparing the sample. Containers that will be frozen (i.e., archived samples)



ED_004850_00001502-00846

will have 0.5–1 in. (1.3–2.6 cm) of headspace above the sediment to prevent the jars from breaking during storage at the laboratory. Immediately after sample containers are filled, the samples will be stored on ice (4 ± 2°C) and within method specifications; no chemical (blue) ice packs will be used during the sampling event.

As stated above, the sample matrix table (Table B-2) shows the total number of sample jars for each analysis needed at each sampling station. Integral's field lead and field personnel in charge of sample handling will use this table as a quality control check to ensure that all samples at a given station are collected and that the appropriate sample container is used for each sample.

### 2.10.2 Subsurface Sediment Sampling

During subsurface sediment sampling, river gauge height and tides will be monitored using the following web sites:

- Real-time information on wind direction, wind speed, and river elevation: U.S. Geological Service National Water Information System (USGS - NWIS) http://waterdata.usgs.gov/nwis/sw
- Tides: NOAA site at http://tidesandcurrents.noaa.gov/.

Subsurface sediment will be collected at the 7 locations using a coring device (e.g., Wildco stainless steel hand corer, piston core, or equivalent type of equipment) depending on conditions encountered in the field. Sampling methods for potential subsurface sediment sampling methods that may be used during sample collection are provided in SOPs SD-08, SD-12, and SD-13 (Attachment B2), respectively.

A minimum of one core will be collected at each station. The holding time requirements for the sediment samples following field collection are specified in Table B-2. The samples will be analyzed for the target analytes listed in Table B-1. If there is a sufficient volume of sediment within a core interval, then additional sediment from each interval will be archived for possible future analysis, if necessary.

A minimum diameter of 3 in. (7.6 cm) will be used for all cores. The following sediment intervals in the core will be sampled: 0–6 in. (0–15 cm), 6–12 in. (15–30 cm), and 12–24 in. (30–61 cm) to refusal or to a maximum depth of 3 ft (91 cm). Any separate sediment horizons that are observed in the core will be noted on the field form (Attachment B3), but will not alter these collection intervals. Sediment will be collected from the entire sediment interval and a discrete sample from the composited, homogenized sediment will be collected. Shorter core lengths will be accepted if native materials are encountered, based on visual inspection of the core, or if multiple attempts (i.e., two attempts) at coring a given station does not provide the anticipated core length.



ED_004850_00001502-00847

The core's position will be monitored by observing the angle of the winch line while the corer is being lowered in the water column. When the inlet of the corer is approximately 2 m above the sediment, the corer will stop being lowered, the boat location confirmed, and the angle of the hydrowire determined. When the angle of the hydrowire is less than 5 degrees, the corer will be lowered into the sediment at a rate of 30 cm/s or less. If the weather is windy or tidal conditions warrant it, the boat will be anchored before the core is lowered. Cable will be released through the winch until there is slack in the line. If the boat drifts significantly (e.g., because of wind or tidal conditions), slack in the line will be permitted only briefly to prevent pulling the corer out at an angle.

The corer will be retrieved at a controlled rate to minimize agitation of the core. Retrieval will be stopped as soon as the top of the corer reaches the water surface. If a core catcher is not installed at the bottom end of the core, a plug may be inserted in the bottom end of the corer to prevent the core from slipping out when the corer is raised out of the water. The corer will be brought on board the sampling vessel and immediately stabilized to prevent it from tipping or falling. Care will be taken at all times to keep the corer in a vertical position. After the corer is secured onboard the sampling vessel, the Lexan® or polyethylene (or similar) liner that contains the sample will be removed from the corer barrel and inspected.

Each core will be evaluated by Integral's field lead for acceptability using the following criteria:

- The sediment surface is relatively undisturbed
- Any overlying water is not excessively turbid
- At least 80 percent core recovery relative to penetration is achieved.

If a sediment core fails to meet any of the above criteria, it will be rejected.

If less than 80 percent core recovery versus penetration is achieved, the recovered core will be retained but considered insufficient, and another attempt to recover a sediment core at the same station will be conducted. If the specified penetration depth is not achieved after two attempts, the station may be relocated slightly. If the slight relocation of the station does not improve the penetration depth, the station may be temporarily abandoned and Integral's project manager will be notified.

After the cores have been collected, both ends of the cores designated for chemical analysis will be securely capped; labeled with the station number, core section, and sediment orientation; and fastened in an upright position. The overlying water will be siphoned or drained off.

Processing of the core may occur either on the sampling vessel or at a specified location onshore. The core will be laid out horizontally on a clean work surface and will either be extruded or be cut lengthwise and the split core will be opened. All cores will be placed next to a tape measure and a station number and photographed. Each successful core sampled will be



ED_004850_00001502-00848

inspected for physical characteristics and each sampled interval described on a core profile form (see Attachment B3).

The sediment from each core section will be homogenized with a decontaminated stainless-steel mixing implement (e.g., spoon) until the sediment attains a visually uniform color and texture. The sediment sample in the decontaminated stainless-steel bowl until a sufficient volume of sediment (approximately 1 L per core interval) is collected. Sediment subsamples will then be removed for the various kinds of laboratory analyses and for archiving.

The subsurface sediment composite samples will be placed in labeled, laboratory-cleaned sample containers without Teflon®-lined lids (Table B-2). Each sample container will be clearly labeled with the task name, sample number, type of analysis to be performed, date and time, and initials of person(s) preparing the sample. Containers that will be frozen (i.e., archived samples) will have 0.5–1 in. (1.3–2.6 cm) of headspace above the sediment to prevent the jars from breaking during storage at the laboratory. Immediately after sample containers are filled, the samples will be stored on ice (4 ± 2°C); no chemical (blue) ice packs will be used during the sampling event.

As stated above, the sample matrix table (Table B-2) shows the total number of sample jars for each analysis needed at each sampling station. Integral's field lead and field personnel in charge of sample handling in the field will use this table as a quality control check to ensure that all samples at a given station are collected and that the appropriate sample container is used for each sample.

## 2.11 SOIL SAMPLING

Soil core samples will be collected from 18 direct-push borings at the Site (see Figure B-5). Soil cores will be laid out horizontally on a clean work surface. All cores will be placed next to a tape measure and a station number and photographed. Each successful core sampled will be inspected for physical characteristics and each sampled interval described on a core profile form (see Attachment B3).

Six-in. intervals of core will be collected using a stainless-steel spoon or similar sampling equipment and directly transferred into laboratory-provided containers. Ten of the soil borings will be analyzed for PFCs at a high resolution, with 1 sample per linear foot from ground surface to the water table (approximately 12 samples per boring). For the remaining eight borings, PFC analysis will be conducted at a lower resolution, with four samples analyzed from each boring (0–6 in., 2–2.5 ft below ground surface [bgs], 5–5.5 ft bgs, and 8–8.5 ft bgs). For these low-resolution borings, additional samples will be collected for batch sorption tests at the Integral laboratory. A total of 152 soil samples (not including duplicates) are anticipated to be collected for PFC analysis. Additionally, two samples from each boring will be collected for total organic carbon (TOC) and grain size analysis. The interval selected for analysis will be



ED_004850_00001502-00849

determined based on field observations. Soil samples will be collected in accordance with the NJDEP's *Field Sampling Procedures Manual* (NJDEP 2005). Methods for soil sampling are provided in the SOPs (Attachment B2).

Samples will be sent to AXYS and Eurofins for analysis of the analytes listed in Table B-1. Container types, method-recommended hold times, and minimum sample sizes are provided in Table B-2. Additional samples will be collected for sorption batch testing and will be shipped to the Integral laboratory in Louisville, Colorado. Sample containers will be clearly labeled with the task name, sample number, type of analysis to be performed, date and time, and initials of person(s) preparing the sample. Immediately after sample containers are filled, the samples will be stored on ice (4 ± 2°C) and/or within the method specifications; no chemical (blue) ice packs will be used during the sampling event.

As stated above, Table B-2 shows the total number of sample jars for each analysis needed at each sampling station. Integral's field lead and field personnel in charge of sample handling will use this table as a quality control check to ensure that all samples at a given station are collected and that the appropriate sample container is used for each sample.

### 2.11.1 Field Quality Control

Field quality control samples will be used to assess sample variability and evaluate potential sources of contamination. The types of quality control samples that will be collected for during the proposed sampling events are described in this section. Detailed information on quality assurance and quality control (QA/QC) procedures, limits, and reporting are described in detail in the QAPP. The estimated numbers of field quality control samples to be collected are listed in the sample matrix tables (Tables B-3, B-4, and B-5). If quality control problems are encountered, they will be brought to the attention of Integral's quality assurance coordinator. Corrective actions, if appropriate, will be implemented to meet the task's data quality indicators.

### 2.11.2 Groundwater

Field quality control samples for the groundwater investigation will include field duplicates, equipment blanks and field blanks. The procedures and rationale for collecting these samples are described below.

- **Field duplicate** – Sample will be used to assess the variability in concentrations of co-located samples due to the combined effects of sample processing in the field and laboratory as well as chemical analysis. Field duplicates will be prepared by collecting two aliquots for the sample and submitting them for analysis as separate samples. A blind field duplicate sample will be collected at a rate of 1 duplicate per 20 samples



ED_004850_00001502-00850

(sample delivery group). Samples will be assigned unique numbers and will not be identified as field duplicates to the laboratory.

- **Equipment blank** – Sample will be collected to help identify possible contamination from the sampling environment or from the decontaminated sampling equipment (e.g., pump). Equipment blanks will be collected for at least 10 percent of the groundwater wells.

  The equipment blank will be collected by filling a 1,000-mL decontaminated, graduated cylinder with distilled/deionized water supplied by the laboratory performing the analysis. A decontaminated pump will be placed into the graduated cylinder with sample tubing and plumbing fittings attached. The required field blank samples will then be collected by operating the pump. As water is removed from the cylinder, additional distilled/deionized water will be added as needed until sufficient sample volume has been collected to perform the required analyses. Due to the larger water volumes required, field blank water may not be supplied in the same identical containers as the sample being collected, as provided for by NJDEP guidance for low-flow purging and sampling.

- **Field (or environmental) blank** – Sample will be prepared in the field to evaluate potential background concentrations present in the air and in the distilled/deionized water used for the final decontamination rinse. One field blank will be collected during the sample event (i.e., at the time that groundwater is being collected into the sample bottle) at a frequency of one field/environmental blank per sample event.

  The environmental blank will be prepared by opening the laboratory-prepared sample bottle while at a sample collection site during sample collection, filling the sample bottle with distilled/deionized water, and then sealing it. The environmental blank will be assigned a unique sample number, and the labeled bottle will be sent to the laboratory with the field samples.

### 2.11.3 Surface Water

Field quality control samples for the surface water investigation will include the same types of samples as used for groundwater. The procedures and rationale for collecting these samples are described below.

- **Field duplicate** – Sample will be used to assess the variability in concentrations of co-located samples due to the combined effects of sample processing in the field and laboratory as well as chemical analysis. Field duplicates will be prepared by collecting two aliquots for the sample and submitting them for analysis as separate samples. A blind field duplicate sample will be collected at a rate of 1 duplicate per 20 samples (sample delivery group). Samples will be assigned unique numbers and will not be identified as field duplicates to the laboratory.



ED_004850_00001502-00851

- **Equipment blank** – Sample will be collected to help identify possible contamination from the sampling environment or from the decontaminated sampling equipment (e.g., pump). Equipment blanks will be collected for at least 10 percent of the surface water sample locations.

  The equipment blank will be collected by rinsing the decontaminated sample collection equipment with distilled/deionized water and collecting the rinsate.

- **Field (or environmental) blank** – Sample will be prepared in the field to evaluate potential background concentrations present in the air and in the distilled/deionized water used for the final decontamination rinse. One field blank will be collected during the sample event (i.e., at the time that surface water is being collected into the sample bottle) at a frequency of one field/environmental blank per sample event.

  The environmental blank will be prepared by opening the laboratory-prepared sample bottle while at a sample collection site during sample collection, filling the sample bottle with distilled/deionized water, and then sealing it. The environmental blank will be assigned a unique sample number, and the labeled bottle will be sent to the laboratory with the field samples.

### 2.11.4 Sediment

Field quality control samples for sediment samples will include field duplicate samples, equipment blanks, travel blanks, and field blanks. In addition to the blanks prepared in the field, distilled/deionized water blanks and bottle blanks will be analyzed by the laboratory to assess potential contamination from the laboratory supplied water and sampling containers. The procedures and rationale for collecting these samples are described below.

- **Field duplicate** – Samples will be used to assess the variability in concentrations of co-located samples due to the combined effects of sample processing in the field and laboratory as well as chemical analysis. Field duplicates will be prepared by collecting two aliquots for the sample and submitting them for analysis as separate samples. Blind duplicate (field split samples) will be collected at a minimum frequency of 1 duplicate per 20 samples (sample delivery group). Samples will be assigned unique numbers and will not be identified as field splits to the laboratory. Field duplicate samples will be collected from both surface and subsurface sediment samples for chemical analysis. A minimum of one field split sample will be collected for each kind of sample collected.
- **Equipment blank** – Samples will be collected to help identify possible contamination from the sampling environment or from the sampling equipment (e.g., stainless-steel grab sampler, coring device, spoons, bowls, and pots). Equipment blanks will be generated at approximately 10 percent of the sediment sampling stations at a minimum. Field equipment blanks will be collected from equipment used to collect both surface and subsurface sediment samples for chemical analysis. All equipment blank samples



ED_004850_00001502-00852

will be clearly noted in the field log (e.g., sample identifier, equipment type, date and time of collection, analysis, and filter lot number).

The equipment blank will be collected by rinsing the decontaminated sample collection equipment (grab sampler or corer and sample compositing equipment [stainless-steel bowl or pot, and spoon]) with distilled/deionized water and collecting the rinsate.

### 2.11.5 Soil

Field quality control samples for soil will include field duplicate samples, equipment blanks, travel blanks, and field blanks. In addition to the blanks prepared in the field, distilled/deionized water blanks and bottle blanks will be analyzed by the laboratory to assess potential contamination from the laboratory supplied water and sampling containers. The procedures and rationale for collecting these samples are described below.

- **Field duplicate** – Samples will be used to assess the variability in concentrations of co-located samples due to the combined effects of sample processing in the field and laboratory as well as chemical analysis. Field duplicates will be prepared by collecting two aliquots for the sample and submitting them for analysis as separate samples. Blind duplicate (field split samples) will be collected at a frequency of 1 duplicate per 20 samples (sampler delivery group) of the low resolution sampling. Samples will be assigned unique numbers and will not be identified as field splits to the laboratory. A minimum of one field split sample will be collected for each kind of sample collected.
- **Equipment blank** – Samples will be collected to help identify possible contamination from the sampling environment or from the sampling equipment (e.g., stainless-steel grab sampler, coring device, spoons, bowls, and pots). Equipment blanks will be generated at approximately 10 percent of the sediment sampling stations (a minimum of 4 total). Field equipment blanks will be collected from equipment used to collect both surface and subsurface sediment samples for chemical analysis. All equipment blank samples will be clearly noted in the field log (e.g., sample identifier, equipment type, date and time of collection, analysis, and filter lot number).

  The equipment blank will be collected by rinsing the decontaminated sample collection equipment with distilled/deionized water and collecting the rinsate.

## 2.12 SAMPLE PACKAGING AND TRANSPORT

As mentioned above, sample coolers and packing materials will be supplied by the analytical laboratories. Individual sample jars will be labeled and placed into plastic bags and sealed. Samples will then be packed in a cooler lined with a large plastic bag. Glass jars will be packed to prevent breakage and separated in the cooler by bubble wrap or other shock-absorbent material. Ice in sealed plastic bags will then be placed in the cooler to maintain a temperature of



ED_004850_00001502-00853

approximately 4°C (±2°C) or in accordance with the specific method requirements. When the cooler is full the COC form will be placed into a zip-locked bag and taped to the inside lid of the cooler for shipment. A temperature blank will be added to each cooler. Each cooler will be sealed with two COC seals, one each on the front and side of the cooler.

The shipping containers will be clearly labeled (i.e., name of task, time and date container was sealed, person sealing the cooler, and company name and address) for positive identification. These packaging and shipping procedures are in accordance with U.S. Department of Transportation regulations (49 CFR 173.6 and 49 CFR 173.24). Coolers containing samples for chemical analyses will be transported to the laboratory by courier or overnight shipping service.

After the samples have been received by the laboratory, they will be stored under refrigeration (4 ± 2°C) or in accordance with the specific method requirements. Archive sediment samples collected from each composite sample for possible future analysis will be stored frozen at –20°C.

## 2.13 STUDY DERIVED WASTES

Any excess phosphate-free, detergent-bearing liquid wastes from decontamination will be deposited in the vicinity of the collection area. Purge water from the groundwater sample collection process will be containerized in drums and temporarily stored at a secure location in the plant for treatment and disposal via the onsite treatment system. Any surface or subsurface sediment present at the end of the sampling event or other non-liquid investigation derived waste will be managed by the Site. This study derived waste will be containerized (e.g., 55-gal drums) and disposed of in accordance with Federal and State requirements using a NJDEP-licensed waste disposal company.



ED_004850_00001502-00854

# 3 FIELD DOCUMENTATION

The integrity of each sample from the time of collection to the point of data reporting must be maintained. Proper record-keeping and COC procedures will allow samples to be traced from collection to final disposition. Representative photographs will be taken of each area where samples are collected. A photograph will be taken of each surface sediment sample and each subsurface sediment interval collected for testing. Site photographs from various angles and close-up views of the overall conditions will also be collected.

## 3.1 FIELD LOGBOOK

All field activities and observations will be noted in a logbook. The field logbook will be a bound document and may contain individual field and sample log forms (depending on the sampling activity). Information will include personnel, date, time, well or station number, sampler, types of samples collected, and general observations. Any changes that occur during sampling (e.g., personnel, responsibilities, or deviations from the FSP) and the reasons for these changes will be documented. The logbook will identify onsite visitors (if any) and the number of photographs taken at each station. Integral's field lead is responsible for ensuring that the respective field logbook for each kind of media sampled and all field data forms are correct. Requirements for log book entries will include the following:

- Logbooks will be bound, with consecutively numbered pages
- Removal of any pages, even if illegible, will be prohibited
- Entries will be made legibly with black (or dark) waterproof ink
- Unbiased, accurate language will be used
- Entries will be made while activities are in progress or as soon afterward as possible (the date and time that the notation is made should be recorded, as well as the time of the observation itself)
- Each consecutive day's first entry will be made on a new, blank page
- The date and time, based on a 24-hour clock (e.g., 0900 for 9:00 a.m. and 2100 for 9:00 p.m.), will appear on each page.

In addition to the preceding requirements, the person recording the information must sign and date each page of the field logbook during each sampling day. If more than one individual makes entries in the logbook on any given day, then each recorder must initial and date their respective entries.



ED_004850_00001502-00855

Logbook corrections will be made by drawing a single line through the original entry, allowing the original entry to be read. The corrected entry will be written alongside the original. Corrections will be initialed and dated and may require a footnote for explanation.

The type of information that may be included in the field logbook and/or field data forms includes the following:

**All Types of Sampling**

- Task name and task number
- Start date and end date
- Weather conditions
- Name of person making entries and other field staff
- Onsite visitors, if any
- Observations made during sample collection, including any complications, and other details associated with the sampling effort.

Specific information on each type of sampling activity that will be recorded in the field logbook is provided below.

**Groundwater Sampling**

- Calibration and QA/QC results for field instruments used
- Description of all sampling/water quality monitoring equipment used including make, model, and material types for equipment contacting groundwater (e.g., tubing, bladder, pump body, and seals, cord)
- Water conditions including approximate air temperature
- For each well sampled the following will be noted:
  - Well number, sample identifier, and sample number
  - Date and time of sample collection
  - Measuring point description
  - Static water level, date, time, and measurement technique prior to pump installation
  - Presence and thickness of any nonaqueous-phase liquid encountered
  - Pump depth
  - Pumping rate
  - Water quality parameters, time, and drawdown at 5-minute intervals



ED_004850_00001502-00856

- Low-flow sampling data sheets will be generated at each onsite monitoring well during sampling
- Any observations or problems encountered.

**Surface Water and Sediment Sampling**

- Sampling vessel, if any
- Station number, sample identifier, and sample number for each sample to be submitted for laboratory analysis
- Date and collection time of each sample
- The specific date and time with corresponding station number associated with the coordinates derived from DGPS
- The sample number, date and time of collection, equipment type, and the lot number for the box of filter papers used for field quality control samples
- Sample description (source and appearance, such as color, oil sheens, odor, and other debris, and sediment type, presence of anthropogenic material and presence and type of biological structures)
- Sediment penetration depth (nearest 0.5 cm) based on sediment depth at the center of the excavation
- Any visible debris near any of the sampling stations
- Any surface vegetation or debris that is removed from the sampling station prior to sampling
- The locations of any surface water runoff or seeps that are located near any of the sampling stations.

In addition, a sampling station map will be updated during each sampling activity and will be maintained throughout each sampling event. All log books must be completed at the time that any observations are made. Copies of all log books and forms will be retained by the technical team.

## 3.2 CHAIN-OF-CUSTODY PROCEDURES

Samples are in custody if they are in the custodian's view, stored in a secure place with restricted access, or placed in a container secured with custody seals (see SOP AP-03, Attachment B2). A COC record will be signed by each person who has custody of the samples and will accompany the samples at all times. Copies of the COC will be included in laboratory and QA/QC reports. Attachment B3 contains an example of the COC form that will be used during the proposed field events.



ED_004850_00001502-00857

At a minimum, the form will include the following information:

- Site name or contract number
- Field lead's name and team members responsible for collection of the listed samples
- Collection date and time for each sample
- Sample type (i.e., sample for immediate analysis or archive)
- Requested analyses
- Sample preservation information (if any)
- Name of the carrier relinquishing the samples to the transporter, noting date and time of transfer and the designated sample custodian at the receiving facility.

Integral's field lead (or delegate) will be the designated field sample custodian for each sampling event and will be responsible for all sample tracking and COC procedures for the samples collected in the field. The field sample custodian will be responsible for final sample inventory and will maintain sample custody documentation. The field sample custodian will complete COC forms prior to removing samples from the field. Upon transferring samples to the laboratory sample custodian (if a local laboratory is selected) or shipping courier (as appropriate), the field sample custodian will sign, date, and note the time of transfer on the COC form. The original COC form will be transported with the samples to the laboratories. All samples will be shipped to the testing laboratories in coolers sealed with custody seals.

Each laboratory will designate a sample custodian who will be responsible for receiving samples and documenting their progress through the laboratory analytical process. The sample custodian for each laboratory will establish the integrity of the custody seals upon sample arrival at the laboratory. The laboratory sample custodian will also ensure that the COC and sample tracking forms are properly completed, signed, and initialed upon receipt of the samples.

When the laboratory receives the samples, the laboratory sample custodian will conduct an inventory by comparing sample labels to those on the COC document. The custodian will enter the sample number into a laboratory tracking system by task code and sample designation. The custodian will assign a unique laboratory number to each sample and will be responsible for distributing the samples to the appropriate analyst or for storing samples at the correct temperature in an appropriate secure area.

## 3.3 WELL AND SAMPLE LOCATION NUMBERING

All wells and sample locations will be assigned a unique identification code based on a designation scheme designed to suit the needs of the field personnel, data management, and



ED_004850_00001502-00858

data users. Groundwater sample locations will be labeled using the previously assigned well designations. Surface water and sediment location numbers will begin with "SESW" to indicate a collocated surface water and sediment location. Soil sample location numbers will begin with SB15 to indicate soil borings collected in 2015.

Well or station numbers will not be recorded on sample labels or COC forms to prevent analytical laboratories from seeing the relationships between samples and stations.

## 3.4 SAMPLE IDENTIFIERS

Each sample from a given well or location will also have a unique label identifier. Sample identifiers will be established before field sampling begins and assigned to each sample as it is collected. Sample identifiers consist of codes designed to fulfill three purposes: 1) to identify related samples (i.e., field split samples) to ensure proper data analysis and interpretation; 2) to obscure the relationships between samples so that laboratory analysis will be unbiased by presumptive similarities between samples; and 3) to track individual sample containers to ensure that the laboratory receives all of the material associated with a single sample. To accomplish these purposes, each container is assigned a sample number and a tag number. These codes and their uses are described below:

- A sample identifier for each sample will be created as follows: the well or station number (e.g., MW-4X), followed by the month, day, and year that the sample was collected (e.g., 030115), and this would be followed by a two-letter code for the kind of sample collected at a given station (GW = groundwater, SW= surface water, SL = Soil, GR = sediment grab sample, CR = sediment core sample). In addition, subsurface core samples will also have a final series of numbers attached to the sample identifier that will distinguish between the different sample intervals of the core (e.g., 0–6 in. [0–15 cm], 6–12 in. [15–30 cm], 12–24 in. [30–61 cm], and 24–36 in. [61–91 cm]). An example sample identifier for a groundwater sample collected on March 1, 2015 at Well M/H-1D would be M/H-1D-030115-GW. Example sample identifiers for a co-located surface water and surface sediment sample would be SESW001-030115-SW, and SESW001-030115-GR. Example sample identifiers for sediment samples at a coring station would be SESW007-030115-CR-0-15, and so on.

- The sample number is an arbitrary number assigned sequentially to each sample collected (e.g., GW0001, GW0002, SW0001, SW0002, SD0001, SD0002). All subsamples of a composited field sample will have the same sample number. Each field split sample will have a different sample number, and the sample numbers of related field quality control samples may not share any content. The sample number will appear on the sample containers and the COC forms.



ED_004850_00001502-00859

- A unique numeric sample tag number will be attached to each sample container. The tag number is a preprinted number on the sample label. If the amount of material (i.e., everything associated with a single sample number) is too large for a single container, each container will have the same sample number and a different sample label with a unique sample tag number. A sample will also be split between containers if a different preservation technique is used for each container (i.e., because different analyses will be conducted). The tag number will appear on the COC forms. Tag numbers will be used by laboratories only to confirm that they have received all of the containers that were filled and shipped. Data will be reported by sample number.
- For equipment blanks, sequential numbers starting at 1000 will be assigned instead of station numbers. For example, the first equipment blank for a surface sediment sample collected with a grab sampler will be labeled as SDEQ-1000G, whereas the second equipment blank for a subsurface sediment sample collected with a coring device will be labeled as SDEQ-1001C (SD = sediment, EQ = equipment blank, G = grab sampler, and C = core). Other types of field quality control blanks will be numbered in a similar fashion: FB = field blank.



ED_004850_00001502-00860

# 4 FIELD DATA MANAGEMENT AND REPORTING PROCEDURES

During field operations, effective data management is critical to providing consistent, accurate, and defensible data and data products. Daily field records (a combination of field logbooks, field forms, if any, and COC forms) will make up the main documentation for field activities. Upon completion of sampling, field notes, data sheets (if any), and COC forms will be scanned to create an electronic record. Field data will be manually entered into the project database. One hundred percent of the transferred data will be verified based on hard copy records. Electronic quality assurance checks to identify anomalous values will also be conducted following entry.

A spreadsheet summarizing the validated PFC results and a map showing sample locations will be provided to NJDEP after each quarterly public water system (PWS) sampling event.



ED_004850_00001502-00861

# 5 REFERENCES

ERM. 2013. Free/residual product and ground water interim remedial investigation submittal. Solvay Specialty Polymers USA, LLC West Deptford, NJ Facility ISRA Case Nos. E89231, E90205, Program Interest No. 015010. Environmental Resources Management, Trenton, NJ.

MacGillivray, A.R. 2012. Contaminants of emerging concern in the tidal Delaware River, pilot monitoring study 2007–2009. Delaware River Basin Commission, West Trenton, NJ.

NJDEP. 2005. Field sampling procedures manual. New Jersey Department of Environmental Protection, Trenton, NJ.

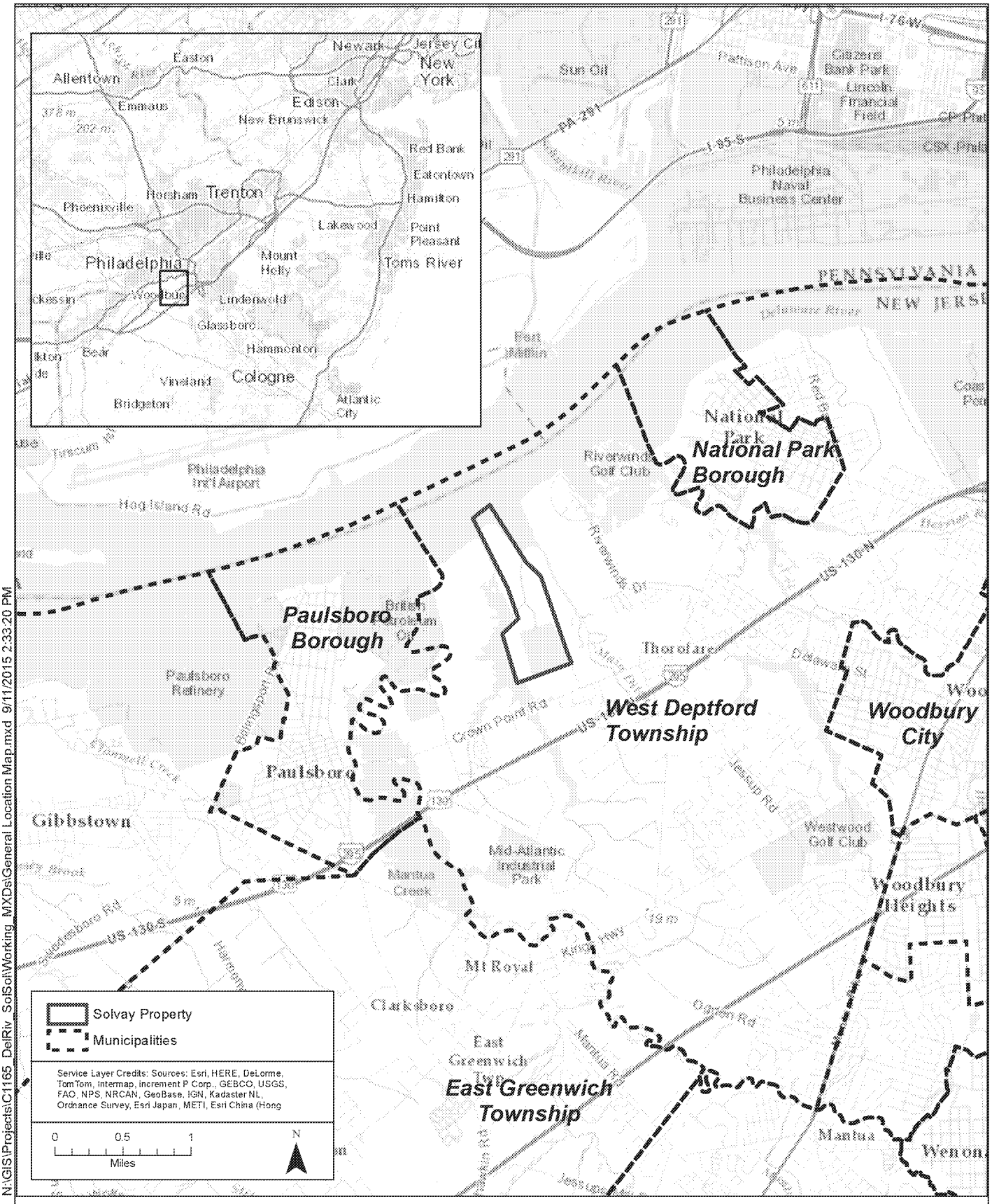
USEPA. 1997. Recommended quality assurance and quality control guidelines for the collection of environmental data in Puget Sound. In: Recommended protocols for measuring selected environmental variables in Puget Sound. U.S. Environmental Protection Agency, Puget Sound Estuary Program, Seattle, WA.

USEPA. 2010. Low stress (low flow) purging and sampling procedures for the collection of groundwater samples from monitoring wells. U. S. Environmental Protection Agency, Washington, DC. Revised January 19, 2010.



ED_004850_00001502-00862

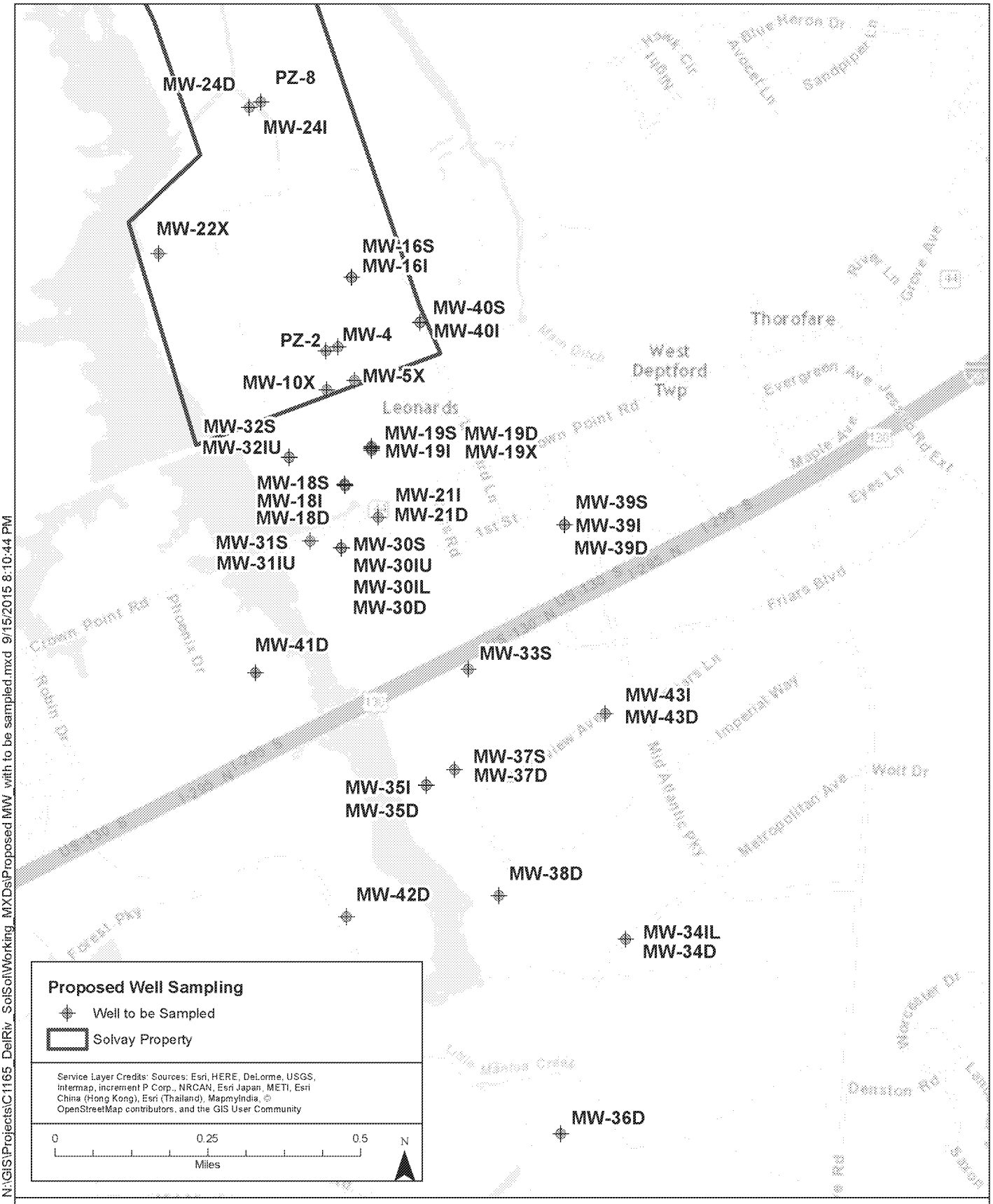
# FIGURES




N:\GIS\Projects\C1165_DelRiv_SolSol\Working_MXDs\General Location Map.mxd 9/11/2015 2:33:20 PM

integral consulting inc.

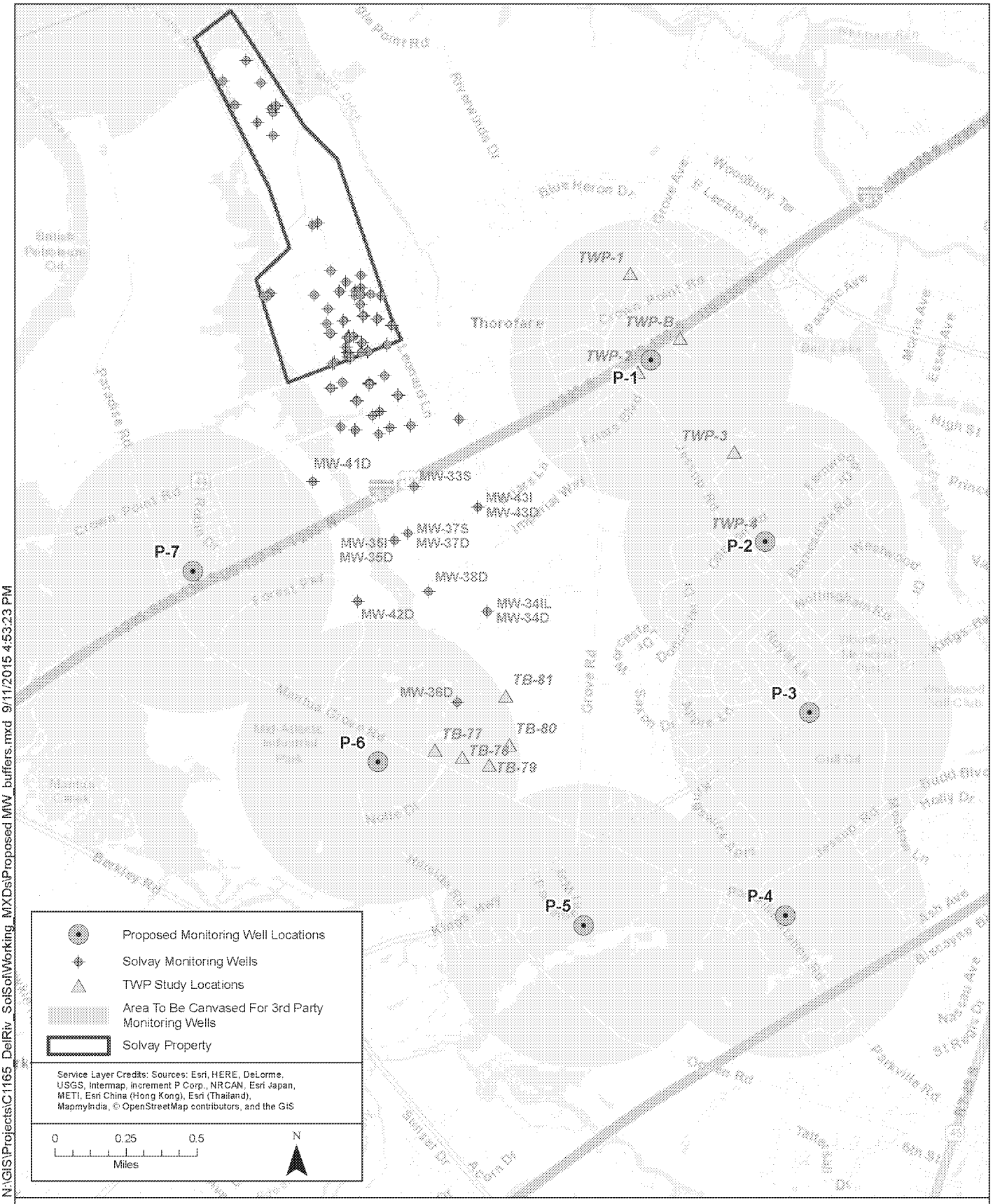
**Figure B-1.**
Location Map




N:\GIS\Projects\C1165_DelRiv_SolSol\Working_MXDs\Proposed MW_with to be sampled.mxd 9/15/2015 8:10:44 PM

integral

**Figure B-2.**
Proposed Monitoring Well Sampling Locations




N:\GIS\Projects\C1165_DelRiv_SolSol\Working_MXDs\Proposed MW_buffers.mxd 9/11/2015 4:53:23 PM

integral consulting inc.

Notes:
All monitoring well locations are approximate pending access considerations and negotiations with property owners.

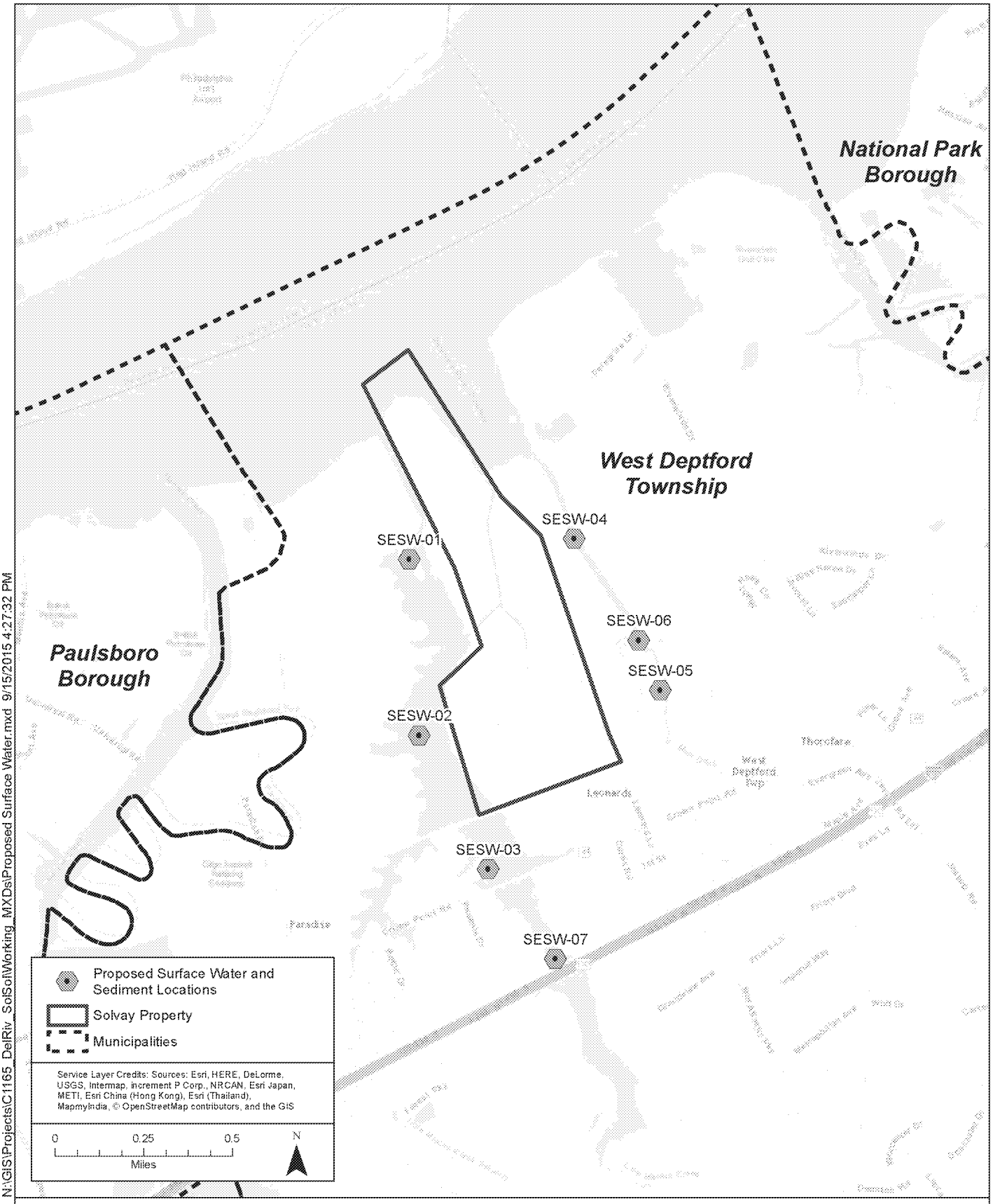
Each location will include a well couplet with anticipated screen zones corresponding to the top and base of the UPRM.

**Figure B-3.**
Proposed Monitoring Well Locations and Areas to be Canvassed for Existing Monitoring Wells

N:\GIS\Projects\C1165_DelRiv_Sol\Sol\Working_MXDs\Proposed Soil Borings_2.mxd 9/15/2015 4:17:45 PM

integral consulting inc.

**Figure B-4.**
Proposed Soil Boring Locations




N:\GIS\Projects\C1165_DelRiv_SolSol\Working_MXDs\Proposed Surface Water.mxd 9/15/2015 4:27:32 PM

integral consulting inc.

**Figure B-5.**
Surface Water and Sediment Sample Locations

# TABLES

Table B-1. Chemicals of Interest

| Analyte | CAS Number | Matrix | | | | |
|---|---|---|---|---|---|---|
| | | Groundwater | Pore Water | Surface Water | Sediment | Soil |
| **PFCs** | | | | | | |
| Perfluorooctanoic acid (PFOA;C8) | 335-67-1 | X | X | X | X | X |
| Perfluorononanoic acid (PFNA;C9) | 375-95-1 | X | X | X | X | X |
| Perfluorodecanoic acid (PFDA; C10) | 335-76-2 | X | X | X | X | X |
| Perfluoroundecanoic acid (PFUnDA; C11) | 2058-94-8 | X | X | X | X | X |
| Perfluorododecanoic acid (PFDoDA; C12) | 307-55-1 | X | X | X | X | X |
| Perfluorooctanesulfonic acid (PFOS; C8) | 1763-23-1 | X | X | X | X | X |
| **Conventional Parameters** | | | | | | |
| Anions | | | | | | |
| Bromide | 24959-67-9 | X | X | X | -- | -- |
| Chloride | 16887-00-6 | X | X | X | -- | -- |
| Fluoride | 16984-48-8 | X | X | X | -- | -- |
| Sulfate | 14808-79-8 | X | X | X | -- | -- |
| Cations | | | | | | |
| Calcium | 7440-70-2 | X | X | X | -- | -- |
| Iron | 7439-89-6 | X | X | X | -- | -- |
| Magnesium | 7439-95-4 | X | X | X | -- | -- |
| Manganese | 7439-96-5 | X | X | X | -- | -- |
| Sodium | 7440-23-5 | X | X | X | -- | -- |
| Potassium | 7440-09-7 | X | X | X | -- | -- |
| Total organic carbon | 7440-44-0 | -- | -- | X | X | X |
| Total suspended solids | -- | X | -- | X | -- | -- |
| Total dissolved solids | -- | -- | -- | X | -- | -- |
| pH | 12408-02-5 | X | X | X | -- | -- |
| Alkalinity | -- | X | -- | -- | -- | -- |
| Grainsize | -- | -- | -- | -- | X | X |

Notes:
CAS = Chemical Abstracts Service registry number
PFC = perfluoroalkyl compound
X = samples will be collected and analyzed for these parameters
-- = not available



ED_004850_00001502-00870

Table B-2. Sample Containers, Preservation, and Holding Time Requirements

| Analyses | Container [a] Type | Container [a] Size | Preservation | Holding Time | Minimum Sample Size |
|---|---|---|---|---|---|
| **Water Samples (Groundwater, Pore Water, Surface Water)** | | | | | |
| PFCs | HDPE | 2 x 500 mL<br>1 x 50 mL | < 10°C | 60 days to extraction<br>30 days from extraction to analysis | 500 mL |
| Cations (calcium, iron, magnesium, manganese, sodium, potassium) | HDPE | 250 mL | 4 ± 2°C, $HNO_3$ to pH<2 | 6 months | 100 mL |
| Anions (bromide, chloride, sulfate) | Glass | 2 x 40 mL | 4 ± 2°C | 28 days | 40 mL |
| Fluoride | HDPE | 2 X 500 mL | 4 ± 2°C | 28 days | 100 mL |
| Total dissolved solids | | | | 7 days | 100 mL |
| Total organic carbon | AG | 2 x 40 mL | 4 ± 2°C, $H_3PO_4$ to pH<2 | 28 days | 40 mL |
| Total suspended solids | HDPE | 1,000 mL | 4 ± 2°C | 7 days | 100 mL |
| pH | HDPE | 250 mL | 4 ± 2°C | Analyze immediately | 100 mL |
| Alkalinity | | | | 14 days | 50 mL |
| **Sediment and Soil Samples** | | | | | |
| PFCs | Wide Mouth HDPE | 250 mL | < 10°C | 1 year to extraction<br>30 days from extraction to analysis | 10 g |
| Grainsize | WMG | 16 oz. | 4 ± 2°C | 6 months | 500 g |
| Total organic carbon | WMG | 4 oz. | 4 ± 2°C | 28 days | 3 g |

Notes:
AG = amber glass
HDPE = high density polyethylene
$HNO_3$ = nitric acid
$H_3PO_4$ = phosphoric acid
PFC = perfluoroalkyl compound
WMG = wide mouth glass

[a] The size and number of containers may be modified by the analytical laboratory.



ED_004850_00001502-00871

Table B-3. Field Sample Collection Matrix for Groundwater (Onsite and Offsite Wells)

| | | | | Groundwater Chemistry | | | | | | | Equipment Rinsate Blank/Environmental Field Blank | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PFCs (C8 to C13) | | | | | | | PFCs (C8 to C14) | | |
| | | | | 3 Sample Bottles | | | Bromide, chloride, fluoride, sulfate | Calcium, iron, magnesium, manganese, sodium and potassium | TSS | Alkalinity | 3 Sample Bottles | | |
| | | | | 500 mL HDPE [b] | 500 mL HDPE [b] | 50 mL HDPE [b] | 60 mL HDPE [b] | 500 mL HDPE [b] | 1,000 mL HDPE [b] | 1,000 mL HDPE [b] | 500 mL HDPE [b] | 500 mL HDPE [b] | 50 mL HDPE [b] |
| Well Number [a] | Sample ID [d] | Sample Number | Sample Type [a] | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated |
| MW-4 | MW-4- xxxxxx-GW | GW-0100 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-5X | MW-5X- xxxxxx-GW | GW-0101 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-10X | MW-10X- xxxxxx-GW | GW-0102 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-16I | MW-16I- xxxxxx-GW | GW-0103 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-16S | MW-16S- xxxxxx-GW | GW-0104 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-22X | MW-22X- xxxxxx-GW | GW-0105 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-40S | MW-40S- xxxxxx-GW | GW-0106 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-40I | MW-40I- xxxxxx-GW | GW-0107 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| PZ-2 | PZ-2- xxxxxx-GW | GW-0108 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-18D | MW-18D- xxxxxx-GW | GW-0109 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| EQ Blank | EQ Blank- xxxxxx-GW | EQ-0001 | Equipment rinsate blank [e] | NA | NA | NA | NA | NA | NA | NA | Tag #_____ | Tag #_____ | Tag #_____ |
| MW-18I | MW-18I- xxxxxx-GW | GW-0111 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-18S | MW-18S- xxxxxx-GW | GW-0112 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ |
| MW-19D | MW-19D- xxxxxx-GW | GW-0113 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-19I | MW-19I- xxxxxx-GW | GW-0114 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-19S | MW-19S- xxxxxx-GW | GW-0115 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-19X | MW-19X- xxxxxx-GW | GW-0116 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-21D | MW-21D- xxxxxx-GW | GW-0117 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-21I | MW-21I- xxxxxx-GW | GW-0118 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-30S | MW-30S- xxxxxx-GW | GW-0119 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-30IU | MW-30IU- xxxxxx-GW | GW-0120 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-30IU | MW-30IU- xxxxxx-GW | GW-0121 | Field duplicate [g] | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-30IU | MW-30IU- xxxxxx-GW | GW-0120MS | Matrix spike | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA | NA | NA | NA |
| MW-30IU | MW-30IU- xxxxxx-GW | GW-0210MSD | Matrix spike duplicate | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA | NA | NA | NA |
| EQ Blank | EQ Blank- xxxxxx-GW | EQ-0002 | Equipment rinsate blank [e] | NA | NA | NA | NA | NA | NA | NA | Tag #_____ | Tag #_____ | Tag #_____ |
| MW-30IL | MW-30IL- xxxxxx-GW | GW-0121 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-30D | MW-30D- xxxxxx-GW | GW-0122 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |

Table B-3. Field Sample Collection Matrix for Groundwater (Onsite and Offsite Wells)

| | | | | Groundwater Chemistry | | | | | | | Equipment Rinsate Blank/Environmental Field Blank | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PFCs (C8 to C13) | | | | | | | PFCs (C8 to C14) | | |
| | | | | 3 Sample Bottles | | | Bromide, chloride, fluoride, sulfate | Calcium, iron, magnesium, manganese, sodium and potassium | TSS | Alkalinity | 3 Sample Bottles | | |
| | | | | 500 mL HDPE [b] | 500 mL HDPE [b] | 50 mL HDPE [b] | 60 mL HDPE [b] | 500 mL HDPE [b] | 1,000 mL HDPE [b] | 1,000 mL HDPE [b] | 500 mL HDPE [b] | 500 mL HDPE [b] | 50 mL HDPE [b] |
| Well Number [a] | Sample ID [d] | Sample Number | Sample Type [a] | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated |
| MW-31S | MW-31S- xxxxxx-GW | GW-0123 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-31IU | MW-31IU- xxxxxx-GW | GW-0124 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-32S | MW-32S- xxxxxx-GW | GW-0125 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-32IU | MW-32IU- xxxxxx-GW | GW-0126 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-33S | MW-33S- xxxxxx-GW | GW-0127 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-34IL | MW-34IL- xxxxxx-GW | GW-0128 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-34D | MW-34D- xxxxxx-GW | GW-0129 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| EQ Blank | EQ Blank- xxxxxx-GW | EQ-0003 | Equipment rinsate blank [e] | NA | NA | NA | NA | NA | NA | NA | Tag #_____ | Tag #_____ | Tag #_____ |
| MW-35I | MW-35I- xxxxxx-GW | GW-0130 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | | | |
| MW-35D | MW-35D- xxxxxx-GW | GW-0131 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-36D | MW-36D- xxxxxx-GW | GW-0132 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-37S | MW-37S- xxxxxx-GW | GW-0133 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-37D | MW-37D- xxxxxx-GW | GW-0134 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-38D | MW-38D- xxxxxx-GW | GW-0135 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-39S | MW-39S- xxxxxx-GW | GW-0136 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-39I | MW-39I- xxxxxx-GW | GW-0137 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-39D | MW-39D- xxxxxx-GW | GW-0138 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-40S | MW-40S- xxxxxx-GW | GW-0139 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-40I | MW-40I- xxxxxx-GW | GW-0140 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-40I | MW-40I- xxxxxx-GW | GW-0141 | Field duplicate [g] | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-40I | MW-40I- xxxxxx-GW | GW-0142MS | Matrix spike | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA | NA | NA | NA |
| MW-40I | MW-40I- xxxxxx-GW | GW-0142MSD | Matrix spike duplicate | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA | NA | NA | NA |
| EQ Blank | EQ Blank- xxxxxx-GW | EQ-0004 | Equipment rinsate blank [e] | NA | NA | NA | NA | NA | NA | NA | Tag #_____ | Tag #_____ | Tag #_____ |
| MW-41D | MW-41D- xxxxxx-GW | GW-0143 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-42D | MW-42D- xxxxxx-GW | GW-0144 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-43D | MW-43D- xxxxxx-GW | GW-0145 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-43I | MW-43I- xxxxxx-GW | GW-0146 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |

Table B-3. Field Sample Collection Matrix for Groundwater (Onsite and Offsite Wells)

| | | | | Groundwater Chemistry | | | | | | | Equipment Rinsate Blank/Environmental Field Blank | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PFCs (C8 to C13) | | | | | | | PFCs (C8 to C14) | | |
| | | | | 3 Sample Bottles | | | Bromide, chloride, fluoride, sulfate | Calcium, iron, magnesium, manganese, sodium and potassium | TSS | Alkalinity | 3 Sample Bottles | | |
| | | | | 500 mL HDPE [b] | 500 mL HDPE [b] | 50 mL HDPE [b] | 60 mL HDPE [b] | 500 mL HDPE [b] | 1,000 mL HDPE [b] | 1,000 mL HDPE [b] | 500 mL HDPE [b] | 500 mL HDPE [b] | 50 mL HDPE [b] |
| Well Number [a] | Sample ID [d] | Sample Number | Sample Type [a] | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated |
| PZ-8 | PZ-8- xxxxxx-GW | GW-0147 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-24I | MW-24I- xxxxxx-GW | GW-0148 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-24D | MW-24D- xxxxxx-GW | GW-0149 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-24D | MW-24D- xxxxxx-GW | GW-0150 | Field duplicate [g] | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| MW-24D | MW-24D- xxxxxx-GW | GW-0149MS | Matrix spike | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA | NA | NA | NA |
| MW-24D | MW-24D- xxxxxx-GW | GW-0149MSD | Matrix spike duplicate | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA | NA | NA | NA |
| EQ Blank | EQ Blank- xxxxxx-GW | EQ-0005 | Equipment rinsate blank [e] | NA | NA | NA | NA | NA | NA | NA | Tag #_____ | Tag #_____ | Tag #_____ |
| Env Field Blank | Env Field Blank- xxxxxx-GW | ENVFB-0001 | Environmental field blank [e] | NA | NA | NA | NA | NA | NA | NA | Tag #_____ | Tag #_____ | Tag #_____ |

Notes:

AG = amber glass

HDPE = high density polyethylene

NA = not applicable

PFC = perfluoroalkyl compound

TDS = total dissolved solids.

TOC = total organic carbon

TSS = total suspended solids

[a] ERM Well Designations.

[b] The size and number of containers may be modified.

[c] Minimum sample size.

[d] Where "xxxxxx" = month, day, and year that the sample was collected (e.g., March 01, 2015 would be 030115).

[e] An equipment rinsate blank sample will be collected at a minimum frequency of approximately 1 per 10 groundwater samples.

[g] Blind field duplicate samples will be collected at a minimum frequency of 1 field duplicate sample per 20 groundwater samples.



ED_004850_00001502-00874

Table B-4. Field Sample Collection Matrix for Surface Water from Little Mantua Creek and the Main Ditch

| | | | | Groundwater Chemistry | | | | | | | | | Equipment Rinsate Blank/Environmental Field Blank | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PFCs (C8 to C13) | | | | | | | | | PFCs (C8 to C14) | | |
| | | | | 3 Sample Bottles | | | Bromide, chloride, fluoride, sulfate | Calcium, iron, magnesium, manganese, sodium and potassium | TOC | TSS | TDS | Alkalinity | 3 Sample Bottles | | |
| | | | | 500 mL HDPE [b] | 500 mL HDPE [b] | 50 mL HDPE [b] | 60 mL HDPE [b] | 500 mL HDPE [b] | 250 mL Ag [b] | 1,000 mL HDPE [b] | 1,000 mL HDPE [b] | 1,000 mL HDPE [b] | 250 mL wide mouth HDPE [a] | 250 mL wide mouth HDPE [a] | 50 mL wide mouth HDPE [a] |
| Station Number | Sample ID [b] | Sample Number | Sample Type | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | to pH<2 | Refrigerated | Refridgerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated |
| **Site** | | | | | | | | | | | | | | | |
| SWSE-001 | SWSE-001- xxxxxx-SW | SW0001 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SWSE-002 | SWSE-002- xxxxxx-SW | SW0002 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SWSE-003 | SWSE-003- xxxxxx-SW | SW0003 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SWSE-004 | SWSE-004- xxxxxx-SW | SW0004 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SWSE-005 | SWSE-005- xxxxxx-SW | SW0005 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SWSE-006 | SWSE-006- xxxxxx-SW | SW0006 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SWSE-007 | SWSE-007- xxxxxx-SW | SW0007 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SWSE-007 | SWSE-007- xxxxxx-SW | SW0007MS | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SWSE-007 | SWSE-007- xxxxxx-SW | SW0007MSD | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SWSE-007 | SWSE-007- xxxxxx-SW | SW0008 | Field duplicate [d] | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| EQ - Blank | EQ - Blank- xxxxxx-SW | EQ-0006 | Equipment rinsate blank [c] | NA | NA | NA | NA | NA | NA | NA | NA | NA | Tag #_____ | Tag #_____ | Tag #_____ |
| Env Field Blank | Env Field Blank- xxxxxx-SW | ENVFB-0002 | Field environmental blank [e] | NA | NA | NA | NA | NA | NA | NA | NA | NA | Tag #_____ | Tag #_____ | Tag #_____ |

Notes:
HDPE = high-density polyethylene
NA = not applicable
PFC = perfluoroalkyl compound

[a] The size and number of containers may be modified.
[b] Where "xxxxxx" = month, day, and year that the sample was collected (e.g., October 1, 2015 would be 100115).
[c] An equipment rinsate blank sample will be collected at a frequency of 10% of the total number of samples.
[d] Blind field duplicate samples aat a minimum frequency of 5 percent.
[e] Field/environmental blanks will be collected once during sample collection.

Table B-5. Field Sample Collection Matrix for Surface and Subsurface Sediment from Little Mantua Creek and the Main Ditch

| | | | | Sediment Chemistry | | | Pore Water | Equipment Rinsate Blank/Environmental Field Blank | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PFCs (C8 to C14) | | |
| | | | | PFCs (C8 to C13) | Grain Size | TOC only | Bulk Sediment for Pore Water Analysis at Lab | 3 Sample Bottles | | |
| | | | | 250 mL wide mouth HDPE [a] | 1 L WMG [a] (1/2 full) | 125 mL WMG [a] | 1 gal LDPE [a] | 500 mL HDPE [a] | 500 mL HDPE [a] | 50 mL HDPE [a] |
| Station Number | Sample ID [b] | Sample Number | Sample Type | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated |
| **Site** | | | | | | | | | | |
| SWSE-01 | SWSE-01- xxxxxx-GR | SD0001 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SWSE-02 | SWSE-02- xxxxxx-GR | SD0002 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SWSE-03 | SWSE-03- xxxxxx-GR | SD0003 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SWSE-04 | SWSE-04- xxxxxx-GR | SD0004 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SWSE-05 | SWSE-05- xxxxxx-GR | SD0005 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SWSE-06 | SWSE-06- xxxxxx-GR | SD0006 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SWSE-07 | SWSE-07- xxxxxx-GR | SD0007 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SWSE-01 | SWSE-01- xxxxxx-GR | SD0008 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SWSE-01 | SWSE-01- xxxxxx-CR | SD0008 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-01 | SWSE-01- xxxxxx-CR | SD0008 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-02 | SWSE-02- xxxxxx-CR | SD0009 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-02 | SWSE-02- xxxxxx-CR | SD0009 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-02 | SWSE-02- xxxxxx-CR | SD0009 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-03 | SWSE-03- xxxxxx-CR | SD010 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-03 | SWSE-03- xxxxxx-CR | SD010 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-03 | SWSE-03- xxxxxx-CR | SD010 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-04 | SWSE-04- xxxxxx-CR | SD011 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-04 | SWSE-04- xxxxxx-CR | SD011 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-04 | SWSE-04- xxxxxx-CR | SD011 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-05 | SWSE-05- xxxxxx-CR | SD012 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-05 | SWSE-05- xxxxxx-CR | SD012 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-05 | SWSE-05- xxxxxx-CR | SD012 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-06 | SWSE-06- xxxxxx-CR | SD013 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-06 | SWSE-06- xxxxxx-CR | SD013 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-06 | SWSE-06- xxxxxx-CR | SD013 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-07 | SWSE-07- xxxxxx-CR | SD014 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-07 | SWSE-07- xxxxxx-CR | SD014 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| SWSE-07 | SWSE-07- xxxxxx-CR | SD014 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| TBD | TBD- xxxxxx-GR | TBD | Field duplicate [d] | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| TBD | TBD- xxxxxx-GR | TBD | Field duplicate [d] | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA | NA |
| EQ Blank | EQ Blank- xxxxxx-SD | EQ-0008 | Equipment rinsate blank [c] | NA | NA | NA | NA | Tag #_____ | Tag #_____ | Tag #_____ |
| EQ Blank | EQ Blank- xxxxxx-SD | EQ-0009 | Equipment rinsate blank [c] | NA | NA | NA | NA | Tag #_____ | Tag #_____ | Tag #_____ |
| EQ Blank | EQ Blank- xxxxxx-SD | EQ-0010 | Equipment rinsate blank [c] | NA | NA | NA | NA | Tag #_____ | Tag #_____ | Tag #_____ |
| EQ Blank | EQ Blank- xxxxxx-SD | EQ-0011 | Equipment rinsate blank [c] | NA | NA | NA | NA | Tag #_____ | Tag #_____ | Tag #_____ |

Notes:

LDPE = low-density polyethylene
NA = not applicable
PFC = perfluoroalkyl compound
TBD = to be determined
TOC = total organic carbon
WMG = wide mouth glass

[a] The size and number of containers may be modified.

[b] Where "xxxxxx" = month, day, and year that the sample was collected (e.g., October 1, 2015 would be 100115).

[c] An equipment rinsate blank sample will be collected at a frequency of 10% of the total number of samples.

[d] Blind field duplicate samples at a frequency of 1 per 20 sample (minimum of 2 samples).

Table B-6. Field Sample Collection Matrix for Soil

| Station Number | Sample ID [b] | Sample Number | Sample Type | Soil Chemistry | | | Equipment Rinsate Blank/Environmental Field Blank | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 Sample Bottles | | |
| | | | | PFCs (C8 to C13) | Grain Size | TOC only | PFCs (C8 to C14) | | |
| | | | | 250 mL wide mouth HDPE [a] | 16 oz WMG [a] | 4 oz. WMG [a] | 250 mL wide mouth HDPE [a] | 250 mL wide mouth HDPE [a] | 50 mL wide mouth HDPE [a] |
| | | | | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated |
| **Site** | | | | | | | | | |
| SB15-01 | SB15-01- xxxxxx-SL-Depth | SL0001 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-01 | SB15-01- xxxxxx-SL-Depth | SL0001 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-01 | SB15-01- xxxxxx-SL-Depth | SL0001 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-01 | SB15-01- xxxxxx-SL-Depth | SL0001 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-01 | SB15-01- xxxxxx-SL-Depth | SL0001 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-01 | SB15-01- xxxxxx-SL-Depth | SL0001 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-01 | SB15-01- xxxxxx-SL-Depth | SL0001 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-01 | SB15-01- xxxxxx-SL-Depth | SL0001 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-01 | SB15-01- xxxxxx-SL-Depth | SL0001 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-01 | SB15-01- xxxxxx-SL-Depth | SL0001 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-02 | SB15-02- xxxxxx-SL-Depth | SL0002 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-02 | SB15-02- xxxxxx-SL-Depth | SL0002 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-02 | SB15-02- xxxxxx-SL-Depth | SL0002 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-02 | SB15-02- xxxxxx-SL-Depth | SL0002 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-02 | SB15-02- xxxxxx-SL-Depth | SL0002 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-02 | SB15-02- xxxxxx-SL-Depth | SL0002 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-02 | SB15-02- xxxxxx-SL-Depth | SL0002 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-02 | SB15-02- xxxxxx-SL-Depth | SL0002 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-02 | SB15-02- xxxxxx-SL-Depth | SL0002 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-02 | SB15-02- xxxxxx-SL-Depth | SL0002 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-02 | SB15-02- xxxxxx-SL-Depth | SL0002 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-03 | SB15-03- xxxxxx-SL-Depth | SL0003 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-03 | SB15-03- xxxxxx-SL-Depth | SL0003 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-03 | SB15-03- xxxxxx-SL-Depth | SL0003 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-03 | SB15-03- xxxxxx-SL-Depth | SL0003 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-03 | SB15-03- xxxxxx-SL-Depth | SL0003 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-03 | SB15-03- xxxxxx-SL-Depth | SL0003 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |

Table B-6. Field Sample Collection Matrix for Soil

| Station Number | Sample ID [b] | Sample Number | Sample Type | Soil Chemistry | | | Equipment Rinsate Blank/Environmental Field Blank | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 Sample Bottles | | |
| | | | | PFCs (C8 to C13) | Grain Size | TOC only | PFCs (C8 to C14) | | |
| | | | | 250 mL wide mouth HDPE [a] | 16 oz WMG [a] | 4 oz. WMG [a] | 250 mL wide mouth HDPE [a] | 250 mL wide mouth HDPE [a] | 50 mL wide mouth HDPE [a] |
| | | | | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated |
| SB15-03 | SB15-03- xxxxxx-SL-Depth | SL0003 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-03 | SB15-03- xxxxxx-SL-Depth | SL0003 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-03 | SB15-03- xxxxxx-SL-Depth | SL0003 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-03 | SB15-03- xxxxxx-SL-Depth | SL0003 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-03 | SB15-03- xxxxxx-SL-Depth | SL0003 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-03 | SB15-03- xxxxxx-SL-Depth | SL0003 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-04 | SB15-04- xxxxxx-SL-Depth | SL0004 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-04 | SB15-04- xxxxxx-SL-Depth | SL0004 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-04 | SB15-04- xxxxxx-SL-Depth | SL0004 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-04 | SB15-04- xxxxxx-SL-Depth | SL0004 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-04 | SB15-04- xxxxxx-SL-Depth | SL0004 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-04 | SB15-04- xxxxxx-SL-Depth | SL0004 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-04 | SB15-04- xxxxxx-SL-Depth | SL0004 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-04 | SB15-04- xxxxxx-SL-Depth | SL0004 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-04 | SB15-04- xxxxxx-SL-Depth | SL0004 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-04 | SB15-04- xxxxxx-SL-Depth | SL0004 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-05 | SB15-05- xxxxxx-SL-Depth | SL0005 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-05 | SB15-05- xxxxxx-SL-Depth | SL0005 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-05 | SB15-05- xxxxxx-SL-Depth | SL0005 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-05 | SB15-05- xxxxxx-SL-Depth | SL0005 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-05 | SB15-05- xxxxxx-SL-Depth | SL0005 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-05 | SB15-05- xxxxxx-SL-Depth | SL0005 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-05 | SB15-05- xxxxxx-SL-Depth | SL0005 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-05 | SB15-05- xxxxxx-SL-Depth | SL0005 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-05 | SB15-05- xxxxxx-SL-Depth | SL0005 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-05 | SB15-05- xxxxxx-SL-Depth | SL0005 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-05 | SB15-05- xxxxxx-SL-Depth | SL0005 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |

Table B-6. Field Sample Collection Matrix for Soil

| Station Number | Sample ID [b] | Sample Number | Sample Type | Soil Chemistry | | | Equipment Rinsate Blank/Environmental Field Blank | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 Sample Bottles | | |
| | | | | PFCs (C8 to C13) | Grain Size | TOC only | PFCs (C8 to C14) | | |
| | | | | 250 mL wide mouth HDPE [a] | 16 oz WMG [a] | 4 oz. WMG [a] | 250 mL wide mouth HDPE [a] | 250 mL wide mouth HDPE [a] | 50 mL wide mouth HDPE [a] |
| | | | | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated |
| SB15-06 | SB15-06- xxxxxx-SL-Depth | SL0006 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-06 | SB15-06- xxxxxx-SL-Depth | SL0006 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-06 | SB15-06- xxxxxx-SL-Depth | SL0006 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-06 | SB15-06- xxxxxx-SL-Depth | SL0006 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-06 | SB15-06- xxxxxx-SL-Depth | SL0006 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-06 | SB15-06- xxxxxx-SL-Depth | SL0006 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-06 | SB15-06- xxxxxx-SL-Depth | SL0006 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-06 | SB15-06- xxxxxx-SL-Depth | SL0006 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-06 | SB15-06- xxxxxx-SL-Depth | SL0006 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-06 | SB15-06- xxxxxx-SL-Depth | SL0006 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-06 | SB15-06- xxxxxx-SL-Depth | SL0006 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-07 | SB15-07- xxxxxx-SL-Depth | SL0007 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-07 | SB15-07- xxxxxx-SL-Depth | SL0007 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-07 | SB15-07- xxxxxx-SL-Depth | SL0007 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-07 | SB15-07- xxxxxx-SL-Depth | SL0007 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-07 | SB15-07- xxxxxx-SL-Depth | SL0007 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-07 | SB15-07- xxxxxx-SL-Depth | SL0007 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-07 | SB15-07- xxxxxx-SL-Depth | SL0007 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-07 | SB15-07- xxxxxx-SL-Depth | SL0007 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-07 | SB15-07- xxxxxx-SL-Depth | SL0007 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-07 | SB15-07- xxxxxx-SL-Depth | SL0007 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-07 | SB15-07- xxxxxx-SL-Depth | SL0007 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-08 | SB15-08- xxxxxx-SL-Depth | SL0008 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-08 | SB15-08- xxxxxx-SL-Depth | SL0008 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-08 | SB15-08- xxxxxx-SL-Depth | SL0008 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-08 | SB15-08- xxxxxx-SL-Depth | SL0008 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-08 | SB15-08- xxxxxx-SL-Depth | SL0008 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-08 | SB15-08- xxxxxx-SL-Depth | SL0008 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |

Table B-6. Field Sample Collection Matrix for Soil

| Station Number | Sample ID [b] | Sample Number | Sample Type | Soil Chemistry | | | Equipment Rinsate Blank/Environmental Field Blank | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 Sample Bottles | | |
| | | | | PFCs (C8 to C13) | Grain Size | TOC only | PFCs (C8 to C14) | | |
| | | | | 250 mL wide mouth HDPE [a] | 16 oz WMG [a] | 4 oz. WMG [a] | 250 mL wide mouth HDPE [a] | 250 mL wide mouth HDPE [a] | 50 mL wide mouth HDPE [a] |
| | | | | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated |
| SB15-08 | SB15-08- xxxxxx-SL-Depth | SL0008 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-08 | SB15-08- xxxxxx-SL-Depth | SL0008 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-08 | SB15-08- xxxxxx-SL-Depth | SL0008 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-08 | SB15-08- xxxxxx-SL-Depth | SL0008 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-08 | SB15-08- xxxxxx-SL-Depth | SL0008 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-08 | SB15-08- xxxxxx-SL-Depth | SL0008 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-09 | SB15-09- xxxxxx-SL-Depth | SL0009 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-09 | SB15-09- xxxxxx-SL-Depth | SL0009 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-09 | SB15-09- xxxxxx-SL-Depth | SL0009 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-09 | SB15-09- xxxxxx-SL-Depth | SL0009 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-09 | SB15-09- xxxxxx-SL-Depth | SL0009 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-09 | SB15-09- xxxxxx-SL-Depth | SL0009 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-09 | SB15-09- xxxxxx-SL-Depth | SL0009 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-09 | SB15-09- xxxxxx-SL-Depth | SL0009 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-09 | SB15-09- xxxxxx-SL-Depth | SL0009 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-09 | SB15-09- xxxxxx-SL-Depth | SL0009 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-10 | SB15-10- xxxxxx-SL-Depth | SL0010 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-10 | SB15-10- xxxxxx-SL-Depth | SL0010 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-10 | SB15-10- xxxxxx-SL-Depth | SL0010 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-10 | SB15-10- xxxxxx-SL-Depth | SL0010 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-10 | SB15-10- xxxxxx-SL-Depth | SL0010 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-10 | SB15-10- xxxxxx-SL-Depth | SL0010 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-10 | SB15-10- xxxxxx-SL-Depth | SL0010 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-10 | SB15-10- xxxxxx-SL-Depth | SL0010 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-10 | SB15-10- xxxxxx-SL-Depth | SL0010 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-10 | SB15-10- xxxxxx-SL-Depth | SL0010 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-10 | SB15-10- xxxxxx-SL-Depth | SL0010 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |

Table B-6. Field Sample Collection Matrix for Soil

| Station Number | Sample ID [b] | Sample Number | Sample Type | Soil Chemistry | | | Equipment Rinsate Blank/Environmental Field Blank | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 Sample Bottles | | |
| | | | | PFCs (C8 to C13) | Grain Size | TOC only | PFCs (C8 to C14) | | |
| | | | | 250 mL wide mouth HDPE [a] | 16 oz WMG [a] | 4 oz. WMG [a] | 250 mL wide mouth HDPE [a] | 250 mL wide mouth HDPE [a] | 50 mL wide mouth HDPE [a] |
| | | | | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated |
| SB15-11 | SB15-11- xxxxxx-SL-Depth | SL0011 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-11 | SB15-11- xxxxxx-SL-Depth | SL0011 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-11 | SB15-11- xxxxxx-SL-Depth | SL0011 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-11 | SB15-11- xxxxxx-SL-Depth | SL0011 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-11 | SB15-11- xxxxxx-SL-Depth | SL0011 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-11 | SB15-11- xxxxxx-SL-Depth | SL0011 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-11 | SB15-11- xxxxxx-SL-Depth | SL0011 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-11 | SB15-11- xxxxxx-SL-Depth | SL0011 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-11 | SB15-11- xxxxxx-SL-Depth | SL0011 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-11 | SB15-11- xxxxxx-SL-Depth | SL0011 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-11 | SB15-11- xxxxxx-SL-Depth | SL0011 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-12 | SB15-12- xxxxxx-SL-Depth | SL0012 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-12 | SB15-12- xxxxxx-SL-Depth | SL0012 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-12 | SB15-12- xxxxxx-SL-Depth | SL0012 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-12 | SB15-12- xxxxxx-SL-Depth | SL0012 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-12 | SB15-12- xxxxxx-SL-Depth | SL0012 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-12 | SB15-12- xxxxxx-SL-Depth | SL0012 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-12 | SB15-12- xxxxxx-SL-Depth | SL0012 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-12 | SB15-12- xxxxxx-SL-Depth | SL0012 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-12 | SB15-12- xxxxxx-SL-Depth | SL0012 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-12 | SB15-12- xxxxxx-SL-Depth | SL0012 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-12 | SB15-12- xxxxxx-SL-Depth | SL0012 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-13 | SB15-13- xxxxxx-SL-Depth | SL0013 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-13 | SB15-13- xxxxxx-SL-Depth | SL0013 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-13 | SB15-13- xxxxxx-SL-Depth | SL0013 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-13 | SB15-13- xxxxxx-SL-Depth | SL0013 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-13 | SB15-13- xxxxxx-SL-Depth | SL0013 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-13 | SB15-13- xxxxxx-SL-Depth | SL0013 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |

Table B-6. Field Sample Collection Matrix for Soil

| Station Number | Sample ID [b] | Sample Number | Sample Type | Soil Chemistry | | | Equipment Rinsate Blank/Environmental Field Blank | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 Sample Bottles | | |
| | | | | PFCs (C8 to C13) | Grain Size | TOC only | PFCs (C8 to C14) | | |
| | | | | 250 mL wide mouth HDPE [a] | 16 oz WMG [a] | 4 oz. WMG [a] | 250 mL wide mouth HDPE [a] | 250 mL wide mouth HDPE [a] | 50 mL wide mouth HDPE [a] |
| | | | | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated |
| SB15-13 | SB15-13- xxxxxx-SL-Depth | SL0013 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-13 | SB15-13- xxxxxx-SL-Depth | SL0013 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-13 | SB15-13- xxxxxx-SL-Depth | SL0013 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-13 | SB15-13- xxxxxx-SL-Depth | SL0013 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-13 | SB15-13- xxxxxx-SL-Depth | SL0013 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-13 | SB15-13- xxxxxx-SL-Depth | SL0013 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-14 | SB15-14- xxxxxx-SL-Depth | SL0014 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-14 | SB15-14- xxxxxx-SL-Depth | SL0014 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-14 | SB15-14- xxxxxx-SL-Depth | SL0014 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-14 | SB15-14- xxxxxx-SL-Depth | SL0014 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-14 | SB15-14- xxxxxx-SL-Depth | SL0014 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-14 | SB15-14- xxxxxx-SL-Depth | SL0014 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-14 | SB15-14- xxxxxx-SL-Depth | SL0014 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-14 | SB15-14- xxxxxx-SL-Depth | SL0014 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-14 | SB15-14- xxxxxx-SL-Depth | SL0014 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-14 | SB15-14- xxxxxx-SL-Depth | SL0014 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-15 | SB15-15- xxxxxx-SL-Depth | SL0015 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-15 | SB15-15- xxxxxx-SL-Depth | SL0015 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-15 | SB15-15- xxxxxx-SL-Depth | SL0015 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-15 | SB15-15- xxxxxx-SL-Depth | SL0015 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-15 | SB15-15- xxxxxx-SL-Depth | SL0015 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-15 | SB15-15- xxxxxx-SL-Depth | SL0015 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-15 | SB15-15- xxxxxx-SL-Depth | SL0015 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-15 | SB15-15- xxxxxx-SL-Depth | SL0015 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-15 | SB15-15- xxxxxx-SL-Depth | SL0015 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-15 | SB15-15- xxxxxx-SL-Depth | SL0015 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-15 | SB15-15- xxxxxx-SL-Depth | SL0015 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |

Table B-6. Field Sample Collection Matrix for Soil

| Station Number | Sample ID [b] | Sample Number | Sample Type | Soil Chemistry | | | Equipment Rinsate Blank/Environmental Field Blank | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 Sample Bottles | | |
| | | | | PFCs (C8 to C13) | Grain Size | TOC only | PFCs (C8 to C14) | | |
| | | | | 250 mL wide mouth HDPE [a] | 16 oz WMG [a] | 4 oz. WMG [a] | 250 mL wide mouth HDPE [a] | 250 mL wide mouth HDPE [a] | 50 mL wide mouth HDPE [a] |
| | | | | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated |
| SB15-16 | SB15-16- xxxxxx-SL-Depth | SL0016 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-16 | SB15-16- xxxxxx-SL-Depth | SL0016 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-16 | SB15-16- xxxxxx-SL-Depth | SL0016 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-16 | SB15-16- xxxxxx-SL-Depth | SL0016 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-16 | SB15-16- xxxxxx-SL-Depth | SL0016 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-16 | SB15-16- xxxxxx-SL-Depth | SL0016 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-16 | SB15-16- xxxxxx-SL-Depth | SL0016 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-16 | SB15-16- xxxxxx-SL-Depth | SL0016 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-16 | SB15-16- xxxxxx-SL-Depth | SL0016 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-16 | SB15-16- xxxxxx-SL-Depth | SL0016 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-16 | SB15-16- xxxxxx-SL-Depth | SL0016 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-17 | SB15-17- xxxxxx-SL-Depth | SL0017 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-17 | SB15-17- xxxxxx-SL-Depth | SL0017 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-17 | SB15-17- xxxxxx-SL-Depth | SL0017 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-17 | SB15-17- xxxxxx-SL-Depth | SL0017 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-17 | SB15-17- xxxxxx-SL-Depth | SL0017 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-17 | SB15-17- xxxxxx-SL-Depth | SL0017 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-17 | SB15-17- xxxxxx-SL-Depth | SL0017 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-17 | SB15-17- xxxxxx-SL-Depth | SL0017 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-17 | SB15-17- xxxxxx-SL-Depth | SL0017 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-17 | SB15-17- xxxxxx-SL-Depth | SL0017 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-17 | SB15-17- xxxxxx-SL-Depth | SL0017 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-18 | SB15-18- xxxxxx-SL-Depth | SL0018 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-18 | SB15-18- xxxxxx-SL-Depth | SL0018 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-18 | SB15-18- xxxxxx-SL-Depth | SL0018 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-18 | SB15-18- xxxxxx-SL-Depth | SL0018 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-18 | SB15-18- xxxxxx-SL-Depth | SL0018 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-18 | SB15-18- xxxxxx-SL-Depth | SL0018 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |

Table B-6. Field Sample Collection Matrix for Soil

| Station Number | Sample ID [b] | Sample Number | Sample Type | Soil Chemistry | | | Equipment Rinsate Blank/Environmental Field Blank | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 Sample Bottles | | |
| | | | | PFCs (C8 to C13) | Grain Size | TOC only | PFCs (C8 to C14) | | |
| | | | | 250 mL wide mouth HDPE [a] | 16 oz WMG [a] | 4 oz. WMG [a] | 250 mL wide mouth HDPE [a] | 250 mL wide mouth HDPE [a] | 50 mL wide mouth HDPE [a] |
| | | | | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated | Refrigerated |
| SB15-18 | SB15-18- xxxxxx-SL-Depth | SL0018 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-18 | SB15-18- xxxxxx-SL-Depth | SL0018 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-18 | SB15-18- xxxxxx-SL-Depth | SL0018 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-18 | SB15-18- xxxxxx-SL-Depth | SL0018 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-18 | SB15-18- xxxxxx-SL-Depth | SL0018 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| SB15-18 | SB15-18- xxxxxx-SL-Depth | SL0018 | Normal | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| EQ Blank | EQ Blank-xxxxxx-SL | EQ-0001 | Equipment rinsate blank [c] | NA | NA | NA | Tag #_____ | Tag #_____ | Tag #_____ |
| EQ Blank | EQ Blank-xxxxxx-SL | EQ-0002 | Equipment rinsate blank [c] | NA | NA | NA | Tag #_____ | Tag #_____ | Tag #_____ |
| EQ Blank | EQ Blank-xxxxxx-SL | EQ-0003 | Equipment rinsate blank [c] | NA | NA | NA | Tag #_____ | Tag #_____ | Tag #_____ |
| EQ Blank | EQ Blank-xxxxxx-SL | EQ-0004 | Equipment rinsate blank [c] | NA | NA | NA | Tag #_____ | Tag #_____ | Tag #_____ |
| TBD | TBD- xxxxxx-SL-Depth | TBD | Field duplicate [d] | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| TBD | TBD- xxxxxx-SL-Depth | TBD | Field duplicate [d] | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| TBD | TBD- xxxxxx-SL-Depth | TBD | Field duplicate [d] | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |
| TBD | TBD- xxxxxx-SL-Depth | TBD | Field duplicate [d] | Tag #_____ | Tag #_____ | Tag #_____ | NA | NA | NA |

Notes:

LDPE = low-density polyethylene
NA = not applicable
PFC = perfluoroalkyl compound
TBD = to be determined
TOC = total organic carbon
WMG = wide mouth glass

[a] The size and number of containers may be modified.
[b] Where "xxxxxx" = month, day, and year that the sample was collected (e.g., October 1, 2015 would be 100115) and Depth represents the depth of the sample.
[c] An equipment rinsate blank sample will be collected at a minimum frequency of 10% of the total number of samples for the low resolution (a minimum of 4 total).
[d] Duplicate samples will be collected at a frequency of 1 per 20 samples (low resolution) for a minimum of 4 duplicates.

Table B-7. Geographic Coordinates of Proposed Sampling Locations for the Field Investigation [a]

| Station Type | Well or Location Identification | Coordinates Northing [b] | Coordinates Easting [b] | Coordinates Latitude [c] | Coordinates Longitude [c] |
|---|---|---|---|---|---|
| **Groundwater Locations** | | | | | |
| | MW-4 | 292917.9982 | 368342.5832 | -75.2095 | 39.8425 |
| | MW-5X | 293061.6700 | 368050.3800 | -75.2090 | 39.8417 |
| | MW-10X | 292819.3200 | 367968.6900 | -75.2098 | 39.8415 |
| | MW-16I | 293037.6418 | 368940.9981 | -75.2091 | 39.8442 |
| | MW-16S | 293034.5672 | 368941.5032 | -75.2091 | 39.8442 |
| | MW-40S | 293626.6000 | 368555.2000 | -75.2070 | 39.8431 |
| | MW-40I | 293624.3500 | 368549.3600 | -75.2070 | 39.8431 |
| | PZ-2 | 292813.0926 | 368304.6637 | -75.2099 | 39.8424 |
| | MW-18D | 292974.2600 | 367156.9500 | -75.2092 | 39.8393 |
| | MW-18I | 292976.2100 | 367148.8600 | -75.2092 | 39.8392 |
| | MW-18S | 292978.8600 | 367139.4400 | -75.2092 | 39.8392 |
| | MW-19D | 293208.5200 | 367481.0200 | -75.2084 | 39.8402 |
| | MW-19I | 293206.2900 | 367471.9400 | -75.2084 | 39.8401 |
| | MW-19S | 293204.3700 | 367463.3900 | -75.2084 | 39.8401 |
| | MW-19X | 293207.6500 | 367447.7000 | -75.2084 | 39.8401 |
| | MW-21D | 293264.4100 | 366868.4800 | -75.2082 | 39.8385 |
| | MW-21I | 293264.1700 | 366868.6100 | -75.2082 | 39.8385 |
| | MW-30S | 292944.6600 | 366607.0900 | -75.2093 | 39.8378 |
| | MW-30IU | 292947.9700 | 366604.1300 | -75.2093 | 39.8377 |
| | MW-30IL | 292944.4300 | 366607.1400 | -75.2093 | 39.8378 |
| | MW-30D | 292947.7700 | 366604.2100 | -75.2093 | 39.8377 |
| | MW-31S | 292677.0100 | 366664.2500 | -75.2103 | 39.8379 |
| | MW-31IU | 292677.1100 | 366664.4800 | -75.2103 | 39.8379 |
| | MW-32S | 292493.6800 | 367388.4200 | -75.2110 | 39.8399 |
| | MW-32IU | 292495.5400 | 367383.3800 | -75.2110 | 39.8399 |
| | MW-33S | 294044.9500 | 365556.4700 | -75.2054 | 39.8349 |
| | MW-34IL | 295402.1800 | 363226.0800 | -75.2005 | 39.8285 |
| | MW-34D | 295402.0600 | 363226.2500 | -75.2005 | 39.8285 |
| | MW-35I | 293678.5100 | 364556.3100 | -75.2067 | 39.8321 |
| | MW-35D | 293678.3100 | 364556.1800 | -75.2067 | 39.8321 |
| | MW-36D | 294840.8800 | 361547.4100 | -75.2024 | 39.8239 |
| | MW-37S | 293923.6800 | 364689.0800 | -75.2058 | 39.8325 |
| | MW-37D | 293923.7200 | 364688.8600 | -75.2058 | 39.8325 |
| | MW-38D | 294307.1800 | 363603.2900 | -75.2044 | 39.8295 |
| | MW-39S | 294877.3876 | 366802.6376 | -75.2025 | 39.8383 |
| | MW-39I | 294871.9210 | 366802.5110 | -75.2025 | 39.8383 |
| | MW-39D | 294877.5989 | 366802.6833 | -75.2025 | 39.8383 |
| | MW-40S | 293626.6000 | 368555.2000 | -75.2070 | 39.8431 |
| | MW-40I | 293624.3500 | 368549.3600 | -75.2070 | 39.8431 |
| | MW-41D | 292204.2900 | 365526.4900 | -75.2119 | 39.8347 |
| | MW-42D | 292990.3414 | 363421.2933 | -75.2091 | 39.8290 |
| | MW-43D | 295226.0515 | 365174.4802 | -75.2012 | 39.8339 |
| | MW-43I | 295226.0946 | 365174.7420 | -75.2012 | 39.8339 |
| | PZ-8 | 292150.9469 | 370410.1543 | -75.2123 | 39.8482 |
| | MW-24I | 292250.2100 | 370455.1200 | -75.2119 | 39.8483 |
| | MW-24D | 292249.9700 | 370455.1900 | -75.2119 | 39.8483 |



ED_004850_00001502-00885

Table B-7. Geographic Coordinates of Proposed Sampling Locations for the Field Investigation [a]

| Station Type | Well or Location Identification | Coordinates Northing [b] | Coordinates Easting [b] | Coordinates Latitude [c] | Coordinates Longitude [c] |
|---|---|---|---|---|---|
| **Surface Water and Sediment Locations** | | | | | |
| | SWSE-01 | 290655.7608 | 371283.1871 | -75.2176 | 39.8505 |
| | SWSE-02 | 290796.9179 | 368665.8363 | -75.2170 | 39.8434 |
| | SWSE-03 | 291829.3741 | 366675.6043 | -75.2133 | 39.8379 |
| | SWSE-04 | 293109.2163 | 371590.0691 | -75.2089 | 39.8514 |
| | SWSE-05 | 294388.2155 | 369337.2815 | -75.2043 | 39.8453 |
| | SWSE-06 | 294066.2812 | 370077.9383 | -75.2054 | 39.8473 |
| | SWSE-07 | 292828.4329 | 365341.7955 | -75.2097 | 39.8343 |
| **Soil Sample Locations** | | | | | |
| | SB15-01 | 293184.3048 | 369627.0460 | -75.2086 | 39.8460 |
| | SB15-02 | 292245.1059 | 369458.7506 | -75.2119 | 39.8456 |
| | SB15-08 | 293554.8395 | 368474.7995 | -75.2072 | 39.8429 |
| | SB15-07 | 293188.6451 | 368649.5085 | -75.2085 | 39.8434 |
| | SB15-04 | 292138.9299 | 369218.1731 | -75.2123 | 39.8449 |
| | SB15-05 | 292415.3415 | 369302.5735 | -75.2113 | 39.8451 |
| | SB15-06 | 292638.9342 | 369265.2204 | -75.2105 | 39.8450 |
| | SB15-03 | 292649.7690 | 369398.3331 | -75.2105 | 39.8454 |
| | SB15-18 | 293460.2319 | 368543.8160 | -75.2076 | 39.8431 |
| | SB15-17 | 293031.9018 | 368638.0487 | -75.2091 | 39.8433 |
| | SB15-11 | 292179.5249 | 369160.6114 | -75.2121 | 39.8447 |
| | SB15-10 | 292226.6412 | 369224.8609 | -75.2120 | 39.8449 |
| | SB15-13 | 292432.2396 | 369231.2859 | -75.2112 | 39.8449 |
| | SB15-12 | 292460.0811 | 369338.3684 | -75.2111 | 39.8452 |
| | SB15-09 | 292361.5652 | 369436.8843 | -75.2115 | 39.8455 |
| | SB15-16 | 293248.2085 | 369460.4425 | -75.2083 | 39.8456 |
| | SB15-15 | 292616.4216 | 369224.8609 | -75.2106 | 39.8449 |
| | SB15-14 | 292689.2377 | 369323.3768 | -75.2103 | 39.8452 |
| **Monitoring Well Locations** | | | | | |
| | P-1 | -75.1898 | 39.8414 | 298443.4184 | 367900.8650 |
| | P-4 | -75.1806 | 39.8131 | 300942.2078 | 357580.8860 |
| | P-2 | -75.1821 | 39.8322 | 300567.8135 | 364533.0907 |
| | P-5 | -75.1940 | 39.8126 | 297189.7149 | 357397.2733 |
| | P-7 | -75.2200 | 39.8305 | 289921.1283 | 363980.6596 |
| | P-6 | -75.2077 | 39.8208 | 293368.8491 | 360434.5192 |
| | P-3 | -75.1791 | 39.8235 | 301396.7288 | 361352.7081 |

Notes:

[a] These proposed station coordinates are approximate and may be adjusted in the field based on field conditions at the time of sampling.

[b] New Jersey State Plane feet, North American Datum of 1983 (NAD83).

[c] World Geodetic System of 1984 (WGS84) decimal degrees.

Table B-8. Solvay Site Wells

| Count | Well ID | Zone | Ground Elevation (ft NAVD88) | TOC Elevation (ft NAVD88) | Depth to TOS (ft TOC) | Screen Length (ft) |
|---|---|---|---|---|---|---|
| 1 | MW-4 | Shallow | 12.561 | 14.647 | 12.086 | 15 |
| 2 | MW-5X | Middle | 11.72 | 14.15 | 189.43 | 10 |
| 3 | MW-10X | Middle | 11.71 | 14.15 | 192.11 | 15 |
| 4 | MW-16I | Intermediate | 11.786 | 11.466 | 44.68 | 15 |
| 5 | MW-16S | Shallow | 11.741 | 11.398 | 8.657 | 15 |
| 6 | MW-22X | Middle | 4.35 | 7.08 | 234.73 | 15 |
| 9 | PZ-2 | Intermediate | 12.59 | 14.91 | 36.32 | 10 |
| 10 | MW-18D | Deep | 7.47 | 9.17 | 119.7 | 10 |
| 11 | MW-18I | Intermediate | 7.41 | 9.49 | 89.08 | 10 |
| 12 | MW-18S | Shallow | 7.28 | 9.5 | 7.22 | 15 |
| 13 | MW-19D | Deep | 12.07 | 14.59 | 122.52 | 10 |
| 14 | MW-19I | Intermediate | 12.16 | 14.66 | 87.5 | 10 |
| 15 | MW-19S | Shallow | 12.36 | 14.76 | 12.4 | 15 |
| 16 | MW-19X | Middle | 12.61 | 15.2 | 190.09 | 15 |
| 17 | MW-21D | Deep | 7.79 | 7.27 | 122.98 | 10 |
| 18 | MW-21I | Intermediate | 7.79 | 7.2 | 90.41 | 10 |
| 19 | MW-30S | Shallow | 7.13 | 6.7 | 5.57 | 25 |
| 20 | MW-30IU | Intermediate | 7.17 | 6.8 | 33.63 | 15 |
| 21 | MW-30IL | Intermediate | 7.13 | 6.72 | 64.59 | 15 |
| 22 | MW-30D | Deep | 7.17 | 6.79 | 124.62 | 15 |
| 23 | MW-31S | Shallow | 4.61 | 4.37 | 6.76 | 15 |
| 24 | MW-31IU | Intermediate | 4.61 | 4.31 | 34.7 | 15 |
| 25 | MW-32S | Shallow | 7.74 | 10.37 | 17.63 | 15 |
| 26 | MW-32IU | Intermediate | 7.77 | 10.51 | 37.74 | 15 |
| 27 | MW-33S | Shallow | 14.5 | 15.79 | 19.29 | 20 |
| 28 | MW-34IL | Intermediate | 25.07 | 24.77 | 91.7 | 15 |
| 29 | MW-34D | Deep | 25.07 | 24.77 | 156.7 | 15 |
| 30 | MW-35I | Intermediate | 14.58 | 17.32 | 82.74 | 15 |
| 31 | MW-35D | Deep | 14.58 | 17.34 | 169.76 | 15 |
| 32 | MW-36D | Deep | 30.2193 | 33.1805 | 198.9612 | 15 |
| 33 | MW-37S | Shallow | 12.42 | 12.34 | 36.92 | 15 |
| 34 | MW-37D | Deep | 12.42 | 12.29 | 144.87 | 15 |
| 35 | MW-38D | Deep | 8.86 | 8.59 | 156.73 | 15 |
| 36 | MW-39S | Shallow | 16.41 | 15.97 | 23.56 | 15 |
| 37 | MW-39I | Intermediate | 16.41 | 15.96 | 69.55 | 15 |
| 38 | MW-39D | Deep | 16.41 | 15.95 | 137.04 | 10 |
| 39 | MW-40S | Shallow | 12.6 | 12.24 | 9.64 | 15 |
| 40 | MW-40I | Intermediate | 12.53 | 12.18 | 44.65 | 15 |

Table B-8. Solvay Site Wells

| Count | Well ID | Zone | Ground Elevation (ft NAVD88) | TOC Elevation (ft NAVD88) | Depth to TOS (ft TOC) | Screen Length (ft) |
|---|---|---|---|---|---|---|
| 41 | MW-41D | Deep | NS | NS | NS | 15 |
| 42 | MW-42D | Deep | 23.09 | 22.7 | 146.61 | 15 |
| 43 | MW-43D | Deep | 23.21 | 22.87 | 146.66 | 5 |
| 44 | MW-43I | Intermediate | 23.21 | 22.84 | 109.63 | 15 |
| 45 | PZ-8 | Shallow | 4.88 | 6.48 | 4.73 | 10 |
| 46 | MW-24I | Intermediate | 4.97 | 7.539 | 45.569 | 10 |
| 47 | MW-24D | Deep | 4.97 | 7.621 | 65.651 | 10 |

Notes:

NAVD88 = North American Vertical Datum of 1988

NS = not surveyed

TOC = top of casing

TOS = top of screen

# ATTACHMENT B1

SOPs

- INTEGRAL CONSULTING SOPs
- ELM SOPs

# INTEGRAL CONSULTING SOPS

# STANDARD OPERATING PROCEDURE (SOP) AP-01

# SAMPLE PACKAGING AND SHIPPING

## SCOPE AND APPLICATION

This SOP describes specific requirements for sample packaging and shipping to ensure the proper transfer and documentation of environmental samples collected during field operations. Procedures for the careful and consistent transfer of samples from the field to the laboratory are outlined herein. This SOP also presents the method to be used when packing samples that will either be hand delivered or shipped by commercial carrier to the laboratory.

## EQUIPMENT AND SUPPLIES REQUIRED

Make sure that you have the equipment and supplies necessary to properly pack and ship environmental samples, including the following:

- Project-specific sampling and analysis plan (SAP)
- Project-specific field logbook
- Sealable airtight bags in assorted sizes (e.g., Ziploc®)
- Wet ice in doubled, sealed bags; frozen Blue Ice®; or dry ice
- Cooler(s)
- Bubble wrap
- Fiber-reinforced packing tape, clear plastic packing tape, and duct tape
- Scissors or knife
- Chain-of-custody (COC) forms
- COC seals
- Large plastic garbage bags (preferably 3 mil [0.003 in.] thick)
- Paper towels
- "Fragile," "This End Up," or "Handle With Care" labels
- Mailing labels
- Air bills for overnight shipment



ED_004850_00001502-00891

## PROCEDURE

Customize the logistics for sample packaging and shipping to each study. If necessary, transfer samples from the field to a local storage facility where they can be frozen or refrigerated. Depending on the logistics of the operation, field personnel may transport samples to the laboratory or use a commercial courier or shipping service. In the latter case, Integral field personnel must be aware of any potentially limiting factors to timely shipping, such as availability of overnight service and weekend deliveries to specific areas, and shipping regulations regarding "restricted articles" (e.g., dry ice, formalin) prior to shipping the samples.

## SAMPLE PREPARATION

Take the following steps to ensure the proper transfer of samples from the field to the laboratories:

At the sample collection site:

1. Document all samples using the proper logbooks or field forms (see SOP AP-02), required sample container identification (i.e., sample labels with tag numbers), and COC form (example provided in SOP AP-03). Fill out the COC form as described in SOP AP-03, and use the sample labeling techniques provided in SOP AP-04.
2. Make all applicable laboratory quality control sample designations on the COC forms. Clearly identify samples that will be archived for future possible analysis. Label these samples as follows: "Do Not Analyze: Hold and archive for possible future analysis." Some laboratories interpret "archive" to mean that they should continue holding the residual sample after analysis.
3. Notify the laboratory contact and the Integral project quality assurance/quality control (QA/QC) coordinator that samples will be shipped and the estimated arrival time. Send copies of all COC forms to Integral's project QA/QC coordinator or project manager, as appropriate.
4. Keep the samples in the possession of the sampling personnel at all times. Lock and secure any temporary onsite sample storage areas to maintain sample integrity and COC requirements.
5. Clean the outside of all dirty sample containers to remove any residual material that may lead to cross-contamination.
6. Complete the COC form as described in SOP AP-03, and retain the back (pink) copy for project records prior to sealing the cooler. Check sample containers against the COC form to ensure all the samples that were collected are in the cooler.



ED_004850_00001502-00892

7. Store each sample container in a sealed plastic bag that allows the sample label (example provided in SOP AP-03) to be read. Before sealing the bags, ensure that volatile organic analyte (VOA) vials are encased in a foam sleeve or in bubble wrap.
8. If the samples require storage at a specific temperature, place enough ice in the sample cooler to maintain the temperature (e.g., 4°C) throughout the sampling day.

At the sample processing area (immediately after sample collection) take the following steps:

1. If the samples require a specific storage temperature, then cool the samples and maintain the temperature prior to shipping. For example, place enough ice in each sample cooler to maintain the temperature at 4°C until processing begins at the testing laboratory.
2. Be aware of holding time requirements for project-specific analytes and arrange the sample shipping schedule accordingly.
3. Place samples in secure storage (i.e., locked room or vehicle) or keep them in the possession of Integral sampling personnel before shipment. Lock and secure any sample storage areas to maintain sample integrity and COC requirements.
4. Store samples in the dark (e.g., keep coolers shut).

At the sample processing area (just prior to shipping), do the following:

1. Check sample containers against the COC form to account for all samples intended for shipment.
2. Choose cooler(s) of appropriate size and make sure they are clean of gross contamination inside and out. If the cooler has a drain, close the drain and secure it with duct tape.
3. Line the cooler with bubble wrap and place a large plastic bag (preferably with a thickness of 3 mil), open, inside the cooler.
4. Individually wrap each glass container (which was sealed in a plastic bag at the collection site) in bubble wrap and secure with tape or a rubber band. Place the wrapped samples in the large plastic bag in the cooler, leaving room for ice to keep the samples cold (i.e., 4°C).
5. If temperature blanks have been provided by the testing laboratory, place one temperature blank in each sample cooler.
6. If the samples require a specific storage temperature, add enough wet ice or Blue Ice® to maintain that temperature during overnight shipping (i.e., 4°C). Always overestimate the amount of ice that will be required. Keep ice in a sealed plastic bag, which is placed in a second sealed plastic bag to prevent leakage. Avoid separating the samples from the ice with excess bubble wrap because it may insulate the samples from the ice. After adding all samples and ice to the cooler, use bubble wrap (or other



ED_004850_00001502-00893

available clean packing material) to fill any empty space and prevent the samples from shifting during transport.

7. If possible, consolidate all VOA samples in a single cooler and ship them with (a) trip blank(s) if the project-specific QA project plan calls for them.
8. Sign, date, and include any tracking numbers provided by the shipper on the COC form. Remove the back (pink) copy of the original COC form and retain this copy for the project records.
9. Seal the rest of the signed COC form in a bag and tape the bag to the inside of the cooler lid. Each cooler should contain an individual COC form for the samples contained inside it. If time is short and it becomes necessary to combine all the samples onto a single set of COC forms and ship multiple coolers together, then indicate on the outside of the appropriate cooler, "Chain-of-Custody Inside."
10. After the cooler is sufficiently packed to prevent shifting of the containers, close the lid and seal it with fiber-reinforced packing tape. Tape the cooler around the opening, joining the lid to the bottom, and around the circumference of the cooler at both hinges.
11. As security against unauthorized handling of the samples, apply two COC seals across the opening of the cooler lid (provided with example field forms). Place one seal on the front right portion of the cooler and one on the back left. Be sure the seals are properly affixed to the cooler to prevent removal during shipment. Additional tape across the seal may be necessary if the outside of the cooler is wet.

## SAMPLE SHIPPING

### Hand Delivery to the Testing Laboratory

1. Notify the laboratory contact and the Integral project QA/QC coordinator that samples will be delivered to the laboratory and the estimated arrival time.
2. When hand-delivering environmental samples, make sure the testing laboratory receives them on the same day that they were packed in the coolers.
3. Fax or scan and e-mail copies of all COC forms to the Integral project QA/QC coordinator. Note: It may be necessary to photocopy the COC form on a slightly darker setting so the form is readable after it has been faxed. Never leave the original COC form in the custody of non-Integral staff.



ED_004850_00001502-00894

## Shipped by Commercial Carrier to the Laboratory

1. Apply a mailing label to the cooler with destination and return addresses, and add other appropriate stickers, such as "This End Up," "Fragile," and "Handle With Care." If the shipment contains multiple coolers, indicate on the mailing label the number of coolers that the testing laboratory should expect to receive (e.g., 1 of 2; 2 of 2). Place clear tape over the mailing label to firmly affix it to the cooler and to protect it from the weather. This is a secondary label in case the air bill is lost during shipment.
2. Fill out the air bill and fasten it to the handle tags provided by the shipper (or the top of the cooler if handle tags are not available).
3. If samples must be frozen (–20°C) during shipping, make sure that dry ice has been placed in the sample cooler. Be aware of any additional shipping, handling, and special labeling requirements that the shipper may require.
4. Make sure that benthic infauna samples have been preserved with formalin in the field prior to shipping. Be aware of any additional shipping, handling, and special labeling requirements that the shipper may require for these samples.
5. Notify the laboratory contact and the Integral project QA/QC coordinator that samples will be shipped and the estimated arrival date and time. If environmental samples must be shipped at 4°C or –20°C, choose overnight shipping for delivery next morning. Fax or scan and e-mail copies of all COC forms to the Integral project QA/QC coordinator. Note: It may be necessary to photocopy the COC form on a slightly darker setting so the form is readable after faxing. Never leave the original COC form in the custody of non-Integral staff.



ED_004850_00001502-00895

# STANDARD OPERATING PROCEDURE (SOP) AP-02

# FIELD DOCUMENTATION

## SCOPE AND APPLICATION

This SOP describes the Integral procedure for accurate record-keeping in the field for the purposes of ensuring that samples can be traced from collection to final disposition.

Document all information relevant to field operations properly to ensure that activities are accounted for in written records to the extent that someone not present at the site could reconstruct the activity without relying on the memory of the field crew. Several types of field documents are used for this purpose and should be consistently used by field personnel. Field documentation should include only a factual description of site-related activities and observations. Field personnel should not include superfluous comments or speculation regarding the field activities or observations.

## FIELD LOGBOOKS

During field sampling events, field logbooks must be used to record all daily activities. The purpose of the field logbook is to document events and record data measured in the field to the extent that someone not present at the site could reconstruct the activity without relying on the memory of the field crew. The project manager (or designee) should issue a field logbook to the appropriate site personnel for the direction of onsite activities (e.g., reconnaissance survey team leader, sampling team leader). It is this designee's responsibility to maintain the site logbook while it is in his or her possession and return it to the project manager or turn it over to another field team.

Make entries in the field logbook as follows:

1. Document all daily field activities in indelible ink in the logbook and make no erasures. Make corrections with a single line-out deletion, followed by the author's initials and the date. The author must initial and date each page of the field logbook. The author must sign and date the last page at the end of each day, and draw a line through any blank space remaining on the page below the last entry.



ED_004850_00001502-00896

2. Write the project name, dates of the field work, site name and location (city and state), and Integral job number on the cover of the field logbook. If more than one logbook is used during a single sampling event, then annotate the upper right-hand corner of the logbook (e.g., Volume 1 of 2, 2 of 2) to indicate the number of logbooks used during the field event. Secure all field logbooks when not in use in the field. The following is a list of the types of information that is appropriate for entry in the field notebook:
   - Project start date and end date
   - Date and time of entry (24-hour clock)
   - Time and duration of daily sampling activities
   - Weather conditions at the beginning of the field work and any changes that occur throughout the day, including the approximate time of the change (e.g., wind speed and direction, rain, thunder, wave action, current, tide, vessel traffic, air and water temperature, thickness of ice if present)
   - Name and affiliation of person making entries and other field personnel and their duties, including what times they are present
   - The location and description of the work area, including sketches, map references, and photograph log, if appropriate
   - Level of personal protection being used
   - Onsite visitors (names and affiliations), if any, including what times they are present
   - The name, agency, and telephone number of any field contacts
   - Notation of the coordinate system used to determine the station location
   - The sample identifier and analysis code for each sample to be submitted for laboratory analysis, if not included on separate field data sheets
   - All field measurements made (or reference to specific field data sheets used for this purpose), including the time of collection and the date of calibration, if appropriate
   - The sampling location name, date, gear, water depth (if applicable), and sampling location coordinates, if not included on separate field data sheets
   - For aquatic sampling, the type of vessel used (e.g., size, power, type of engine)
   - Specific information on each type of sampling activity
   - The sample type (e.g., groundwater, soil, surface sediment), sample number, sample tag number, and any preservatives used, if not included on separate field data sheets
   - Sample storage methods



ED_004850_00001502-00897

- Cross-references of numbers for duplicate samples
- A description of the sample (source and appearance, such as soil or sediment type, color, texture, consistency, presence of biota or debris, presence of oily sheen, changes in sample characteristics with depth, presence/location/thickness of the redox potential discontinuity [RPD] layer, and odor) and penetration depth, if not included on separate field data sheets
- Estimate of length and appearance of recovered cores, if not included on separate field data sheets
- Photographs (uniquely identified) taken at the sampling location, if any
- Details of the work performed
- Variations, if any, from the project-specific sampling and analysis plan (SAP) or standard operating protocols and reasons for deviation
- Details pertaining to unusual events that might have occurred during sample collection (e.g., possible sources of sample contamination, equipment failure, unusual appearance of sample integrity, control of vertical descent of the sampling equipment)
- References to other logbooks or field forms used to record information (e.g., field data sheets, health and safety log)
- Any field results not appearing on the field data sheets (if used), including station identification and location, date, and time of measurement
- Sample shipment information (e.g., shipping manifests, chain-of-custody (COC) form numbers, carrier, air bill numbers, time addresses)
- A record of quantity of investigation-derived wastes (if any) and storage and handling procedures.

3. During the field day, as listed above, record in the logbook a summary of all site activities. Provide a date and time for each entry. The information need not duplicate anything recorded in other field logbooks or field forms (e.g., site health and safety officer's logbook, calibration logbook, field data sheets), but should summarize the contents of the other logbooks and refer to the pages in these logbooks for detailed information.
4. If measurements are made at any location, record the measurements and equipment used, or refer to the logbook and page number(s) or field forms on which they are recorded. All maintenance and calibration records for equipment should be traceable through field records to the person using the instrument and to the specific piece of instrumentation itself.



ED_004850_00001502-00898

5. Upon completion of the field sampling event, the sampling team leader will be responsible for submitting all field logbooks to be copied. A discussion of copy distribution is provided below.

## FIELD DATA FORMS

Occasionally, additional field data forms are generated during a field sampling event (e.g., groundwater monitoring form, sediment core profile form, water quality measurement form) to record the relevant sample information collected. For instructions regarding the proper identification of field data forms, sampling personnel should consult the project-specific SAP.

Upon completion of the field sampling event, the sampling team leader will be responsible for submitting all field data forms to be copied. A discussion of copy distribution is provided below.

## PHOTOGRAPHS

In certain cases, photographs (print or digital) of sampling stations may be taken using a camera-lens system with a perspective similar to the naked eye. Ensure that photographs include a measured scale in the image, when practical. If you take photographs of sample characteristics and routine sampling activities, avoid using telephoto or wide-angle shots, because they cannot be used in enforcement proceedings. Record the following items in the field logbook for each photograph taken:

1. The photographer's name or initials, the date, the time of the photograph, and the general direction faced (orientation)
2. A brief description of the subject and the field work shown in the picture
3. For print photographs, the sequential number of the photograph and the roll number on which it is contained
4. For digital photographs, the sequential number of the photograph, the file name, the file location, and back-up disk number (if applicable).

Upon completion of the field sampling event, the sampling team leader is responsible for submitting all photographic materials to be developed (prints) or copied (disks). Place the prints or disks and associated negatives in the project files (at the Integral project manager's location). Make photocopies of photo logs and any supporting documentation from the field logbooks, and place them in the project files with the prints or disks.



ED_004850_00001502-00899

## EQUIPMENT CALIBRATION RECORDS

Record in the field logbook all equipment calibration records, including instrument type and serial number, calibration supplies used, calibration methods and calibration results, date, time, and personnel performing the calibration. Calibrate all equipment used during the investigation daily, at a minimum, in accordance with the manufacturers' recommendations.

## DISTRIBUTION OF COPIES

When the field team has returned from the sampling event, the field team leader is responsible for making sure that the field documentation is 1) scanned and placed into the project file on the portal (in a subfolder named Field under Working_Files), and 2) a copy of all field logbooks and additional field data forms is made and placed into the project file. Both the scanned copy and the hard copy will be available for general staff use.

The original field logbooks and forms will be placed in a locked file cabinet for safekeeping. One file cabinet at each Integral office will contain the original field documentation for multiple projects. The original field documentation will be filed at the Integral office where the project manager is located.

## SET-UP OF LOCKING FILE CABINET

Place each project in its own file folder in a locking file cabinet. On the folder label, include the project name and contract number. Each project folder will include up to six kinds of files:

- Field logbook(s)
- Additional field data forms
- Photographs
- COC forms
- Acknowledgment of Sample Receipt forms
- Archive Record form (to be completed only if samples are archived at an Integral field storage facility or Integral laboratory).



ED_004850_00001502-00900

# STANDARD OPERATING PROCEDURE (SOP) AP-03

# SAMPLE CUSTODY

## SCOPE AND APPLICATION

This SOP describes Integral procedures for custody management of environmental samples.

A stringent, established program of sample chain-of-custody will be followed during sample storage and shipping activities to account for each sample. The procedure outlined herein will be used with SOP AP-01, which covers sample packaging and shipping; SOP AP-02, which covers the use of field logbooks and other types of field documentation; and SOP AP-04, which covers sample labeling. Chain-of-custody (COC) forms ensure that samples are traceable from the time of collection through processing and analysis until final disposition. A sample is considered to be in a person's custody if any of the following criteria are met:

1. The sample is in the person's possession
2. The sample is in the person's view after being in his or her possession
3. The sample is in the person's possession and is being transferred to a designated secure area
4. The sample has been locked up to prevent tampering after it was in the person's possession.

At no time is it acceptable for samples to be outside of Integral personnel's custody unless the samples have been transferred to a secure area (i.e., locked up). If the samples cannot be placed in a secure area, then an Integral field team member must physically remain with the samples (e.g., at lunch time one team member must remain with the samples).

## CHAIN-OF-CUSTODY FORMS

The COC form is critical because it documents sample possession from the time of collection through final disposition. The form also provides information to the laboratory regarding what analyses are to be performed on the samples that are shipped.

Complete the COC form after each field collection activity and before shipping the samples to the laboratory. Sampling personnel are responsible for the care and custody of the samples until they are shipped. The individuals relinquishing and receiving the samples must sign the



ED_004850_00001502-00901

COC form(s), indicating the time and date of the transfer, when transferring possession of the samples.

A COC form consists of three-part carbonless paper with white, yellow, and pink copies. The sampling team leader keeps the pink copy. The white and yellow sheets are placed in a sealed plastic bag and secured inside the top of each transfer container (e.g., cooler). Field staff retain the pink sheet for filing at the Integral project manager's location. Each COC form has a unique four-digit number. This number and the samples on the form must be recorded in the field logbook. Integral also uses computer-generated COC forms. If computer-generated forms are used, then the forms must be printed in triplicate and all three sheets signed so that two sheets can accompany the shipment to the laboratory and one sheet can be retained on file. Alternatively, if sufficient time is available, the computer-generated forms will be printed on three-part carbonless paper.

Record on the COC form the project-assigned sample number and the unique tag number at the bottom of each sample label. The COC form also identifies the sample collection date and time, type of sample, project name, and sampling personnel. In addition, the COC form provides information on the preservative or other sample pretreatment applied in the field and the analyses to be conducted by referencing a list of specific analyses or the statement of work for the laboratory. The COC form is sent to the laboratory along with the sample(s).

## PROCEDURES

Use the following guidelines to ensure the integrity of the samples:

1. Sign and date each COC form. Have the person who relinquishes custody of the samples also sign this form.
2. At the end of each sampling day and prior to shipping or storage, make COC entries for all samples. Check the information on the labels and tags against field logbook entries.
3. Do not sign the COC form until the team leader has checked the information for inaccuracies. Make corrections by drawing a single line through any incorrect entry, and then initial and date it. Make revised entries in the space below the entries. After making corrections, mark out any blank lines remaining on the COC form, using single lines that are initialed and dated. This procedure will prevent any unauthorized additions.

   At the bottom of each COC form is a space for the signatures of the persons relinquishing and receiving the samples and the time and date of the transfer. The time the samples were relinquished should match exactly the time they were received by another party. Under no circumstances should there be any time when custody of the samples is undocumented.



ED_004850_00001502-00902

4. If samples are sent by a commercial carrier not affiliated with the laboratory, such as FedEx or United Parcel Service (UPS), record the name of the carrier on the COC form. Also enter on the COC form any tracking numbers supplied by the carrier. The time of transfer should be as close to the actual drop-off time as possible. After signing the COC forms and removing the pink copy, seal them inside the transfer container.
5. If errors are found after the shipment has left the custody of sampling personnel, make a corrected version of the forms and send it to all relevant parties. Fix minor errors by making the change on a copy of the original with a brief explanation and signature. Errors in the signature block may require a letter of explanation.
6. Provide a COC form and an Archive Record form for any samples that are archived internally at Integral.

Upon completion of the field sampling event, the sampling team leader is responsible for submitting all COC forms to be copied. A discussion of copy distribution is provided in SOP AP-02.

## CUSTODY SEAL

As security against unauthorized handling of the samples during shipping, affix two custody seals to each sample cooler. Place the custody seals across the opening of the cooler (front right and back left) prior to shipping. Be sure the seals are properly affixed to the cooler so they cannot be removed during shipping. Additional tape across the seal may be prudent.

## SHIPPING AIR BILLS

When samples are shipped from the field to the testing laboratory via a commercial carrier (e.g., FedEx, UPS), the shipper provides an air bill or receipt. Upon completion of the field sampling event, the sampling team leader will be responsible for submitting the sender's copy of all shipping air bills to be copied at an Integral office. A discussion of copy distribution is provided in SOP AP-02. Note the air bill number (or tracking number) on the applicable COC forms or, alternatively, note the applicable COC form number on the air bill to enable the tracking of samples if a cooler becomes lost.

## ACKNOWLEDGMENT OF SAMPLE RECEIPT FORMS

In most cases, when samples are sent to a testing laboratory, an Acknowledgment of Sample Receipt form is faxed to the project QA/QC coordinator the day the samples are received by the laboratory. The person receiving this form is responsible for reviewing it, making sure that the laboratory has received all the samples that were sent, and verifying that the correct analyses were requested. If an error is found, call the laboratory immediately, and document



ED_004850_00001502-00903

any decisions made during the telephone conversation, in writing, on the Acknowledgment of Sample Receipt form. In addition, correct the COC form and fax the corrected version to the laboratory.

Submit the Acknowledgment of Sample Receipt form (and any modified COC forms) to be copied. A discussion of copy distribution is provided in SOP AP-02.

## ARCHIVE RECORD FORMS

On the rare occasion that samples are archived at an Integral office, it is the responsibility of the project manager to complete an Archive Record form. This form is to be accompanied by a copy of the COC form for the samples, and will be placed in a locked file cabinet. The original COC form remains with the samples in a sealed Ziploc® bag.



ED_004850_00001502-00904

# STANDARD OPERATING PROCEDURE (SOP) AP-04

# SAMPLE LABELING

## SCOPE AND APPLICATION

This SOP describes the general Integral procedures for labeling samples, and the three kinds of labels that can be used on a project (i.e., sample labels, sample tags, and internal sample labels). Consult the project-specific sampling and analysis plan (SAP) to determine the exact sample identifiers and sample labels that are required for a given project. If they are not specified in the SAP, then follow the designations below.

## SAMPLE IDENTIFIERS

Before field sampling begins, establish sample identifiers to be assigned to each sample as it is collected. Sample identifiers consist of codes designed to fulfill three purposes: 1) to identify related samples (i.e., replicates) to ensure proper data analysis and interpretation, 2) to obscure the relationships between samples so that laboratory analysis will be unbiased by presumptive similarities between samples, and 3) to track individual sample containers to ensure that the laboratory receives all material associated with a single sample. To accomplish these purposes, each container may have three different codes associated with it: the sample identifier, the sample number, and the sample tag number. These codes and their use are described as follows:

- **Sample Identification Code**—The sample identification code (Sample ID) is a unique designation that identifies where and how the sample was collected. The sample identifier is recorded in the field logbook *only* and is not provided on the sample label or chain-of-custody (COC) form. The sample identifier is a multiple-part code. The first component begins with the letter abbreviation; for example, "SWNS" or "SWNB" to designate the surface water sample was collected from the near-surface or near-bottom of the water column. The second part could identify the sampling event; for example, "1" to designate Round 1 sampling. The third part could contain an abbreviation for whether the station is a single point (SP), a transect (TR), a composite (CO), or a vertically integrated station (VI). The station number would be the final component of the sample identifier. Use leading zeros for stations with numbers below 100 for ease of data management and correct data sorting.

  If appropriate, add a supplemental component to the sample identifier to code field



ED_004850_00001502-00905

duplicate samples and splits. Use a single letter (i.e., a suffix of "A" and "B") to indicate field duplicates or splits in the final component of the sample identifiers. For equipment decontamination blanks, assign sequential numbers starting at 900 instead of station numbers. Use a sample type code that corresponds to the sample type for which the decontamination blank was collected. Additional codes may be adopted, if necessary, to reflect sampling equipment requirements (see project-specific SAP).

Examples of sample IDs are as follows:

- SWNS-1-SP-002: Surface water sample collected from the near-surface at a single point during Round 1 from Station 2.
- SWNB-1-TR-010-A: Duplicate surface water sample from the near-bottom transect during Round 1 from Station 10.

- **Sample Number**—The sample number is an arbitrary number assigned to each distinct sample or split that is shipped to the laboratory for separate analysis. The sample number appears on the sample containers and the COC forms. Each sample will be assigned a unique sample number. All aliquots of a composited field sample will have the same sample number. In cases where samples consist of multiple bottles from the same location, assign each bottle the same sample number and time. However, assign replicates from the same location different sample numbers and times. Sample numbers of related field replicates will not necessarily have any shared content.

  Each field split of a single sample will also have a different sample number and time. The sample number is generally a unique six-digit number that includes a two-digit media code and a four-digit number. The media code may be site-specific, but the Integral default codes are as follows:

  - SS—Surface soil
  - BH—Subsurface soil or rock (typically from borehole)
  - GW—Groundwater
  - SW—Surface water
  - PW—Pore water
  - SD—Sediment
  - BT—Biota or biological tissue

  The exact sample numbering scheme may vary from project to project. Variances in the sample numbering scheme will be described in the project-specific SAP for the field event. Example sample numbers are PW0001, PW0002, PW0003, etc.



ED_004850_00001502-00906

- **Tag Number**—Attach a different tag number to each sample container. If the amount of material (i.e., everything associated with a single sample number) is too large for a single container, assign each container the same sample number and a different sample tag. A sample will also be split between containers if a different preservation technique is used for each container (i.e., because different analyses will be conducted).

  The sample tag number is a unique five- or six-digit number assigned to each sample label (or "tag") for multiple bottles per sample. Integral sample labels come with a preprinted sample tag number. The tag number provides a unique tracking number to a specific sample bottle. This allows for greater flexibility in tracking sample bottles and assists in field quality control when filling out documentation and shipping. Sample tags are not used by many other consultants, and there may be resistance from such firms during teaming situations. However, experience has shown that tags can be very valuable, both in the field and while processing data from field efforts.

  Record tag numbers on the COC form. Laboratories use tag numbers only to confirm that they have received all of the containers that were filled and shipped. Data are reported by sample number.

Assign sample numbers sequentially in the field; sample labels are preprinted with sequential tag numbers.

## SAMPLE LABELS

Integral sample labels are designed to uniquely identify each individual sample container that is collected during a sampling event. Field sampling teams are provided with preprinted sample labels, which must be affixed to each sample container used. Fill out the labels at the time the samples are collected, documenting the following information:

- Sample number
- Site name or project number
- Date and time sample is collected
- Initials of the samplers
- Preservatives used, if any
- A unique number (commonly referred to as the "Tag Number") that is preprinted on the label consisting of five or six digits; used to identify individual containers.

## SAMPLE TAGS

Integral sample tags are designed to be affixed to each container that is used for a sample. Sample tags are required only for environmental samples collected in certain U.S.



ED_004850_00001502-00907

Environmental Protection Agency (EPA) regions (e.g., EPA Region 5). Field crews are provided with preprinted sample tags. Attach sample tags to each individual sample container with a rubber band or wire through a reinforced hole in the tag. Mark all sample tag entries with indelible ink. Fill out the tags at the time the samples are collected, documenting the following information:

- Sample number
- Site name or project number
- Date and time sample is collected
- Initials of the samplers
- Preservatives used, if any
- Type of analysis.

A space for the laboratory sample number (provided by the laboratory at log-in) will also be provided on the sample tag.

## INTERNAL SAMPLE LABELS

For benthic infaunal samples, wash away the sediment from the sample and collect the remaining benthic infauna into a sample container. Affix sample label (as discussed above) to the outside of the sample container. In addition, place an internal sample label inside the sample container. This internal sample label is made of waterproof paper; be sure to make all internal sample label entries with pencil. Fill out the internal sample labels at the time the samples are collected, documenting the following information:

- Sample number
- Site name or project number
- Date and time sample is collected
- Initials of the samplers
- Preservative used (e.g., formalin).



ED_004850_00001502-00908

# STANDARD OPERATING PROCEDURE (SOP) AP-05

# INVESTIGATION-DERIVED WASTE HANDLING

## SCOPE AND APPLICATION

This SOP presents the method to be used for handling wastes generated during field sampling activities that could be hazardous. These wastes are referred to as investigation-derived waste and are subject to specific regulations.

All disposable materials used for sample collection and processing, such as paper towels and gloves, are not considered investigation-derived wastes and will be placed in heavyweight garbage bags or other appropriate containers. Disposable supplies will be removed from the site by sampling personnel and placed in a normal refuse container for disposal at a solid waste landfill.

## EQUIPMENT AND REAGENTS REQUIRED

- 55-gallon drums (or appropriately sized waste container)
- Paint markers
- Tools (to open and close drum)
- Ziploc® bags
- Drum labels.

## PROCEDURES

1. Place solid wastes that need to be containerized in properly labeled, DOT- approved, 55-gallon drums.
2. Properly close, seal, label, and stage all filled or partially filled drums before demobilization. Properly profile full drums and have them shipped off site to a RCRA Subtitle C facility.



ED_004850_00001502-00909

3. Sampling activities generate personal protective equipment and miscellaneous debris that require disposal. Remove gross contamination from these items, and place the items in plastic bags. It is acceptable to store these items in plastic bags as an interim measure. At the end of each day, dispose of the bags at an appropriate solid waste facility dumpster.



ED_004850_00001502-00910

# STANDARD OPERATING PROCEDURE (SOP) AP-06

# NAVIGATION AND STATION POSITIONING

## SCOPE AND APPLICATION

This SOP describes procedures for accurate station positioning required to ensure quality and consistency in collecting samples and in data interpretation and analysis. Station positioning must be both absolutely accurate in that it correctly defines a position by latitude and longitude, and relatively accurate in that the position must be repeatable, allowing field crew to reoccupy a station location in the future (e.g., for long-term monitoring programs).

This SOP describes the most commonly used station positioning method, differential global positioning system (DGPS). Integral uses a Trimble Pathfinder™ Pro XRS DGPS for station positioning for many field efforts. The Pro XRS offers the submeter accuracy often required for documenting sampling station locations and for re-locating previously sampled stations. A comprehensive discussion of the Trimble Pathfinder™ Pro XRS DGPS is provided in Attachments 1, 2, and 3 of this SOP.

## SUMMARY OF METHOD

Global positioning system (GPS) navigation is used to position the sampler at the desired location. GPS is a satellite-based system that receives positioning data at 1-second intervals from multiple satellites at known positions in space. Standard GPS is calculated to an accuracy of about 10 m.

One can obtain a higher accuracy of approximately 2 m by applying differential corrections to the standard GPS positioning data using DGPS. These differential corrections are applied by sending GPS differential corrections to the GPS receiver via radio transmission. If the sampling location is near the coastal U.S, the U.S. Coast Guard generates differential corrections that are transmitted via radio link to the GPS receiver. If a Coast Guard station is out of range of the sampling area, then a receiver may be set up at a known (i.e., surveyed) reference point on land, or real-time satellite differential signals can be purchased from a private company (e.g., OmniSTAR).

With the Pro XRS, GPS data can be gathered to submeter accuracy using a choice of differential correction sources (i.e., free beacon differential signals such as Coast Guard beacons or OmniSTAR) without establishing a reference station. Data must be corrected to gain submeter accuracy. Free beacon or base station signals allow differential corrections to be



ED_004850_00001502-00911

performed after data collection by using a nearby beacon or base station logging data files. (Note: The station must be within 300 miles of the data collection location.) For satellite-based signals, a built-in virtual base station allows for real-time data correction, eliminating the need for post-processing data in some cases. However, postprocessing data corrections can obtain accuracies in the range of 30–50 cm. These accuracies are for the horizontal (northing and easting) component only. The vertical component (elevation) accuracy ranges from submeter to 3 times larger than the horizontal accuracy.

The GPS receiver displays and transmits differentially corrected positioning data to the computer using an integrated navigation software package (e.g., HYPACK, Terrasync). The computer data are typically displayed and recorded in World Geodetic System of 1984 (WGS-1984) geographic coordinates (latitude/longitude). However, the integrated navigation system can display and record information in other datums (e.g., UTM, NAD83). The integrated navigation system, acting as a data manager, displays the sampler's position relative to a target station location in plan view on a video screen. The resulting pictorial screen presentation, as well as numeric navigation data (e.g., range and bearing to the target sampling location) assists the vessel operator (when sampling on-water) in approaching and maintaining the station position while sampling.

## SUPPLIES AND EQUIPMENT

- Cable
- GPS antenna
- Telemetry antenna (for differential corrections)
- GPS receiver
- Differential corrections receiver
- Computer and monitor
- Navigation software (e.g., Terrasync)
- Logbook or log sheets.

## PROCEDURES

Obtain latitude and longitude coordinates at the locations where samples are collected. An average positioning objective is to accurately determine and record the positions of all sampling locations to within 2 m. Positioning accuracies on the order of 1–3 m can be achieved by avoiding the few minutes per day when the satellites are not providing the same level of signal. The GPS provides the operator with a listing of the time intervals during the



ED_004850_00001502-00912

day when accuracies are decreased. Avoiding these times allows for better positioning accuracy.

## On-Land Sampling Event

A backpack DGPS unit may be used to direct the sampling team to the proposed sampling location. To expedite field activities, enter the target station coordinates into the navigation system database prior to beginning sampling. Place the DGPS antenna as close as possible to where the sampling will occur. Once the sample(s) have been collected at the appropriate location, record the horizontal coordinates of the station in the field logbook.

## On-Water Sampling Event

Mount the GPS antenna vertically at the outboard end of the vessel's boom, with the GPS antenna cable extended along the boom into the cabin. Mount the telemetry antenna for receiving differential corrections on a convenient fixture outside the cabin. Locate the GPS receiver, the differential corrections receiver, and the computer in the cabin. Orient the video screen for the computer to allow the vessel operator to observe on-screen positioning data from the helm.

Alternatively, use a backpack DGPS unit to position the sampling vessel (e.g., barge) over a proposed sampling location. Place the DGPS beacon as close as possible to where the drilling will occur (i.e., moon pool). Using the DGPS unit, direct the sampling vessel operator to the sample station location.

Once the sampling vessel is anchored at the appropriate location, record the horizontal coordinates of the station in the field logbook. To expedite field activities, enter the target station coordinates in the navigation system database prior to beginning sampling.

## Positioning System Verification

GPS requires no calibration, as all signal propagation is controlled by the U.S. government (the Department of Defense for satellite signals and the U.S. Coast Guard for differential corrections). Verifying the accuracy of the GPS requires coordinates to be known for one (or more) horizontal control point within the study area. The GPS position reading at any given station can then be compared to the known control point. Verify the GPS accuracy at the beginning and end of each sampling day.

## Station Positioning Activities

Use a consistent routine for each day's positioning activities. After confirming successful reception of differential signals, turn on the computer on, and the boot the software. Verify the accuracy of the system at a horizontal control point, as described in the previous section.



ED_004850_00001502-00913

The sampling team proceeds to a target station location selected by the team leader. That station location is then selected from a number of preselected station locations that have been entered into the integrated navigation system database. Once the station has been selected, the positioning data are displayed on the computer screen or hand-held unit to assist in proceeding to the station and in maintaining the station position during sampling. A confirmed position is recorded electronically each time a sample collection is attempted. (This means that during sediment grab sampling and coring, the locations of both accepted and rejected grabs or cores are recorded.) Upon recovery of the sampling device, read the station position northing (y) and easting (x) coordinates from the archived computer file and record them in the field logbook or on log sheets as a backup to the computer record. Also record time and water depth, if applicable. Ancillary information recorded in the field logbook may include personnel operating the GPS, tidal phase, type of sampling activity, and time when coordinates were collected.

## REFERENCES

Trimble Navigation Limited. 2001. TSC1 Asset Surveyor operation manual. Version 5.20. http://trl.trimble.com/dscgi/ds.py/Get/File-8145/Oper.pdf.

Trimble Navigation Limited. 2007. GPS tutorial. Accessed on January 12, 2007. http://www.trimble.com/gps/index.shtml.



ED_004850_00001502-00914

# ATTACHMENT 1
# PRO XRS DESCRIPTION

The Pro XRS combines a high-performance GPS receiver and antenna, beacon differential receiver, and satellite differential receiver in one compact unit. It also includes Trimble's advanced Everest™ technology, which allows users to collect accurate position data near walls, water, vehicles, or other surfaces that reflect satellite signals. Reflected signals, also called multipath signals, make it difficult for GPS receivers to accurately determine position. Everest™ uses a patented technique to remove multipath signals before measurements are used to calculate position.

## Equipment Required

The GPS Pathfinder™ Pro XRS consists of the following:

- GPS receiver in backpack casing (with system batteries and cables)
- Hand-held data logger (TSC1) and cable, *or* laptop computer with Terrasync software installed and cable. (Note: Terrasync procedures are described under separate cover.)
- Pro XRS antenna, range poles, and cable
- Compass and tape measure
- Spare 12-volt camcorder and 9-volt batteries (minimum of two each) (use only Kodak, Duracell, or Energizer 9-volt batteries)
- Battery charger and power cord.

## Pro XRS Setup

Follow these procedures for the proper setup of the Pro XRS:

1. Ensure that connections between batteries, receiver, and data logger are correct and secure. The coaxial antenna cable connects from the GPS receiver port "ANT" to the base of the antenna. The TSC1 cable (a "pig-tail"-type cable) connects from the bottom or top of the TSC1 to the receiver port "B," where a 9-pin serial port dongle is attached. The dual Y-clip cables should be connected from the receiver to the batteries. Alternatively, if AC power is available (e.g., aboard a vessel), then the power cable for the battery charger can be attached directly to the receiver on some models.
2. Screw the three long antenna poles together (the shorter pole may be added if necessary for taller users). Screw on the antenna and connect its cable.
3. Put backpack and/or shoulder strap on. The pouch for the data logger should be in place around the waist strap or in the backpack.



ED_004850_00001502-00915

4. Screw antenna to the attachments on the top of the backpack. Wind cord around pole, and ensure the antenna is secure. Please be aware of overhead hazards, especially if working near low-hanging power lines. Severe injury or death can result.

## Basic Operation of the Pro XRS

### Recording a Feature

Before beginning field use, ensure that all GPS configurations and settings are set correctly for the particular use of the Pro XRS and that an appropriate data dictionary is loaded onto the TSC1 (see Attachments 2 and 3 for typical settings). These steps outline the basic use of the GPS to document a sample position or any other defined "feature." Note that the TSC1 has both hard and soft keys that allow for its operation. The hard keys comprise all of the keys (e.g., letters and numbers) on its surface. The soft keys are the F1 through F5 hard keys. The function of these changes depending upon the context. These keys will be referred to with brackets around them (<soft-key>).

1. Turn data logger on outside in an open area. Wait for antenna to receive satellite signals. The display will read Recording Almanac, Too Few SVs, and PDOP Too High. Continue to wait until enough satellites (four) are acquired and the PDOP is below 5.0.
2. Ensure that the real-time settings are correct according to the parameters listed in Attachment 2.
3. Select **Data Collection**, and create a new rover file or open an existing file. This file should be named according to the format specified by the project GIS analyst. Note: If opening an existing file, press **<NEW>** to access the *Antenna Options* menu and *Start Feature* menu.
4. Enter the height of the antenna from the ground to the *Measurement Method* reference point shown in the *Antenna Options* menu and then press **ENTER** to bring up the *Start Feature* menu.
5. Pick the appropriate data dictionary to use with the rover file. Only one dictionary can be used with a rover file. Consult with the project GIS analyst to formulate the most appropriate data dictionary for the type of sampling you wish to perform. The data dictionary titled *Generic* contains only a comment field and is appropriate for simple navigation tasks. If using a data dictionary, make sure to become familiar with its attributes before recording information in the field.



ED_004850_00001502-00916

6. Move to the location of the first feature for which you want to record the GPS position. Select the appropriate feature and press **ENTER** to begin logging. Log data points in accordance with the feature type. Point features should have at least 10 points collected at a stationary location. Line features should be collected while moving. If movement is stopped, press the **<PAUSE>** key. When movement starts again, press the **<RESUME>** key. Area features should be collected with enough points to define the outline of the area (e.g., a square building would have four single points, collected on each corner, and the **<PAUSE>** key would be used between each of the points).
7. Depending on the setup of the data dictionary, each feature may have one or more feature attributes. An attribute is used to record additional data associated with the feature. For example, the attributes assigned to a sediment sampling station could be the sample number, station ID, sampling gear, sediment color, odor, etc.
8. Use the **<PAUSE>** key while recording feature attributes to avoid too many data points being collected at one point feature. (Body movements while logging attributes for an extended time can decrease the accuracy of collection.) The **<PAUSE>** key must be used when recording attributes of a line or area feature because only one data point should be collected in a single location.
9. Once all attributes are entered and the feature data points are logged, press **ENTER** to complete and save the feature and move on to a new feature. Pressing **ESC** instead of **ENTER** will allow the user to abandon the logged feature without saving.
10. When all features in a given area have been recorded, from the *Data Collection* menu, press **ESC** to exit data capture and then press **<YES>** to close the file. Features are appended and saved to the file after each collection, so there is no need to "save" the file. When the Pro XRS is not in use, it should be turned off. If you need to come back to the same rover file later in the day, the rover file may be reopened at that time. Rover files may not be edited after 7 days from the first feature was created. Please consult the project GIS analyst for the best way to handle multi-week sampling projects.
11. At the end of each day, download the rover file to a PC using Pathfinder Office software.

### Feature Collection Options

**Offsets**—The Pro XRS can collect a point or line feature while standing at a set distance away from the feature. This option may be necessary because of obstructions such as tree cover, buildings, or car traffic. For a point feature, measure the distance between the object you want recorded and the Pro XRS antenna. Use the compass to determine the bearing (e.g., west is 270°). The bearing is the direction the point should be moved for it to be located in the correct place (e.g., if you are due north of the feature, the bearing is south, or 180°; i.e., the position you want recorded is south of where you are standing). Estimate the inclination from the



ED_004850_00001502-00917

feature to the GPS antenna (if altitude determination is critical, a clinometer should be used). The inclination is the degree angle up from the feature to the antenna (e.g., if the feature is 5° below the antenna position, enter −5°). During data capture, from within the feature, press the **<OFFSET>** button, and enter the distance, bearing, and inclination. Press **OK** to complete the feature. Note: This procedure describes an offset of a single feature. A constant offset may be applied to all features collected as well.

**Nesting**—While recording a line feature or an area feature, a point feature may be collected to avoid backtracking. While recording the line or area feature, press **<PAUSE>** and then **<NEST>**. The Pro XRS will prompt for collection of a new feature. Move to the feature, and collect data as for any other point feature. When the feature is complete, press **OK**. The Pro XRS is ready to resume collecting data as part of the line/area feature: press **<RESUME>**. (Remember to continue moving before pressing resume to avoid having multiple positions recorded in the same place in the line or area feature.)

**Segmenting**—While moving along a line feature, changing the attributes of that line may be necessary (e.g., because of a change in surface type from paved to dirt road). This change may be done without having to begin a new feature by pressing **<PAUSE>** and then ****. Change the appropriate attributes and then press **<RESUME>** to continue recording.

**Repeat**—This function allows the collection of a new feature with the same feature attributes as the previous feature. If features are not exactly the same, it also allows editing of the attributes.

**Quickmark**—Allows collection of point features while moving (e.g., from a car or a boat) by estimating the exact location. The use of this feature will not result in positionally accurate locations and is not recommended for most sampling operations.

## Reviewing and Editing Features

It is possible to review or edit features collected in the field while still in the data capture mode. For example, it may be necessary to document the GPS location in the field logbook or to edit one of the feature's attributes. Without exiting data capture, press **<REVIEW>**. (If data capture is already complete, just press **<REVIEW>** and then select the appropriate rover file.) This step will display a list of data points including each feature collected. Scroll to the appropriate feature, and follow the steps below depending on the required action:

- To view the GPS location (e.g., lat/lon), press **<POS>**.
- To edit the attributes, press **ENTER**. Make any necessary edits to the attributes by scrolling through.
- To change or add an offset, press **<POS>** and then **<OFFSET>**. Make any necessary changes.
- To delete a feature collected in error, press **<DEL>**.



ED_004850_00001502-00918

## Navigating to an Existing Location

### Waypoints

To use the Pro XRS to navigate to a previously established position, this position must be loaded into the data logger as a waypoint, present as a feature position in the data files, or generated in the field using the GPS unit. Waypoints may be entered into the TSC1 by:

- Entering coordinates manually
- Choosing previously recorded locations and importing them into the TSC1 by using Pathfinder Office
- Defining a location stored in a rover file saved to the TSC1 as a waypoint (see *Reviewing/Editing Features*, above)
- Creating a way point from the current position being shown by the operating GPS unit in the field.

### Navigating

Usually you will use the *Navigation* module (accessed by pressing **MENU** followed by **Navigation**) to guide yourself to a target (waypoint or feature). You can also use the *Map* module (accessed by pressing **MENU** followed by **Map**) to:

1. Orient yourself in the area where you are working.
2. Get a general indication of the location of a feature or waypoint that you want to find.
3. Find or select features or waypoints to which you wish to navigate toward.
4. Plot a course from one place to another.
   a. While in the Map screen, the GPS cursor x shows the current position reported by the receiver and is always shown on the Map screen (Note: it may not always be within the visible part of the screen when panning or scrolling). The **<OPTIONS>** key can be used to hide or display the GPS trail (line of dots showing up to 60 previous positions), the heading showing the direction of travel, and other options on the map display.
   b. Select a feature by pressing **MENU**, Data Collection to reach the *Start Feature* screen, and then **<REVIEW>** to access all features contained in the data file. Highlight and select the desired feature by pressing the **<Target>** key, which adds a crossed flag to the feature. Reaccess the *Map* screen by selecting **MENU**, then **Map**, which will now show the highlighted feature with a crossed flag symbol on the Map screen. You can then start moving toward the feature, and the current position (shown by the x) will move closer to the target position as the user approaches.



ED_004850_00001502-00919

c. There are two graphical modes of navigation with the Pro XRS in the TSC1 *Navigation* module. On both modes, text information appears on the right of the screen in the *Info* panels, which can be configured by the user. The graphical modes available are the *Directional Dial* screen or the *Road* screen, which can be toggled between using the **<Mode>** key.

d. To navigate, select a target and then a start position. Each of these positions can be features from an open data file or a waypoint. Access a list of available features or waypoints by pressing **<TARGET>** or **<START>**. Once the item has been chosen as a target, it will show the crossed flags symbol in the list. Once a target has been selected, *Distance to Go* appears at the bottom of the *Navigation* screen, which indicates the distance from the current GPS position to the target. Select a start position (not required but useful for calculating crosstrack error and other navigation information) by pressing **<START>**. A waypoint of the current GPS position can be created for use as the Start point by selecting **<CREATE>**. Once the Start position is selected, a flag symbol will appear next to the item in the list.

e. In the *Directional Dial* mode, an arrow will appear that will always point at the target. This is the bearing to go. (Note: You need to be moving for this to be accurate, as it will lock if you are moving too slowly or have stopped.) The triangle at the top represents the direction that you are going or heading. This triangle never moves, but by changing directions, you can line up the arrow with the triangle. When the two are aligned, you are heading in the direction of the target. When you are close to the target, a bull's-eye (two concentric circles) will appear at the edge of the screen. This is warning you that the unit will be switching to the close up screen. A proximity alarm will sound and the directional arrow will be replaced by the bull's-eye on the close up screen. Your current position will be shown by an x and the target by the bull's-eye. Move so that the x is in the same location as the bull's-eye.

f. In the *Road* mode, navigate by walking down a road. Your position is shown by a stick figure and is always positioned in the center of the screen. The target (crossed flags) shows the point to which you are navigating toward. Your heading is shown by the top center of the screen and the bearing to go is shown by the direction of the road, which will rotate as you change your heading. Change your heading until the road is pointing at the top of the screen (*Target* is also at the top of the screen) and the edges are parallel to the sides of the screen. As you move toward the target the screen zooms in, so the road appears to get wider.

## Downloading Rover Files

Upon returning to the office, download all rover files from the TSC1 to a PC for post-processing. You will need the Trimble Pathfinder software installed on your computer. If you



ED_004850_00001502-00920

are not using a field laptop that already has the program installed, contact your project GIS analyst for instructions on how to install the software.

Connect the TSC1 to your computer using the appropriate cables. In addition to the "pigtail" cable, you will also need a null modem (a 9-pin female-to-female cable) to plug into a PC serial port. Once connected, power up the TSC1 unit and navigate to *MENU>File Manager>File Transfer*. Then, open the Pathfinder software and navigate to the *Utilities>Data Transfer…* window from the menu bar. Select **GIS Datalogger** on COM1 (for most computer systems), and press the green **Connect** button. Download files from the TSC1 by selecting the **Receive** tab and choosing the data file type from the *Add* pulldown menu (Figure 1).

After downloading, remove all rover files and waypoints from the TSC1 to conserve memory. Rover files may be deleted from the *File Manager* menu as follows:

1. Select **MENU>File Manager>Delete File(s)**
2. Select the rover file to be deleted, and press **<ENTER>**
3. Confirm the deletion of this file by pressing **<YES>**.

Delete data dictionaries in the same manner by selecting **Data Dictionaries** from the *File Manager* menu. Delete waypoints by selecting **Utilities** from the *Main* menu and then by selecting **Waypoints,** followed by **<DEL>**.

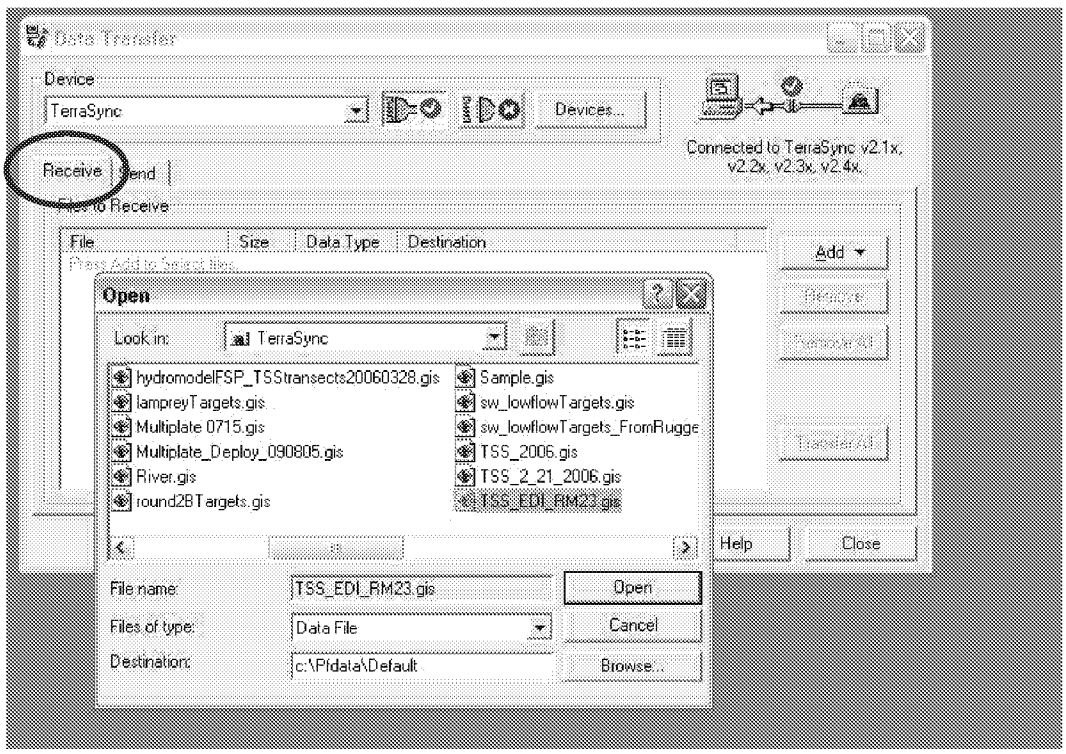



Figure 1. Transferring File from Terrasync



ED_004850_00001502-00921

# ATTACHMENT 2
# TSC1 SETTINGS

The following are lists of menus that can be accessed through the TSC1 keypad. Please ensure that settings are correct before proceeding. Do not make changes to the settings unless necessary. Each menu will list all available subheadings, the correct setting, and the available **<soft-keys>** to access additional menus. Comments are included only where necessary.

## GPS Rover Options

To access this menu, select **Configuration** from the main menu and then select **GPS Rover Options**. The table below lists logging options and settings.

| Logging Options | Setting | Comment |
|---|---|---|
| *Logging intervals* | | |
| Point feature | 1s | |
| Line/area feature | 2s–5s | depending upon speed of movement |
| Not in feature | None | |
| Velocity | None | |
| Confirm end feature | No | |
| Minimum pos | 10 | |
| Carrier Mode | Off | |
| Carrier phase min. time | 10 minutes | |
| Dynamics code | Land | May be changed to sea or air, as appropriate |
| Audible click | Yes | |
| Log DOP data | Yes | |
| Log PPRT data | Yes | |
| Log QA/QC data | Yes | |
| Allow GPS update | Warn First | |
| Warning Distance | Any | |
| Position Mode Manual | 3D | |
| Elevation Mask | 15° | Should not go below 13° (accuracy decreases) |
| SNR Mask | 6.0 | Can raise to 7 if multi-path filtering is poor |
| PDOP Mask | 5.0 | Can be raised up to 8; reduces accuracy |
| PDOP Switch | 6.0 | |



ED_004850_00001502-00922

## Real-Time Input Options

Access this menu from the GPS Rover *Options* menu by selecting **Real-Time Input**. The table below shows options and settings for real-time input.

| Options | Setting | Comment |
|---|---|---|
| Preferred Correction Source | | |
| | Choice 1 | Integrated Beacon |
| | Choice 2 | Integrated WAAS |
| | Choice 3 | Use uncorrected GPS |
| Correction Age Limit | 20s | |

## Antenna Options

Access this menu from the GPS rover *Options* menu by selecting **Antenna Options**. The table below shows antenna options and settings.

| Option | Setting | Comment |
|---|---|---|
| Height | 6 ft | Enter correct user antenna height using measurement method indicated below |
| Measure | Uncorrected | |
| Type | Integrated GPS/Beacon/Satellite | |
| Confirm | Per file | Can be changed to “Per feature” if antenna height varies and elevation is critical |
| Part Number | 33580-50 | Auto selected based on TYPE selected |
| Measurement | Bottom of Antenna | |
| Method | Mount | |



ED_004850_00001502-00923

# ATTACHMENT 3
# ADDITIONAL SETTINGS FOR THE TSC1

Additional TSC1 settings can be found in the *Configuration* menu. Items of particular importance are indicated in italics.

## Configuration

This menu can be accessed by selecting **Configuration** from the main menu. The table below lists options and descriptions for the *Configuration* menu.

| Options | Description |
|---|---|
| GPS base station options | For using a land base station or beacon for real time corrections |
| NMEA/TSIP output | Consult manual |
| Coordinate system | Changes coordinate system among latitude/longitude, UTM, and other coordinate systems. System can be converted, if necessary, after data capture by using Pathfinder Office software. |
| Map Display options | Change layers, scale, background files and items shown on the TSC1 screen during data collection |
| Navigation options | Changes Navigation parameters |
| Units and display | Changes various units, for example: length (e.g., feet, meters), altitude reference (e.g., MSL), *North reference* (i.e., true or magnetic). Units can be converted, if necessary, after data capture by using Pathfinder Office software. |
| Time and date | Changes to *local time*, 24-hour clock, date format, and other options |
| Quickmarks | Set-up parameters for use with Quickmarks. |
| Constant offset | Set-up parameters for use with a constant offset. |
| External sensors | Connections with external sensors. |
| Hardware (TSC1) | TSC1 settings such as beep volume, contrast, *internal and external battery status*, software version, free space. |

## Contrast and Backlighting

The TSC1 display can be viewed in various light settings. Press **FUNC,** then **L** to turn on the display backlight for viewing in dim lighting. Adjust the contrast by pressing **FUNC**, then **E** or **F**.



ED_004850_00001502-00924

# ATTACHMENT 4
# PRE-SAMPLING ACTIVITIES BEFORE USE OF THE PRO XRS

## Determination of Optimal Satellite-Use Time

Positioning accuracies on the order of ±1 to 3 m can be achieved by avoiding the few minutes per day when the satellites are not providing the same level of signal. The GPS unit provides the operator with a listing of the time intervals during the day when accuracies are decreased. Avoiding these time intervals permits the operator to maintain better positioning accuracy.



ED_004850_00001502-00925

# ATTACHMENT 5
# MANAGING GPS DATA FROM TERRASYNC—A TUTORIAL

Currently, positional data collected in the field is most often done with a Trimble GPS unit (usually rented) interfaced with a laptop via Trimble's Terrasync software. The Terrasync software sometimes exhibits quirks that interfere with the smooth operation of data collection in otherwise stressful field conditions. This tutorial is meant to supplement the Terrasync software documentation and serve as a guide to field personnel to help them retrieve and collect geographic data as efficiently as possible with existing software.

## Scope

This document is intended to be a reference for procedures involving the following:

- Fixing files that are more than 7 days old so that they can be updated
- Adding features in GPS Pathfinder software (companion to Terrasync) and then importing them as base files in Terrasync..

This document is not intended to be a comprehensive manual for using Terrasync or Pathfinder software. It is assumed that the reader has received at least some training on how to use the basic features of Terrasync and is competent at using MS Windows.

## The Basics

GPS data collection currently relies on two pieces of complementary software:

- Terrasync—the interface for GPS navigation and data collection.
- Pathfinder Office—a multiuse piece of software that acts as a conduit between GIS data files (shape files) and Terrasync GPS files. Pathfinder can also be used as a simple map editor.

### Installing the Correct Versions of Terrasync and Pathfinder

Important Note: This tutorial uses Pathfinder Office v. 3.00 and Terrasync v. 2.50. It is very important to use the proper versions of this software to avoid compatibility issues. These software versions should be included in the same folder as this tutorial, or can be obtained from GIS staff.

http://www.trimble.com/terrasync_ts.asp?Nav=Collection-4576

Key code for TerraSync
499043-00110-05273-EDD049BC

Pathfinder v.3.00
001533-00300-04152-0ee4d11f



ED_004850_00001502-00926

### Initial Setup of Terrasync/Pathfinder

Certain settings and configuration setups are needed before Pathfinder can talk to Terrasync. Whether you are installing this software for the first time or have an existing installation, check to make sure that these settings are in place.

1. Open Pathfinder Office and go to the *Utilities>Data Transfer...* menu. A dialog box should appear. This is the interface for communicating with Terrasync.
2. Click the **Devices** button, and then **New…** (Figure 1).
3. Click on **GIS Folder**.
4. Browse to the Terrasync data folder on your computer, which in most cases will be *C:\My Documents\TerraSync*.
5. In the next box, *Type* will be **Terrasync**, and *Version* will be **v. 2.1x, v.2.2x, v.2.3x,** and **v2.4x**.
6. At the prompt for a name that will display in the device list, enter **Terrasync**.
7. Go back to the Data Transfer dialog box, select **Terrasync** from the dropdown menu, press the **Connect** icon, and look for a green check mark indicating success.



ED_004850_00001502-00927

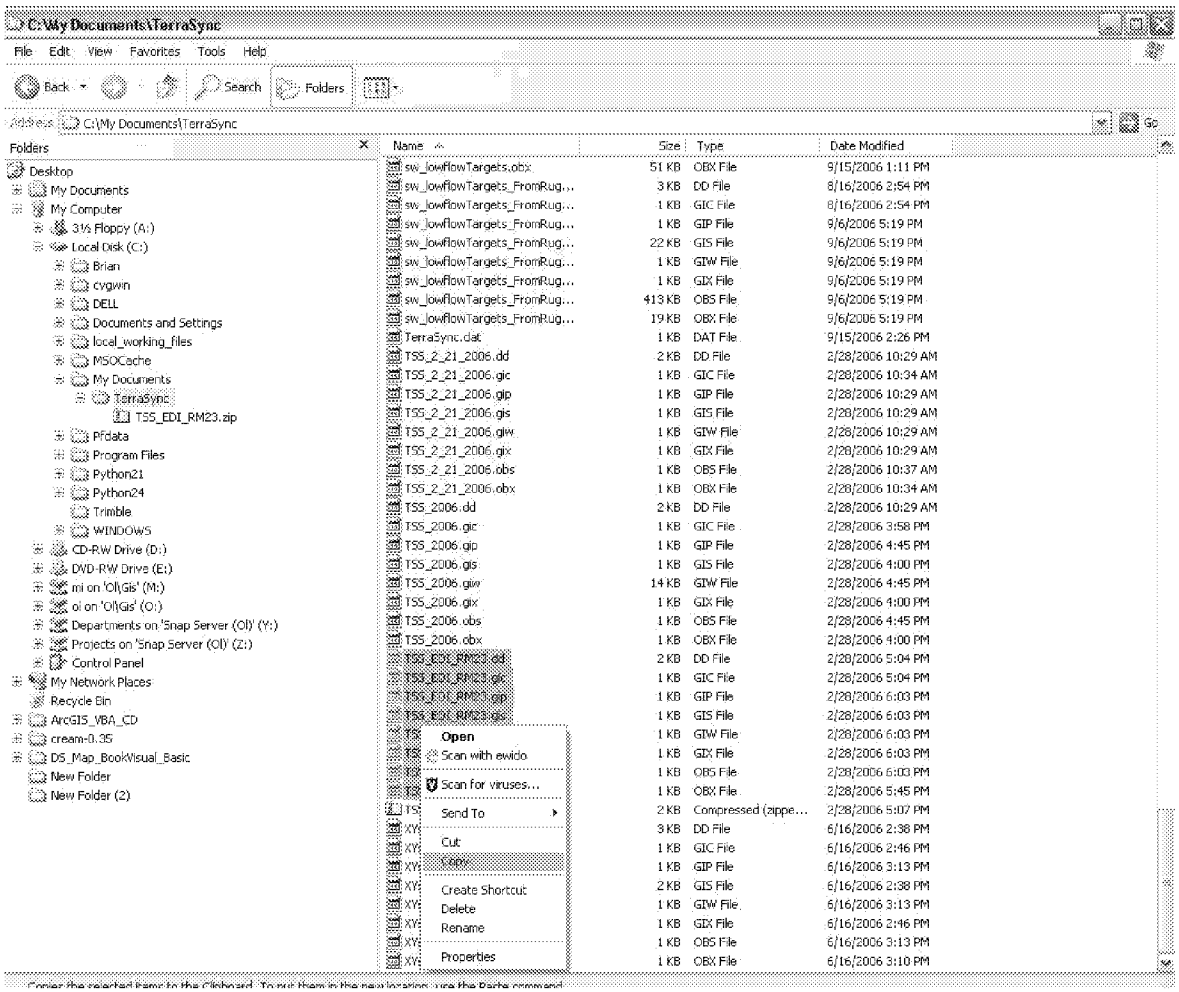



Figure 2. Selecting Files To Copy to a Different Directory

If this procedure does not work for you, you may have the wrong version of Pathfinder. For some unknown reason, with each version upgrade of Pathfinder, connectivity to older versions of Terrasync is lost. You can check what version of Pathfinder you have installed by going to the *Help>About GPS Pathfinder Office...* menu. To find out what version of Terrasync you have, go to *C:\Program Files\TerraSync*, right-click on **Terrasync.exe**, and choose the **Version** tab.

## Handling Expired Files in Terrasync

One of the most common problems that field personnel will have to deal with is the 1-week expiration date when trying to collect data with Terrasync. This is a built-in function of Terrasync, and there is no simple way to work around it. The following instructions will guide you through the process to make the files usable. See Figure 3.



ED_004850_00001502-00928

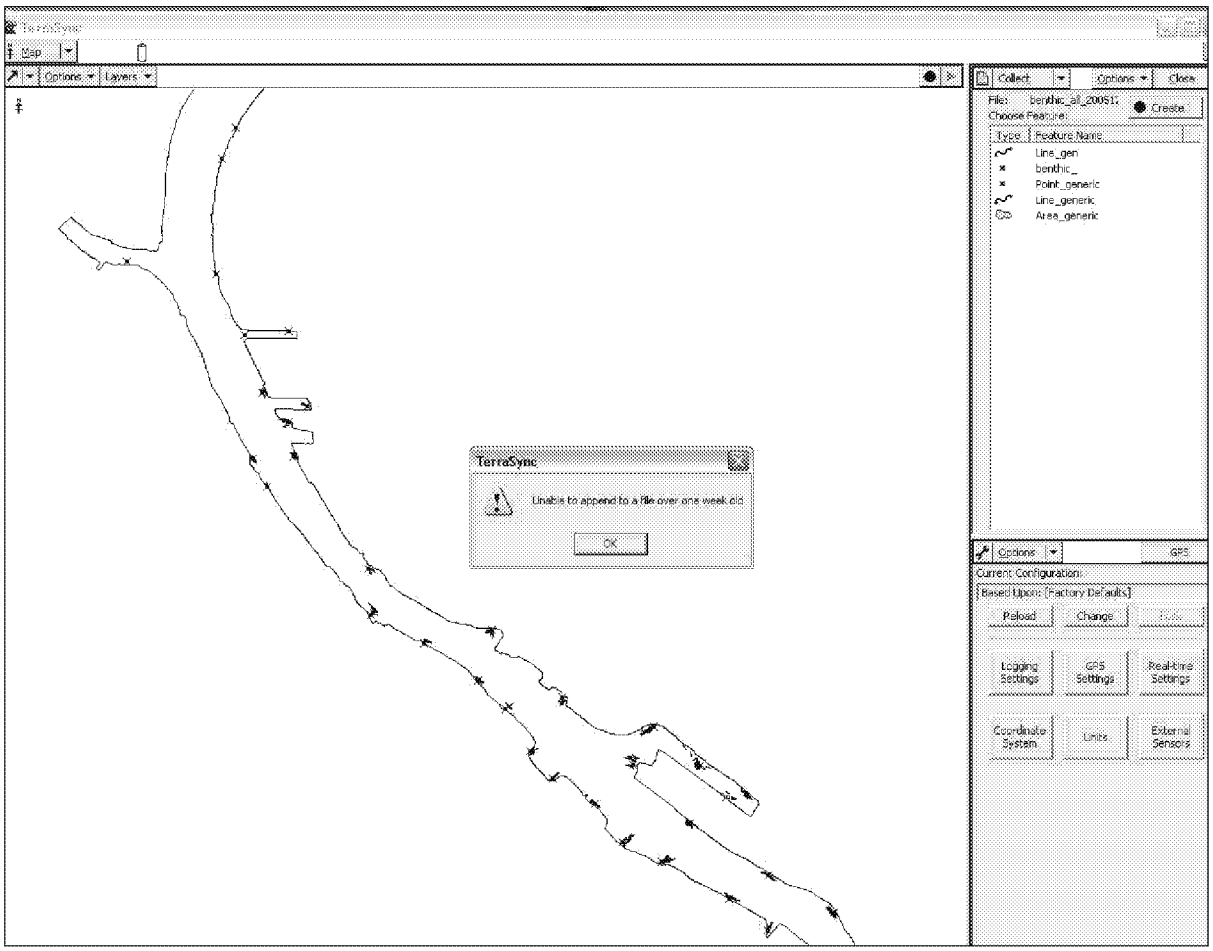



Figure 3. Notice That Terrasync File Older Than 1 Week Will Not Allow User To Collect Features (time begins to elapse when first feature is collected in the field, not when file is created)

Two options are available, depending on your needs. If you do not need to see the previously logged locations and need only to see the targets, use the original files provided by GIS staff (Option 1). If you need to see previously occupied locations in order to make decisions about where to go next, then transfer the file to Pathfinder and back again (Option 2).

### Option 1: Move and replace logged files with original targets.

At the beginning of the field effort, you should receive a set of files with the target locations, most likely in a zip archive (.zip file extension). There will be six to eight files with the same name but with different extensions (Figure 4). These files will have to go into the *C:\My Documents\TerraSync* folder in order to be available to Terrasync.



ED_004850_00001502-00929

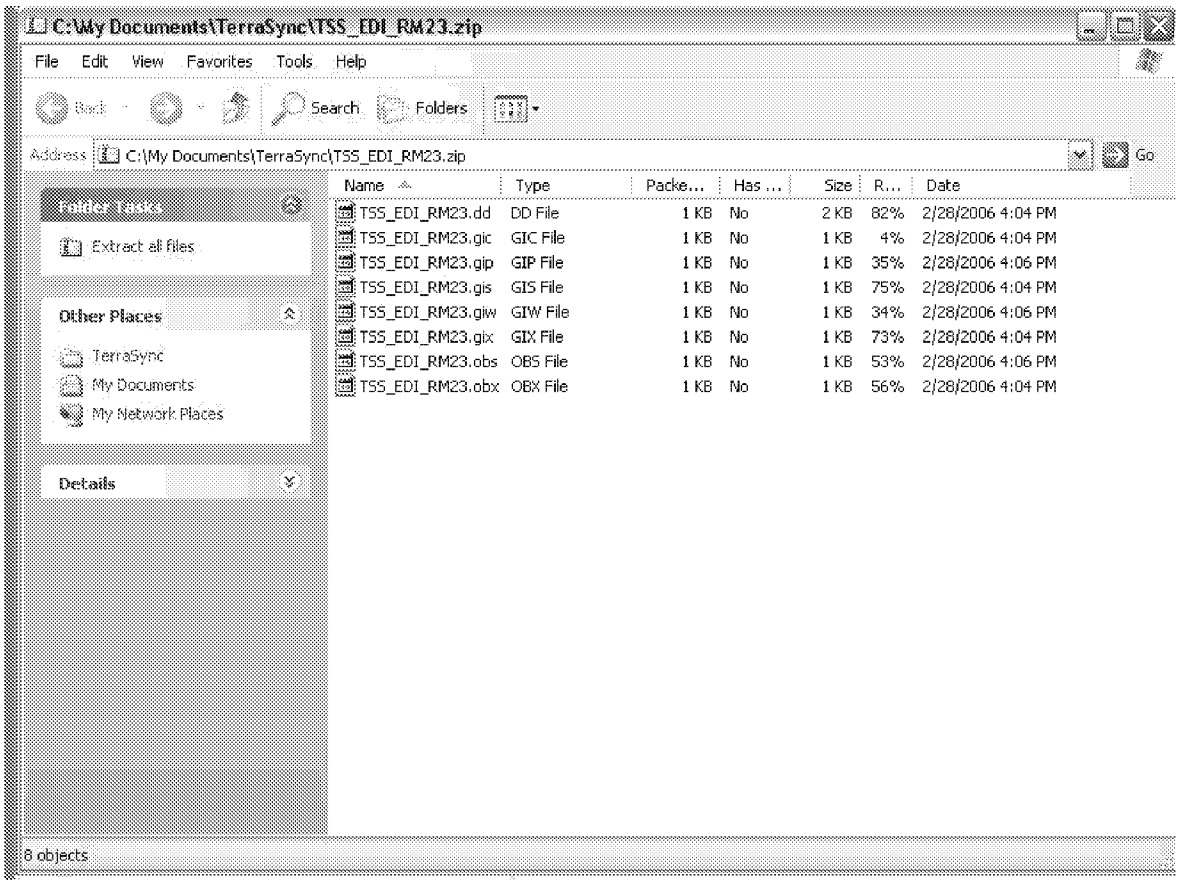



Figure 4. Example of File Set To Be Unzipped into the Terrasync Folder

After you unzip these files to Terrasync, keep this zip archive around in an easy-to-find place, such as your computer desktop, because the 1-week clock does not start until you begin collecting your first point in the field. You can use this unadulterated file again, as long as you make a copy of the work you did the previous week. The detailed steps are as follows:

1. Make sure you have the original files with the target locations available in a handy place. This will probably be the original zip archive. Also, be sure to close Terrasync while performing this process.
2. Navigate to C:\My Documents\TerraSync\ in Windows Explorer. Locate the files that you have been using the previous week. Note: It is crucial to get all of the small files associated with the data set. While it is useful to sort the files by date modified, you can miss some of the small files—it is highly recommended that you sort the files alphabetically.



ED_004850_00001502-00930

3. Copy all of these files to a different directory, preferably one that is named appropriately to reflect the data and time period that you were collecting. For example: C:\Documents and Settings\bpointer\Desktop\lampreyTargets_20060925. These files contain the data you have collected the previous week and should be backed up and/or emailed to the appropriate project manager or GIS staff.
4. You can now safely replace the files you just copied with the ones from the original zip file. Right-click the zip archive, and click Extract All. When prompted to Select a folder to extract files to, browse to C:\My Documents\TerraSync. (Figure 5). If prompted about replacing existing files, select Yes to All. Note: It is crucial to make copies of the files first (see Step 3 above)—otherwise, you may lose the data.
5. You should now be able to open the file in Terrasync and begin logging as normal.

Figure 5. Extract (or copy) Original Target Files into the Terrasync Directory

### Option 2: Transfer files back and forth from Terrasync.

If you need to be able to see the previously occupied positions from last week while positioning this week, you need to use Pathfinder to reset the file. This process will essentially combine the targets and actuals from last week into one file. However, this method has its drawbacks; once converted, the actuals from last week will not be able to be corrected, so a backup procedure similar to the one in the previous option should be carried out to maintain data integrity.



ED_004850_00001502-00931

The steps for file transfer are as follows:

1. For good data management, back up the data files from the previous week using the procedure laid out in steps 1 through 3 in Option 1 above.
2. Close Terrasync and open up Pathfinder Office.
3. Go to the Utilities>Data Transfer menu or just click the icon on the left (Figure 6).
4. Ensure that the device listed is Terrasync. If not, follow the initial setup instructions at the beginning of this document. Most of the computers used for GPS logging are already setup for this.
5. There are two tabs, Receive and Send. Make sure that Receive is selected and then go to Add>Data File. Select the file(s) that you are using and select Open. The file should now be in the Files to Receive box. Click Transfer All and wait for the transfer to take place. If you have made the recommended backups, it is fine to replace any files.
6. Now select the Send tab (Figure 7), and go to Add>Data File. Select the file you just transferred (it will have the same name as the Terrasync file) and click Open. Now click Transfer All to move the file back to Terrasync.

   By transferring the file back and forth from Terrasync to Pathfinder, you have "reset the clock" and can now update the file for an additional 7 days. This file will have your targets and actual positions from the last week, so it is important to be aware of the features you are selecting for navigation.

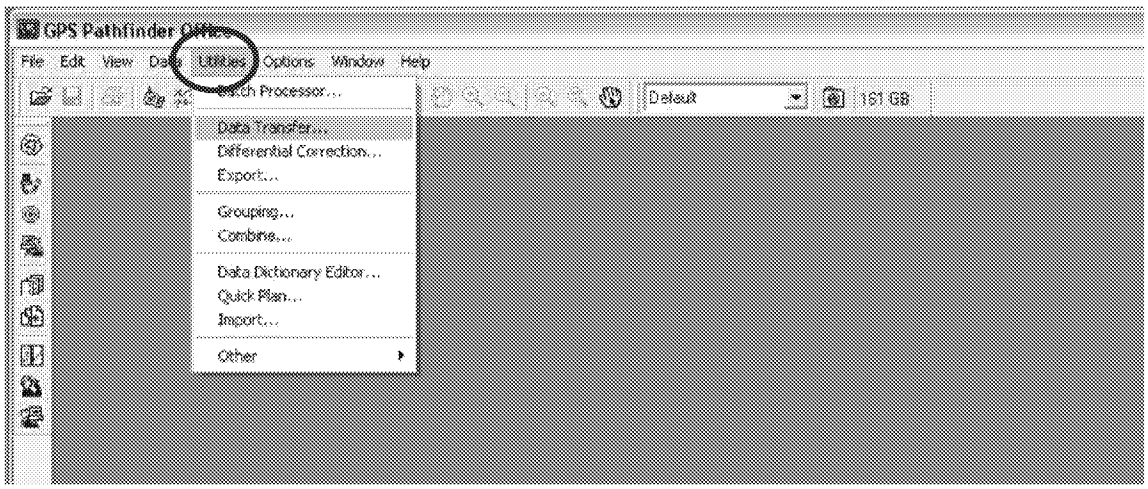



Figure 6. Data Transfer Menu



ED_004850_00001502-00932

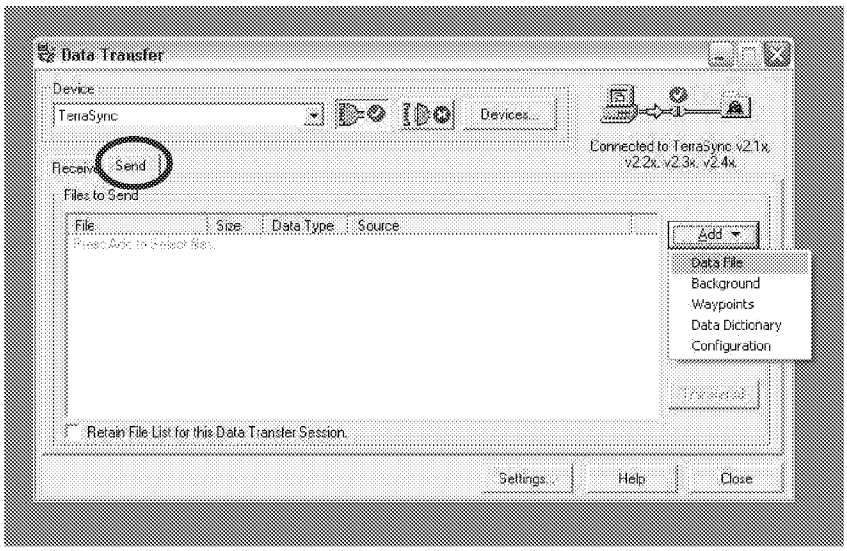



Figure 7. Sending Data File



ED_004850_00001502-00933

# STANDARD OPERATING PROCEDURE (SOP) SD-01

# DECONTAMINATION OF SEDIMENT SAMPLING EQUIPMENT

## SCOPE AND APPLICATION

This SOP describes procedures for decontaminating sampling and processing equipment contaminated by either inorganic or organic materials. To prevent potential cross contamination of samples, all reusable sediment sampling and processing equipment is decontaminated before each use. At the sample collection site, a decontamination area is established in a clean location that is upwind of actual sampling locations, if possible. All sediment sampling and processing equipment is cleaned in this location. Decontaminated equipment is stored away from areas that may cause recontamination. When handling decontamination chemicals, field personnel must follow all relevant procedures and wear protective clothing as stipulated in the site-specific health and safety plan (HSP).

Sampling equipment (e.g., van Veen, Ekman, Ponar, core tubes) may be used to collect samples that will 1) undergo a full-suite analysis (organics, metals, and conventional parameters) or 2) be analyzed for metals and conventional parameters only. Decontamination of sampling equipment used for both analyte groups should follow the order of a detergent wash, site water rinse, organic solvent rinses, and final site water rinse. Sample processing equipment (e.g., bowls, spoons) has a final rinse with distilled/deionized water rinse instead of site water. If the surface of stainless steel equipment appears to be rusting (possibly due to prolonged contact with organic-rich sediment), it should undergo an acid rinse and a site-water rinse at the end of each sampling day to minimize corrosion.

## EQUIPMENT AND REAGENTS REQUIRED

Equipment required for decontamination includes the following:

- Polyethylene or polypropylene tub (to collect solvent rinsate)
- Plastic bucket(s) (e.g., 5-gal bucket)
- Tap water or site water
- Carboy, distilled/deionized water (analyte-free; received from testing laboratory or other reliable source)
- Properly labeled squirt bottles



ED_004850_00001502-00934

- Funnels
- Alconox®, Liquinox®, or equivalent industrial detergent
- Pesticide-grade acetone and hexane (consult the project-specific field sampling plan [FSP], as the solvents may vary by EPA region or state)
- 10 percent (v/v) nitric acid (reagent grade) for inorganic contaminants
- Baking soda
- Long-handled, hard-bristle brushes
- Extension arm for cleaning core liners
- Plastic sheeting, garbage bags, and aluminum foil
- Core liner caps or plastic wrap and rubber bands
- Personal protective equipment as specified in the health and safety plan.

## PROCEDURES

### Decontamination Procedures for Full Suite Analysis (Organic, Metal, or Conventional Parameters)

Two organic solvents are used in this procedure. The first is miscible with water (e.g., ethanol) and is intended to scavenge water from the surface of the sampling equipment and allow the equipment to dry quickly. This allows the second solvent to fully contact the surface of the sampler. Make sure that the solvent ordered is anhydrous or has a very low water content (i.e., < 1 percent). If ethanol is used, make sure that the denaturing agent in the alcohol is not an analyte in the samples. The second organic solvent is hydrophobic (e.g., hexane) and is intended to dissolve any organic chemicals that are on the surface of the equipment.

The exact solvents used for a given project may vary by EPA region or state (see project-specific FSP). Integral uses ethanol and hexane as preferred solvents for equipment decontamination. If specified in the project-specific FSP, isopropanol or acetone can be substituted for ethanol, and methanol can be substituted for hexane in the decontamination sequence. The choice of solvents is also dependent on the kind of material from which the equipment is made (e.g., acetone cannot be used on polycarbonate), and the ambient temperature (e.g., hexane is too volatile in hot climates). In addition, although methanol is sometimes slightly more effective than other solvents, its use is discouraged due to potential toxicity to sampling personnel.

The specific procedures for decontaminating sediment sampling equipment and sediment compositing equipment are as follows:



ED_004850_00001502-00935

1. Rinse the equipment thoroughly with tap or site water to remove visible sediment. Perform this step onsite for all equipment, including core liners that will not be used again until the next day of sampling. After removing visible solids, set aside sampling equipment that does not need to be used again that day; this equipment should be thoroughly cleaned in the field laboratory at the end of the day.
2. Pour a small amount of concentrated laboratory detergent into a bucket (i.e., about 1–2 tablespoons per 5-gal bucket) and fill it halfway with tap or site water. If the detergent is in crystal form, make sure all crystals are completely dissolved prior to use.
3. Scrub the equipment in the detergent solution using a long-handled brush with rigid bristles. For the polycarbonate core liners, use a round brush attached to an extension arm to reach the entire inside of the liners, scrubbing with a back-and-forth motion. Be sure to clean the outside of core liners, bowls, and other pieces that may be covered with sediment.
4. Double rinse the equipment with tap or site water and set right-side-up on a stable surface to drain. The more completely the equipment drains, the less solvent will be needed in the next step. Do not allow any surface that will come in contact with the sample to touch any contaminated surface.
5. If the surface of stainless steel equipment appears to be rusting (this will occur during prolonged use in anoxic marine sediments), passivate[1] the surface as follows (if no rust is present, skip to next step). Rinse with a 10 percent (v/v) nitric acid solution using a squirt bottle, or wipe all surfaces using a saturated paper towel. Areas showing rust may require some rubbing with the paper towel. If using a squirt bottle, let the excess acid drain into the waste container (which may need to be equipped with a funnel). Double-rinse equipment with tap or site water and set right-side-up on a stable surface to drain thoroughly.
6. Carefully rinse the equipment with ethanol from a squirt bottle, and let the excess solvent drain into a waste container (which may need to be equipped with a funnel). Hold core liners over the waste container and turn them slowly so the stream of solvent contacts the entire surface. Turn the sample apparatus (e.g., grab sampler) on its side and open it to wash it most effectively. Set the equipment in a clean location and allow it to air dry. Use only enough solvent to scavenge all of the water and flow off the surface of the equipment (i.e., establish sheet flow) into the waste container. Allow equipment to drain as much as possible. Ideally, the equipment will be dry. The more thoroughly it drains, the less solvent will be needed in the next step.

[1] Passivation is the process of making a material less reactive relative to another material. For example, before sediment is placed in a stainless-steel container, the container can be passivated by rinsing it with a dilute solution of nitric acid and deionized water.



ED_004850_00001502-00936

7. Carefully rinse the drained or air-dried equipment with hexane from a squirt bottle, and let the excess solvent drain into the waste container (which may need to be equipped with a funnel). If necessary, widen the opening of the squirt bottle to allow enough solvent to run through the core liners without evaporating. (Hexane acts as the primary solvent of organic chemicals. Ethanol is soluble in hexane but water is not. If water beading occurs, it means that the equipment was not thoroughly rinsed with acetone or that the acetone that was purchased was not free of water.) When the equipment has been rinsed with hexane, set it in a clean location and allow the hexane to evaporate before using the equipment for sampling. Use only enough solvent to scavenge all of the acetone and flow off the surface of the equipment (i.e., establish sheet flow) into the waste container.
8. Do a final rinse with site water for the sampling equipment (i.e., van Veen, Ekman, Ponar, core tubes) and with distilled/deionized water for processing equipment (i.e., stainless-steel bowls and spoons). Equipment does not need to be dried before use.
9. If the decontaminated sampling equipment is not to be used immediately, wrap small stainless-steel items in aluminum foil (dull side facing the cleaned area). Seal the polycarbonate core liners at both ends with either core caps or cellophane plastic and rubber bands. Close the jaws of the Ekman and Ponar grab samplers and wrap in aluminum foil.

   If the sample collection or processing equipment is cleaned at the field laboratory and transported to the site, then the decontaminated equipment will be wrapped in aluminum foil (dull side facing the cleaned area) and stored and transported in a clean plastic bag (e.g., a trash bag) until ready for use, unless the project-specific FSP lists special handling procedures.
10. Rinse or wipe with a wetted paper towel all stainless-steel equipment at the end of each sampling day with 10 percent (v/v) normal nitric acid solution. Follow with a freshwater rinse (site water is okay as long as it is not brackish or salt water).
11. After decontaminating all of the sampling equipment, place the disposable gloves and used foil in garbage bags for disposal in a solid waste landfill. When not in use, keep the waste solvent container closed and store in a secure area. The waste should be transferred to empty solvent bottles and disposed of at a licensed facility per the procedures listed in the project-specific FSP. When not in use, keep the waste acid container closed and store in a secure area. The acid waste should be neutralized with baking soda and disposed of per the procedures listed in the project-specific FSP.

## Decontamination Procedures for Metals and Conventional Parameters Only

The specific procedures for decontaminating sediment sampling equipment and sediment processing equipment are as follows:



ED_004850_00001502-00937

1. Rinse the equipment thoroughly with tap or site water to remove the visible sediment. Perform this step onsite for all equipment, including core liners that will not be used again until the next day of sampling. Set aside pieces that do not need to be used again that day; these pieces should be and thoroughly cleaned in the field laboratory at the end of the day.
2. Pour a small amount of concentrated laboratory detergent into a bucket (i.e., about 1–2 tablespoons per 5-gal bucket) and fill it halfway with tap or site water. If the detergent is in crystal form, make sure all crystals are completely dissolved prior to use.
3. Scrub the equipment in the detergent solution using a long-handled brush with rigid bristles. For the polycarbonate core liners, use a round brush attached to an extension arm to reach the entire inside of the liners, scrubbing with a back-and-forth motion. Be sure to clean the outside of core liners, bowls, and other pieces that may be covered with sediment.
4. Double-rinse the equipment with tap or site water and set right-side-up on a stable surface to drain. Do not allow any surface that will come in contact with the sample to touch any contaminated surface.
5. If the surface of stainless steel equipment appears to be rusting (this will occur during prolonged use in anoxic marine sediments), passivate[2] the surface as follows (if no rust is present, skip to next step). Rinse with a 10 percent (v/v) nitric acid solution using a squirt bottle, or wipe all surfaces using a saturated paper towel. Areas showing rust may require some rubbing with the paper towel. If using a squirt bottle, let the excess acid drain into the waste container (which may need to be equipped with a funnel). Double-rinse sampling equipment with tap or site water and set right-side-up on a stable surface to drain. Double-rinse processing equipment with distilled/deionized water and allow to drain.
6. If the decontaminated sampling equipment is not to be used immediately, wrap small stainless-steel items in aluminum foil (dull side facing the cleaned area). Seal the polycarbonate core liners at both ends with either core caps or cellophane plastic and rubber bands. Close the jaws of the Ekman and Ponar grab samplers and wrap in aluminum foil.

   If the sample collecting or processing equipment is cleaned at the field laboratory and transported to the site, then the decontaminated equipment will be wrapped in aluminum foil (dull side facing the cleaned area) and stored and transported in a clean plastic bag until ready for use, unless the project-specific FSP lists special handling procedures.

---

[2] Passivation is the process of making a material less reactive relative to another material. For example, before sediment is placed in a stainless-steel container, the container can be passivated by rinsing it with a dilute solution of nitric acid and deionized water.



ED_004850_00001502-00938

7. After decontaminating all of the sampling equipment, place the disposable gloves and used foil in garbage bags for disposal in a solid waste landfill. When not in use, keep the waste acid container closed and store in a secure area. The acid waste should be neutralized with baking soda and disposed of per the procedures listed in the project-specific FSP.



ED_004850_00001502-00939

# STANDARD OPERATING PROCEDURE (SOP) SD-02

# PREPARATION OF FIELD QUALITY CONTROL SAMPLES FOR SEDIMENTS

## SCOPE AND APPLICATION

This SOP describes the purpose, preparation, and collection frequency of field duplicate samples, field replicate samples, matrix spike/matrix spike duplicates, equipment rinsate blanks, bottle blanks, trip blanks, temperature blanks, environmental blanks, and reference materials (i.e., a standard reference material, a certified reference material, or other reference material; for the purposes herein, all types of reference materials are referred to as standard reference material, or SRM) for sediment sampling efforts. Not all of the field quality control samples discussed in this SOP may be required for a given project. The specific field quality control samples will be identified in the project-specific field sampling plan (FSP) and quality assurance project plan (QAPP). For most projects, Integral's recommended field quality control samples are an equipment rinsate blank, a field duplicate, and trip blanks if samples are to be analyzed for volatile organic compounds (VOCs). Definitions of all potential quality control samples are described below.

As part of the quality assurance/quality control (QA/QC) program, all field quality control samples will be sent to the laboratories "blind." To accomplish this, field quality control samples will be prepared and labeled in the same manner as regular samples, with each quality control sample being assigned a unique sample number that is consistent with the numbering for regular samples. All of the containers with preservatives that are required to complete the field quality control sample for the applicable analyte list shall be labeled with the same sample number. The sample ID for field quality control samples should allow data management and data validation staff to identify them as such and should be recorded only in the field logbook. Under no circumstances should the laboratory be allowed to use reference materials, rinsate blanks, or trip blanks for laboratory quality control analysis (i.e., duplicates, matrix spike, and matrix spike duplicates). To prevent such an occurrence, regular samples should be selected and marked on the chain-of-custody/sampling analysis request (COC/SAR) form or the laboratory should be instructed to contact the project QA/QC coordinator to select appropriate samples for each sample group.

Field quality control samples will be prepared at least once per sampling event, and certain types will be prepared more often at predetermined frequencies. If the number of samples taken does not equal an integer multiple of the intervals specified in this SOP, the number of



ED_004850_00001502-00940

field quality control samples is specified by the next higher multiple. For example, if a frequency of 1 quality control sample per 20 is indicated and 28 samples are collected, 2 quality control samples will be prepared. Field quality control samples for sediment sampling activities should be prepared consistent with the requirements discussed below and at the frequency indicated unless different frequency requirements are listed in the FSP and QAPP.

The following table lists the quality control sample types and suggested frequencies for sediment sampling programs. Because sediment quality control sampling may require assessment of site cross-contamination, additional blanks may be required. A detailed explanation of each quality control sample type with the required preparation follows.

Table 1. Field Quality Control Sample Requirements

| Quality Control Sample Name | Abbreviation | Preparation | | Frequency[a] |
|---|---|---|---|---|
| | | Location | Method | |
| Duplicate | DUP | Sampling site | Additional natural sample | One per 20 samples. May not be applicable if REP is being collected. |
| Replicate | REP | Sampling site | Additional natural sample | One replicate per 20 samples. May not be applicable if DUP is being collected. |
| Matrix spike/matrix spike duplicate | MS/MSD | Sampling site | Additional sample bottles filled for laboratory quality control requirements | One per 20 samples. |
| Equipment rinsate blank | ER | Sampling site | Deionized water collected after pouring through and over decontaminated equipment | Minimum of one per sampling event per type of sampling equipment used and then 1 per 20 thereafter. |
| Filter wipe | FW | Sampling site | Whatman filter papers (organic analysis) and Ghost Wipes (metals/mercury analysis) will be wiped over decontaminated equipment | Minimum of one per sampling event per type of sampling equipment used and then 1 per 20 thereafter. |
| Filter paper blank | FB | Sampling site | Clean, unused Whatman filter papers (organic analysis) and Ghost Wipes (metals/mercury analysis) will be sent to the analytical laboratory | Minimum of one for each lot number of filter papers used. |
| Bottle blank | BB | Field | Unopened bottle | One per sample episode or one per bottle type. |
| Trip blank | TB | Laboratory | Deionized water with preservative | One pair per each VOC sample cooler shipment. |



ED_004850_00001502-00941

| Quality Control Sample Name | Abbreviation | Preparation | | Frequency[a] |
|---|---|---|---|---|
| | | Location | Method | |
| Temperature blank | TMB | Laboratory | Deionized water | One per sample cooler. |
| Environmental blank | EB | Field | Bottle filled at sample site with deionized water | One per 20 samples. |
| Standard reference material | SRM | Field laboratory or sampling site | SRM ampules or other containers for each analyte group | One set per 50 samples or one per episode. |

[a] Frequencies provided here are general recommendations; specific frequencies should be provided in the project-specific FSP or QAPP.

## FIELD DUPLICATE SAMPLES

Field duplicate (or split) samples are collected to assess the homogeneity of the samples collected in the field and the precision of the sampling process. Field duplicates will be prepared by collecting two aliquots for the sample and submitting them for analysis as separate samples. Field duplicates will be collected at a minimum frequency of 1 per 20 samples or once per sampling event, whichever is more frequent. The actual number of field duplicate samples collected during a sampling event will be determined on a case-by-case basis by the project QA/QC coordinator (consult the project-specific FSP and QAPP, as the requirements on frequency of field duplicate collection may vary by EPA region or state).

## FIELD REPLICATE SAMPLES

Field replicate samples are co-located samples collected in an identical manner over a minimum period of time to provide a measure of the field and laboratory variance, including variance resulting from sample heterogeneity. Field replicates will be prepared by collecting two completely separate samples from the same station and submitting them for analysis as separate samples. Field replicates will be collected at a minimum frequency of 1 per 20 samples or once per sampling event, whichever is more frequent. If field duplicate samples are collected, then it is unlikely that field replicate samples will also be collected during a sampling event. The actual number of field replicate samples collected during a sampling event will be determined on a case-by-case basis by the project QA/QC coordinator (consult the project-specific FSP and QAPP, as the requirements on frequency of field duplicate collection may vary by EPA region or state).



ED_004850_00001502-00942

## MATRIX SPIKE/MATRIX SPIKE DUPLICATES

The matrix spike/matrix spike duplicate (MS/MSD) analyses provide information about the effect of the sample matrix on the design and measurement methodology used by the laboratory. To account for the additional volume needed by the laboratory to perform the analyses, extra sample volumes may be required to be collected from designated sediment stations. MS/MSDs may be collected at a minimum frequency of 1 per 20 samples or once per sampling event, whichever is more frequent. The actual number of extra bottles collected during a sampling event will be determined on a case-by-case basis by the project QA/QC coordinator (consult the project-specific FSP and QAPP, as the requirements may vary by analyte group).

## EQUIPMENT RINSATE BLANKS

Equipment rinsate blanks will be used to help identify possible contamination from the sampling environment and/or from decontaminated sampling equipment. Equipment rinsate blanks will be prepared by pouring laboratory distilled/deionized water through, over, and into the decontaminated sample collection equipment, and then transferring the water to the appropriate sample containers and adding any necessary preservatives. Equipment rinsate blanks will be prepared for all inorganic, organic, and conventional analytes at least once per sampling event per the type of sampling equipment used. The actual number of equipment rinsate blanks prepared during an event will be determined on a case-by-case basis by the project QA/QC coordinator (consult the project-specific FSP and QAPP, as the requirements on frequency of equipment rinsate blank collection may vary by EPA region or state).

## FILTER WIPES

Filter wipe samples will be used to help identify possible contamination from the sampling environment or from the decontaminated sediment sampling equipment (e.g., sediment grab sampler, stainless-steel bowls and spoons, shovel, trowel).

Filter wipe samples will be prepared by grasping a piece of clean, ashless filter wipe/paper with decontaminated tongs and/or tweezers and wiping down all surfaces of dry, decontaminated equipment that comes into contact with the sediment sample (e.g., stainless-steel spoon, inside of sediment grab sampler). Whatman filter papers will be used for organic analysis and Ghost Wipes will be used for metals/mercury analysis. The filter wipes/papers will be from the same lot used to prepare the filter paper blanks (see below), and the filter lot number will be clearly noted in the field logbook. One filter wipe/paper will be used for each equipment type, solid matrix type, and analysis type. For example, if two pieces of equipment were used for sediment sampling (trowel and stainless-steel spoon) and both metals and



ED_004850_00001502-00943

organic compounds were being analyzed, then a total of four filter wipes/papers would be sent to the analytical laboratory.

Tongs and/or tweezers will be used to handle the filter wipe/paper, and all sediment sample-exposed surfaces will be thoroughly wiped down using one piece of filter wipe/paper (per equipment type and for each analysis). The filter wipe sample will then be placed into a labeled certified pre-cleaned sample jar provided by the analytical laboratory. The filter wipe/paper box will be stored in a clean glass container and must NOT be stored in a plastic bag. In moist environments, the filters should be wrapped thoroughly in aluminum foil to protect them from moisture.

Filter wipe samples will be prepared for all inorganic and organic analytes at least once per sampling event per the type of sampling equipment used. The actual number of filter wipe samples prepared during an event will be determined on a case-by-case basis by the project QA/QC coordinator (consult the project-specific FSP and QAPP, as the requirements on frequency of filter wipe sample collection may vary by EPA region or state).

## FILTER PAPER BLANKS

Whenever a filter wipe sample is prepared in the field, a filter paper blank will also be prepared in the field to evaluate potential background concentrations present in the filter paper used for the equipment filter wipe sample.

Filter paper blanks will be prepared by using tongs and/or tweezers to remove the clean ashless filter paper from its box. Whatman filter papers will be used for organic analysis and Ghost Wipes will be used for metals/mercury analysis. The filter papers will be from the same lot used to prepare the filter wipe samples (see above), and the filter lot number will be clearly noted in the field logbook. One filter wipe/paper will be sent to the analytical laboratory for each type of analysis to be performed (i.e., inorganic or organic analytes). The filter paper blank will be placed into a labeled certified pre-cleaned sample jar provided by the analytical laboratory.

Filter paper blanks will be collected at a minimum frequency of one for each filter lot number. The actual number of filter paper blanks prepared during an event will be determined on a case-by-case basis by the project QA/QC coordinator (consult the project-specific FSP and QAPP, as the requirements on frequency of filter paper blank collection may vary by EPA region or state).

## BOTTLE BLANKS

The bottle blank is an unopened sample bottle. Bottle blanks are submitted along with sediment samples to ensure that contaminants are not originating from the bottles themselves because of improper preparation, handling, or cleaning techniques. If required, one bottle



ED_004850_00001502-00944

blank per lot of prepared bottles will be submitted for analysis. If more than one type of bottle will be used in the sampling (e.g., high-density polyethylene or glass), then a bottle blank should be submitted for each type of bottle and preservative. The actual number of bottle blanks analyzed during a project will be determined on a case-by-case basis by the project QA/QC coordinator (consult the project-specific FSP and QAPP as the requirements on frequency of bottle blank analysis may vary by EPA region or state).

To prepare a bottle blank in the field, set aside one unopened sample bottle from each bottle lot sent from the testing laboratory. Label the bottle as "Bottle Blank" on the sample label (and in the "Remarks" column on the COC/SAR form), and send the empty bottle to the laboratory with the field samples.

## TRIP BLANKS

Trip blanks will be used to help identify whether contaminants may have been introduced during the shipment of the sediment samples from the field to the laboratory for VOC analyses only. Trip blanks are prepared at the testing laboratory by pouring distilled/ deionized water into two 40-mL VOC vials and tightly closing the lids. Each vial will be inverted and tapped lightly to ensure no air bubbles exist.

The trip blanks will be transported unopened to and from the field in the cooler with the VOC samples. A trip blank is labeled and placed inside the cooler that contains newly collected VOC samples and it remains in the cooler at all times. A trip blank must accompany samples at all times in the field. One trip blank (consisting of a pair of VOC vials) will be sent with each cooler of samples shipped to the testing laboratory for VOC analysis.

## TEMPERATURE BLANKS

Temperature blanks will be used by the laboratory to verify the temperature of the samples upon receipt at the testing laboratory. Temperature blanks will be prepared at the testing laboratory by pouring distilled/deionized water into a vial and tightly closing the lid. The blanks will be transported unopened to and from the field in the cooler with the sample containers. A temperature blank shall be included with each sample cooler shipped to the testing laboratory.

## ENVIRONMENTAL BLANKS

The environmental (field) blank is prepared in the field to evaluate potential background concentrations present in the air and in the distilled/deionized water used for the final decontamination rinse. If unpreserved bottles are to be used, then the appropriate preservative (i.e., for metals samples use a 10 percent nitric acid solution to bring sample pH



ED_004850_00001502-00945

to 2 or less) must be added, as may be required. Environmental blanks should be collected at a minimum frequency of 1 in 20 samples. The actual number of environmental blanks analyzed during a project will be determined on a case-by-case basis by the project QA/QC coordinator (consult the project-specific FSP and QAPP, as the requirements on frequency of environmental blank analysis may vary by EPA region or state).

To prepare an environmental blank in the field, open the laboratory-prepared sample bottle while at a sample collection site, fill the sample bottle with distilled/deionized water, and then seal it. Assign the environmental blank a unique sample number, label the bottle, and then send the bottle to the laboratory with the field samples.

## REFERENCE MATERIALS

SRMs are samples containing known analytes at known concentrations that have been prepared by and obtained from EPA-approved sources. The SRMs have undergone multi-laboratory analyses using a standard method that provides certified concentrations. When available for a specific analyte, SRMs provide a measure of analytical performance and/or analytical method bias (i.e., accuracy) of the laboratory. Several SRMs may be required to cover all analytical parameters. For all analytes where available, one SRM will be analyzed at a frequency of one per 50 samples. The actual number of SRMs analyzed during a project will be determined on a case-by-case basis by the project QA/QC coordinator (consult the project-specific FSP and QAPP, as the requirements on frequency of SRM analysis may vary by EPA region or state).



ED_004850_00001502-00946

# STANDARD OPERATING PROCEDURE (SOP) SD-04

# SURFACE SEDIMENT SAMPLING

## SCOPE AND APPLICATION

This SOP defines and standardizes the methods for collecting surface sediment samples from freshwater or marine environments. Surface sediments are defined as those from 0 to at most 10 cm below the sediment-water interface. The actual definition of surface sediments is typically program-specific and depends on the purpose of the study and the regulatory criteria (if any) to which the data will be compared.

This SOP utilizes and augments the procedures outlined in USEPA (1996) and ASTM (2003) guidelines. A goal of this SOP is to ensure that the highest quality, most representative data are collected, and that these data are comparable to data collected by different programs that follow the USEPA (1996) guidelines.

## SUMMARY OF METHOD

Sediment samples for chemical and toxicity analysis are collected using a surface sediment sampling device (e.g., grab sampler) or hand implements (i.e., spoons, scoops, shovels, or trowels). If a sample meets acceptability guidelines, overlying water is carefully siphoned off the surface in a grab sampler, and the sediment is described in the field logbook. Depending upon the type of analysis to be performed, sediment samples for chemical analysis may be collected directly from an undisturbed surface (e.g., volatile organic compounds and sulfides), or may be homogenized using decontaminated, stainless-steel containers and utensils prior to being placed in sample jars. Sediment from several sampler casts or exposed sediment locations may also be composited and homogenized prior to being placed in sample jars.

## SUPPLIES AND EQUIPMENT

A generalized supply and equipment list is provided below. Additional equipment may be required depending on project requirements.

- Sampling device
  - Grab sampler or box corer (see examples below in procedures for "Sediment Sample Collection")



ED_004850_00001502-00947

  - Stainless-steel spoon, scoop, shovel, or trowel
- Field equipment
  - Siphoning hose
  - Stainless-steel bowls or containers
  - Stainless-steel spoons, spatulas, and/or mixer
  - Stainless-steel ruler
  - Project-specific decontamination supplies (e.g., Alconox™ detergent, 0.1 N nitric acid, methanol, hexane, distilled/deionized water)
  - Personal protective equipment for field team (e.g., rain gear, safety goggles, hard hats, nitrile gloves)
  - First aid kit
  - Cell phone
  - Camera
  - Sample containers
  - Ziploc® bags
  - Bubble wrap
  - Sample jar labels
  - Clear tape
  - Permanent markers
  - Indelible black-ink pens
  - Pencils
  - Coolers
  - Ice
- Documentation
  - Waterproof field logbook
  - Field sampling plan
  - Health and safety plan
  - Correction forms
  - Request for change forms
  - Waterproof sample description forms.



ED_004850_00001502-00948

# PROCEDURES

## Sediment Sample Collection with a Grab Sampler

Use a sampler that obtains a quantifiable volume of sediment with minimal disturbance of the surrounding sediments to collect sediment for chemical and biological analyses. The sampler should be composed of a material such as stainless steel or aluminum, or have a noncontaminating coating such as Teflon™. Samplers capable of providing high-quality sediment samples include grab-type samplers (e.g., van Veen, Ekman, Smith-McIntyre, Young grab, Power Grab and modified-ponar grab) and box cores (Soutar, mini-Soutar, Gray-O'Hara, spade core). Some programs require a sampler that collects from a specific area (e.g., 0.1 $m^2$). Most sampling devices are typically a standard size; however, some non-standard sizes are available to meet the requirements of specific programs. Grab samplers, especially van Veen grab and Ekman grab, are the most commonly used samplers to collect surface sediment. Power Grab samplers are often used for programs requiring collection of sediment deeper than 10 cm (4 in.) or in areas with debris.

Depending on grab weight and water depth, use a hydraulic winch system to deploy the heavier samplers at a rate not exceeding 1 m/second to minimize the bow wake associated with sampler descent. Once the sampler hits the bottom, close the jaws slowly and bring the sampler to the deck of the vessel at a rate not exceeding 1 m/second to minimize any washing and disturbance of the sediment within the sampler. At the moment the sampler hits the bottom, record the time, water depth, and location of sample acquisition in the field logbook.

Retrieve and secure the sampler, and carefully siphon off any overlying water. Inspect the sample to determine acceptability using the criteria detailed in USEPA (1996), except when noted in the project-specific field sampling plan. These criteria include but are not limited to the following:

- There is minimal or no excessive water leakage from the jaws of the sampler
- There is no excessive turbidity in the water overlying the sample
- The sampler is not over-penetrated
- The sediment surface appears to be intact with minimal disturbance
- There is no anthropogenic (i.e., man-made) debris in the sampler
- The program-specified penetration depths are attained.

If the sample meets acceptability criteria, record the sample collection location using a global positioning system (GPS) and enter observations onto a sample collection form or the field logbook. Depending on programmatic goals, remove the sampling interval specified in the field sampling plan. Use a decontaminated stainless-steel ruler to measure the sample collection depth (0 to 10 cm) within the sampler. To prevent possible cross-contamination, do not use sediments touching the margins of the sampler.



ED_004850_00001502-00949

Take a photograph of the sediment in the grab sampler and in the stainless-steel bowl in the field. Verify that the station number or sample ID, time, and date are shown in the photograph.

Typically, sediment from a minimum of three separate casts of the sampler is composited at each station (see project-specific field sampling plan). Once the sample has been characterized, subsample the sediment for chemical and biological analyses using a decontaminated stainless-steel spoon.

## Sediment Sample Collection with Hand Implements

Obtain a quantifiable volume of sediment with minimal disturbance of the surrounding sediments to collect sediment for chemical and biological analyses. Hand implements (e.g., spoons, scoops, shovels, or trowels) must be composed of stainless steel.

Use GPS to locate the sampling site and approach the location carefully to avoid disturbing the area of sediment to be sampled. Prior to sample collection, describe and characterize the undisturbed surface sediment in the field logbook. If necessary, expose the sediment surface by clearing an approximately 1-$ft^2$ area at the sampling site of any rocks greater than approximately 5 in. Remove any anthropogenic (i.e., man-made) debris and organic material on the sediment surface. Note any material removed from the sampling site in the field logbook.

Using a decontaminated, stainless-steel hand implement (i.e., spoon, scoop, shovel, or trowel), excavate the sediment to 10 cm. Place the sediment in a decontaminated stainless-steel bowl and use a decontaminated stainless-steel ruler to confirm that the correct sampling interval has been collected. If the full sample collection interval (i.e., 10 cm) has not been reached, collect additional sediment, place it in the stainless-steel bowl, and reconfirm the sampling interval. Continue this process until the full sample collection interval (0 to 10 cm) has been reached.

Take a photograph of the excavated hole from where the sediment sample was removed. Verify that the station number or sample ID, time, and date are shown in the photograph.

## Sample Processing

Complete all sample collection forms, labels, custody seals, and chain-of-custody forms, and record sample information in the field logbook.

Collect samples for volatile compounds (either organics or sulfides) using a decontaminated stainless-steel spoon while sediment is still in the grab sampler or, if the sample is collected using a hand implement, in the stainless-steel bowl. Sediments for volatile analysis are not homogenized. Tightly pack the volatile organics sample jar with sediment (to eliminate obvious air pockets) and fill it so that no headspace remains in the jar. Alternatively, if there is adequate water in the sediment, fill the container to overflowing so that a convex meniscus forms at the top, and then carefully place the cap on the jar. Once sealed, the jar should contain no air bubbles.



ED_004850_00001502-00950

Place the remaining sediment in the grab sampler in a precleaned, stainless-steel bowl; sediment collected using hand implements are already in a stainless-steel bowl. Once a sufficient amount of sediment has been collected, mix the sediment using a decontaminated stainless-steel spoon until it is of uniform color and texture throughout.

If required for analysis, collect samples for grain-size tests before any large rocks are removed from the homogenized sediment. Identify any rocks that are greater than 0.5 in. in diameter. Determine their percentage contribution to the homogenized sediment volume, note it on the sediment field collection form or in the field logbook, and then discard the rocks.

Dispense the sediment into precleaned sample jars for the various chemical or biological analyses. For toxicity testing, fill sample jars to the top with sediment to minimize available headspace. This procedure will minimize any oxidation reactions within the sediment. For chemical analysis, sample containers may be frozen for storage. Leave enough headspace to allow for sediment expansion.

After dispensing the sediment, place the containers into coolers with ice and either ship them directly to the analytical laboratories or transport them to a storage facility.

## REFERENCES

ASTM. 2003. *Standard Practice for Collecting Benthic Macroinvertebrates with Ekman Grab Sampler.* ASTM Standards on Disc, Volume 11.05.

USEPA. 1996. Puget Sound Estuary Program: Recommended protocols for measuring selected environmental variables in Puget Sound. Prepared for U.S. Environmental Protection Agency, Region 10, and Puget Sound Estuary Program, Seattle, WA. Tetra Tech and HRA, Inc., Bellevue, WA.



ED_004850_00001502-00951

# STANDARD OPERATING PROCEDURE (SOP) SD-06

# HOLLOW-STEM AUGER DRILLING/SEDIMENT SAMPLING

## SCOPE AND APPLICATION

Soil/sediment cores are collected to evaluate sediment at depths that greatly exceed those achieved by grab or other surface samplers. The purpose of this standard operating procedure (SOP) is to define and standardize procedures for core collection using split-spoon and Shelby tube samplers advanced through hollow-stem auger borings, following American Society for Testing and Materials (ASTM) Method D1586 and Method D1587, respectively. The use of Shelby tube samplers or split-spoon samplers is specified in the Slip 4 Pre-Design Sampling and Analysis Plan Addendum (Integral 2006). Shelby tubes will be used to recover relatively undisturbed soil samples suitable for laboratory tests of engineering properties such as strength, compressibility, permeability, and density.

## REQUIRED EQUIPMENT

- Sampling and Analysis Plan (SAP).
- Health and Safety Plan (HSP).
- Site logbook and boring log.
- Indelible black-ink pens and markers.
- Camera.
- Hollow-stem auger drill rig.
- Driller and helper.
- Split-spoon samplers (typically 2-in. diameter; a larger 3-in. diameter, 2-ft-length split-spoon may be used to obtain more material from each depth interval).
- Shelby tube samplers conforming to thin-walled tube specifications outlined in ASTM D1587 with a 2- to 5-in. O.D and 5 to 10 times the diameter in length. Wax and end caps will also be provided for proper field sealing.
- Photoionization detector (PID).
- Plastic sheeting.
- 55-gallon drums (if required).
- Insulated cooler(s), chain-of-custody seals, Ziploc® bags.
- Sample labels and appropriate documentation.



ED_004850_00001502-00952

- Assorted geology supplies (e.g., hand lens, grain-size card, scales, etc.).
- Decontamination equipment (SOP-10).

## Typical Procedures

1. Ensure underground utilities in vicinity of each boring location have been marked prior to mobilizing drill rig to site.
2. Conduct daily site activity/health and safety briefing.
3. Calibrate field instrumentation, if applicable.
4. Record necessary data in field logbook.
5. Obtain photograph(s) of site before drilling.
6. Place plastic sheeting and/or drums at drilling location to collect cuttings (if necessary).
7. Move equipment and supplies to drilling location.
8. Set up decontamination and sampling stations.

### Split-Spoon Sampling

1. Obtain surface soil samples, if required.
2. Drill to first sampling depth, as described in the SAP.
3. Place decontaminated split-spoon sampler on center rods.
4. Drive split-spoon sampler, as described in ASTM Method D-1586. Drive sampler to 18 inch or to refusal (no progress for 50 blows). Record blow counts on boring log form. Retrieve sampler.
5. Screen sampler with PID (if required).
6. Describe soil in accordance with ASTM D2488 on the boring log form.
7. Composite soil sample, as necessary. If volatile organic compound (VOC) samples are to be collected, collect VOC sample prior to describing soil.
8. Continue drilling at next sample location. Collect samples as outlined above.
9. Label and manage sample containers in accordance with the site-specific SAP section for shipping and handling of samples.
10. Decontaminate sampling equipment in accordance with the site-specific SAP.
11. Document activities in site logbook.
12. Backfill or grout borehole, as required.



ED_004850_00001502-00953

13. Move to next location.

### Shelby Tube Sampling

1. Obtain surface soil samples, if required.
2. Drill to first sampling depth, as described in the SAP.
3. Place decontaminated Shelby tube sampler on center rods.
4. Drive Shelby tube sampler, as described in ASTM Method D1587. Retrieve the sampling tube and remove the disturbed material from the top of the tube. In addition, remove 1 inch of soil from the base of the tube. Place an impervious disk at both ends of the tube seal with a wax plug prior to shipment to the laboratory.
5. If Shelby tubes are to be extruded in the field for composite sampling, the driller will use a hydraulic extruder to obtain the sample. The core is then described in accordance with ASTM Method D2488 on the boring log form. Samples will then be composited, as necessary, for analysis.
6. Screen sampler with PID (if required).
7. Label and manage sample containers in accordance with the site-specific SAP section for shipping and handling of samples. The sample tube should be packed in Styrofoam™ plugs or other cushioning material to prevent disturbance of the sample.
8. Continue drilling to next sample location. Collect samples as outlined above.
9. Decontaminate sampling equipment in accordance with the site-specific SAP section.
10. Document activities in site logbook.
11. Backfill or grout borehole, as required.
12. Move to next location.

## Reference

Integral. 2006. Lower Duwamish Waterway Slip 4 Early Action Area: Sampling and Analysis Plan for Boundary Definition Addendum: Pre-Design Investigation Sampling. Prepared for Seattle City Light and King County, Seattle, WA. Integral Consulting Inc., Mercer Island, WA.



ED_004850_00001502-00954

# STANDARD OPERATING PROCEDURE (SOP) SD-08

# SUBSURFACE SEDIMENT CORE COLLECTION USING A VIBRACORER

## SCOPE AND APPLICATION

This SOP describes the procedure for collecting and processing sediment core samples using a vibracore system, which collects continuous and relatively undisturbed sediment cores. This method of sediment coring is performed from a boat and uses high-frequency low-amplitude vibration to break down the frictional resistance of the sediment and allow the core tube to penetrate into the sediment with minimal distortion. It is best used for sampling coarse, consolidated sediment and very cohesive sediment, where static weight (e.g., piston-type or conventional gravity corers) will not produce adequate penetration into the sediment. In addition, the vibracorer offers a high rate of production, superior retention of shallow samples, and a greater sample volume compared to conventional drilling equipment.

Vibracorers generally consist of a metal corer barrel (usually a 4-in.-outside-diameter, aluminum core barrel) with a location-dedicated polycarbonate or Lexan®-lined core tube, and a vibrator mechanism attached to the top of the barrel. The vibration is created either by an electric motor, a hydraulic system, or a pneumatic piston attached to the top of the barrel. Therefore, a generator or air compressor is needed on board to power the corer. The pneumatic piston does not have the same function as a piston in a piston corer. Because vibracorers generally do not have a piston in the corer, some compaction and/or bypass will occur, and recovery will be less than 100 percent.

A continuous sediment sample is retained within the tubing with the aid of a stainless-steel core cutter/catcher or nosecone attached to the bottom of each aluminum tube.

It is always best to keep the core in a vertical position to prevent the top layers of sediment (i.e., the top 5 to 15 cm) from slumping. However, in many cases, it is not feasible to process the core in a vertical position because the tripod needs to be at least twice the height of corer, and sectioning and logging the sample would have to be performed from a ladder. For studies that specify sectioning the sample into coarse intervals (>20 cm), processing the core in a horizontal position will generally not significantly disrupt the stratigraphy. For studies that specify shorter intervals (<5–10 cm), processing the core in a horizontal position is likely to disrupt stratigraphy. In this case, the top layers of sediment that have high water content should be sectioned while the core is in a vertical position, and when the sediment becomes thicker, the corer can be laid horizontally.



ED_004850_00001502-00955

# PROCEDURES

## Decontamination

To prevent potential cross-contamination of samples, all reusable sediment sampling equipment must be decontaminated prior to use at each station and between field replicates.

Before each station is sampled, decontaminate the inner surfaces of the corer or core tube liner and all stainless-steel sample compositing equipment. Prior to sampling, all core liners will be washed in sequence with a standard detergent (e.g., Alconox®), rinsed with site water, and then air-dried. During storage and transport, decontaminated core liners will be capped at both ends to prevent contamination. Details on correct decontamination procedures can be found in SOP SD-01, *Decontamination of Equipment—Sediment*. The project-specific field sampling plan (FSP) should also be consulted to determine any project-specific decontamination procedures. The personnel performing the decontamination procedures will wear protective clothing as specified in the site-specific health and safety plan.

All solvent rinsates (if used) will be collected into a bucket or tub and allowed to evaporate over the course of the day. Any rinsate that has not evaporated by the end of the sampling event will be containerized and disposed of in accordance with applicable regulations.

## Vibracorer Deployment and Retrieval

The following procedures are based on using the vibracorer aboard a boat equipped with a tripod or A-frame of sufficient height to allow recovery of the core (see project-specific FSP for information on target coring depth), and a power winch. On pontoon boats, the tripod is centered over a hole in the floor, whereas on other boats, the corer may be lowered over the side or stern. To obtain cores of high quality, the boat must be anchored with at least three anchors so the boat will not drift during the coring process.

1. Maneuver the sampling vessel to the targeted sampling location using the positioning procedures and minimum water depth restrictions.
2. Deploy 3- or 4-point anchor system to maintain position; record and monitor position throughout core acquisition.
3. Once on location, measure the water depth (depth to top of sediment) using the onboard depth sounder (fathometer) or lead line and record measured depth in the field logbook. If the water level is affected by tides, obtain tide level measurements and calculate tidal height in feet above mean low water. The date, time, weather, and water conditions (e.g., high wave activity, strong currents, turbidity, tidal flux) should also be recorded in the field logbook.



ED_004850_00001502-00956

4. Assemble the decontaminated core tube, liner, core catcher, and cutter heads (or nose cone depending on the model of vibracorer used), using care to not contact decontaminated surfaces. Attach assembled vibracorer to winch cable. Note that several decontaminated catchers and cutterheads will be on hand, in case of loss. Core catchers and cutter heads can be decontaminated and reused for subsequent core collection.
5. Attach a tape measure to the vibracorer or mark the winch cable in 1/2-ft increments to measure penetration depth.
6. Inspect connections of winch cable and electrical or pneumatic lines to confirm they are secure.
7. Signal the winch operator to slowly raise the vibracorer into a vertical position and guide the vibracorer (with core liner, valve, core catcher, and cutterhead in place) overboard until it is clear of the vessel.
8. Using the winch, slowly lower the vibracorer through the water column at a speed of about 1 ft/s to avoid creating a bow wake or overturning of the vibracore. Stop lowering the corer a few feet above the sediment and confirm that the boat has not drifted.
9. Continue lowering the vibracorer until the tip of the core is resting on the sediment or to the depth recorded by the fathometer, depending on the consistency of the sediment. Record the vibracorer depth as derived from the attached tape measure or marked winch cable. Measurements will serve as a basis for determining penetration depth.
10. Resume lowering the corer at about 1 ft/s. When the nosecone or core catcher contacts the sediment, turn on the vibracorer motor. The vibracorer is then allowed to slowly penetrate the sediments. Initially, light tension should be maintained on the cable to keep the corer from tipping over.
11. Lower the vibracorer to the target penetration depth as measured by the attached tape measure or marked winch cable. If the targeted penetration depth is met, proceed to the next step; if refusal is met, retrieve the vibracorer, perform gross decontamination (i.e., rinse with river water and brush off visible sediment from the outside of the core barrel) and re-attempt at new location offset at least 3–5 ft from original location.
12. When the target penetration depth is reached, or refusal occurs, turn off the vibracorer and record the time, penetration depth, angle of the cable relative to the boat, and any other observations.
13. The vibracorer is slowly withdrawn from the sediments at a constant rate, to keep it upright and not dislodge any sediment from within the core barrel, and raised to the surface.



ED_004850_00001502-00957

14. With the corer hanging in a vertical position, clean the vibracorer assembly by hosing down the equipment with site water prior to being brought on board. If the corer is not plugged, care should be taken not to direct water into the open end of the core barrel.
15. After collection of the core sample, the vibracorer is slowly guided onboard the vessel; use care to avoid jostling that might disturb the integrity of the core. Care must be taken to keep the top end of core elevated to prevent sediment from "pouring" out. Use a sawhorse or equivalent to elevate the top of the core. If necessary, as soon as the nosecone clears the water surface, the bottom of the corer may be plugged with a rubber stopper to prevent loss of sediment.
16. Before the polycarbonate or Lexan®-lined core tube is removed from the vibracorer, the nosecone or core cutter/catcher is visually inspected to ensure that proper penetration has been attained and that there is no obvious loss of sediment from the tube. Any presence of noticeable odors, the core penetration depth, and physical characteristics (e.g., color, texture, odor) of the sediment sample as observed at the ends of the tube will be recorded in the field logbook or on the Field Sediment Core form by an experienced geologist. In addition, any sheen in the water will also be noted in the field logbook.
17. If the core will be processed horizontally, slowly lay the corer down. Unscrew the cutter head (or nosecone) and carefully remove the core catcher, while retaining as much sediment as possible.
18. While removing the core catcher (or nosecone), be ready to immediately seal the end of the core liner by placing a plastic cap over the open end.
19. Carefully remove the core liner that contains the sample by lifting the lower end from the deck as needed to provide clearance. Affix core cap, wrap with tape, label core liner and end of core, remove valve from top of core liner, stand core upright, and place in a processing rack or tray to allow the sediment at the top of the core to settle. Avoid sudden movements to the core that would disrupt the sediment interface.
20. While waiting for sediment to settle, prepare the Field Sediment Core form. Identify any debris and note its depth in the core and what the debris is, if possible.
21. Once resuspended sediment has settled, measure the length of the recovered core, calculate percent recovery (100 x recovered length/penetration depth), and record in the logbook or on the Field Sediment Core form.
22. Check the core for acceptability. The following acceptability criteria should be satisfied:
    - The core tube is not overfilled with sample so that the sediment surface presses against the bottom of the vibracorer head.
    - Overlying water is present (indicates minimal leakage).



ED_004850_00001502-00958

- The overlying water is not excessively turbid (indicates minimal disturbance).
- The desired penetration depth (see project-specific FSP for required penetration depth) or refusal has been reached.

Depending on requirements of the project-specific FSP, a core may be rejected based on percent recovery. Commonly, a core is deemed unacceptable if recovery is less than 80 percent. If recovery is less than 80 percent, the core sample will be retained for possible processing, while additional sampling attempts are made to collect a core with greater than 80 percent recovery. If subsequent attempts result in recoveries of less than 80 percent, then the sample with the highest percent recovery may be used for analysis. The number of attempts to collect an acceptable sample will be specified in the project-specific FSP. If recovery is less than 80 percent, the core may be acceptable if the penetration depth is deeper than the target core length. In this case, the recovered length should be equal to the target length.

23. Once sufficient time has been allowed for the sediment to settle (i.e., no sediment is suspended in the overlying water), use a decontaminated saw to cut a drain-slit or a decontaminated drill bit to drill in the side of the core liner approximately 1 to 2 in. above the sediment–water interface; allow excess water to drain. Cut excess polycarbonate liner with decontaminated blade and use a siphon to decant off the overlying water. Ensure that the saw blade, drill bit, or siphon does not contact the sediments and that fine-grained suspended sediment is not removed.
24. Cut cores into manageable sections (3–4 ft) aboard the vessel immediately after their retrieval. Cap each section with aluminum foil and plastic caps, and seal with duct tape. Mark the core with permanent marker using a unique number or alphanumeric code identifying sampling location, core number, core section, and segment orientation (i.e., which end is up). Following sectioning, store the cores in an upright position onboard the vessel in a core box and have them transported periodically throughout each field day by small boat to a field processing area where they are to be stored upright under custody on ice or refrigerated at 4°C to await processing.
25. In preparation for next core, thoroughly rinse the interior of the core barrel until all loose sediment has been washed off. Repeat process at next sampling location. Continue coring until requirements are met.

In situations where there is significant surface water depth and/or water current that could cause the vibracorer setup to lean at an unacceptable angle, a buoyant frame or rigid frame configuration should be used.

With the buoyant frame, the vibracorer is maintained in proper vertical position by two guidelines held taut between a float package and a weight stand. The larger weight stand is provided with ballast boxes so that easy-to-find ballasting material such as lead bags or scrap



ED_004850_00001502-00959

metal can be used in the field. For deployment, the vibracorer is lowered with the weight stand hanging on its guidelines from the vibrahead. The float package is hooked up to the guidelines when the vibrahead reaches the deck level.

After coring and pull-up, the system is retrieved in the reverse manner. In case of limited deck space or overhead clearance, or to further accelerate the procedure on the water, the weight stand can be left in as overboard cradle.

## Sample Handling, Storage, and Processing

Cores should be processed concurrently with core collection, and every effort should be made to ensure cores are processed within 24 hours of collection. Cores awaiting processing will be sealed tightly at both ends and stored upright in ice or in a refrigerator. If core collection outpaces processing such that significant delays in core processing appear likely, core collection will be suspended to allow the core processing to catch up.

As mentioned above, once coring has been completed at a given location, the cores will be transported in an upright position on ice to a designated field processing area, where they will be logged and processed. The field processing area will be equipped with a core-cutting table, core-processing tables, a decontamination area, and a storage area with appropriate refrigeration. Appropriate lighting will be installed in the field processing area so that consistent, high quality photographs can be taken of the opened cores. Care should be taken to create a field processing area that minimizes the potential for outside contamination.

Sample processing includes removing the sample from the liner, recording observations of sample characteristics, mixing subsamples, and distributing the sample to containers for shipping to the testing laboratory. Vibracore processing most often consists of the following steps:

1. Cut each core tube along the long axis using decontaminated hook blade. Rotate the tube 180° and cut again.
2. After each core is cut, move the entire core tube to an aluminum foil-covered table and open it so that it can be systematically logged, described, and photographed.

However, depending on the project-specific FSP, the core may be extruded from the liner and cut into the specified intervals as it emerges or the core liner may be cut into sections, sealed, and shipped intact to the testing laboratory.

### Core Observations

1. Verify that the length of the core, water depth, and all required position data have been recorded in the field logbook together with all pertinent observations and communications with the field team leader.



ED_004850_00001502-00960

2. After each core is cut open, describe the sediment on a Field Sediment Core form in the field processing area notebook. When recording the information for each core, follow the guidelines below:
   - Physical sediment description (i.e., sediment type [e.g., silt, sand], density/consistency, color)
   - Odor (e.g., hydrogen sulfide, petroleum, creosote)
   - Visual stratification, laminations, and lenses
   - Presence/location/thickness of the redox potential discontinuity layer (a visual indication of black is often adequate for documenting anoxia)
   - Approximate percentage of moisture
   - Vegetation
   - Approximate percentage of vegetation
   - Debris
   - Approximate percentage of debris
   - Presence of biological structures (e.g., detritus, shells, tubes, bioturbation, live or dead organisms, chironomids)
   - Approximate percentage of biological structures
   - Presence of a sheen
   - Other distinguishing characteristics or features.

   The visual observations of sediment lithology (dominant grain sizes) will be the primary criteria for determining sample intervals (i.e., lithologic units) in the cores. For consistency, core descriptions and terms used will follow the criteria below, which are modified from methods presented in ASTM D 2488-00 (ASTM 2000):

3. Record visual estimates of the grain-size percentages of sediment units within each core on the Field Sediment Core form so that the total sum will add up to 100 percent. Make estimates of gravel, sand, and fines (silt and clay) content generally to the nearest quartiles:
   - 0 to 25 percent
   - >25 to 50 percent
   - >50 to 75 percent
   - >75 to 100 percent.

   If appropriate, describe the sediment narratively on the log based on the estimated grain-size percentages. Use the dominant constituent grain size as the primary unit



ED_004850_00001502-00961

descriptor, and describe the abundance of other grain sizes present using the following terms:

- The grain-size adjective (e.g., gravelly, sandy, silty, or clayey), if estimated to constitute more than 25 percent of the sediment
- *With*, for example, sand with silt, silt with sand, etc., if estimated to constitute less than 25 percent of the sediment
- *Trace*, if estimated at less than 5 percent of the sediment (and not included in the total 100 percent).

For other features observed, such as organic matter or debris, use the following additional descriptive terms as appropriate:

- *Mostly*, if estimated to constitute 50 percent or more of the unit
- *Some*, if estimated to constitute more than 25 to 50 percent of the unit
- *Little*, if estimated to be 25 percent of the unit or less
- *Trace*, if estimated at less than 5 percent (and not included in the total 100 percent).

4. Describe density using the following terms:
   - *Loose*, if easily penetrated with a sampling spoon
   - *Dense*, if penetration is more difficult.
5. Describe consistency using the following terms:
   - *Very soft*, if present as an ooze that holds no shape
   - *Soft*, if saggy
   - *Stiff*, if it holds a shape
   - *Very stiff*, if penetration with a spoon is low
   - *Hard*, if no penetration with a spoon is possible.
6. Use other observations (e.g., obvious anthropogenic material, dramatic color changes) to define or help define sample intervals (check project-specific FSP for sample interval definition; depending upon the project-specific requirements the sample interval could be based on lithology or it could be set to a specific interval [e.g., 1 ft]).
7. Determine the boundaries of lithologic units primarily by changes in the top two dominant grain sizes estimated visually (e.g., a change from a silty sand to a gravelly sand or to a sandy silt).



ED_004850_00001502-00962

8. Photograph the cores after they have been described and before any sediment is removed for processing. It is important for each core section to be photographed with adequate lighting from a standard measured distance from the core. Digital photographs will be used later in the production of digital core logs.

### Mixing and Sample Preparation

1. After the sample is characterized and the core observation logged on the Field Sediment Core form, remove the specified sample interval using a stainless-steel spatula or spoon (see project-specific FSP for correct sampling interval). Exercise care to not include sediment that is in direct contact with the core tube. With the approval of the field team leader, and using a decontaminated stainless-steel instrument, carefully remove unrepresentative material (e.g., large shells, stones). Exercise care not to touch the sediment during this process. Note any unrepresentative material removed from the sample in the field processing area notebook.
2. Remove subsamples for analysis of unstable constituents (e.g., volatile organic compounds, acid- volatile sulfides), and place them directly into sample containers without homogenization. Completely fill the sample container so that there is no headspace or entrapped bubbles.
3. Transfer the remainder of the sample interval to a decontaminated stainless-steel bowl for homogenization. If additional sediment volume is required to fill all sample bottles (see project-specific FSP) and multiple cores need to be collected at a given station, cover the compositing bowl covered with aluminum foil (dull side down) to prevent sample contamination (e.g., from precipitation, engine exhaust, splashing water) and place in a cool dark place until the next core from that location is processed.
4. After all the sediment is transferred to the compositing bowl, homogenize the contents of the bowl using stainless-steel spoons until the texture and color of the sediment appears to be uniform.
5. Distribute subsamples to the various containers specified in the project-specific FSP and preserve the samples as specified in the project-specific FSP. Briefly stir the sediment in the compositing bowl between each spoon transfer to the sample containers.
6. After all subsamples have been placed in the sample containers, if it is suspected that there is clay in a sample, perform a "ribbon test." Perform a separate ribbon test for each interval within the core where clay is suspected to be present. To perform this test, remove a small piece of sediment from the sampled interval using a decontaminated stainless-steel spoon and roll it between the fingers while wearing protective gloves. If the piece easily rolls into a ribbon it is clay; if it breaks apart, it is silt. Note this information in the field processing area notebook.
7. Subsequent intervals should be processed in the same way.



ED_004850_00001502-00963

## Field Quality Control Samples

If additional volumes of sediment are required to perform all analyses including quality control analyses, an additional core may need to be collected from the same location and subsampled and homogenized accordingly. Details on collection of field quality control samples (e.g., field duplicates) will be specified in the project-specific FSP. Details on collection of field quality control samples and preparation of the certified reference materials can be found in SOP SD-02, *Preparation of Field Quality Control Samples—Sediment,* and SOP SD-03, *Preparation of Reference Materials—Sediment*. Not all of the field quality control samples discussed in this SOP may be required for a given project. The specific field quality control samples will be described in the project-specific FSP and quality assurance project plan.

## Field Measurements

A water depth measurement must be collected at every sampling location. Depending on the specific project objectives, it may be necessary to perform field measurements of the *in situ* environment. Possible field measurements include temperature and pH of the sediment at the sediment-water interface and concentration of dissolved oxygen, salinity, or conductivity in the overlying water. Details on collection of field measurements can be found in SOP SD-11, *Field Analyses for Sediment*. The specific field measurements, if any, will be specified in the project-specific FSP.

## Station Location Coordinates

Station locations for all field sampling will be determined using a differential global positioning system (DGPS) or by surveying. The accuracy to which the latitude and longitude of a station location is determined will be specified in the FSP. At a minimum, a DGPS capable of providing latitude and longitude coordinates with an accuracy of approximately 3 m is recommended. The DGPS consists of two satellite receivers linked to each other by a VHF telemetry radio system. The receiver will be on the sampling vessel. Details on collection of very accurate station coordinates can be found in SOP AP-06, *Navigation.*

## Sample Custody and Shipping

Sample custody will be maintained in accordance with procedures outlined in SOP AP-03, *Sample Custody*. All samples will be packaged and shipped with other samples in accordance with procedures outlined in SOP AP-01, *Sample Packaging and Shipping*.



ED_004850_00001502-00964

## Troubleshooting

### Insufficient Sample

The corer may not collect enough sediment because of 1) inadequate penetration, 2) adequate penetration but poor recovery due to compaction, 3) adequate penetration but poor recovery as a result of bypass, or 4) adequate penetration but loss of sample during retrieval. Compaction and bypass are two different artifacts that are difficult to distinguish and quantify. Following is an approach to identifying the causes and remedies of insufficient sample length. Keep in mind that a combination of these causes may occur:

- **Inadequate Penetration**—Allow more vibration time at the refusal depth, or increase the vibrator frequency.
- **Poor Recovery Due to Compaction**—Compaction is the process of rearranging the sediment particles, so that less volume is occupied by pore water, which results in a shorter column of sediment in the corer than *in situ*. Compaction occurs only in clean coarse silt, sand, and gravel sediments that have a high hydraulic conductivity and are not terminally compacted *in situ*. Fine-grained cohesive sediment (i.e., low hydraulic conductivity) does not compact. The key feature of compaction is that all of the solids ahead of the nosecone are collected as the corer penetrates. So, although the calculated recovery is less than 10 percent, 100 percent of the sediment solids were recovered. Therefore, if the sample has poor recovery, is composed of clean coarse-grained materials, and there is no evidence of sediment falling out the bottom, then the sample is likely to have been compacted. Depending on the project-specific FSP, the specified sample intervals may be shortened proportional to recovery. Because compaction of the solids displaces pore water, minimal compaction is needed for cores that are intended for porewater studies, or cores that will be analyzed for substances that have low $K_d$ values. Vibration in vibracorers is known to rearrange particles, which leads to compaction, so another type of corer may be appropriate if compaction is a problem.
- **Poor Recovery as a Result of Bypass**—Bypass is the process of pushing sediment out of the path of the nosecone/corer as it penetrates the sediment. This is caused by the friction of sediment inside the core liner making it difficult for more sediment to enter the tube. This is most pronounced in fine-grained sediments that have low hydraulic conductivity, or layers of hard and soft sediment, or long cores. The low hydraulic conductivity prevents porewater from being displaced, so compaction cannot occur. Fine-grained sediments in this context are those in which particles cannot be felt between the thumb and forefinger of an ungloved hand. These are generally "sticky" or cohesive sediments. Therefore, if a sample has poor recovery, is fine grained and cohesive, and there is no evidence of sediment falling out the bottom, then some of the sediment column has likely been bypassed.
- **Poor Recovery Because of Loss of Sample during Retrieval**—This is often diagnosed by observing some of the core falling out the bottom as the corer approaches the water surface during retrieval, or a core liner that is empty near the bottom. Sample slipping



ED_004850_00001502-00965

out the bottom of the corer can be caused by a loss of suction or noncohesive sediment that does not stick to the liner wall. Depending on the specific design of the vibracorer, there are several places at which suction can be lost. These may include the valve seat, the valve assembly, the nose piece, and couplings between the barrel and extensions. To prevent loss of suction, Teflon® plumber's tape should be used on all the threaded connections, and the valve assembly should be clean. For coarse-grained sediment (e.g., clean coarse sand and gravel, and shells) that is non-cohesive and falls out the bottom of the corer, it is sometimes possible to penetrate to a lower layer that is finer grained and will effectively plug the bottom of the core. As mentioned above, core catchers may are used to retain sediment in a vibracorer, although they should not be used if the surface sediments have high water contents and are to be sectioned at less than about 2 inch intervals.

Because recovery can be an important indicator of corer performance, sediment characteristics, and sample quality, some simple tests can be performed as a diagnostic tool. Penetration of the corer can be measured by putting Velcro® tape on the outside of the corer. Velcro® tape can also be used on the inside of the liner during testing to see how far up inside the liner the sediment interface moves, how much sample slips out the bottom, and how much compaction or bypass occurs.

### Notes

1. For long cores that require more than one piece of liner, squarely cut the ends of both pieces with a plastic pipe cutter, butt the ends of the two pieces of liner squarely together and tape them securely so no leaks occur. Do not use too many layers of tape or the liner will not fit into the barrel. Do not use duct tape for this process. Use a high quality tape (i.e., 3M 3750) and dry the tubes before applying.
2. Sometimes tripods are not tall enough to lift the corer so that the barrel will clear the top edge of the liner when removing the liner. To remove the liner in this case, upon unscrewing the cutter head (or nose piece), lower the cutter head (or nose piece) and liner into a pail that has a rope securely tied to the handle. While the corer is raised by the winch, lower the pail through the hole in the deck and into the water (if necessary) until the top edge of the liner clears the bottom edge of the barrel. Then lift it back onto the deck.
3. If the vibracorer does not penetrate significantly or if the cable is let out too quickly, the vibracorer will contact the bottom, tip over, and fall sideways. When this happens, the line will initially go slack, then quickly snap to the side and take up the slack. In this case, reject the core and begin again.



ED_004850_00001502-00966

4. A good measure of whether the vibracorer collected the sediment-water interface is to inspect the interface for a thin layer (about 1 mm) of olive green benthic or detrital algae. Also, if the core liner is rotated back and forth gently, the top centimeter will appear to have a gelatinous response.
5. It is sometimes impossible to collect an intact interface because gas bubbles are commonly released from sediment when the corer contacts the sediment. The released gas bubbles entrain surface sediment and cause the overlying water to become turbid. If this is the case, gas bubbles in the sediment can likely be observed through the liner wall.

## REFERENCES

ASTM. 2000. Standard practice for description and identification of soils (visual-manual procedure). ASTM Standard Method No. D 2488-00. In: ASTM Book of Standards, Volume 04.08. American Society for Testing and Materials, West Conshohocken, PA.



ED_004850_00001502-00967

# STANDARD OPERATING PROCEDURE (SOP) SD-12

# LOGGING OF SEDIMENT CORES

## SCOPE AND APPLICATION

The following procedures for completing the Field Sediment Core Form establish the minimum information that must be recorded in the field to adequately document sediment coring activities. The field sediment core form must be filled out completely. Depending upon project specific requirements, some of the items listed below can be recorded in the observing scientist's field logbook and/or on the Station Core Log. All field forms must be filled out completely.

All of the information addressed in this standard operating procedure (SOP) should be included in the observing scientist's field documentation. Additionally, standards presented may need to be supplemented with additional technical descriptions or field test results (see project specific field sampling plan [FSP]).

## ACTIVITIES OF THE OBSERVING SCIENTIST DURING CORING

1. Record the name of the coring contractor and personnel performing the coring (lead person and any support staff)
2. Record the type and make of the coring equipment being used
3. Note the weather or any special external conditions that influence the coring
4. Be certain that the coring contractor is informed about the nature of the daily records that the contractor will keep
5. Check the coring contractor's daily records to verify their accuracy
6. Note date and time of all activities associated with the coring
7. Make certain that the coring contractor follows all required procedures
8. The observing scientist's daily record shall include, but may not be limited to, the following items:

    - Date and depth of core
    - Depth of start and finish of each sampled interval
    - Depth and size of any casing or core tubing used
    - Time required to advance the core
    - Loss of water, mud, or air during sample retrieval



ED_004850_00001502-00968

- Depth of overlying water
- Simplified description of strata
- Total sample recovery (in inches or centimeters)
- Details of delays and breakdowns.

The observing scientist should also record the coring start and finish dates and times. For consecutive sheets, provide, at a minimum, the project number, the station number, and the sheet number. This list excludes any special items that may be required for contractual record purposes or for special tests (see project-specific FSP).

## Data on Field Sediment Core Form

**Core Type/Method:** Provide the sampler type (e.g., GC = gravity corer, PC = piston corer, DRCV = drive rod check valve corer, VC = vibracorer, BC = box corer).

**Sample Number/Tag Number:** Provide the sample number. The sample numbering scheme should be established before sampling begins. Consult the project-specific FSP for the sample numbering scheme. The depth of the sample is the depth to the top of the recovered sample to the nearest centimeter. Samples should be obtained from the entire recovered core (depending upon the sampling intervals specified in the project-specific FSP). The tag number(s) and respective sample number(s) of the sample container(s) should also be recorded in the field logbook.

**Photograph Number:** Provide the number of the film roll and the photograph number.

**Odor:** Provide information on presence of any odor associated with the sediment. Document each interval in the core at which an odor is present. Describe the odor in the *Sediment Description* section of the field sediment core form.

**Sheen:** Provide information on presence of any sheen associated with the sediment. Document each interval in the core at which sheen is present. Also note if sheen is present on the water surface during coring activities.

**Blank Columns:** Two blank columns are provided on the field sediment core form. These columns can be used for site-specific information, usually related to the contaminants of concern (e.g., sheen, air quality measurements).

**Water Breaks:** Record the location of any observed breaks in the sediment core.

**Depth Scale:** Enter the depth of the core below sediment surface. Match the sediment descriptions with the depth scale.



ED_004850_00001502-00969

**Unified Symbol:** If a geologist is providing the sediment descriptions of the core, then the unified symbol code (USC) for different sediment types (e.g., silt, clay, sand) should be placed in this column. The USC name should be identical to the ASTM D-2488-84 Group Name with the appropriate modifiers.

Table SD-12(1) presents the USC classification system. The USC system is an engineering properties system that uses grain size to classify soils, it can however also be used by a geologist to characterize the sediment in a core.

**Table SD-12(1). USC Classification System**

| Major Divisions | | | Group Symbol | Group Name |
|---|---|---|---|---|
| **Coarse-grained soils** | **Gravel** | Clean Gravel | GW | Well-graded gravel, fine to coarse gravel |
| | More than 50 percent of | | GP | Poorly graded gravel |
| | coarse fraction retained on | Gravel with fines | GM | Silty gravel |
| More than 50 percent | No. 4 sieve | | GC | Clayey gravel |
| | **Sand** | Clean Sand | SW | Well-graded sand, fine to coarse sand |
| retained by | More than 50 percent of | | SP | Poorly graded sand |
| No. 200 sieve | coarse fraction passes | Sand with fines | SM | Silty sand |
| | No. 4 sieve | | SC | Clayey sand |
| **Fine-grained soils** | **Silt and clay** | Inorganic | ML | Silt |
| | | | CL | Clay |
| | Liquid limit < 50 | Organic | OL | Organic silt, organic clay |
| More than 50 | **Silt and clay** | Inorganic | MH | Silt of high plasticity, elastic silt |
| percent passes | | | CH | Clay of high plasticity, fat clay |
| No. 200 sieve | Liquid limit ³ 50 | Organic | OH | Organic clay, organic silt |
| Highly organic soils | | | PT | Peat |

**Note:** Field classification is based on visual examination of soil in general accordance with ASTM D-2488-84.

Soil classification using laboratory tests is based on ASTM D-2487-83.

Descriptions of soil density or consistency are based on interpretation of blow count data, visual appearance of soils, and/or test data.

Liquid limit is the water content of soil-water where the consistency changed from plastic to liquid.

**Sediment Description:** The sediment description should follow the format described in SOP SD-13, *Field Classification of Sediment*. Information on sediment should include sediment type, percent moisture with depth through the core, color, and presence or absence of vegetation or biota. The surface conditions within the core (i.e., overlying water is present, undisturbed sediment/water interface, presence of any vegetation or biota) should also be described. The project-specific FSP should be consulted for any special descriptive items that may be required.

**Comments:** Include all pertinent observations. Coring observations might include coring chatter, core-bounce (hard object hit by corer during penetration), sudden differences in

coring speed, damaged coring equipment, and malfunctioning equipment. Information provided by the coring contractor should be attributed to the coring contractor.

## Data on Station Core Log

**Cast Number:** Record the number of coring attempts at each station.

**Start/End Time:** The time should be recorded during coring to determine coring speed. Time should be recorded in 24- hour mode (e.g., 3:00 p.m. = 1500 hours).

**Water Depth:** Record the overlying water depth at the station. Note: The overlying water depth can change between coring attempts and therefore must be measured prior to each attempt.

**Core Penetration Depth:** Record the depth that the core was pushed into the sediment. Note: If this information is not readily apparent, it can be obtained from the coring contractor.

**Retrieved Core Length:** While the sediment core is vertical, record the length of the retrieved core.

**Overlying Water:** Record whether or not there is water on top of the sediment core once the core has been retrieved. This is necessary to determine measurable sediment/water interface.

**Coordinates:** Record the latitude and longitude (or geographic) of the station location. The datum used to collect the station location coordinates (e.g., WGS84) must also be recorded in the field notes.



ED_004850_00001502-00971

# STANDARD OPERATING PROCEDURE (SOP) SD-13

# FIELD CLASSIFICATION OF SEDIMENT

## SCOPE AND APPLICATION

This SOP presents the field classification of sediments to be used by Integral field staff. Sediment descriptions should be precise and comprehensive without being verbose. Assumptions and personal comments should not be included in the sediment descriptions. These descriptions will be used to interpret environmental conditions and other potential properties, rather than the exact mineralogy or tectonic environment.

Sediment descriptions should be recorded in either the observing scientist's field logbook, or if subsurface sediment is collected, then the sediment description column of the Field Sediment Core Form should be completed for each core collected. If no difference between consecutive sediment samples exists, subsequent descriptions can be noted as "same as above," or minor changes such as "increasing sand" or "becomes dark brown" can be added.

After the overlying water is removed, characterize the sediment. Sediment characteristics that are often recorded in the field logbook or the Field Sediment Core Form if subsurface sediment is collected, include:

- Sediment type (e.g., silt, sand)
- Texture (e.g., fine grain, coarse, poorly sorted sand)
- Color
- Presence/location/thickness of the redox potential discontinuity layer (a visual
- indication of black is often adequate for documenting anoxia)
- Approximate percentage of moisture
- Presence of biological structures (e.g., chironomids, tubes, macrophytes) and the
- approximate percentage of these structures
- Presence of organic debris (e.g., twigs, leaves) and the approximate percentage of
- debris
- Presence of shells and the approximate percentage of shells
- Stratification, if any
- Presence of a sheen
- Odor (e.g., hydrogen sulfide, oil, creosote).



ED_004850_00001502-00972

In addition, the project-specific field sampling plan should be reviewed to determine if there are any project-specific reporting requirements.

In general, the similarities of consecutive sediment samples should be noted. Examples of surface sediment descriptions are provided in Table SD-13(1). The minimum elements of the sediment descriptions are discussed below. The format of sediment descriptions for each sample should be consistent throughout the logbook.

**Table SD-13(1). Example of Surface Sediment Desctiptions**

| Station No. | Grab No. | Example Descriptions |
|---|---|---|
| TC01 | 1 | SILT, mottled dark gray (10YR 4/1) with thin layer < 1 cm of very pale brown (10YR 7/4) on surface. Occasional roots, some twigs, and leaves on surface. Slight reducing odor. Sheen on overlying water in grab. |
| TC02 | 1 | Sandy SILT, fine sand, dark gray (10YR 4/1) throughout grab, with 10 percent medium to coarse sand, trace woody debris. Chironomid on surface. |
| TC02 | 2 | Same description as first grab at Station TC02. |
| TC02 | 3 | Same description as first grab at Station TC02, but no sand (SILT only) and color is very dark gray (10YR 3/1) with no chironomid present. |

## Definition of Sediment Types

Fine- grained sediments are classified as either silts or clays. Field determinations of silts and clays are based on observations of dry strength, dilatancy, toughness, and plasticity. Field procedures for these tests are included in ASTM D-2488-84. If these tests are used, the results should be included in the sediment description. Sediments with high plasticity can be emphasized by describing them as "silty CLAY with high plasticity." Plasticity is an important descriptor because a sediment can be dilatant/nonplastic and serve as a transport pathway, or it can be highly plastic and very impervious.

Coarse-grained sediments are classified as predominantly sand. The gradation of a coarse grained sediment is included in the specific sediment name (i.e., fine to medium SAND with silt). Estimating the percentage of size ranges following the group name is encouraged for mixtures of silty sand and sand. If applicable, use the modifiers "poorly graded" or "well graded" when describing the sand component of the sediment.

## Color

The basic color of a sediment, such as brown or gray, must be provided in the description. The color term can be modified by adjectives such as light, dark, or very dark. Especially



ED_004850_00001502-00973

note streaking or mottling. The color chart designations provided in either the *Globe Soil Color Book* or the Munsell color guide can be used.

## Moisture Content

The degree of moisture present in the sediment should be defined as moist, wet, or very wet. The percent moisture content should be estimated.

## Other Components

Other components, such as organic debris and shell fragments, should be preceded by the appropriate adjective reflecting relative percentages: trace (0–5 percent), few (5–10 percent), little (15–25 percent), and some (30–45 percent). The word "occasional" can be applied to random particles of a larger size than the general sediment matrix (i.e., occasional stone, large piece of wood).

## Additional Descriptions

Features such as sloped surface in the grab, root holes, odor, and sheen should be noted if they are observed. Anything unusual should be noted. Additional sediment descriptions may be made at the discretion of the project manager or as the field conditions warrant.



ED_004850_00001502-00974

# STANDARD OPERATING PROCEDURE (SOP) SL-01

# DECONTAMINATION OF SOIL SAMPLING EQUIPMENT

## SCOPE AND APPLICATION

This SOP describes procedures for decontaminating sampling and processing equipment contaminated by either organic or inorganic materials. To prevent potential cross contamination of samples, all reusable soil sampling and processing equipment is decontaminated before each use. At the sample collection site, a decontamination area is established in a clean location that is upwind of actual sampling locations, if possible. All soil sampling and processing equipment is cleaned in this location. Decontaminated equipment is stored away from areas that may cause recontamination. When handling decontamination chemicals, field personnel must follow all relevant procedures and wear protective clothing as stipulated in the site-specific health and safety plan (HSP).

Sampling equipment may be used to collect samples that will 1) undergo a full-suite analysis (organics, metals, and conventional parameters) or 2) be analyzed for metals and conventional parameters only. Decontamination of sampling equipment (e.g., hand auger, split-spoon sampler) used for both analyte groups should follow the order of a detergent wash, site water rinse, organic solvent rinses, and final site water rinse. Sample processing equipment (e.g., bowls, spoons) is rinsed with distilled/deionized water instead of with site water.

## EQUIPMENT AND REAGENTS REQUIRED

Equipment required for decontamination includes the following:

- Steam cleaner and collection basin (if required)
- 55-gal, Department of Transportation (DOT)-approved drums (if required)
- Polyethylene or polypropylene tub (to collect solvent rinsate)
- Plastic bucket(s) (e.g., 5-gal bucket)
- Tap water or site water (i.e., potable water)
- Carboy, distilled/deionized water (analyte-free; received from testing laboratory or other reliable source)
- Properly labeled squirt bottles



ED_004850_00001502-00975

- Funnels
- Alconox®, Liquinox®, or equivalent industrial nonphosphate detergent
- Pesticide-grade ethanol and hexane (consult project-specific field sampling plan [FSP], as the solvents may vary by U.S. Environmental Protection Agency [EPA] region or state)
- 10 percent diluted nitric acid or hydrochloric acid (reagent grade) for inorganic contaminants (if required; see project-specific FSP)
- Baking soda (if required)
- Long handled, hard-bristle brushes
- Plastic sheeting, garbage bags, and aluminum foil
- Personal protective equipment as specified in the HSP.

## PROCEDURES

### Decontamination Procedures for Full Suite Analysis (Organic, Metal, or Conventional Parameters)

Two organic solvents are used in this procedure. The first is miscible with water (e.g., ethanol) and is intended to scavenge water from the surface of the sampling equipment and allow the equipment to dry quickly. This allows the second solvent to fully contact the surface of the sampler. Make sure that the solvent ordered is anhydrous or has a very low water content (i.e., <1 percent). If ethanol is used, make sure that the denaturing agent in the alcohol is not one of the sample analytes. The second organic solvent is hydrophobic (e.g., hexane) and is intended to dissolve any organic chemicals that are on the surface of the equipment.

The exact solvents used for a given project may vary by EPA region or state (see project-specific FSP). Integral uses ethanol and hexane as preferred solvents for equipment decontamination. If specified in the project-specific FSP, isopropanol or acetone can be substituted for ethanol, and methanol can be substituted for hexane in the decontamination sequence. The choice of solvents is also dependent on the kind of material from which the equipment is made (e.g., acetone cannot be used on polycarbonate), and the ambient temperature (e.g., hexane is too volatile in hot climates). In addition, although methanol is slightly more effective than other solvents, its use is discouraged because of its potential toxicity to sampling personnel. Always follow the procedures listed in the site-specific HSP when decontaminating sampling equipment (e.g., always stand upwind when using volatile solvents, wear appropriate gloves and safety glasses or goggles). Containerize all decontamination fluids for proper disposal, following procedures listed in the FSP.



ED_004850_00001502-00976

The specific procedures for decontaminating soil sampling equipment and soil compositing equipment are as follows:

1. Rinse the equipment thoroughly with tap or site water to remove visible soil. This step should be performed onsite for all equipment. After removing visible solids, set aside sampling equipment that does not need to be used again that day and see that it is thoroughly cleaned in the field laboratory at the end of the day.
2. Pour a small amount of concentrated laboratory detergent into a bucket (i.e., about 1 to 2 tablespoons per 5-gal bucket) and fill it halfway with tap or site water. If the detergent is in crystal form, make sure all crystals are completely dissolved prior to use.
3. Scrub the equipment in the detergent solution using a long-handled brush with rigid bristles, using a back-and-forth motion. Be sure to clean the outside of the compositing bowls and other pieces that may be covered with soil.
4. Double rinse the equipment with tap or site water and set upright on a stable surface to drain. The more completely the equipment drains, the less solvent will be needed in the next step. Do not allow any surface that will come in contact with the sample to touch any contaminated surface. If acid and solvent rinses are not required by the FSP, skip to step 8.
5. If an acid rinse is required by the FSP, rinse the equipment using a squirt bottle using a 10 percent acid solution. Double-rinse equipment with tap or site water and set right-side-up on a stable surface to drain. If solvent rinses are not required by the FSP, skip to step 8.
6. Carefully rinse the equipment with ethanol from a squirt bottle, and let the excess solvent drain into a waste container (which may need to be equipped with a funnel). These solvents act primarily as a drying agent by scavenging water from the equipment surface and carrying it away, but they also work as a solvent for some organic contamination. Hand-augers must be held over the waste container and turned slowly so the stream of solvent contacts the entire surface. The sample apparatus may be turned on its side, and if applicable, opened to be washed more effectively. Set the equipment in a clean location and allow it to air dry. Use only enough solvent to scavenge all of the water and flow off the surface of the equipment (i.e., establish sheet flow) into the waste container. Allow equipment to drain as much as possible. Ideally, the equipment will be dry. The more thoroughly it drains, the less solvent will be needed in the next step.
7. Carefully rinse the drained or air-dried equipment with hexane from a squirt bottle, and let the excess solvent drain into the waste container, which may need to be equipped with a funnel. Hexane acts as the primary solvent of organic chemicals. Ethanol is soluble in hexane but water is not. If water beading occurs, it means that the



ED_004850_00001502-00977

equipment was not thoroughly rinsed with ethanol or that the ethanol that was purchased was not free of water. When the equipment has been rinsed with hexane, set it in a clean location and allow the hexane to evaporate before using the equipment for sampling. Use only enough solvent to scavenge all of the ethanol and flow off the surface of the equipment (i.e., establish sheet flow) into the waste container.

8. Do a final rinse with site water for the sampling equipment (i.e., hand-auger) and distilled/deionized water for the processing equipment (i.e., stainless-steel bowls and spoons). Equipment does not need to be dried before use.
9. If the decontaminated sampling equipment is not to be used immediately, wrap small stainless-steel items in aluminum foil (dull side facing the cleaned area).

   If the sample collection or processing equipment is precleaned at the field laboratory and transported to the site, then the decontaminated equipment will be wrapped in aluminum foil (dull side facing the cleaned area) and stored and transported in a clean plastic bag (e.g., a trash bag) until ready for use, unless the project-specific FSP lists special handling procedures.
10. After decontaminating all of the sampling equipment, dispose of the disposable gloves and used foil per the procedures listed in the project-specific FSP. When not in use, keep the waste solvent container closed and store in a secure area. The waste should be transferred to empty solvent bottles for disposal at a licensed facility per the procedures listed in the project-specific FSP. When not in use, keep the waste acid container closed and store in a secure area. The acid waste should be neutralized with baking soda or containerized and disposed of per the procedures listed in the project-specific FSP.

## Decontamination Procedures for Metals and Conventional Parameters Only

The specific procedures for decontaminating soil sampling equipment and soil processing equipment are as follows:

1. Rinse the equipment thoroughly with tap or site water to remove the visible soil. Perform this step onsite for all equipment. Set aside any pieces that do not need to be used again that day see that they are thoroughly cleaned in the field laboratory at the end of the day.
2. Pour a small amount of concentrated laboratory detergent into a bucket (i.e., about 1 to 2 tablespoons per 5-gal bucket) and fill it halfway with tap or site water. If the detergent is in crystal form, make sure all crystals are completely dissolved prior to use.



ED_004850_00001502-00978

3. Scrub the equipment in the detergent solution using a long-handled brush with rigid bristles. Be sure to clean the outside of the compositing bowls and other pieces that may be covered with soil.
4. Double-rinse the equipment with tap or site water (if an acid rinse is required) or with distilled/deionized water (if no acid rinse) and set right-side-up on a stable surface to drain. Do not allow any surface that will come in contact with the sample to touch any contaminated surface.
5. If an acid rinse is required by the FSP, rinse the equipment using a squirt bottle containing a 10 percent acid solution. Double-rinse equipment with distilled/deionized water and set right-side-up on a stable surface to drain.
6. If the decontaminated sampling equipment is not to be used immediately, wrap small stainless-steel items in aluminum foil (dull side facing the cleaned area).

   If the sample collecting or processing equipment is cleaned at the field laboratory and transported to the site, then the decontaminated equipment will be wrapped in aluminum foil (dull side facing the cleaned area) and stored and transported in a clean plastic bag until ready for use, unless the project-specific FSP lists special handling procedures.
7. After decontaminating all of the sampling equipment, place the disposable gloves and used foil in garbage bags for disposal in a solid waste landfill. When not in use, keep the waste acid container closed and store in a secure area. The acid waste should be neutralized with baking soda and disposed of per the procedures listed in the project-specific FSP.

## Decontamination Procedures for Drill Rig or Test Pit Sampling Equipment

1. Decontaminate sampling equipment before use, between samples and stations, and upon completion of sampling operations.
2. Equipment used during drilling/test pit operations should be decontaminated in the Exclusion Zone prior to transport to the Support Zone (refer to site-specific HSP).
3. If the steam-cleaning location is in an area outside of the Exclusion Zone, remove loose soil on the drill rig, augers, drill pipe, and rods, and other large equipment at the drill site, then move the equipment directly to the steam-cleaning decontamination area for more thorough cleaning.
4. To decontaminate a drill rig or backhoe, pressure wash with a steam cleaner using potable water rinse upon mobilization, between drilling locations, and upon demobilization. Cleaning water can generally be allowed to drain directly on the ground near the station (refer to the FSP).



ED_004850_00001502-00979

5. To decontaminate auger, drill rods, and other down-hole tools, pressure wash with a steam cleaner and potable water rinse upon mobilization, between drilling locations, and upon demobilization. All decontamination fluids are to be containerized for proper disposal.
6. To decontaminate split-spoon and hand-auger samplers, follow the decontamination procedures listed above (the selected decontamination procedures is dependent upon analyte list provided in the project-specific FSP). To the extent possible, allow to air dry prior to sampling. If the split-spoon is not used immediately, wrap it in aluminum foil. All decontamination fluids are to be containerized for proper disposal.



ED_004850_00001502-00980

# STANDARD OPERATING PROCEDURE (SOP) SL-02

# PREPARATION OF FIELD QUALITY CONTROL SAMPLES FOR SOILS

## SCOPE AND APPLICATION

This SOP describes the purpose, preparation, and collection frequency of field duplicate samples, field replicate samples, matrix spike/matrix spike duplicates (MS/MSDs), equipment rinsate blanks, bottle blanks, trip blanks, temperature blanks, environmental blanks, and reference materials (i.e., a standard reference material, a certified reference material, or other reference material) for soil samples. Not all of the field quality control samples discussed in this SOP may be required for a given project. The specific field quality control samples will be identified in the project-specific field sampling plan (FSP) and quality assurance project plan (QAPP). For most projects, Integral's recommended field quality control samples include an equipment rinsate blank, a field duplicate, and trip blanks if volatile organic compounds (VOCs) are to be analyzed. Definitions of all potential quality control samples are described below.

As part of the quality assurance and quality control (QA/QC) program, all field quality control samples will be sent to the laboratories blind. To accomplish this, field quality control samples will be prepared and labeled in the same manner as regular samples, with each quality control sample being assigned a unique sample number that is consistent with the numbering for regular samples. All of the containers that are required to complete the field quality control sample for the applicable analyte list must be labeled with the same sample number. The sample ID for field quality control samples should allow data management and data validation staff to identify them as such and should only be recorded in the field logbook or field sampling forms. Under no circumstances should the laboratory be allowed to use reference materials, rinsate blanks, or trip blanks for laboratory quality control analysis (i.e., duplicates, matrix spike, and matrix spike duplicates). To prevent this from happening, select and mark regular samples on the chain-of-custody/sampling analysis request (COC) form or instruct the laboratory to contact the project QA/QC coordinator to select appropriate samples for each sample group.

Prepare field quality control samples at least once per sampling event, and prepare certain types more often at predetermined frequencies. If the number of samples taken does not equal an integer multiple of the intervals specified in this SOP, the number of field quality control samples is specified by the next higher multiple. For example, if a frequency of 1 quality



ED_004850_00001502-00981

control sample per 20 is indicated and 28 samples are collected, prepare 2 quality control samples. The method of preparation and frequency of field quality control samples required for soil sampling activities are described below. These protocols must be followed, unless different frequency requirements are listed in the FSP and QAPP.

For most projects, Integral's recommended field quality control samples include an equipment rinsate blank, a field duplicate, and trip blanks if VOCs are to be analyzed. The following table lists the possible quality control sample types and suggested frequencies for soil sampling programs (not all types of quality control samples will always be collected; see project-specific FSP and QAPP for actual quality control samples that need to be collected for a particular sampling event). A detailed explanation of each type of quality control sample with the required preparation follows.

Field Quality Control Sample Requirements

| Quality Control Sample Name | Abbreviation | Preparation | | Frequency[a] |
|---|---|---|---|---|
| | | Location | Method | |
| Duplicate | DUP | Sampling site | Additional natural sample | One per 20 samples. May not be applicable if REP is being collected. |
| Replicate | REP | Sampling site | Additional natural sample | One replicate per 20 samples. May not be applicable if DUP is being collected. |
| Matrix spike/matrix spike duplicate | MS/MSD | Sampling site | Additional sample bottles filled for laboratory quality control requirements | One per 20 samples |
| Equipment rinsate blank | ER | Sampling site | Deionized water collected after pouring through and over decontaminated equipment | Minimum of one per sampling event per type of sampling equipment used and then 1:20 thereafter |
| Bottle blank | BB | Field | Unopened bottle | One per sample episode or one per bottle type |
| Trip blank | TB | Laboratory | Deionized water with preservative | One pair per each VOC sample cooler shipment |
| Temperature blank | TMB | Laboratory | Deionized water | One per sample cooler |
| Environmental (transfer) blank | EB | Field | Bottle filled at sample site with deionized water | One per 20 samples |
| Standard reference material | SRM | Field laboratory or sampling site | SRM ampules or other containers for each analyte group | One set per 50 samples or one per episode |

[a] Frequencies provided here are general recommendations; specific frequencies should be provided in the project-specific FSP or QAPP.



ED_004850_00001502-00982

## FIELD DUPLICATE SAMPLES

Collect field duplicate (or split) samples to assess the homogeneity of the samples collected in the field and the precision of the sampling process. Prepare field duplicates by collecting two aliquots for the sample and submitting them for analysis as separate samples. Collect field duplicates at a minimum frequency of 1 per 20 samples or once per sampling event, whichever is more frequent. The project QA/QC coordinator will determine the actual number of field duplicate samples collected during a sampling event on a case-by-case basis (consult the project-specific FSP and QAPP, as the requirements on frequency of field duplicate collection may vary by EPA region or state).

## FIELD REPLICATE SAMPLES

Field replicate samples are co-located samples collected in an identical manner over a minimum period of time to provide a measure of the field and laboratory variance, including variance resulting from sample heterogeneity. Prepare field replicates by collecting two completely separate samples from the same station and submitting them for analysis as separate samples. Collect field replicates at a minimum frequency of 1 per 20 samples or once per sampling event, whichever is more frequent. If field duplicate samples are collected, then it is unlikely that field replicate samples will also be collected during a sampling event. The project QA/QC coordinator will determine the actual number of field replicate samples collected during a sampling event on a case-by-case basis (consult the project-specific FSP and QAPP, as the requirements on frequency of field duplicate collection may vary by EPA region or state).

## MATRIX SPIKE/MATRIX SPIKE DUPLICATES

The MS/MSD analyses provide information about the effect of the sample matrix on the design and measurement methodology used by the laboratory. To account for the additional volume that may be needed by the laboratory to perform the analyses, extra sample volumes may be required to be collected from designated soil stations. MS/MSDs may be collected at a minimum frequency of 1 per 20 samples or once per sampling event, whichever is more frequent. The project QA/QC coordinator will determine the actual number of extra bottles collected during a sampling event on a case-by-case basis (consult the project-specific FSP and QAPP, as the requirements may vary by analyte group).

## EQUIPMENT RINSATE BLANKS

Use equipment rinsate blanks to help identify possible contamination from the sampling environment and/or from decontaminated sampling equipment. Prepare equipment rinsate



ED_004850_00001502-00983

blanks by pouring laboratory distilled/deionized water through, over, and into the decontaminated sample collection equipment, then transferring the water to the appropriate sample containers and adding any necessary preservatives. Prepare equipment rinsate blanks for all inorganic, organic, and sometimes conventional analytes at least once per sampling event per the type of sampling equipment used. The project QA/QC coordinator will determine the actual number of equipment rinsate blanks prepared during an event on a case-by-case basis (consult the project-specific FSP and QAPP, as the requirements on frequency of equipment rinsate blank collection may vary by EPA region or state).

## BOTTLE BLANKS

The bottle blank is an unopened sample bottle. Submit bottle blanks along with soil samples to ensure that contaminants are not originating from the bottles themselves because of improper preparation, handling, or cleaning techniques. If required, submit one bottle blank per lot of prepared bottles for analysis. If more than one type of bottle will be used in the sampling (e.g., HDPE or glass), then submit a bottle blank for each type of bottle and preservative. The project QA/QC coordinator will determine the actual number of bottle blanks analyzed during a project on a case-by-case basis (consult the project-specific FSP and QAPP, as the requirements on frequency of bottle blank analysis may vary by EPA region or state).

To prepare a bottle blank in the field, set aside one unopened sample bottle from each bottle lot sent from the testing laboratory. Label the bottle as "Bottle Blank" on the sample label (and in the "Remarks" column on the COC form), and send the empty bottle to the laboratory with the field samples.

## TRIP BLANKS

Use trip blanks to help identify whether contaminants may have been introduced during shipment of the soil samples from the field to the laboratory for VOC analyses only. Trip blanks are prepared at the testing laboratory by pouring distilled/deionized water into two 40 mL VOC vials and tightly closing the lids. Invert each vial and tap lightly to determine if air bubbles exist. There should be no air bubbles in the VOC trip blank vials. If air bubbles are present, then note this information in the field logbook.

Transport the trip blanks unopened to and from the field in the cooler with the VOC samples. Label the trip blank and place it inside the cooler that contains newly collected VOC samples; it must remain in the cooler at all times. A trip blank must accompany samples at all times in the field. Send one trip blank (consisting of a pair of VOC vials) with each cooler of samples shipped to the testing laboratory for VOC analysis.



ED_004850_00001502-00984

## TEMPERATURE BLANKS

The laboratory will use temperature blanks to verify the temperature of the samples upon receipt at the testing laboratory. The testing laboratory will prepare temperature blanks by pouring distilled/deionized water into a vial and tightly closing the lid. The blanks will be transported unopened to and from the field in the cooler with the sample containers. A temperature blank must be included with each sample cooler shipped to the testing laboratory.

## ENVIRONMENTAL BLANKS

Prepare the environmental (i.e., transfer) blank in the field to evaluate potential background concentrations present in the air and in the distilled/deionized water used for the final decontamination rinse. If you use unpreserved bottles, then you must add the appropriate preservative (e.g., for metals samples, use a 10 percent nitric acid solution to bring sample pH to 2 or less), if required. Collect environmental blanks at a minimum frequency of 1 in 20 samples. The project QA/QC coordinator will determine the actual number of environmental blanks analyzed during a project on a case-by-case basis (consult the project-specific FSP and QAPP, as the requirements on frequency of environmental blank analysis may vary by EPA region or state).

To prepare an environmental blank in the field, open the laboratory-prepared sample bottle while at a sample collection site, fill the sample bottle with distilled/deionized water and then seal. Note the location from which the environmental blank was collected along with atmospheric conditions at the time of its collection in the field logbook. Assign the environmental blank a unique sample number, label the bottle, and then send the bottle to the laboratory with the field samples.

## REFERENCE MATERIALS

Reference materials (i.e., a standard reference material, a certified reference material, or other reference material are samples containing known analytes at known concentrations that have been prepared by and obtained from EPA-approved sources. Reference materials have undergone multilaboratory analyses using a standard method which provides certified concentrations. When available for a specific analyte, Reference material samples provide a measure of analytical performance and/or analytical method bias (i.e., accuracy) of the laboratory. Several reference materials may be required to cover all analytical parameters. For all analytes where available, one reference material will be analyzed at a frequency of one per 50 samples. The project QA/QC coordinator will determine the actual number of reference materials analyzed during a project on a case-by-case basis (consult the project-specific FSP



ED_004850_00001502-00985

and QAPP, as the requirements on frequency of reference material analysis may vary by EPA region or state).



ED_004850_00001502-00986

# STANDARD OPERATING PROCEDURE (SOP) SL-04

# FIELD CLASSIFICATION OF SOIL

## SCOPE AND APPLICATION

This SOP establishes the minimum information that must be recorded in the field to adequately document surface soil sampling and soil borehole advancement activities performed during field exploration. The surface soil sampling or borehole log form must be filled out completely for each station.

This SOP presents the field classification of soils to be used by Integral field staff. In general, Integral has adopted the procedures provided in American Society for Testing and Materials (ASTM) Method D-2488-00, Standard Practice for Description and Identification of Soils (attached). ASTM D-2488-00 uses the Unified Soil Classification (USC) system for naming soils. Field personnel are encouraged to study these procedures prior to initiation of fieldwork.

Soil descriptions should be precise and comprehensive without being verbose. The overall impression of the soil should not be distorted by excessive emphasis on minor constituents. In general, the similarities of consecutive soil samples should be emphasized and minor differences de-emphasized. These descriptions will be used to interpret potential contaminant transport properties, rather than interpret the exact mineralogy or tectonic environment. We are primarily interested in engineering and geochemical properties of the soil.

Soil descriptions should be provided on the surface soil field collection form or in the soil description column of the Integral's soil boring log for each sample collected. If there is no difference between consecutive soil samples, subsequent descriptions can be noted as "same as above" or minor changes such as "increasing sand" or "becomes dark brown" can be added.

The format and order of soil descriptions should be as follows:

- Group symbol (in the Unified Symbol column)
- USC name (should be identical to the ASTM D-2488-00 Group Name with the appropriate modifiers)
- Minor components
- Color
- Moisture
- Additional descriptions.



ED_004850_00001502-00987

## EQUIPMENT AND REAGENTS REQUIRED

- Surface soil field collection form or borehole log form (see SOP SL-06, *Logging of Soil Boreholes*)
- Munsell® soil color chart.

## PROCEDURES

The USC is an engineering properties system that uses grain size to classify soils. The first major distinction is between fine-grained soils (more than 50 percent passing the No. 200 sieve [75 µm/0.0029 in.]) and coarse-grained soils (more than 50 percent retained by the No. 200 sieve). Small No. 200 sieves are necessary to classify soils near the cutoff size.

1. Fine-grained soils are classified as either silts or clays. Field determinations of silts and clays are based on observations of dry strength, dilatancy, toughness, and plasticity. Field procedures for these tests are included in ASTM D-2488-00. If these tests are used, include the results in the soil description. If these materials are encountered, perform at least one complete round of field tests for a site, preferably at the beginning of the field investigation. The modifiers "fat" and "lean" are used by ASTM to describe soils of high and low plasticity. The soil group symbols (e.g., CL, MH) already indicate plasticity characteristics, and these modifiers are not necessary in the description. Soils with high plasticity can be emphasized by describing them as "silty CLAY with high plasticity." Plasticity, for example, is an important descriptor because it is often used to interpret whether an ML soil is acting as either a leaky or a competent aquitard. For example, an ML soil can be dilatant/nonplastic and serve as a transport pathway, or it can be highly plastic and very impervious.
2. Coarse-grained soils are classified as either predominantly gravel or sand, with the No. 4 sieve (4.75 mm/0.19 in.) being the division. Use modifiers to describe the relative amounts of fine-grained soil, as noted below:

| Description | Percent Fines | Group Symbol |
|---|---|---|
| Gravel (sand) | <5 percent | GW, GP (SW, SP) |
| Gravel (sand) with silt (clay) | 5–15 percent | Hyphenated names |
| Silty (clayey) gravel (sand) | >15 percent | GM, GC (SM, SC) |



ED_004850_00001502-00988

The gradation of a coarse-grained soil is included in the specific soil name (e.g., fine to medium SAND with silt). Estimating the percent of size ranges following the group name is encouraged for mixtures of silt sand and gravel. Use of the modifiers "poorly graded" or "well graded" is not necessary, as they are indicated by the group symbol.

Show a borderline classification with a slash (e.g., GM/SM). Use this symbol when the soil cannot be distinctly placed in either soil group. Also use a borderline symbol when describing interbedded soils of two or more soil group names when the thickness of the beds are approximately equal, such as "interbedded lenses and layers of fine sand and silt." Do not use a borderline symbol indiscriminately. Make every effort to place the soil into a single group. (One very helpful addition to the soil log form description is the percentage of silt/sand/gravel. Even if the geologist did not have sufficient time to properly define the soil, this percentage breakdown allows classification at a later date).

3. Precede minor components, such as cobbles, roots, and construction debris with the appropriate adjective reflecting relative percentages: trace (0–5 percent), few (5–10 percent), little (15–25 percent), and some (30–45 percent). Use the word "occasional" to describe random particles of a larger size than the general soil matrix (i.e., occasional cobbles, occasional brick fragments). The term "with" indicates definite characteristics regarding the percentage of secondary particle size in the soil name. It is not to be used to describe minor components. If a nonsoil component exceeds 50 percent of an interval, state it in place of the group name.
4. Give the basic color of a soil, such as brown, gray, or red. Modify the color term with adjectives such as light, dark, or mottled, as appropriate. Especially note staining or mottling. This information, for example, may be useful to establish water table fluctuations or contamination in boreholes. The Munsell® soil color chart designation is the Integral color standard. These charts are readily available and offer a high degree of consistency in descriptions between geologists.
5. Define the degree of moisture present in the soil as dry, moist, or wet. Moisture content can be estimated from the criteria listed in Table 3 of ASTM D-2488-00.
6. If observed, note such features as discontinuities, inclusions, joints, fissures, slickensides, bedding, laminations, root holes, and major mineralogical components. Note anything unusual. Additional soil descriptions may be made at the discretion of the project manager or as the field conditions warrant. The surface soil field collection and soil boring log forms list some optional descriptions, as does Table 13 of the ASTM standard. The reader is referred to the ASTM standard for procedures of these descriptions.

The contact between two soil types must be clearly marked on the surface soil field collection or soil boring log forms. If the contact is obvious and sharp, draw it in with a straight line. If



ED_004850_00001502-00989

it is gradational, use a slanted line over the interval. In the case where it is unclear, use a dashed line over the most likely interval.

For drilling activities, the field geologist, who has the advantage of watching the drilling rate and cuttings removal and can talk with the driller in real time, has a much better chance of interpreting the interval than someone in the office.



ED_004850_00001502-00990

# ATTACHMENT 1. ASTM D 2488 – 00, STANDARD PRACTICE FOR DESCRIPTION AND IDENTIFICATION OF SOILS (VISUAL-MANUAL PROCEDURE)

Designation: D 2488 – 00

# Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)[1]

This standard is issued under the fixed designation D 2488; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

## 1. Scope *

1.1 This practice covers procedures for the description of soils for engineering purposes.

1.2 This practice also describes a procedure for identifying soils, at the option of the user, based on the classification system described in Test Method D 2487. The identification is based on visual examination and manual tests. It must be clearly stated in reporting an identification that it is based on visual-manual procedures.

1.2.1 When precise classification of soils for engineering purposes is required, the procedures prescribed in Test Method D 2487 shall be used.

1.2.2 In this practice, the identification portion assigning a group symbol and name is limited to soil particles smaller than 3 in. (75 mm).

1.2.3 The identification portion of this practice is limited to naturally occurring soils (disturbed and undisturbed).

NOTE 1—This practice may be used as a descriptive system applied to such materials as shale, claystone, shells, crushed rock, etc. (see Appendix X2).

1.3 The descriptive information in this practice may be used with other soil classification systems or for materials other than naturally occurring soils.

1.4 The values stated in inch-pound units are to be regarded as the standard.

1.5 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific precautionary statements see Section 8.

1.6 *This practice offers a set of instructions for performing one or more specific operations. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this practice may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

## 2. Referenced Documents

2.1 *ASTM Standards:*

D 653 Terminology Relating to Soil, Rock, and Contained Fluids[2]

D 1452 Practice for Soil Investigation and Sampling by Auger Borings[2]

D 1586 Test Method for Penetration Test and Split-Barrel Sampling of Soils[2]

D 1587 Practice for Thin-Walled Tube Sampling of Soils[2]

D 2113 Practice for Diamond Core Drilling for Site Investigation[2]

D 2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System)[2]

D 3740 Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and rock as Used in Engineering Design and Construction[3]

D 4083 Practice for Description of Frozen Soils (Visual-Manual Procedure)[2]

## 3. Terminology

3.1 *Definitions*—Except as listed below, all definitions are in accordance with Terminology D 653.

NOTE 2—For particles retained on a 3-in. (75-mm) US standard sieve, the following definitions are suggested:
*Cobbles*—particles of rock that will pass a 12-in. (300-mm) square opening and be retained on a 3-in. (75-mm) sieve, and
*Boulders*—particles of rock that will not pass a 12-in. (300-mm) square opening.

3.1.1 *clay*—soil passing a No. 200 (75-µm) sieve that can be made to exhibit plasticity (putty-like properties) within a range of water contents, and that exhibits considerable strength when air-dry. For classification, a clay is a fine-grained soil, or the

[1] This practice is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.07 on Identification and Classification of Soils.

Current edition approved Feb. 10, 2000. Published May 2000. Originally published as D 2488 – 66 T. Last previous edition D 2488 – 93$^{\epsilon 1}$.

[2] *Annual Book of ASTM Standards*, Vol 04.08.

[3] *Annual Book of ASTM Standards*, Vol 04.09.

***A Summary of Changes section appears at the end of this standard.**

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States.



ED_004850_00001502-00992

fine-grained portion of a soil, with a plasticity index equal to or greater than 4, and the plot of plasticity index versus liquid limit falls on or above the "A" line (see Fig. 3 of Test Method D 2487).

3.1.2 *gravel*—particles of rock that will pass a 3-in. (75-mm) sieve and be retained on a No. 4 (4.75-mm) sieve with the following subdivisions:

*coarse*—passes a 3-in. (75-mm) sieve and is retained on a ¾-in. (19-mm) sieve.

*fine*—passes a ¾-in. (19-mm) sieve and is retained on a No. 4 (4.75-mm) sieve.

3.1.3 *organic clay*—a clay with sufficient organic content to influence the soil properties. For classification, an organic clay is a soil that would be classified as a clay, except that its liquid limit value after oven drying is less than 75 % of its liquid limit value before oven drying.

3.1.4 *organic silt*—a silt with sufficient organic content to influence the soil properties. For classification, an organic silt is a soil that would be classified as a silt except that its liquid limit value after oven drying is less than 75 % of its liquid limit value before oven drying.

3.1.5 *peat*—a soil composed primarily of vegetable tissue in various stages of decomposition usually with an organic odor, a dark brown to black color, a spongy consistency, and a texture ranging from fibrous to amorphous.

3.1.6 *sand*—particles of rock that will pass a No. 4 (4.75-mm) sieve and be retained on a No. 200 (75-µm) sieve with the following subdivisions:

*coarse*—passes a No. 4 (4.75-mm) sieve and is retained on a No. 10 (2.00-mm) sieve.

*medium*—passes a No. 10 (2.00-mm) sieve and is retained on a No. 40 (425-µm) sieve.

*fine*—passes a No. 40 (425-µm) sieve and is retained on a No. 200 (75-µm) sieve.

3.1.7 *silt*—soil passing a No. 200 (75-µm) sieve that is nonplastic or very slightly plastic and that exhibits little or no strength when air dry. For classification, a silt is a fine-grained soil, or the fine-grained portion of a soil, with a plasticity index less than 4, or the plot of plasticity index versus liquid limit falls below the "A" line (see Fig. 3 of Test Method D 2487).

## 4. Summary of Practice

4.1 Using visual examination and simple manual tests, this practice gives standardized criteria and procedures for describing and identifying soils.

4.2 The soil can be given an identification by assigning a group symbol(s) and name. The flow charts, Fig. 1a and Fig. 1b for fine-grained soils, and Fig. 2, for coarse-grained soils, can be used to assign the appropriate group symbol(s) and name. If the soil has properties which do not distinctly place it into a specific group, borderline symbols may be used, see Appendix X3.

NOTE 3—It is suggested that a distinction be made between *dual symbols* and *borderline symbols*.

*Dual Symbol*—A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC, CL-ML used to indicate that the soil has been identified as having the properties of a classification in accordance with Test Method D 2487 where two symbols are required. Two symbols are required when the soil has between 5 and 12 % fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart.

*Borderline Symbol*—A borderline symbol is two symbols separated by a slash, for example, CL/CH, GM/SM, CL/ML. A borderline symbol should be used to indicate that the soil has been identified as having properties that do not distinctly place the soil into a specific group (see Appendix X3).

## 5. Significance and Use

5.1 The descriptive information required in this practice can be used to describe a soil to aid in the evaluation of its significant properties for engineering use.

5.2 The descriptive information required in this practice should be used to supplement the classification of a soil as determined by Test Method D 2487.

5.3 This practice may be used in identifying soils using the classification group symbols and names as prescribed in Test Method D 2487. Since the names and symbols used in this practice to identify the soils are the same as those used in Test Method D 2487, it shall be clearly stated in reports and all other appropriate documents, that the classification symbol and name are based on visual-manual procedures.

5.4 This practice is to be used not only for identification of soils in the field, but also in the office, laboratory, or wherever soil samples are inspected and described.

5.5 This practice has particular value in grouping similar soil samples so that only a minimum number of laboratory tests need be run for positive soil classification.

NOTE 4—The ability to describe and identify soils correctly is learned more readily under the guidance of experienced personnel, but it may also be acquired systematically by comparing numerical laboratory test results for typical soils of each type with their visual and manual characteristics.

5.6 When describing and identifying soil samples from a given boring, test pit, or group of borings or pits, it is not necessary to follow all of the procedures in this practice for every sample. Soils which appear to be similar can be grouped together; one sample completely described and identified with the others referred to as similar based on performing only a few of the descriptive and identification procedures described in this practice.

5.7 This practice may be used in combination with Practice D 4083 when working with frozen soils.

NOTE 5—Notwithstanding the statements on precision and bias contained in this standard: The precision of this test method is dependent on the competence of the personnel performing it and the suitability of the equipment and facilities used. Agencies that meet the criteria of Practice D 3740 are generally considered capable of competent and objective testing. Users of this test method are cautioned that compliance with Practice D 3740 does not in itself assure reliable testing. Reliable testing depends on several factors; Practice D 3740 provides a means for evaluating some of those factors.

## 6. Apparatus

6.1 *Required Apparatus*:

6.1.1 *Pocket Knife or Small Spatula.*

6.2 *Useful Auxiliary Apparatus*:

6.2.1 *Small Test Tube and Stopper* (or jar with a lid).

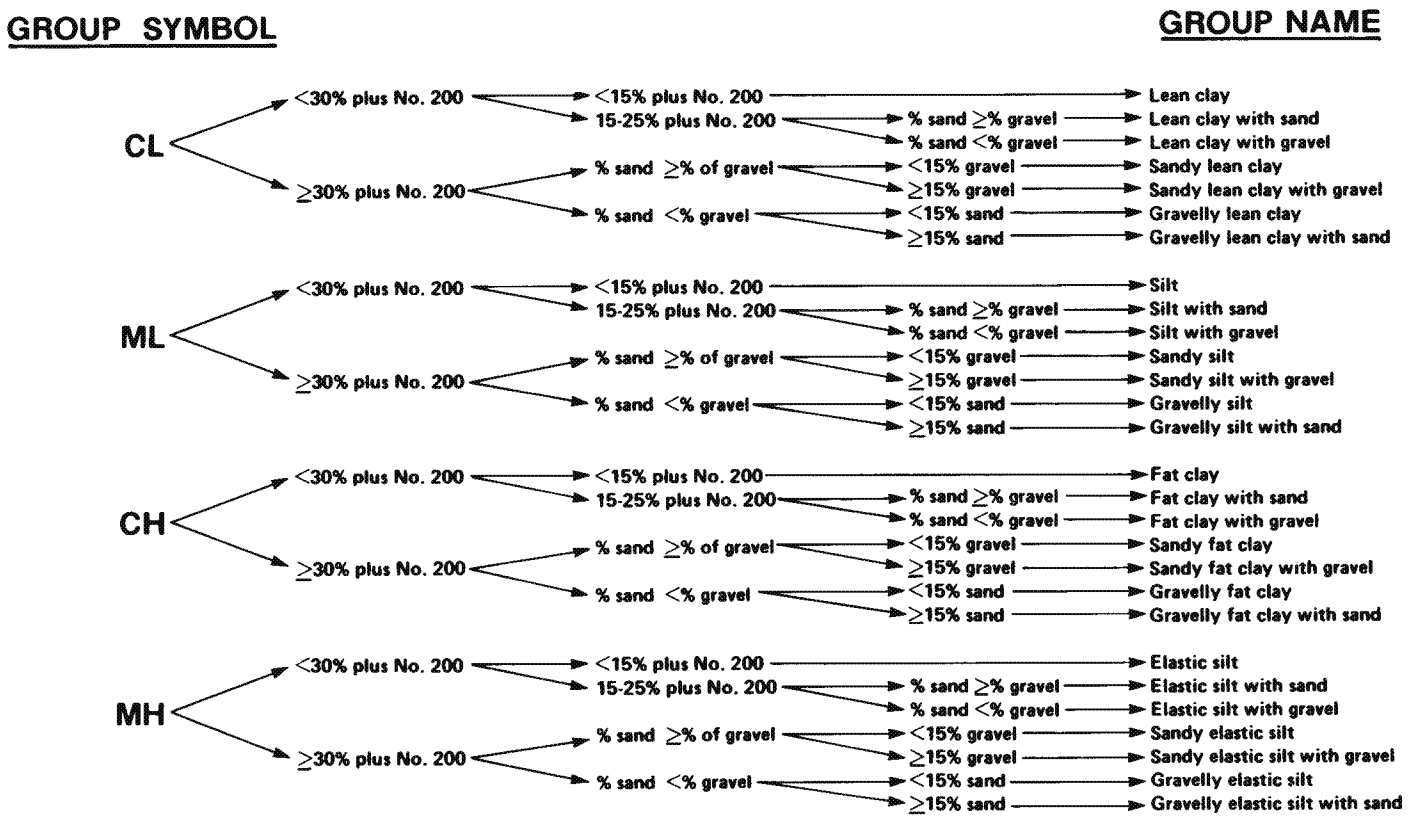
6.2.2 *Small Hand Lens.*

## 7. Reagents

7.1 *Purity of Water*—Unless otherwise indicated, references

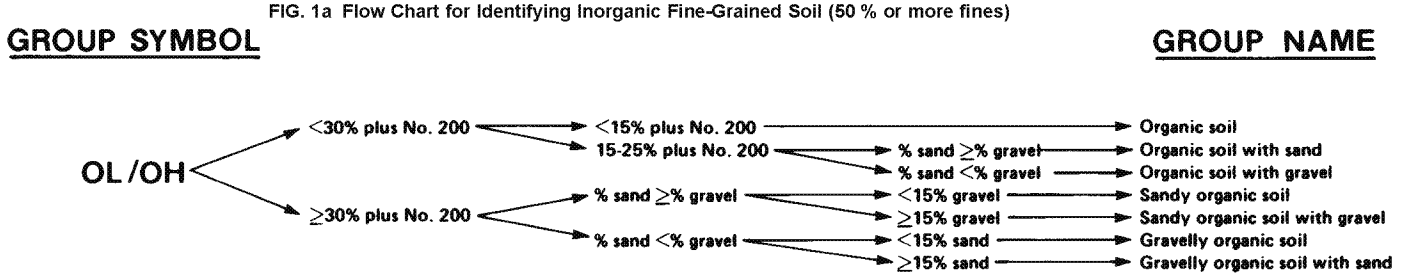


ED_004850_00001502-00993




NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

**FIG. 1a Flow Chart for Identifying Inorganic Fine-Grained Soil (50 % or more fines)**




NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

**FIG. 1 b Flow Chart for Identifying Organic Fine-Grained Soil (50 % or more fines)**

to water shall be understood to mean water from a city water supply or natural source, including non-potable water.

7.2 *Hydrochloric Acid*—A small bottle of dilute hydrochloric acid, HCl, one part HCl (10 *N*) to three parts water (This reagent is optional for use with this practice). See Section 8.

## 8. Safety Precautions

8.1 When preparing the dilute HCl solution of one part concentrated hydrochloric acid (10 *N*) to three parts of distilled water, slowly add acid into water following necessary safety precautions. Handle with caution and store safely. If solution comes into contact with the skin, rinse thoroughly with water.

8.2 **Caution**—Do not add water to acid.

## 9. Sampling

9.1 The sample shall be considered to be representative of the stratum from which it was obtained by an appropriate, accepted, or standard procedure.

NOTE 6—Preferably, the sampling procedure should be identified as having been conducted in accordance with Practices D 1452, D 1587, or D 2113, or Test Method D 1586.

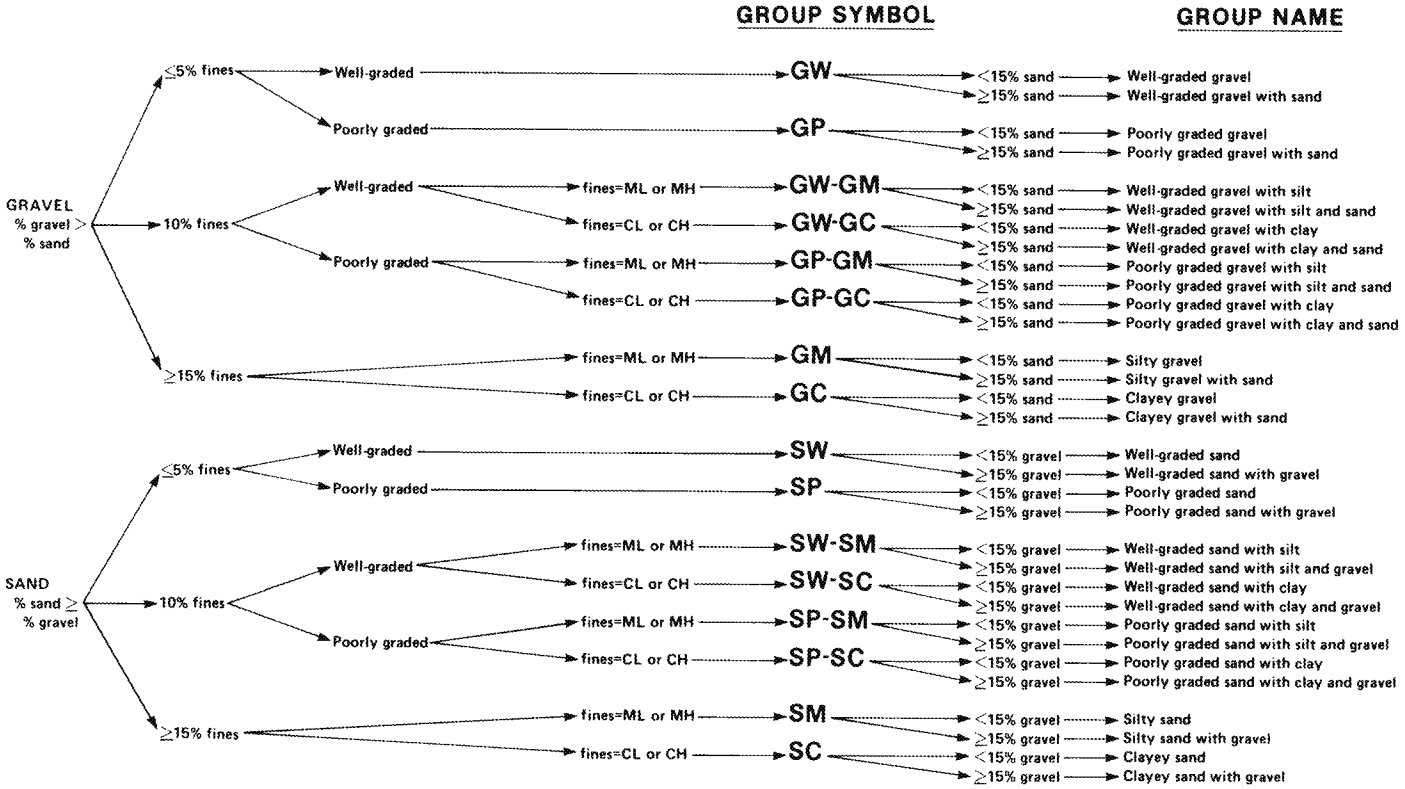
9.2 The sample shall be carefully identified as to origin.

NOTE 7—Remarks as to the origin may take the form of a boring number and sample number in conjunction with a job number, a geologic stratum, a pedologic horizon or a location description with respect to a permanent monument, a grid system or a station number and offset with respect to a stated centerline and a depth or elevation.

9.3 For accurate description and identification, the minimum amount of the specimen to be examined shall be in accordance with the following schedule:



ED_004850_00001502-00994




NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

**FIG. 2 Flow Chart for Identifying Coarse-Grained Soils (less than 50 % fines)**

| Maximum Particle Size, Sieve Opening | Minimum Specimen Size, Dry Weight |
|---|---|
| 4.75 mm (No. 4) | 100 g (0.25 lb) |
| 9.5 mm (⅜ in.) | 200 g (0.5 lb) |
| 19.0 mm (¾ in.) | 1.0 kg (2.2 lb) |
| 38.1 mm (1½ in.) | 8.0 kg (18 lb) |
| 75.0 mm (3 in.) | 60.0 kg (132 lb) |

NOTE 8—If random isolated particles are encountered that are significantly larger than the particles in the soil matrix, the soil matrix can be accurately described and identified in accordance with the preceeding schedule.

9.4 If the field sample or specimen being examined is smaller than the minimum recommended amount, the report shall include an appropriate remark.

## 10. Descriptive Information for Soils

10.1 *Angularity*—Describe the angularity of the sand (coarse sizes only), gravel, cobbles, and boulders, as angular, subangular, subrounded, or rounded in accordance with the criteria in Table 1 and Fig. 3. A range of angularity may be stated, such as: subrounded to rounded.

10.2 *Shape*—Describe the shape of the gravel, cobbles, and boulders as flat, elongated, or flat and elongated if they meet the criteria in Table 2 and Fig. 4. Otherwise, do not mention the shape. Indicate the fraction of the particles that have the shape, such as: one-third of the gravel particles are flat.

10.3 *Color*—Describe the color. Color is an important property in identifying organic soils, and within a given locality it may also be useful in identifying materials of similar geologic origin. If the sample contains layers or patches of varying colors, this shall be noted and all representative colors shall be described. The color shall be described for moist samples. If the color represents a dry condition, this shall be stated in the report.

**TABLE 1 Criteria for Describing Angularity of Coarse-Grained Particles (see Fig. 3)**

| Description | Criteria |
|---|---|
| Angular | Particles have sharp edges and relatively plane sides with unpolished surfaces |
| Subangular | Particles are similar to angular description but have rounded edges |
| Subrounded | Particles have nearly plane sides but have well-rounded corners and edges |
| Rounded | Particles have smoothly curved sides and no edges |

10.4 *Odor*—Describe the odor if organic or unusual. Soils containing a significant amount of organic material usually have a distinctive odor of decaying vegetation. This is especially apparent in fresh samples, but if the samples are dried, the odor may often be revived by heating a moistened sample. If the odor is unusual (petroleum product, chemical, and the like), it shall be described.

10.5 *Moisture Condition*—Describe the moisture condition as dry, moist, or wet, in accordance with the criteria in Table 3.

10.6 *HCl Reaction*—Describe the reaction with HCl as none, weak, or strong, in accordance with the critera in Table 4. Since calcium carbonate is a common cementing agent, a report of its presence on the basis of the reaction with dilute hydrochloric acid is important.

10.7 *Consistency*—For intact fine-grained soil, describe the



ED_004850_00001502-00995

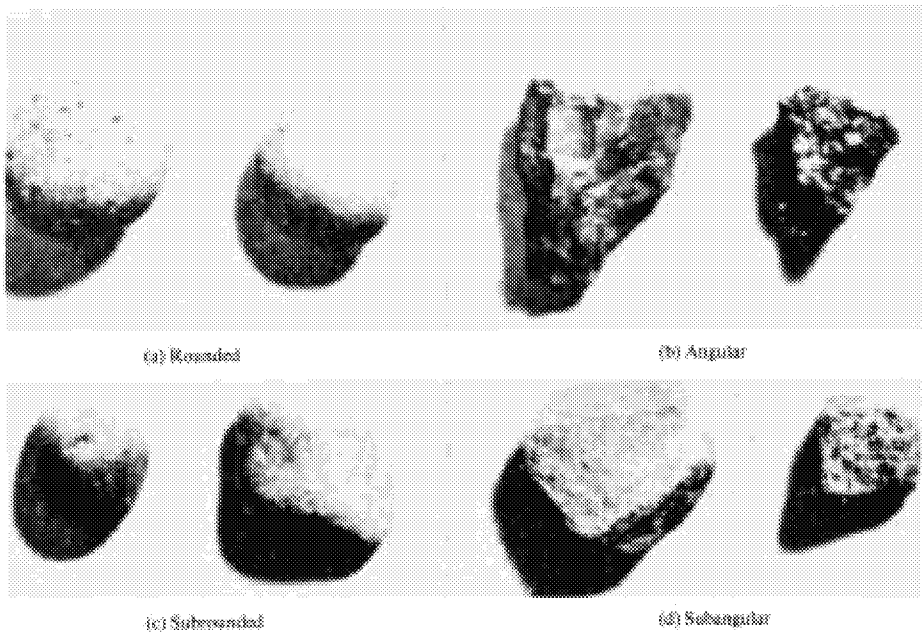



**FIG. 3 Typical Angularity of Bulky Grains**

**TABLE 2 Criteria for Describing Particle Shape (see Fig. 4)**

| | |
|---|---|
| The particle shape shall be described as follows where length, width, and thickness refer to the greatest, intermediate, and least dimensions of a particle, respectively. | |
| Flat | Particles with width/thickness > 3 |
| Elongated | Particles with length/width > 3 |
| Flat and elongated | Particles meet criteria for both flat and elongated |

consistency as very soft, soft, firm, hard, or very hard, in accordance with the criteria in Table 5. This observation is inappropriate for soils with significant amounts of gravel.

10.8 *Cementation*—Describe the cementation of intact coarse-grained soils as weak, moderate, or strong, in accordance with the criteria in Table 6.

10.9 *Structure*—Describe the structure of intact soils in accordance with the criteria in Table 7.

10.10 *Range of Particle Sizes*—For gravel and sand components, describe the range of particle sizes within each component as defined in 3.1.2 and 3.1.6. For example, about 20 % fine to coarse gravel, about 40 % fine to coarse sand.

10.11 *Maximum Particle Size*—Describe the maximum particle size found in the sample in accordance with the following information:

10.11.1 *Sand Size*—If the maximum particle size is a sand size, describe as fine, medium, or coarse as defined in 3.1.6. For example: maximum particle size, medium sand.

10.11.2 *Gravel Size*—If the maximum particle size is a gravel size, describe the maximum particle size as the smallest sieve opening that the particle will pass. For example, maximum particle size, 1½ in. (will pass a 1½-in. square opening but not a ¾-in. square opening).

10.11.3 *Cobble or Boulder Size*—If the maximum particle size is a cobble or boulder size, describe the maximum dimension of the largest particle. For example: maximum dimension, 18 in. (450 mm).

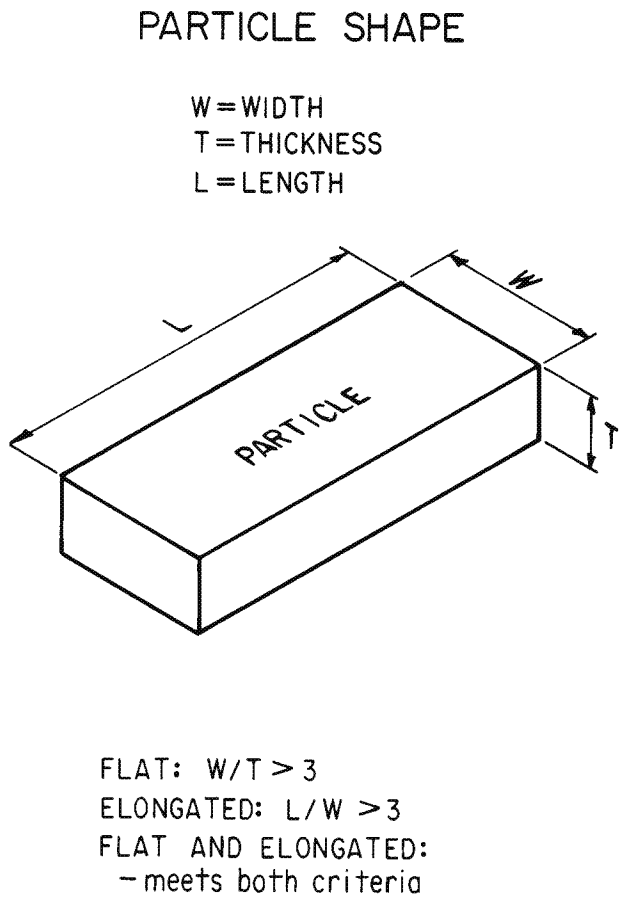



**FIG. 4 Criteria for Particle Shape**

10.12 *Hardness*—Describe the hardness of coarse sand and larger particles as hard, or state what happens when the



ED_004850_00001502-00996

TABLE 3 Criteria for Describing Moisture Condition

| Description | Criteria |
|---|---|
| Dry | Absence of moisture, dusty, dry to the touch |
| Moist | Damp but no visible water |
| Wet | Visible free water, usually soil is below water table |

TABLE 4 Criteria for Describing the Reaction With HCl

| Description | Criteria |
|---|---|
| None | No visible reaction |
| Weak | Some reaction, with bubbles forming slowly |
| Strong | Violent reaction, with bubbles forming immediately |

TABLE 5 Criteria for Describing Consistency

| Description | Criteria |
|---|---|
| Very soft | Thumb will penetrate soil more than 1 in. (25 mm) |
| Soft | Thumb will penetrate soil about 1 in. (25 mm) |
| Firm | Thumb will indent soil about ¼in. (6 mm) |
| Hard | Thumb will not indent soil but readily indented with thumbnail |
| Very hard | Thumbnail will not indent soil |

TABLE 6 Criteria for Describing Cementation

| Description | Criteria |
|---|---|
| Weak | Crumbles or breaks with handling or little finger pressure |
| Moderate | Crumbles or breaks with considerable finger pressure |
| Strong | Will not crumble or break with finger pressure |

TABLE 7 Criteria for Describing Structure

| Description | Criteria |
|---|---|
| Stratified | Alternating layers of varying material or color with layers at least 6 mm thick; note thickness |
| Laminated | Alternating layers of varying material or color with the layers less than 6 mm thick; note thickness |
| Fissured | Breaks along definite planes of fracture with little resistance to fracturing |
| Slickensided | Fracture planes appear polished or glossy, sometimes striated |
| Blocky | Cohesive soil that can be broken down into small angular lumps which resist further breakdown |
| Lensed | Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness |
| Homogeneous | Same color and appearance throughout |

particles are hit by a hammer, for example, gravel-size particles fracture with considerable hammer blow, some gravel-size particles crumble with hammer blow. "Hard" means particles do not crack, fracture, or crumble under a hammer blow.

10.13 Additional comments shall be noted, such as the presence of roots or root holes, difficulty in drilling or augering hole, caving of trench or hole, or the presence of mica.

10.14 A local or commercial name or a geologic interpretation of the soil, or both, may be added if identified as such.

10.15 A classification or identification of the soil in accordance with other classification systems may be added if identified as such.

## 11. Identification of Peat

11.1 A sample composed primarily of vegetable tissue in various stages of decomposition that has a fibrous to amorphous texture, usually a dark brown to black color, and an organic odor, shall be designated as a highly organic soil and shall be identified as peat, PT, and not subjected to the identification procedures described hereafter.

## 12. Preparation for Identification

12.1 The soil identification portion of this practice is based on the portion of the soil sample that will pass a 3-in. (75-mm) sieve. The larger than 3-in. (75-mm) particles must be removed, manually, for a loose sample, or mentally, for an intact sample before classifying the soil.

12.2 Estimate and note the percentage of cobbles and the percentage of boulders. Performed visually, these estimates will be on the basis of volume percentage.

NOTE 9—Since the percentages of the particle-size distribution in Test Method D 2487 are by dry weight, and the estimates of percentages for gravel, sand, and fines in this practice are by dry weight, it is recommended that the report state that the percentages of cobbles and boulders are by volume.

12.3 Of the fraction of the soil smaller than 3 in. (75 mm), estimate and note the percentage, by dry weight, of the gravel, sand, and fines (see Appendix X4 for suggested procedures).

NOTE 10—Since the particle-size components appear visually on the basis of volume, considerable experience is required to estimate the percentages on the basis of dry weight. Frequent comparisons with laboratory particle-size analyses should be made.

12.3.1 The percentages shall be estimated to the closest 5 %. The percentages of gravel, sand, and fines must add up to 100 %.

12.3.2 If one of the components is present but not in sufficient quantity to be considered 5 % of the smaller than 3-in. (75-mm) portion, indicate its presence by the term *trace*, for example, trace of fines. A trace is not to be considered in the total of 100 % for the components.

## 13. Preliminary Identification

13.1 The soil is *fine grained* if it contains 50 % or more fines. Follow the procedures for identifying fine-grained soils of Section 14.

13.2 The soil is *coarse grained* if it contains less than 50 % fines. Follow the procedures for identifying coarse-grained soils of Section 15.

## 14. Procedure for Identifying Fine-Grained Soils

14.1 Select a representative sample of the material for examination. Remove particles larger than the No. 40 sieve (medium sand and larger) until a specimen equivalent to about a handful of material is available. Use this specimen for performing the dry strength, dilatancy, and toughness tests.

14.2 *Dry Strength*:

14.2.1 From the specimen, select enough material to mold into a ball about 1 in. (25 mm) in diameter. Mold the material until it has the consistency of putty, adding water if necessary.

14.2.2 From the molded material, make at least three test specimens. A test specimen shall be a ball of material about ½ in. (12 mm) in diameter. Allow the test specimens to dry in air, or sun, or by artificial means, as long as the temperature does not exceed 60°C.



ED_004850_00001502-00997

14.2.3 If the test specimen contains natural dry lumps, those that are about ½ in. (12 mm) in diameter may be used in place of the molded balls.

NOTE 11—The process of molding and drying usually produces higher strengths than are found in natural dry lumps of soil.

14.2.4 Test the strength of the dry balls or lumps by crushing between the fingers. Note the strength as none, low, medium, high, or very high in accorance with the criteria in Table 8. If natural dry lumps are used, do not use the results of any of the lumps that are found to contain particles of coarse sand.

14.2.5 The presence of high-strength water-soluble cementing materials, such as calcium carbonate, may cause exceptionally high dry strengths. The presence of calcium carbonate can usually be detected from the intensity of the reaction with dilute hydrochloric acid (see 10.6).

14.3 *Dilatancy*:

14.3.1 From the specimen, select enough material to mold into a ball about ½ in. (12 mm) in diameter. Mold the material, adding water if necessary, until it has a soft, but not sticky, consistency.

14.3.2 Smooth the soil ball in the palm of one hand with the blade of a knife or small spatula. Shake horizontally, striking the side of the hand vigorously against the other hand several times. Note the reaction of water appearing on the surface of the soil. Squeeze the sample by closing the hand or pinching the soil between the fingers, and note the reaction as none, slow, or rapid in accordance with the criteria in Table 9. The reaction is the speed with which water appears while shaking, and disappears while squeezing.

14.4 *Toughness*:

14.4.1 Following the completion of the dilatancy test, the test specimen is shaped into an elongated pat and rolled by hand on a smooth surface or between the palms into a thread about ⅛ in. (3 mm) in diameter. (If the sample is too wet to roll easily, it should be spread into a thin layer and allowed to lose some water by evaporation.) Fold the sample threads and reroll repeatedly until the thread crumbles at a diameter of about ⅛ in. The thread will crumble at a diameter of ⅛ in. when the soil is near the plastic limit. Note the pressure required to roll the thread near the plastic limit. Also, note the strength of the thread. After the thread crumbles, the pieces should be lumped together and kneaded until the lump crumbles. Note the toughness of the material during kneading.

14.4.2 Describe the toughness of the thread and lump as low, medium, or high in accordance with the criteria in Table 10.

**TABLE 8 Criteria for Describing Dry Strength**

| Description | Criteria |
|---|---|
| None | The dry specimen crumbles into powder with mere pressure of handling |
| Low | The dry specimen crumbles into powder with some finger pressure |
| Medium | The dry specimen breaks into pieces or crumbles with considerable finger pressure |
| High | The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface |
| Very high | The dry specimen cannot be broken between the thumb and a hard surface |

**TABLE 9 Criteria for Describing Dilatancy**

| Description | Criteria |
|---|---|
| None | No visible change in the specimen |
| Slow | Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing |
| Rapid | Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing |

14.5 *Plasticity*—On the basis of observations made during the toughness test, describe the plasticity of the material in accordance with the criteria given in Table 11.

14.6 Decide whether the soil is an *inorganic* or an *organic* fine-grained soil (see 14.8). If inorganic, follow the steps given in 14.7.

14.7 *Identification of Inorganic Fine-Grained Soils*:

14.7.1 Identify the soil as a *lean clay*, CL, if the soil has medium to high dry strength, no or slow dilatancy, and medium toughness and plasticity (see Table 12).

14.7.2 Identify the soil as a *fat clay*, CH, if the soil has high to very high dry strength, no dilatancy, and high toughness and plasticity (see Table 12).

14.7.3 Identify the soil as a *silt*, ML, if the soil has no to low dry strength, slow to rapid dilatancy, and low toughness and plasticity, or is nonplastic (see Table 12).

14.7.4 Identify the soil as an *elastic silt*, MH, if the soil has low to medium dry strength, no to slow dilatancy, and low to medium toughness and plasticity (see Table 12).

NOTE 12—These properties are similar to those for a lean clay. However, the silt will dry quickly on the hand and have a smooth, silky feel when dry. Some soils that would classify as MH in accordance with the criteria in Test Method D 2487 are visually difficult to distinguish from lean clays, CL. It may be necessary to perform laboratory testing for proper identification.

14.8 *Identification of Organic Fine-Grained Soils*:

14.8.1 Identify the soil as an *organic soil*, OL/OH, if the soil contains enough organic particles to influence the soil properties. Organic soils usually have a dark brown to black color and may have an organic odor. Often, organic soils will change color, for example, black to brown, when exposed to the air. Some organic soils will lighten in color significantly when air dried. Organic soils normally will not have a high toughness or plasticity. The thread for the toughness test will be spongy.

NOTE 13—In some cases, through practice and experience, it may be possible to further identify the organic soils as organic silts or organic clays, OL or OH. Correlations between the dilatancy, dry strength, toughness tests, and laboratory tests can be made to identify organic soils in certain deposits of similar materials of known geologic origin.

**TABLE 10 Criteria for Describing Toughness**

| Description | Criteria |
|---|---|
| Low | Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft |
| Medium | Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness |
| High | Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness |



ED_004850_00001502-00998

**TABLE 11 Criteria for Describing Plasticity**

| Description | Criteria |
|---|---|
| Nonplastic | A ⅛-in. (3-mm) thread cannot be rolled at any water content |
| Low | The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit |
| Medium | The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit |
| High | It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit |

**TABLE 12 Identification of Inorganic Fine-Grained Soils from Manual Tests**

| Soil Symbol | Dry Strength | Dilatancy | Toughness |
|---|---|---|---|
| ML | None to low | Slow to rapid | Low or thread cannot be formed |
| CL | Medium to high | None to slow | Medium |
| MH | Low to medium | None to slow | Low to medium |
| CH | High to very high | None | High |

14.9 If the soil is estimated to have 15 to 25 % sand or gravel, or both, the words "with sand" or "with gravel" (whichever is more predominant) shall be added to the group name. For example: "lean clay with sand, CL" or "silt with gravel, ML" (see Fig. 1a and Fig. 1b). If the percentage of sand is equal to the percentage of gravel, use "with sand."

14.10 If the soil is estimated to have 30 % or more sand or gravel, or both, the words "sandy" or "gravelly" shall be added to the group name. Add the word "sandy" if there appears to be more sand than gravel. Add the word "gravelly" if there appears to be more gravel than sand. For example: "sandy lean clay, CL", "gravelly fat clay, CH", or "sandy silt, ML" (see Fig. 1a and Fig. 1b). If the percentage of sand is equal to the percent of gravel, use "sandy."

## 15. Procedure for Identifying Coarse-Grained Soils
(Contains less than 50 % fines)

15.1 The soil is a *gravel* if the percentage of gravel is estimated to be more than the percentage of sand.

15.2 The soil is a *sand* if the percentage of gravel is estimated to be equal to or less than the percentage of sand.

15.3 The soil is a *clean gravel* or *clean sand* if the percentage of fines is estimated to be 5 % or less.

15.3.1 Identify the soil as a *well-graded gravel*, GW, or as a *well-graded sand*, SW, if it has a wide range of particle sizes and substantial amounts of the intermediate particle sizes.

15.3.2 Identify the soil as a *poorly graded gravel*, GP, or as a *poorly graded sand*, SP, if it consists predominantly of one size (uniformly graded), or it has a wide range of sizes with some intermediate sizes obviously missing (gap or skip graded).

15.4 The soil is either a *gravel with fines* or a *sand with fines* if the percentage of fines is estimated to be 15 % or more.

15.4.1 Identify the soil as a *clayey gravel*, GC, or a *clayey sand*, SC, if the fines are clayey as determined by the procedures in Section 14.

15.4.2 Identify the soil as a *silty gravel*, GM, or a *silty sand*, SM, if the fines are silty as determined by the procedures in Section 14.

15.5 If the soil is estimated to contain 10 % fines, give the soil a dual identification using two group symbols.

15.5.1 The first group symbol shall correspond to a clean gravel or sand (GW, GP, SW, SP) and the second symbol shall correspond to a gravel or sand with fines (GC, GM, SC, SM).

15.5.2 The group name shall correspond to the first group symbol plus the words "with clay" or "with silt" to indicate the plasticity characteristics of the fines. For example: "well-graded gravel with clay, GW-GC" or "poorly graded sand with silt, SP-SM" (see Fig. 2).

15.6 If the specimen is predominantly sand or gravel but contains an estimated 15 % or more of the other coarse-grained constituent, the words "with gravel" or "with sand" shall be added to the group name. For example: "poorly graded gravel with sand, GP" or "clayey sand with gravel, SC" (see Fig. 2).

15.7 If the field sample contains any cobbles or boulders, or both, the words "with cobbles" or "with cobbles and boulders" shall be added to the group name. For example: "silty gravel with cobbles, GM."

## 16. Report

16.1 The report shall include the information as to origin, and the items indicated in Table 13.

NOTE 14—*Example: Clayey Gravel with Sand and Cobbles, GC*—About 50 % fine to coarse, subrounded to subangular gravel; about 30 % fine to coarse, subrounded sand; about 20 % fines with medium plasticity, high dry strength, no dilatancy, medium toughness; weak reaction with HCl; original field sample had about 5 % (by volume) subrounded cobbles, maximum dimension, 150 mm.

In-Place Conditions—Firm, homogeneous, dry, brown

Geologic Interpretation—Alluvial fan

**TABLE 13 Checklist for Description of Soils**

1. Group name
2. Group symbol
3. Percent of cobbles or boulders, or both (by volume)
4. Percent of gravel, sand, or fines, or all three (by dry weight)
5. Particle-size range:
   Gravel—fine, coarse
   Sand—fine, medium, coarse
6. Particle angularity: angular, subangular, subrounded, rounded
7. Particle shape: (if appropriate) flat, elongated, flat and elongated
8. Maximum particle size or dimension
9. Hardness of coarse sand and larger particles
10. Plasticity of fines: nonplastic, low, medium, high
11. Dry strength: none, low, medium, high, very high
12. Dilatancy: none, slow, rapid
13. Toughness: low, medium, high
14. Color (in moist condition)
15. Odor (mention only if organic or unusual)
16. Moisture: dry, moist, wet
17. Reaction with HCl: none, weak, strong

*For intact samples:*

18. Consistency (fine-grained soils only): very soft, soft, firm, hard, very hard
19. Structure: stratified, laminated, fissured, slickensided, lensed, homogeneous
20. Cementation: weak, moderate, strong
21. Local name
22. Geologic interpretation
23. Additional comments: presence of roots or root holes, presence of mica, gypsum, etc., surface coatings on coarse-grained particles, caving or sloughing of auger hole or trench sides, difficulty in augering or excavating, etc.



ED_004850_00001502-00999

NOTE 15—Other examples of soil descriptions and identification are given in Appendix X1 and Appendix X2.

NOTE 16—If desired, the percentages of gravel, sand, and fines may be stated in terms indicating a range of percentages, as follows:

*Trace*—Particles are present but estimated to be less than 5 %
*Few*—5 to 10 %
*Little*—15 to 25 %
*Some*—30 to 45 %
*Mostly*—50 to 100 %

16.2 If, in the soil description, the soil is identified using a classification group symbol and name as described in Test Method D 2487, it must be distinctly and clearly stated in log forms, summary tables, reports, and the like, that the symbol and name are based on visual-manual procedures.

## 17. Precision and Bias

17.1 This practice provides qualitative information only, therefore, a precision and bias statement is not applicable.

## 18. Keywords

18.1 classification; clay; gravel; organic soils; sand; silt; soil classification; soil description; visual classification

# APPENDIXES

**(Nonmandatory Information)**

## X1. EXAMPLES OF VISUAL SOIL DESCRIPTIONS

X1.1 The following examples show how the information required in 16.1 can be reported. The information that is included in descriptions should be based on individual circumstances and need.

X1.1.1 *Well-Graded Gravel with Sand (GW)*—About 75 % fine to coarse, hard, subangular gravel; about 25 % fine to coarse, hard, subangular sand; trace of fines; maximum size, 75 mm, brown, dry; no reaction with HCl.

X1.1.2 *Silty Sand with Gravel (SM)*—About 60 % predominantly fine sand; about 25 % silty fines with low plasticity, low dry strength, rapid dilatancy, and low toughness; about 15 % fine, hard, subrounded gravel, a few gravel-size particles fractured with hammer blow; maximum size, 25 mm; no reaction with HCl (Note—Field sample size smaller than recommended).

*In-Place Conditions*—Firm, stratified and contains lenses of silt 1 to 2 in. (25 to 50 mm) thick, moist, brown to gray; in-place density 106 lb/ft$^3$; in-place moisture 9 %.

X1.1.3 *Organic Soil (OL/OH)*—About 100 % fines with low plasticity, slow dilatancy, low dry strength, and low toughness; wet, dark brown, organic odor; weak reaction with HCl.

X1.1.4 *Silty Sand with Organic Fines (SM)*—About 75 % fine to coarse, hard, subangular reddish sand; about 25 % organic and silty dark brown nonplastic fines with no dry strength and slow dilatancy; wet; maximum size, coarse sand; weak reaction with HCl.

X1.1.5 *Poorly Graded Gravel with Silt, Sand, Cobbles and Boulders (GP-GM)*—About 75 % fine to coarse, hard, subrounded to subangular gravel; about 15 % fine, hard, subrounded to subangular sand; about 10 % silty nonplastic fines; moist, brown; no reaction with HCl; original field sample had about 5 % (by volume) hard, subrounded cobbles and a trace of hard, subrounded boulders, with a maximum dimension of 18 in. (450 mm).

## X2. USING THE IDENTIFICATION PROCEDURE AS A DESCRIPTIVE SYSTEM FOR SHALE, CLAYSTONE, SHELLS, SLAG, CRUSHED ROCK, AND THE LIKE

X2.1 The identification procedure may be used as a descriptive system applied to materials that exist in-situ as shale, claystone, sandstone, siltstone, mudstone, etc., but convert to soils after field or laboratory processing (crushing, slaking, and the like).

X2.2 Materials such as shells, crushed rock, slag, and the like, should be identified as such. However, the procedures used in this practice for describing the particle size and plasticity characteristics may be used in the description of the material. If desired, an identification using a group name and symbol according to this practice may be assigned to aid in describing the material.

X2.3 The group symbol(s) and group names should be placed in quotation marks or noted with some type of distinguishing symbol. See examples.

X2.4 Examples of how group names and symbols can be incororated into a descriptive system for materials that are not naturally occurring soils are as follows:

X2.4.1 *Shale Chunks*—Retrieved as 2 to 4-in. (50 to 100-mm) pieces of shale from power auger hole, dry, brown, no reaction with HCl. After slaking in water for 24 h, material identified as "Sandy Lean Clay (CL)"; about 60 % fines with medium plasticity, high dry strength, no dilatancy, and medium toughness; about 35 % fine to medium, hard sand; about 5 % gravel-size pieces of shale.

X2.4.2 *Crushed Sandstone*—Product of commercial crushing operation; "Poorly Graded Sand with Silt (SP-SM)"; about 90 % fine to medium sand; about 10 % nonplastic fines; dry, reddish-brown, strong reaction with HCl.

X2.4.3 *Broken Shells*—About 60 % gravel-size broken



ED_004850_00001502-01000

shells; about 30 % sand and sand-size shell pieces; about 10 % fines; "Poorly Graded Gravel with Sand (GP)."

X2.4.4 *Crushed Rock*—Processed from gravel and cobbles in Pit No. 7; "Poorly Graded Gravel (GP)"; about 90 % fine, hard, angular gravel-size particles; about 10 % coarse, hard, angular sand-size particles; dry, tan; no reaction with HCl.

## X3. SUGGESTED PROCEDURE FOR USING A BORDERLINE SYMBOL FOR SOILS WITH TWO POSSIBLE IDENTIFICATIONS.

X3.1 Since this practice is based on estimates of particle size distribution and plasticity characteristics, it may be difficult to clearly identify the soil as belonging to one category. To indicate that the soil may fall into one of two possible basic groups, a borderline symbol may be used with the two symbols separated by a slash. For example: SC/CL or CL/CH.

X3.1.1 A borderline symbol may be used when the percentage of fines is estimated to be between 45 and 55 %. One symbol should be for a coarse-grained soil with fines and the other for a fine-grained soil. For example: GM/ML or CL/SC.

X3.1.2 A borderline symbol may be used when the percentage of sand and the percentage of gravel are estimated to be about the same. For example: GP/SP, SC/GC, GM/SM. It is practically impossible to have a soil that would have a borderline symbol of GW/SW.

X3.1.3 A borderline symbol may be used when the soil could be either well graded or poorly graded. For example: GW/GP, SW/SP.

X3.1.4 A borderline symbol may be used when the soil could either be a silt or a clay. For example: CL/ML, CH/MH, SC/SM.

X3.1.5 A borderline symbol may be used when a fine-grained soil has properties that indicate that it is at the boundary between a soil of low compressibility and a soil of high compressibility. For example: CL/CH, MH/ML.

X3.2 The order of the borderline symbols should reflect similarity to surrounding or adjacent soils. For example: soils in a borrow area have been identified as CH. One sample is considered to have a borderline symbol of CL and CH. To show similarity, the borderline symbol should be CH/CL.

X3.3 The group name for a soil with a borderline symbol should be the group name for the first symbol, except for:

CL/CH lean to fat clay
ML/CL clayey silt
CL/ML silty clay

X3.4 The use of a borderline symbol should not be used indiscriminately. Every effort shall be made to first place the soil into a single group.

## X4. SUGGESTED PROCEDURES FOR ESTIMATING THE PERCENTAGES OF GRAVEL, SAND, AND FINES IN A SOIL SAMPLE

X4.1 *Jar Method*—The relative percentage of coarse- and fine-grained material may be estimated by thoroughly shaking a mixture of soil and water in a test tube or jar, and then allowing the mixture to settle. The coarse particles will fall to the bottom and successively finer particles will be deposited with increasing time; the sand sizes will fall out of suspension in 20 to 30 s. The relative proportions can be estimated from the relative volume of each size separate. This method should be correlated to particle-size laboratory determinations.

X4.2 *Visual Method*—Mentally visualize the gravel size particles placed in a sack (or other container) or sacks. Then, do the same with the sand size particles and the fines. Then, mentally compare the number of sacks to estimate the percentage of plus No. 4 sieve size and minus No. 4 sieve size present. The percentages of sand and fines in the minus sieve size No. 4 material can then be estimated from the wash test (X4.3).

X4.3 *Wash Test (for relative percentages of sand and fines)*—Select and moisten enough minus No. 4 sieve size material to form a 1-in (25-mm) cube of soil. Cut the cube in half, set one-half to the side, and place the other half in a small dish. Wash and decant the fines out of the material in the dish until the wash water is clear and then compare the two samples and estimate the percentage of sand and fines. Remember that the percentage is based on weight, not volume. However, the volume comparison will provide a reasonable indication of grain size percentages.

X4.3.1 While washing, it may be necessary to break down lumps of fines with the finger to get the correct percentages.



ED_004850_00001502-01001

## X5. ABBREVIATED SOIL CLASSIFICATION SYMBOLS

X5.1 In some cases, because of lack of space, an abbreviated system may be useful to indicate the soil classification symbol and name. Examples of such cases would be graphical logs, databases, tables, etc.

X5.2 This abbreviated system is not a substitute for the full name and descriptive information but can be used in supplementary presentations when the complete description is referenced.

X5.3 The abbreviated system should consist of the soil classification symbol based on this standard with appropriate lower case letter prefixes and suffixes as:

| *Prefix:* | Suffix: |
|---|---|
| s = sandy | s = with sand |
| g = gravelly | g = with gravel |
| | c = with cobbles |
| | b = with boulders |

X5.4 The soil classification symbol is to be enclosed in parenthesis. Some examples would be:

| *Group Symbol and Full Name* | Abbreviated |
|---|---|
| CL, Sandy lean clay | s(CL) |
| SP-SM, Poorly graded sand with silt and gravel | (SP-SM)g |
| GP, poorly graded gravel with sand, cobbles, and boulders | (GP)scb |
| ML, gravelly silt with sand and cobbles | g(ML)sc |

## SUMMARY OF CHANGES

In accordance with Committee D18 policy, this section identifies the location of changes to this standard since the last edition (1993$^{\epsilon 1}$) that may impact the use of this standard.

(1) Added Practice D 3740 to Section 2.

(2) Added Note 5 under 5.7 and renumbered subsequent notes.

*ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.*

*This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).*



ED_004850_00001502-01002

# STANDARD OPERATING PROCEDURE (SOP) SL-05

# SURFACE SOIL SAMPLING

## SCOPE AND APPLICATION

This SOP defines and standardizes the collection of surface soil samples (e.g., 0 to 12 in. below ground surface). Soil samples should be collected from areas having lower levels of constituents of interest first, followed by stations with higher expected levels of constituents of interest.

The procedures listed below may be modified in the field upon the agreement of the lead site sampler and field personnel, based on field and site conditions, after appropriate annotations have been made in the field logbook. If specialized sampling methods (e.g., ENCORE®) are to be used, refer to the manufacturer's recommended procedures. If methanol preservation is required, refer to Integral's SOP on methanol preservation of soil samples. Record all pertinent information on Integral's surface soil sampling field data form or field logbook.

## EQUIPMENT AND SUPPLIES REQUIRED

- Decontaminated sampling tool (stainless-steel shovel, scoop, trowel, or spoon)
- Large stainless steel mixing bowl and spoon
- Laboratory-supplied sample containers, insulated coolers, and ice
- Chain-of-custody forms, custody seals, sample labels
- Ziploc® bags
- Camera
- Tape measure
- Field logbook, surface soil field collection form, and pens
- Project-specific field sampling plan (FSP) and health and safety plan (HSP)
- Personal protective equipment (safety glasses, steel-toed boots, nitrile gloves, and any other items required by the project-specific HSP)
- Decontamination equipment.



ED_004850_00001502-01003

## PROCEDURES

1. Locate the sample station as directed in the project-specific FSP. Label containers with sample tags prior to filling in accordance with Integral's SOP on sample labeling (SOP-AP04). If analytical testing will be performed for volatile organic compounds (VOCs), collect the VOC sample first (with a minimum of disturbance) by placing the sample into the container with a minimum amount of headspace and sealed tightly.
2. Don a new pair of nitrile gloves and expose the soil surface by clearing an approximately 1 $ft^2$ area at the sampling site of any rocks or organic material greater than approximately 3 in. in size. Note any material removed from the sampling site in the field logbook.
3. Using a decontaminated stainless-steel sampling tool, excavate soil to the depth specified in the work plan.
4. If required for analysis, first collect VOC samples (prior to any homogenization) from a discrete location, placing the samples in the appropriate containers. Label sample containers before filling in accordance with Integral's SOP on sample labeling (SOP AP-04).
5. Place additional sample material in a decontaminated plastic or stainless-steel mixing bowl.
6. Describe the soil in accordance with ASTM D2488-00 (see Integral's SOP on field classification of soils, SOP SL-04).
7. Thoroughly mix and homogenize the sample using disposable equipment or a decontaminated stainless-steel spoon until the color and texture are consistent throughout.
8. If required for analysis, first collect samples for grain-size tests before any large rocks are removed from the homogenized soil.
9. Identify any rocks that are greater than 0.5 in. in diameter. Determine their percentage contribution to the homogenized soil volume, note it on the surface soil field collection form or in the field logbook, and then discard the rocks.
10. Remove samples of the homogenized soil from the mixing bowl with the decontaminated stainless steel spoon and place in the appropriate size sample container. Do not touch the sample with your gloves. Fill the sample container with soil to just below the container lip, and seal the container tightly. Label sample containers before filling in accordance with Integral's SOP on sample labeling.
11. Mark the sampling site with a wire flag, wooden stake, metal rebar, or flagging, as appropriate.



ED_004850_00001502-01004

12. Complete all pertinent field QA/QC documentation, logbooks, sample labels, and field data sheets. Record any deviations from the specified sampling procedures or any obstacles encountered.
13. Photograph sample location and document it in the logbook.
14. Decontaminate all sampling equipment according to Integral's SOP on decontaminating equipment for soil sampling (SOP SL-01) and in accordance with the project-specific FSP.



ED_004850_00001502-01005

# STANDARD OPERATING PROCEDURE (SOP) SL-06

# LOGGING OF SOIL BOREHOLES

## SCOPE AND APPLICATION

This SOP describes how to complete a Soil Boring Log form, which must be completed for Integral projects where soil boring techniques are performed during field exploration. A correctly completed form contains all of the information that must be recorded in the field to adequately characterize soil boreholes.

These procedures are adapted from ASTM D-2488-00. Field staff are encouraged to examine ASTM D-2488-00 in its entirety. This SOP represents minor modifications to emphasize environmental investigations rather than geotechnical investigations, for which the standards were written. Because each environmental project is unique and because job requirements can vary widely, the minimum standards presented may need to be supplemented with additional technical descriptions or field test results. However, all soil boring field logs, regardless of special project circumstances, must include information addressed in this SOP to achieve the minimum acceptable standards required by Integral.

## LOG FORM INFORMATION

**Project Number**—Use the standard contract number.

**Client**—Identify the name of the client and the project site location.

**Location**—If stations, coordinates, mileposts, or similar markers are applicable, use them to identify the location of the project. If this information is not available, identify the facility (e.g., 20 ft NE of Retort #1).

**Drilling Method**—Identify the bit size and type, drilling fluid (if used), and method of drilling (e.g., rotary, hollow-stem auger, cable tool) and the name of the drill rig (e.g., Mobil B 61, CME 55).

**Diameter**—Provide the diameter of the borehole. If the borehole has variable diameters, provide the depth interval for each diameter.

**Sampling Method**—Identify the type of sampler(s) used (e.g., standard split spoon, Dames & Moore sampler, grab).

**Drilling Contractor**—Provide the name of the drilling contractor.



ED_004850_00001502-01006

**Integral Staff**—Enter the name(s) of Integral staff members performing logging and sampling activities.

**Water Level Information**—Provide the date, time, depth to static water, and casing depth. Generally, water levels should be taken each day before resuming drilling and at the completion of drilling. If water is not encountered in the boring, this information should be recorded.

**Boring Number**—Provide the boring number. A numbering system should be developed prior to drilling that does not conflict with other site information, such as previous drilling or other sampling activities.

**Sheet**—Number the sheets consecutively for each boring and continue the consecutive depth numbering.

**Drilling Start and Finish**—Provide the drilling start and finish dates and times.

For consecutive sheets, provide (at a minimum) the job number, boring number, and sheet number.

## TECHNICAL DATA

**Sampler Type**—Provide the sampler type (e.g., SS = split spoon, G = grab).

**Depth of Casing**—Enter the depth of the casing below ground surface immediately prior to sampling.

**Driven/Recovery**—Provide the length that the sampler was driven and the length of sample recovered in the sampler. This column would not apply to grab samples.

**Sample Number/Sample Depth**—Provide the sample number. The sample numbering scheme should be established prior to drilling. One method is to use the boring number and consecutive alphabetical letters. For instance, the first sample obtained from boring MW-4 would be identified as 4A, the second would be identified as 4B, and so on. Another method for sample identification is naming the boring number with the depth. For example, the sample from Boring 1 at 10 ft would be labeled B1-10'. The depth of the sample is the depth of the casing plus the length to the middle of the recovered sample to the nearest 0.1 ft. Typically, split spoon samplers are 18 in. long. Samples should be obtained from the middle of the recovered sample. The depth of the sample with the casing at 10 ft would then be 10.7 ft.

**Number of Blows**—For standard split-spoon samplers, record the number of blows for each 6 in. of sampler penetration. A typical blow count of 6, 12, and 14 is recorded as 6/12/14. Refusal is a penetration of less than 6 in. with a blow count of 50. A partial penetration of 50 blows for 4 in. is recorded as 50/4". Total blows will be recorded for nonstandard split spoons (e.g., 5-ft tube used for continuous sampling).



ED_004850_00001502-01007

**Blank Columns**—Two blank columns are provided. Use these columns for site-specific information, usually related to the chemicals of concern. Examples for a hydrocarbon site would be sheen and photoionization detector readings of the samples.

**Depth**—Use a depth scale that is appropriate for the complexity of the subsurface conditions. The boxes located to the right of the scale should be used to graphically indicate sample locations as shown in the example.

**Surface Conditions**—Describe the surface conditions (e.g., paved, 4-in. concrete slab, grass, natural vegetation and surface soil, oil-stained gravel).

**Soil Description**—Enter the soil classification and definition of soil contacts using the format described in SOP SL-04, *Field Classification of Soil.*

**Comments**—Include all pertinent observations. Drilling observations might include drilling chatter, rod-bounce (boulder), sudden differences in drilling speed, damaged samplers, and malfunctioning equipment. Information provided by the driller should be attributed to the driller. Information on possible contaminants might include odor, staining, color, and presence or absence of some indicator of contamination. Describe what it is that indicates contamination (e.g., fuel-like odor, oily sheen in drill cuttings, yellow water in drill cuttings).



ED_004850_00001502-01008

# ATTACHMENT 1. SOIL BORING LOG FORM

integral

319 SW Washington St., Suite 1150
Portland, OR 97204
(503) 284-5545

STATION NUMBER
PROJECT
LOCATION
PROJECT NUMBER
LOGGED BY



| SAMPLE INFORMATION | | | | | | STRATA | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| Sample ID | Depth | Time | Tag No. | % Recov. | Depth (Feet) | | USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc. |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | 2-- | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | 4-- | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | 6-- | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | 8-- | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | 10-- | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | 12-- | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | 14-- | | |
| | | | | | | | |
| | | | | | | | |

DRILLING CONTRACTOR
DRILLING METHOD
SAMPLING EQUIPMENT
DRILLING STARTED
COORDINATES
SURFACE ELEVATION
DATUM

Location Sketch

# ATTACHMENT 2. ASTM D 2488 – 00, STANDARD PRACTICE FOR DESCRIPTION AND IDENTIFICATION OF SOILS (VISUAL-MANUAL PROCEDURE)

Designation: D 2488 – 00

# Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)[1]

This standard is issued under the fixed designation D 2488; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

## 1. Scope *

1.1 This practice covers procedures for the description of soils for engineering purposes.

1.2 This practice also describes a procedure for identifying soils, at the option of the user, based on the classification system described in Test Method D 2487. The identification is based on visual examination and manual tests. It must be clearly stated in reporting an identification that it is based on visual-manual procedures.

1.2.1 When precise classification of soils for engineering purposes is required, the procedures prescribed in Test Method D 2487 shall be used.

1.2.2 In this practice, the identification portion assigning a group symbol and name is limited to soil particles smaller than 3 in. (75 mm).

1.2.3 The identification portion of this practice is limited to naturally occurring soils (disturbed and undisturbed).

NOTE 1—This practice may be used as a descriptive system applied to such materials as shale, claystone, shells, crushed rock, etc. (see Appendix X2).

1.3 The descriptive information in this practice may be used with other soil classification systems or for materials other than naturally occurring soils.

1.4 The values stated in inch-pound units are to be regarded as the standard.

1.5 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific precautionary statements see Section 8.

1.6 *This practice offers a set of instructions for performing one or more specific operations. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this practice may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

## 2. Referenced Documents

2.1 *ASTM Standards:*

D 653 Terminology Relating to Soil, Rock, and Contained Fluids[2]

D 1452 Practice for Soil Investigation and Sampling by Auger Borings[2]

D 1586 Test Method for Penetration Test and Split-Barrel Sampling of Soils[2]

D 1587 Practice for Thin-Walled Tube Sampling of Soils[2]

D 2113 Practice for Diamond Core Drilling for Site Investigation[2]

D 2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System)[2]

D 3740 Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and rock as Used in Engineering Design and Construction[3]

D 4083 Practice for Description of Frozen Soils (Visual-Manual Procedure)[2]

## 3. Terminology

3.1 *Definitions*—Except as listed below, all definitions are in accordance with Terminology D 653.

NOTE 2—For particles retained on a 3-in. (75-mm) US standard sieve, the following definitions are suggested:
*Cobbles*—particles of rock that will pass a 12-in. (300-mm) square opening and be retained on a 3-in. (75-mm) sieve, and
*Boulders*—particles of rock that will not pass a 12-in. (300-mm) square opening.

3.1.1 *clay*—soil passing a No. 200 (75-µm) sieve that can be made to exhibit plasticity (putty-like properties) within a range of water contents, and that exhibits considerable strength when air-dry. For classification, a clay is a fine-grained soil, or the

[1] This practice is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.07 on Identification and Classification of Soils.

Current edition approved Feb. 10, 2000. Published May 2000. Originally published as D 2488 – 66 T. Last previous edition D 2488 – 93$^{\epsilon 1}$.

[2] *Annual Book of ASTM Standards*, Vol 04.08.

[3] *Annual Book of ASTM Standards*, Vol 04.09.

***A Summary of Changes section appears at the end of this standard.**

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States.



ED_004850_00001502-01012

fine-grained portion of a soil, with a plasticity index equal to or greater than 4, and the plot of plasticity index versus liquid limit falls on or above the "A" line (see Fig. 3 of Test Method D 2487).

3.1.2 *gravel*—particles of rock that will pass a 3-in. (75-mm) sieve and be retained on a No. 4 (4.75-mm) sieve with the following subdivisions:

*coarse*—passes a 3-in. (75-mm) sieve and is retained on a ¾-in. (19-mm) sieve.

*fine*—passes a ¾-in. (19-mm) sieve and is retained on a No. 4 (4.75-mm) sieve.

3.1.3 *organic clay*—a clay with sufficient organic content to influence the soil properties. For classification, an organic clay is a soil that would be classified as a clay, except that its liquid limit value after oven drying is less than 75 % of its liquid limit value before oven drying.

3.1.4 *organic silt*—a silt with sufficient organic content to influence the soil properties. For classification, an organic silt is a soil that would be classified as a silt except that its liquid limit value after oven drying is less than 75 % of its liquid limit value before oven drying.

3.1.5 *peat*—a soil composed primarily of vegetable tissue in various stages of decomposition usually with an organic odor, a dark brown to black color, a spongy consistency, and a texture ranging from fibrous to amorphous.

3.1.6 *sand*—particles of rock that will pass a No. 4 (4.75-mm) sieve and be retained on a No. 200 (75-µm) sieve with the following subdivisions:

*coarse*—passes a No. 4 (4.75-mm) sieve and is retained on a No. 10 (2.00-mm) sieve.

*medium*—passes a No. 10 (2.00-mm) sieve and is retained on a No. 40 (425-µm) sieve.

*fine*—passes a No. 40 (425-µm) sieve and is retained on a No. 200 (75-µm) sieve.

3.1.7 *silt*—soil passing a No. 200 (75-µm) sieve that is nonplastic or very slightly plastic and that exhibits little or no strength when air dry. For classification, a silt is a fine-grained soil, or the fine-grained portion of a soil, with a plasticity index less than 4, or the plot of plasticity index versus liquid limit falls below the "A" line (see Fig. 3 of Test Method D 2487).

## 4. Summary of Practice

4.1 Using visual examination and simple manual tests, this practice gives standardized criteria and procedures for describing and identifying soils.

4.2 The soil can be given an identification by assigning a group symbol(s) and name. The flow charts, Fig. 1a and Fig. 1b for fine-grained soils, and Fig. 2, for coarse-grained soils, can be used to assign the appropriate group symbol(s) and name. If the soil has properties which do not distinctly place it into a specific group, borderline symbols may be used, see Appendix X3.

NOTE 3—It is suggested that a distinction be made between *dual symbols* and *borderline symbols*.

*Dual Symbol*—A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC, CL-ML used to indicate that the soil has been identified as having the properties of a classification in accordance with Test Method D 2487 where two symbols are required. Two symbols are required when the soil has between 5 and 12 % fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart.

*Borderline Symbol*—A borderline symbol is two symbols separated by a slash, for example, CL/CH, GM/SM, CL/ML. A borderline symbol should be used to indicate that the soil has been identified as having properties that do not distinctly place the soil into a specific group (see Appendix X3).

## 5. Significance and Use

5.1 The descriptive information required in this practice can be used to describe a soil to aid in the evaluation of its significant properties for engineering use.

5.2 The descriptive information required in this practice should be used to supplement the classification of a soil as determined by Test Method D 2487.

5.3 This practice may be used in identifying soils using the classification group symbols and names as prescribed in Test Method D 2487. Since the names and symbols used in this practice to identify the soils are the same as those used in Test Method D 2487, it shall be clearly stated in reports and all other appropriate documents, that the classification symbol and name are based on visual-manual procedures.

5.4 This practice is to be used not only for identification of soils in the field, but also in the office, laboratory, or wherever soil samples are inspected and described.

5.5 This practice has particular value in grouping similar soil samples so that only a minimum number of laboratory tests need be run for positive soil classification.

NOTE 4—The ability to describe and identify soils correctly is learned more readily under the guidance of experienced personnel, but it may also be acquired systematically by comparing numerical laboratory test results for typical soils of each type with their visual and manual characteristics.

5.6 When describing and identifying soil samples from a given boring, test pit, or group of borings or pits, it is not necessary to follow all of the procedures in this practice for every sample. Soils which appear to be similar can be grouped together; one sample completely described and identified with the others referred to as similar based on performing only a few of the descriptive and identification procedures described in this practice.

5.7 This practice may be used in combination with Practice D 4083 when working with frozen soils.

NOTE 5—Notwithstanding the statements on precision and bias contained in this standard: The precision of this test method is dependent on the competence of the personnel performing it and the suitability of the equipment and facilities used. Agencies that meet the criteria of Practice D 3740 are generally considered capable of competent and objective testing. Users of this test method are cautioned that compliance with Practice D 3740 does not in itself assure reliable testing. Reliable testing depends on several factors; Practice D 3740 provides a means for evaluating some of those factors.

## 6. Apparatus

6.1 *Required Apparatus*:

6.1.1 *Pocket Knife or Small Spatula.*

6.2 *Useful Auxiliary Apparatus*:

6.2.1 *Small Test Tube and Stopper* (or jar with a lid).

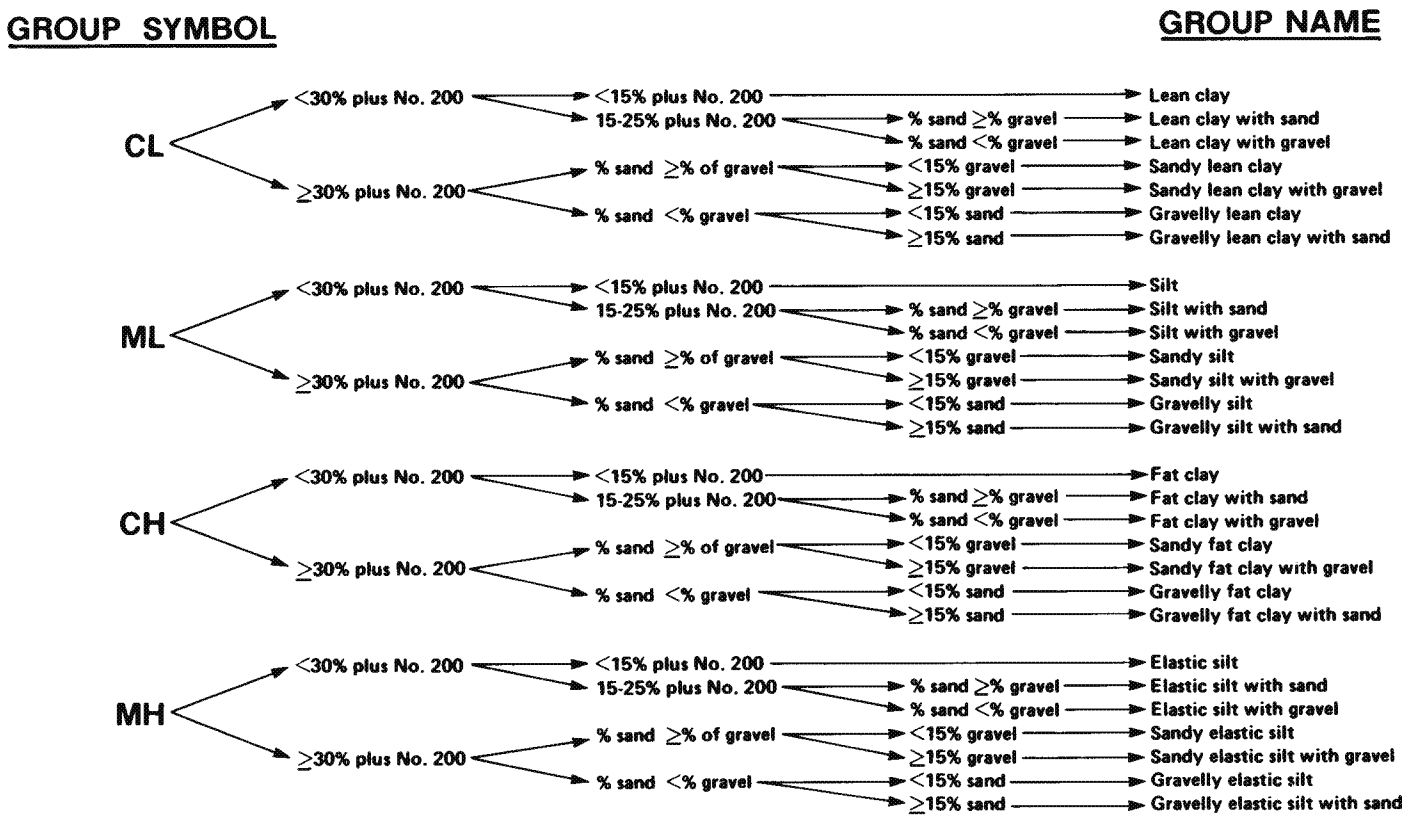
6.2.2 *Small Hand Lens.*

## 7. Reagents

7.1 *Purity of Water*—Unless otherwise indicated, references

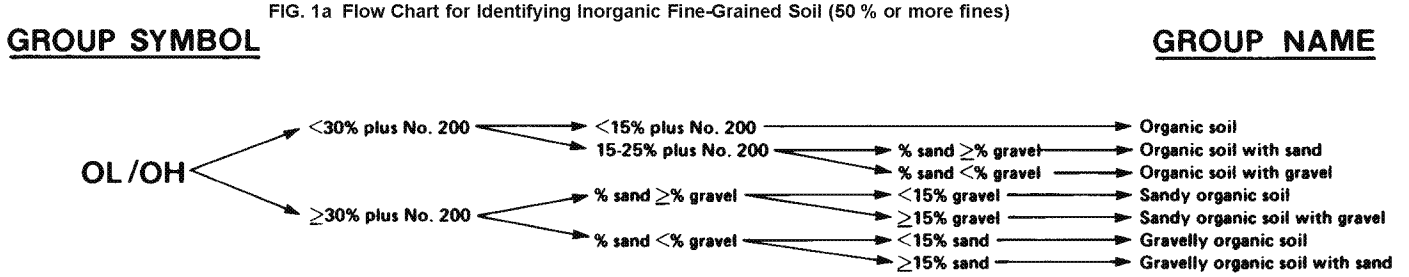


ED_004850_00001502-01013




NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

**FIG. 1a Flow Chart for Identifying Inorganic Fine-Grained Soil (50 % or more fines)**




NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

**FIG. 1 b Flow Chart for Identifying Organic Fine-Grained Soil (50 % or more fines)**

to water shall be understood to mean water from a city water supply or natural source, including non-potable water.

7.2 *Hydrochloric Acid*—A small bottle of dilute hydrochloric acid, HCl, one part HCl (10 *N*) to three parts water (This reagent is optional for use with this practice). See Section 8.

## 8. Safety Precautions

8.1 When preparing the dilute HCl solution of one part concentrated hydrochloric acid (10 *N*) to three parts of distilled water, slowly add acid into water following necessary safety precautions. Handle with caution and store safely. If solution comes into contact with the skin, rinse thoroughly with water.

8.2 **Caution**—Do not add water to acid.

## 9. Sampling

9.1 The sample shall be considered to be representative of the stratum from which it was obtained by an appropriate, accepted, or standard procedure.

NOTE 6—Preferably, the sampling procedure should be identified as having been conducted in accordance with Practices D 1452, D 1587, or D 2113, or Test Method D 1586.

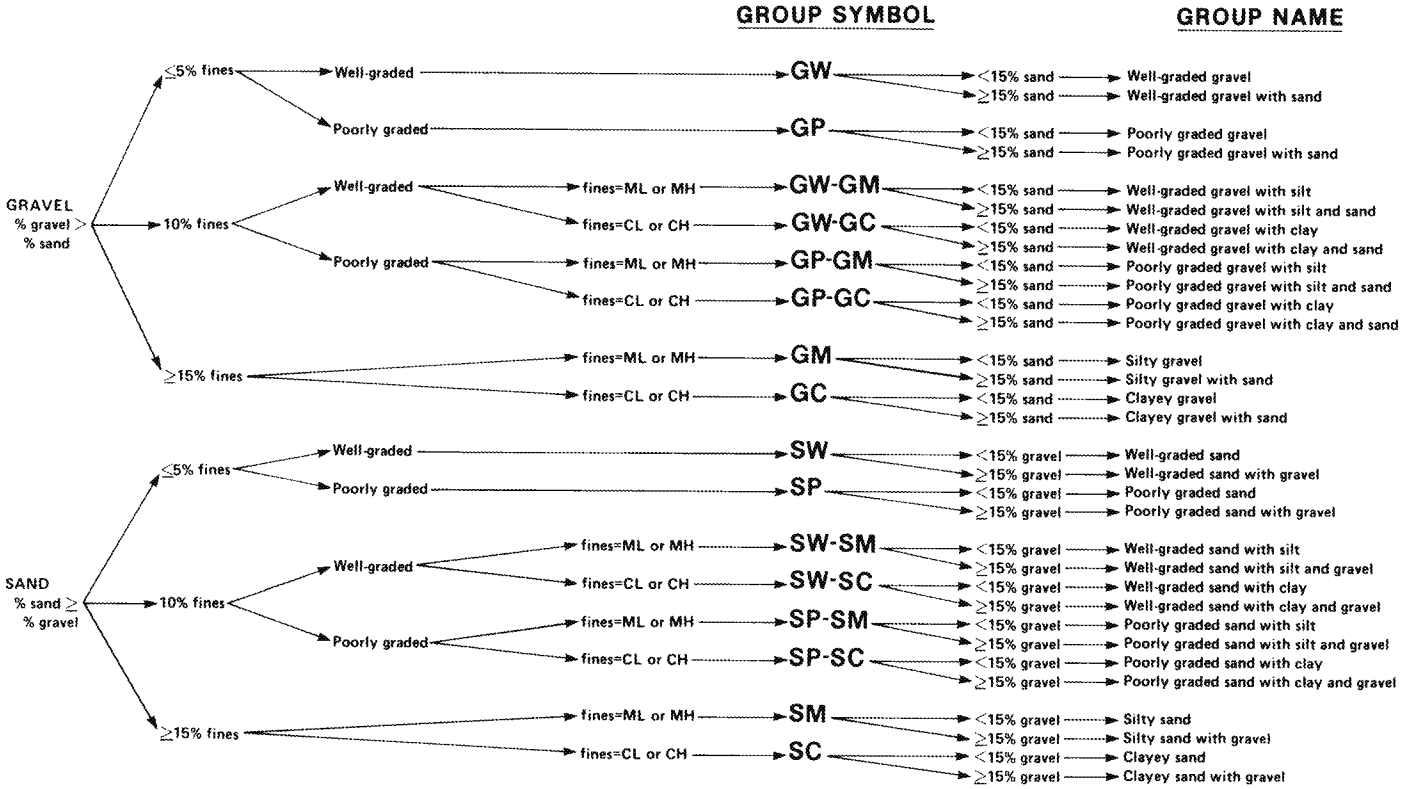
9.2 The sample shall be carefully identified as to origin.

NOTE 7—Remarks as to the origin may take the form of a boring number and sample number in conjunction with a job number, a geologic stratum, a pedologic horizon or a location description with respect to a permanent monument, a grid system or a station number and offset with respect to a stated centerline and a depth or elevation.

9.3 For accurate description and identification, the minimum amount of the specimen to be examined shall be in accordance with the following schedule:



ED_004850_00001502-01014




NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

**FIG. 2 Flow Chart for Identifying Coarse-Grained Soils (less than 50 % fines)**

| Maximum Particle Size, Sieve Opening | Minimum Specimen Size, Dry Weight |
|---|---|
| 4.75 mm (No. 4) | 100 g (0.25 lb) |
| 9.5 mm (⅜ in.) | 200 g (0.5 lb) |
| 19.0 mm (¾ in.) | 1.0 kg (2.2 lb) |
| 38.1 mm (1½ in.) | 8.0 kg (18 lb) |
| 75.0 mm (3 in.) | 60.0 kg (132 lb) |

NOTE 8—If random isolated particles are encountered that are significantly larger than the particles in the soil matrix, the soil matrix can be accurately described and identified in accordance with the preceeding schedule.

9.4 If the field sample or specimen being examined is smaller than the minimum recommended amount, the report shall include an appropriate remark.

## 10. Descriptive Information for Soils

10.1 *Angularity*—Describe the angularity of the sand (coarse sizes only), gravel, cobbles, and boulders, as angular, subangular, subrounded, or rounded in accordance with the criteria in Table 1 and Fig. 3. A range of angularity may be stated, such as: subrounded to rounded.

10.2 *Shape*—Describe the shape of the gravel, cobbles, and boulders as flat, elongated, or flat and elongated if they meet the criteria in Table 2 and Fig. 4. Otherwise, do not mention the shape. Indicate the fraction of the particles that have the shape, such as: one-third of the gravel particles are flat.

10.3 *Color*—Describe the color. Color is an important property in identifying organic soils, and within a given locality it may also be useful in identifying materials of similar geologic origin. If the sample contains layers or patches of varying colors, this shall be noted and all representative colors shall be described. The color shall be described for moist samples. If the color represents a dry condition, this shall be stated in the report.

**TABLE 1 Criteria for Describing Angularity of Coarse-Grained Particles (see Fig. 3)**

| Description | Criteria |
|---|---|
| Angular | Particles have sharp edges and relatively plane sides with unpolished surfaces |
| Subangular | Particles are similar to angular description but have rounded edges |
| Subrounded | Particles have nearly plane sides but have well-rounded corners and edges |
| Rounded | Particles have smoothly curved sides and no edges |

10.4 *Odor*—Describe the odor if organic or unusual. Soils containing a significant amount of organic material usually have a distinctive odor of decaying vegetation. This is especially apparent in fresh samples, but if the samples are dried, the odor may often be revived by heating a moistened sample. If the odor is unusual (petroleum product, chemical, and the like), it shall be described.

10.5 *Moisture Condition*—Describe the moisture condition as dry, moist, or wet, in accordance with the criteria in Table 3.

10.6 *HCl Reaction*—Describe the reaction with HCl as none, weak, or strong, in accordance with the critera in Table 4. Since calcium carbonate is a common cementing agent, a report of its presence on the basis of the reaction with dilute hydrochloric acid is important.

10.7 *Consistency*—For intact fine-grained soil, describe the



ED_004850_00001502-01015

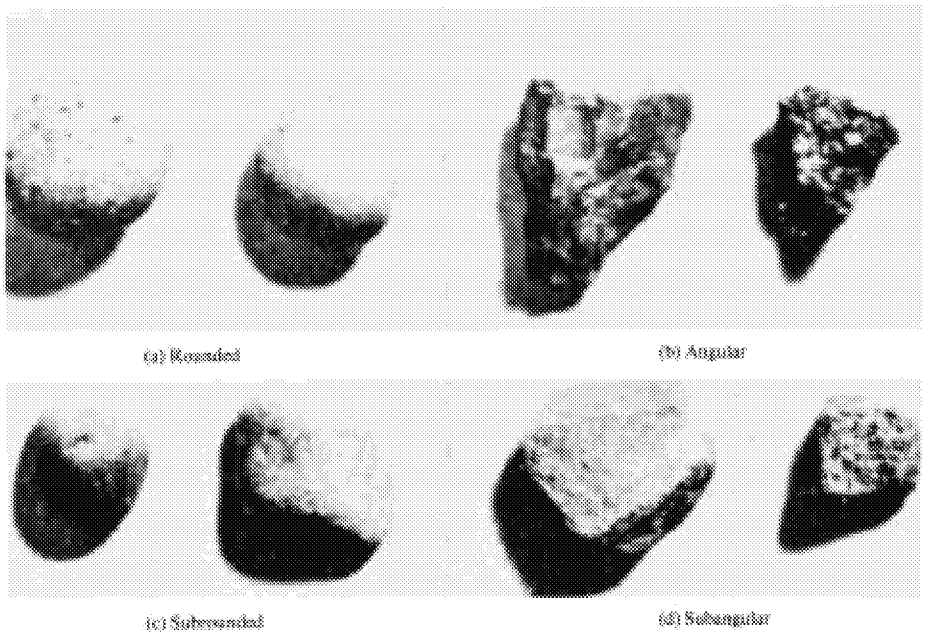



**FIG. 3 Typical Angularity of Bulky Grains**

**TABLE 2 Criteria for Describing Particle Shape (see Fig. 4)**

| | |
|---|---|
| The particle shape shall be described as follows where length, width, and thickness refer to the greatest, intermediate, and least dimensions of a particle, respectively. | |
| Flat | Particles with width/thickness > 3 |
| Elongated | Particles with length/width > 3 |
| Flat and elongated | Particles meet criteria for both flat and elongated |

consistency as very soft, soft, firm, hard, or very hard, in accordance with the criteria in Table 5. This observation is inappropriate for soils with significant amounts of gravel.

10.8 *Cementation*—Describe the cementation of intact coarse-grained soils as weak, moderate, or strong, in accordance with the criteria in Table 6.

10.9 *Structure*—Describe the structure of intact soils in accordance with the criteria in Table 7.

10.10 *Range of Particle Sizes*—For gravel and sand components, describe the range of particle sizes within each component as defined in 3.1.2 and 3.1.6. For example, about 20 % fine to coarse gravel, about 40 % fine to coarse sand.

10.11 *Maximum Particle Size*—Describe the maximum particle size found in the sample in accordance with the following information:

10.11.1 *Sand Size*—If the maximum particle size is a sand size, describe as fine, medium, or coarse as defined in 3.1.6. For example: maximum particle size, medium sand.

10.11.2 *Gravel Size*—If the maximum particle size is a gravel size, describe the maximum particle size as the smallest sieve opening that the particle will pass. For example, maximum particle size, 1½ in. (will pass a 1½-in. square opening but not a ¾-in. square opening).

10.11.3 *Cobble or Boulder Size*—If the maximum particle size is a cobble or boulder size, describe the maximum dimension of the largest particle. For example: maximum dimension, 18 in. (450 mm).

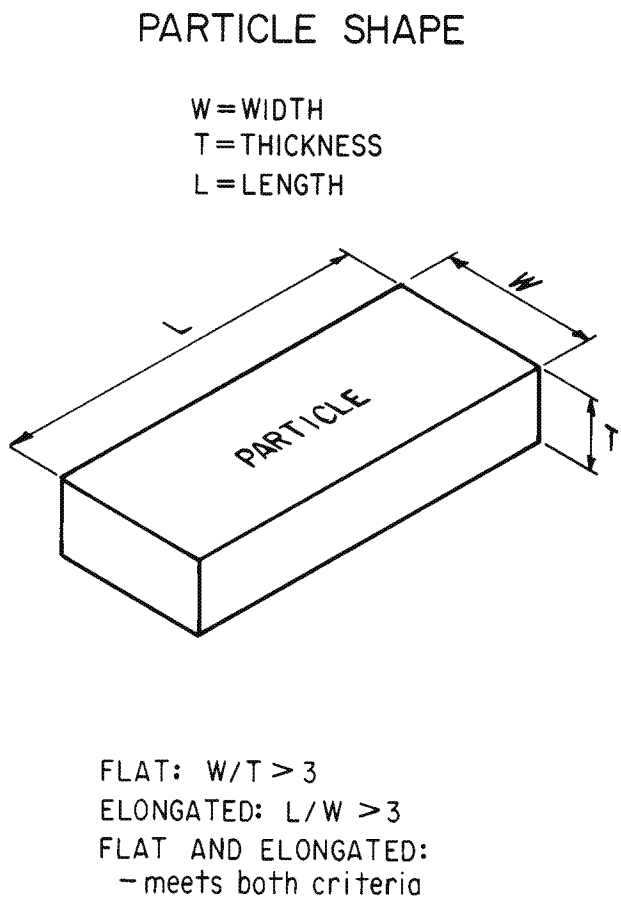



**FIG. 4 Criteria for Particle Shape**

10.12 *Hardness*—Describe the hardness of coarse sand and larger particles as hard, or state what happens when the



ED_004850_00001502-01016

TABLE 3 Criteria for Describing Moisture Condition

| Description | Criteria |
|---|---|
| Dry | Absence of moisture, dusty, dry to the touch |
| Moist | Damp but no visible water |
| Wet | Visible free water, usually soil is below water table |

TABLE 4 Criteria for Describing the Reaction With HCl

| Description | Criteria |
|---|---|
| None | No visible reaction |
| Weak | Some reaction, with bubbles forming slowly |
| Strong | Violent reaction, with bubbles forming immediately |

TABLE 5 Criteria for Describing Consistency

| Description | Criteria |
|---|---|
| Very soft | Thumb will penetrate soil more than 1 in. (25 mm) |
| Soft | Thumb will penetrate soil about 1 in. (25 mm) |
| Firm | Thumb will indent soil about ¼in. (6 mm) |
| Hard | Thumb will not indent soil but readily indented with thumbnail |
| Very hard | Thumbnail will not indent soil |

TABLE 6 Criteria for Describing Cementation

| Description | Criteria |
|---|---|
| Weak | Crumbles or breaks with handling or little finger pressure |
| Moderate | Crumbles or breaks with considerable finger pressure |
| Strong | Will not crumble or break with finger pressure |

TABLE 7 Criteria for Describing Structure

| Description | Criteria |
|---|---|
| Stratified | Alternating layers of varying material or color with layers at least 6 mm thick; note thickness |
| Laminated | Alternating layers of varying material or color with the layers less than 6 mm thick; note thickness |
| Fissured | Breaks along definite planes of fracture with little resistance to fracturing |
| Slickensided | Fracture planes appear polished or glossy, sometimes striated |
| Blocky | Cohesive soil that can be broken down into small angular lumps which resist further breakdown |
| Lensed | Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness |
| Homogeneous | Same color and appearance throughout |

particles are hit by a hammer, for example, gravel-size particles fracture with considerable hammer blow, some gravel-size particles crumble with hammer blow. "Hard" means particles do not crack, fracture, or crumble under a hammer blow.

10.13 Additional comments shall be noted, such as the presence of roots or root holes, difficulty in drilling or augering hole, caving of trench or hole, or the presence of mica.

10.14 A local or commercial name or a geologic interpretation of the soil, or both, may be added if identified as such.

10.15 A classification or identification of the soil in accordance with other classification systems may be added if identified as such.

## 11. Identification of Peat

11.1 A sample composed primarily of vegetable tissue in various stages of decomposition that has a fibrous to amorphous texture, usually a dark brown to black color, and an organic odor, shall be designated as a highly organic soil and shall be identified as peat, PT, and not subjected to the identification procedures described hereafter.

## 12. Preparation for Identification

12.1 The soil identification portion of this practice is based on the portion of the soil sample that will pass a 3-in. (75-mm) sieve. The larger than 3-in. (75-mm) particles must be removed, manually, for a loose sample, or mentally, for an intact sample before classifying the soil.

12.2 Estimate and note the percentage of cobbles and the percentage of boulders. Performed visually, these estimates will be on the basis of volume percentage.

NOTE 9—Since the percentages of the particle-size distribution in Test Method D 2487 are by dry weight, and the estimates of percentages for gravel, sand, and fines in this practice are by dry weight, it is recommended that the report state that the percentages of cobbles and boulders are by volume.

12.3 Of the fraction of the soil smaller than 3 in. (75 mm), estimate and note the percentage, by dry weight, of the gravel, sand, and fines (see Appendix X4 for suggested procedures).

NOTE 10—Since the particle-size components appear visually on the basis of volume, considerable experience is required to estimate the percentages on the basis of dry weight. Frequent comparisons with laboratory particle-size analyses should be made.

12.3.1 The percentages shall be estimated to the closest 5 %. The percentages of gravel, sand, and fines must add up to 100 %.

12.3.2 If one of the components is present but not in sufficient quantity to be considered 5 % of the smaller than 3-in. (75-mm) portion, indicate its presence by the term *trace*, for example, trace of fines. A trace is not to be considered in the total of 100 % for the components.

## 13. Preliminary Identification

13.1 The soil is *fine grained* if it contains 50 % or more fines. Follow the procedures for identifying fine-grained soils of Section 14.

13.2 The soil is *coarse grained* if it contains less than 50 % fines. Follow the procedures for identifying coarse-grained soils of Section 15.

## 14. Procedure for Identifying Fine-Grained Soils

14.1 Select a representative sample of the material for examination. Remove particles larger than the No. 40 sieve (medium sand and larger) until a specimen equivalent to about a handful of material is available. Use this specimen for performing the dry strength, dilatancy, and toughness tests.

14.2 *Dry Strength*:

14.2.1 From the specimen, select enough material to mold into a ball about 1 in. (25 mm) in diameter. Mold the material until it has the consistency of putty, adding water if necessary.

14.2.2 From the molded material, make at least three test specimens. A test specimen shall be a ball of material about ½ in. (12 mm) in diameter. Allow the test specimens to dry in air, or sun, or by artificial means, as long as the temperature does not exceed 60°C.



ED_004850_00001502-01017

14.2.3 If the test specimen contains natural dry lumps, those that are about ½ in. (12 mm) in diameter may be used in place of the molded balls.

NOTE 11—The process of molding and drying usually produces higher strengths than are found in natural dry lumps of soil.

14.2.4 Test the strength of the dry balls or lumps by crushing between the fingers. Note the strength as none, low, medium, high, or very high in accorance with the criteria in Table 8. If natural dry lumps are used, do not use the results of any of the lumps that are found to contain particles of coarse sand.

14.2.5 The presence of high-strength water-soluble cementing materials, such as calcium carbonate, may cause exceptionally high dry strengths. The presence of calcium carbonate can usually be detected from the intensity of the reaction with dilute hydrochloric acid (see 10.6).

14.3 *Dilatancy*:

14.3.1 From the specimen, select enough material to mold into a ball about ½ in. (12 mm) in diameter. Mold the material, adding water if necessary, until it has a soft, but not sticky, consistency.

14.3.2 Smooth the soil ball in the palm of one hand with the blade of a knife or small spatula. Shake horizontally, striking the side of the hand vigorously against the other hand several times. Note the reaction of water appearing on the surface of the soil. Squeeze the sample by closing the hand or pinching the soil between the fingers, and note the reaction as none, slow, or rapid in accordance with the criteria in Table 9. The reaction is the speed with which water appears while shaking, and disappears while squeezing.

14.4 *Toughness*:

14.4.1 Following the completion of the dilatancy test, the test specimen is shaped into an elongated pat and rolled by hand on a smooth surface or between the palms into a thread about ⅛ in. (3 mm) in diameter. (If the sample is too wet to roll easily, it should be spread into a thin layer and allowed to lose some water by evaporation.) Fold the sample threads and reroll repeatedly until the thread crumbles at a diameter of about ⅛ in. The thread will crumble at a diameter of ⅛ in. when the soil is near the plastic limit. Note the pressure required to roll the thread near the plastic limit. Also, note the strength of the thread. After the thread crumbles, the pieces should be lumped together and kneaded until the lump crumbles. Note the toughness of the material during kneading.

14.4.2 Describe the toughness of the thread and lump as low, medium, or high in accordance with the criteria in Table 10.

**TABLE 8 Criteria for Describing Dry Strength**

| Description | Criteria |
|---|---|
| None | The dry specimen crumbles into powder with mere pressure of handling |
| Low | The dry specimen crumbles into powder with some finger pressure |
| Medium | The dry specimen breaks into pieces or crumbles with considerable finger pressure |
| High | The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface |
| Very high | The dry specimen cannot be broken between the thumb and a hard surface |

**TABLE 9 Criteria for Describing Dilatancy**

| Description | Criteria |
|---|---|
| None | No visible change in the specimen |
| Slow | Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing |
| Rapid | Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing |

14.5 *Plasticity*—On the basis of observations made during the toughness test, describe the plasticity of the material in accordance with the criteria given in Table 11.

14.6 Decide whether the soil is an *inorganic* or an *organic* fine-grained soil (see 14.8). If inorganic, follow the steps given in 14.7.

14.7 *Identification of Inorganic Fine-Grained Soils*:

14.7.1 Identify the soil as a *lean clay*, CL, if the soil has medium to high dry strength, no or slow dilatancy, and medium toughness and plasticity (see Table 12).

14.7.2 Identify the soil as a *fat clay*, CH, if the soil has high to very high dry strength, no dilatancy, and high toughness and plasticity (see Table 12).

14.7.3 Identify the soil as a *silt*, ML, if the soil has no to low dry strength, slow to rapid dilatancy, and low toughness and plasticity, or is nonplastic (see Table 12).

14.7.4 Identify the soil as an *elastic silt*, MH, if the soil has low to medium dry strength, no to slow dilatancy, and low to medium toughness and plasticity (see Table 12).

NOTE 12—These properties are similar to those for a lean clay. However, the silt will dry quickly on the hand and have a smooth, silky feel when dry. Some soils that would classify as MH in accordance with the criteria in Test Method D 2487 are visually difficult to distinguish from lean clays, CL. It may be necessary to perform laboratory testing for proper identification.

14.8 *Identification of Organic Fine-Grained Soils*:

14.8.1 Identify the soil as an *organic soil*, OL/OH, if the soil contains enough organic particles to influence the soil properties. Organic soils usually have a dark brown to black color and may have an organic odor. Often, organic soils will change color, for example, black to brown, when exposed to the air. Some organic soils will lighten in color significantly when air dried. Organic soils normally will not have a high toughness or plasticity. The thread for the toughness test will be spongy.

NOTE 13—In some cases, through practice and experience, it may be possible to further identify the organic soils as organic silts or organic clays, OL or OH. Correlations between the dilatancy, dry strength, toughness tests, and laboratory tests can be made to identify organic soils in certain deposits of similar materials of known geologic origin.

**TABLE 10 Criteria for Describing Toughness**

| Description | Criteria |
|---|---|
| Low | Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft |
| Medium | Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness |
| High | Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness |



ED_004850_00001502-01018

**TABLE 11 Criteria for Describing Plasticity**

| Description | Criteria |
|---|---|
| Nonplastic | A ⅛-in. (3-mm) thread cannot be rolled at any water content |
| Low | The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit |
| Medium | The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit |
| High | It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit |

**TABLE 12 Identification of Inorganic Fine-Grained Soils from Manual Tests**

| Soil Symbol | Dry Strength | Dilatancy | Toughness |
|---|---|---|---|
| ML | None to low | Slow to rapid | Low or thread cannot be formed |
| CL | Medium to high | None to slow | Medium |
| MH | Low to medium | None to slow | Low to medium |
| CH | High to very high | None | High |

14.9 If the soil is estimated to have 15 to 25 % sand or gravel, or both, the words "with sand" or "with gravel" (whichever is more predominant) shall be added to the group name. For example: "lean clay with sand, CL" or "silt with gravel, ML" (see Fig. 1a and Fig. 1b). If the percentage of sand is equal to the percentage of gravel, use "with sand."

14.10 If the soil is estimated to have 30 % or more sand or gravel, or both, the words "sandy" or "gravelly" shall be added to the group name. Add the word "sandy" if there appears to be more sand than gravel. Add the word "gravelly" if there appears to be more gravel than sand. For example: "sandy lean clay, CL", "gravelly fat clay, CH", or "sandy silt, ML" (see Fig. 1a and Fig. 1b). If the percentage of sand is equal to the percent of gravel, use "sandy."

## 15. Procedure for Identifying Coarse-Grained Soils
(Contains less than 50 % fines)

15.1 The soil is a *gravel* if the percentage of gravel is estimated to be more than the percentage of sand.

15.2 The soil is a *sand* if the percentage of gravel is estimated to be equal to or less than the percentage of sand.

15.3 The soil is a *clean gravel* or *clean sand* if the percentage of fines is estimated to be 5 % or less.

15.3.1 Identify the soil as a *well-graded gravel*, GW, or as a *well-graded sand*, SW, if it has a wide range of particle sizes and substantial amounts of the intermediate particle sizes.

15.3.2 Identify the soil as a *poorly graded gravel*, GP, or as a *poorly graded sand*, SP, if it consists predominantly of one size (uniformly graded), or it has a wide range of sizes with some intermediate sizes obviously missing (gap or skip graded).

15.4 The soil is either a *gravel with fines* or a *sand with fines* if the percentage of fines is estimated to be 15 % or more.

15.4.1 Identify the soil as a *clayey gravel*, GC, or a *clayey sand*, SC, if the fines are clayey as determined by the procedures in Section 14.

15.4.2 Identify the soil as a *silty gravel*, GM, or a *silty sand*, SM, if the fines are silty as determined by the procedures in Section 14.

15.5 If the soil is estimated to contain 10 % fines, give the soil a dual identification using two group symbols.

15.5.1 The first group symbol shall correspond to a clean gravel or sand (GW, GP, SW, SP) and the second symbol shall correspond to a gravel or sand with fines (GC, GM, SC, SM).

15.5.2 The group name shall correspond to the first group symbol plus the words "with clay" or "with silt" to indicate the plasticity characteristics of the fines. For example: "well-graded gravel with clay, GW-GC" or "poorly graded sand with silt, SP-SM" (see Fig. 2).

15.6 If the specimen is predominantly sand or gravel but contains an estimated 15 % or more of the other coarse-grained constituent, the words "with gravel" or "with sand" shall be added to the group name. For example: "poorly graded gravel with sand, GP" or "clayey sand with gravel, SC" (see Fig. 2).

15.7 If the field sample contains any cobbles or boulders, or both, the words "with cobbles" or "with cobbles and boulders" shall be added to the group name. For example: "silty gravel with cobbles, GM."

## 16. Report

16.1 The report shall include the information as to origin, and the items indicated in Table 13.

NOTE 14—*Example: Clayey Gravel with Sand and Cobbles, GC*—About 50 % fine to coarse, subrounded to subangular gravel; about 30 % fine to coarse, subrounded sand; about 20 % fines with medium plasticity, high dry strength, no dilatancy, medium toughness; weak reaction with HCl; original field sample had about 5 % (by volume) subrounded cobbles, maximum dimension, 150 mm.

In-Place Conditions—Firm, homogeneous, dry, brown

Geologic Interpretation—Alluvial fan

**TABLE 13 Checklist for Description of Soils**

1. Group name
2. Group symbol
3. Percent of cobbles or boulders, or both (by volume)
4. Percent of gravel, sand, or fines, or all three (by dry weight)
5. Particle-size range:
   Gravel—fine, coarse
   Sand—fine, medium, coarse
6. Particle angularity: angular, subangular, subrounded, rounded
7. Particle shape: (if appropriate) flat, elongated, flat and elongated
8. Maximum particle size or dimension
9. Hardness of coarse sand and larger particles
10. Plasticity of fines: nonplastic, low, medium, high
11. Dry strength: none, low, medium, high, very high
12. Dilatancy: none, slow, rapid
13. Toughness: low, medium, high
14. Color (in moist condition)
15. Odor (mention only if organic or unusual)
16. Moisture: dry, moist, wet
17. Reaction with HCl: none, weak, strong

*For intact samples:*

18. Consistency (fine-grained soils only): very soft, soft, firm, hard, very hard
19. Structure: stratified, laminated, fissured, slickensided, lensed, homogeneous
20. Cementation: weak, moderate, strong
21. Local name
22. Geologic interpretation
23. Additional comments: presence of roots or root holes, presence of mica, gypsum, etc., surface coatings on coarse-grained particles, caving or sloughing of auger hole or trench sides, difficulty in augering or excavating, etc.



ED_004850_00001502-01019

NOTE 15—Other examples of soil descriptions and identification are given in Appendix X1 and Appendix X2.

NOTE 16—If desired, the percentages of gravel, sand, and fines may be stated in terms indicating a range of percentages, as follows:

*Trace*—Particles are present but estimated to be less than 5 %
*Few*—5 to 10 %
*Little*—15 to 25 %
*Some*—30 to 45 %
*Mostly*—50 to 100 %

16.2 If, in the soil description, the soil is identified using a classification group symbol and name as described in Test Method D 2487, it must be distinctly and clearly stated in log forms, summary tables, reports, and the like, that the symbol and name are based on visual-manual procedures.

## 17. Precision and Bias

17.1 This practice provides qualitative information only, therefore, a precision and bias statement is not applicable.

## 18. Keywords

18.1 classification; clay; gravel; organic soils; sand; silt; soil classification; soil description; visual classification

# APPENDIXES

**(Nonmandatory Information)**

## X1. EXAMPLES OF VISUAL SOIL DESCRIPTIONS

X1.1 The following examples show how the information required in 16.1 can be reported. The information that is included in descriptions should be based on individual circumstances and need.

X1.1.1 *Well-Graded Gravel with Sand (GW)*—About 75 % fine to coarse, hard, subangular gravel; about 25 % fine to coarse, hard, subangular sand; trace of fines; maximum size, 75 mm, brown, dry; no reaction with HCl.

X1.1.2 *Silty Sand with Gravel (SM)*—About 60 % predominantly fine sand; about 25 % silty fines with low plasticity, low dry strength, rapid dilatancy, and low toughness; about 15 % fine, hard, subrounded gravel, a few gravel-size particles fractured with hammer blow; maximum size, 25 mm; no reaction with HCl (Note—Field sample size smaller than recommended).

*In-Place Conditions*—Firm, stratified and contains lenses of silt 1 to 2 in. (25 to 50 mm) thick, moist, brown to gray; in-place density 106 lb/ft$^3$; in-place moisture 9 %.

X1.1.3 *Organic Soil (OL/OH)*—About 100 % fines with low plasticity, slow dilatancy, low dry strength, and low toughness; wet, dark brown, organic odor; weak reaction with HCl.

X1.1.4 *Silty Sand with Organic Fines (SM)*—About 75 % fine to coarse, hard, subangular reddish sand; about 25 % organic and silty dark brown nonplastic fines with no dry strength and slow dilatancy; wet; maximum size, coarse sand; weak reaction with HCl.

X1.1.5 *Poorly Graded Gravel with Silt, Sand, Cobbles and Boulders (GP-GM)*—About 75 % fine to coarse, hard, subrounded to subangular gravel; about 15 % fine, hard, subrounded to subangular sand; about 10 % silty nonplastic fines; moist, brown; no reaction with HCl; original field sample had about 5 % (by volume) hard, subrounded cobbles and a trace of hard, subrounded boulders, with a maximum dimension of 18 in. (450 mm).

## X2. USING THE IDENTIFICATION PROCEDURE AS A DESCRIPTIVE SYSTEM FOR SHALE, CLAYSTONE, SHELLS, SLAG, CRUSHED ROCK, AND THE LIKE

X2.1 The identification procedure may be used as a descriptive system applied to materials that exist in-situ as shale, claystone, sandstone, siltstone, mudstone, etc., but convert to soils after field or laboratory processing (crushing, slaking, and the like).

X2.2 Materials such as shells, crushed rock, slag, and the like, should be identified as such. However, the procedures used in this practice for describing the particle size and plasticity characteristics may be used in the description of the material. If desired, an identification using a group name and symbol according to this practice may be assigned to aid in describing the material.

X2.3 The group symbol(s) and group names should be placed in quotation marks or noted with some type of distinguishing symbol. See examples.

X2.4 Examples of how group names and symbols can be incororated into a descriptive system for materials that are not naturally occurring soils are as follows:

X2.4.1 *Shale Chunks*—Retrieved as 2 to 4-in. (50 to 100-mm) pieces of shale from power auger hole, dry, brown, no reaction with HCl. After slaking in water for 24 h, material identified as "Sandy Lean Clay (CL)"; about 60 % fines with medium plasticity, high dry strength, no dilatancy, and medium toughness; about 35 % fine to medium, hard sand; about 5 % gravel-size pieces of shale.

X2.4.2 *Crushed Sandstone*—Product of commercial crushing operation; "Poorly Graded Sand with Silt (SP-SM)"; about 90 % fine to medium sand; about 10 % nonplastic fines; dry, reddish-brown, strong reaction with HCl.

X2.4.3 *Broken Shells*—About 60 % gravel-size broken



ED_004850_00001502-01020

shells; about 30 % sand and sand-size shell pieces; about 10 % fines; "Poorly Graded Gravel with Sand (GP)."

X2.4.4 *Crushed Rock*—Processed from gravel and cobbles in Pit No. 7; "Poorly Graded Gravel (GP)"; about 90 % fine, hard, angular gravel-size particles; about 10 % coarse, hard, angular sand-size particles; dry, tan; no reaction with HCl.

## X3. SUGGESTED PROCEDURE FOR USING A BORDERLINE SYMBOL FOR SOILS WITH TWO POSSIBLE IDENTIFICATIONS.

X3.1 Since this practice is based on estimates of particle size distribution and plasticity characteristics, it may be difficult to clearly identify the soil as belonging to one category. To indicate that the soil may fall into one of two possible basic groups, a borderline symbol may be used with the two symbols separated by a slash. For example: SC/CL or CL/CH.

X3.1.1 A borderline symbol may be used when the percentage of fines is estimated to be between 45 and 55 %. One symbol should be for a coarse-grained soil with fines and the other for a fine-grained soil. For example: GM/ML or CL/SC.

X3.1.2 A borderline symbol may be used when the percentage of sand and the percentage of gravel are estimated to be about the same. For example: GP/SP, SC/GC, GM/SM. It is practically impossible to have a soil that would have a borderline symbol of GW/SW.

X3.1.3 A borderline symbol may be used when the soil could be either well graded or poorly graded. For example: GW/GP, SW/SP.

X3.1.4 A borderline symbol may be used when the soil could either be a silt or a clay. For example: CL/ML, CH/MH, SC/SM.

X3.1.5 A borderline symbol may be used when a fine-grained soil has properties that indicate that it is at the boundary between a soil of low compressibility and a soil of high compressibility. For example: CL/CH, MH/ML.

X3.2 The order of the borderline symbols should reflect similarity to surrounding or adjacent soils. For example: soils in a borrow area have been identified as CH. One sample is considered to have a borderline symbol of CL and CH. To show similarity, the borderline symbol should be CH/CL.

X3.3 The group name for a soil with a borderline symbol should be the group name for the first symbol, except for:

CL/CH lean to fat clay
ML/CL clayey silt
CL/ML silty clay

X3.4 The use of a borderline symbol should not be used indiscriminately. Every effort shall be made to first place the soil into a single group.

## X4. SUGGESTED PROCEDURES FOR ESTIMATING THE PERCENTAGES OF GRAVEL, SAND, AND FINES IN A SOIL SAMPLE

X4.1 *Jar Method*—The relative percentage of coarse- and fine-grained material may be estimated by thoroughly shaking a mixture of soil and water in a test tube or jar, and then allowing the mixture to settle. The coarse particles will fall to the bottom and successively finer particles will be deposited with increasing time; the sand sizes will fall out of suspension in 20 to 30 s. The relative proportions can be estimated from the relative volume of each size separate. This method should be correlated to particle-size laboratory determinations.

X4.2 *Visual Method*—Mentally visualize the gravel size particles placed in a sack (or other container) or sacks. Then, do the same with the sand size particles and the fines. Then, mentally compare the number of sacks to estimate the percentage of plus No. 4 sieve size and minus No. 4 sieve size present. The percentages of sand and fines in the minus sieve size No. 4 material can then be estimated from the wash test (X4.3).

X4.3 *Wash Test (for relative percentages of sand and fines)*—Select and moisten enough minus No. 4 sieve size material to form a 1-in (25-mm) cube of soil. Cut the cube in half, set one-half to the side, and place the other half in a small dish. Wash and decant the fines out of the material in the dish until the wash water is clear and then compare the two samples and estimate the percentage of sand and fines. Remember that the percentage is based on weight, not volume. However, the volume comparison will provide a reasonable indication of grain size percentages.

X4.3.1 While washing, it may be necessary to break down lumps of fines with the finger to get the correct percentages.



ED_004850_00001502-01021

## X5. ABBREVIATED SOIL CLASSIFICATION SYMBOLS

X5.1 In some cases, because of lack of space, an abbreviated system may be useful to indicate the soil classification symbol and name. Examples of such cases would be graphical logs, databases, tables, etc.

X5.2 This abbreviated system is not a substitute for the full name and descriptive information but can be used in supplementary presentations when the complete description is referenced.

X5.3 The abbreviated system should consist of the soil classification symbol based on this standard with appropriate lower case letter prefixes and suffixes as:

| *Prefix:* | Suffix: |
|---|---|
| s = sandy | s = with sand |
| g = gravelly | g = with gravel |
| | c = with cobbles |
| | b = with boulders |

X5.4 The soil classification symbol is to be enclosed in parenthesis. Some examples would be:

| *Group Symbol and Full Name* | Abbreviated |
|---|---|
| CL, Sandy lean clay | s(CL) |
| SP-SM, Poorly graded sand with silt and gravel | (SP-SM)g |
| GP, poorly graded gravel with sand, cobbles, and boulders | (GP)scb |
| ML, gravelly silt with sand and cobbles | g(ML)sc |

## SUMMARY OF CHANGES

In accordance with Committee D18 policy, this section identifies the location of changes to this standard since the last edition (1993$^{\epsilon 1}$) that may impact the use of this standard.

(1) Added Practice D 3740 to Section 2.

(2) Added Note 5 under 5.7 and renumbered subsequent notes.

*ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.*

*This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).*



ED_004850_00001502-01022

# ATTACHMENT 3. FIELD CLASSIFICATION OF SOILS, BASED ON UNIFIED SOIL CLASSIFICATION SYSTEM AND ASTM STANDARD D-2488

integral consulting inc.

# Field Classification of Soils, Based on Unified Soil Classification System and ASTM Standard D-2488

| Major Divisions | | Symbol and Pattern | General Soil Description |
|---|---|---|---|
| **Coarse-Grained Soils** (More than 1/2 of soil >No. 200 sieve size) | **Gravels** | GW | Well-graded gravels or gravel-sand mixtures, little to no fines |
| | | GP | Poorly-graded gravels or gravel-sand mixtures, little to no fines |
| | | GM | Silty gravels or gravel-sand-silt mixtures |
| | | GC | Clayey gravels or gravel-sand-clay mixtures |
| | **Sands** | SW | Well-graded sands or gravel-sand mixtures, little to no fines |
| | | SP | Poorly-graded sands or gravelly sands, little to no fines |
| | | SM | Silty sands, sand-silt mixtures |
| | | SC | Clayey sands, sand-clay mixtures |
| **Fine-Grained Soils** (More than 1/2 of soil <No. 200 sieve size) | **Silts** | ML | Inorganic silts with slight plasticity |
| | | MH | Inorganic elastic silts |
| | | OL | Organic elastic silts |
| | **Clays** | CL | Inorganic clays of low to medium plasticity, lean clays |
| | | CH | Inorganic clays of high plasticity, fat clays |
| | | OH | Organic clays of medium to high plasticity |
| **Highly Organic Soils** | | Pt | Peat, sample composed primarily of vegetable tissue |

## Soil Classification Notes

Groundwater, First Observed

Groundwater, Static

### Sampling Equipment

| | |
|---|---|
| SS | Split Spoon |
| ST | Shelby Tube |
| GS | Geoprobe® Macrocore Sampler |

### Sheen Types

| | |
|---|---|
| NS | No Sheen |
| LS | Light Sheen |
| MS | Moderate Sheen |
| HS | Heavy Sheen |

### Sample Moisture

| | |
|---|---|
| Dry | No moisture, dry to touch |
| Moist | Damp, but no free water |
| Wet | Visible free water |

### Sample Plasticity (Fine-Grained Soils)

| | |
|---|---|
| Non-Plastic - | Cannot be rolled at any moisture content. |
| Low - | Can barely be rolled, lump cannot be formed when drier than plastic limit. |
| Medium - | Can easily be rolled, lump crumbles when drier than plastic limit. |
| High - | Can easily be rolled, but takes considerable time to reach the plastic limit. Lump can be formed without crumbling when drier than the plastic limit. |

### Particle Size Range (Coarse-Grained Soils)

| | |
|---|---|
| Gravel - | Fine, Coarse |
| Sand - | Fine, Medium, Coarse |

# STANDARD OPERATING PROCEDURE (SOP) SL-07

# SUBSURFACE SOIL SAMPLING

## SCOPE AND APPLICATION

The following procedures are designed to be used to collect subsurface soil samples using a hand auger, direct-push drill rig, and a backhoe. *All underground utilities must be located and cleared prior to drilling or excavating*. Soil samples should be collected from areas having lower levels of constituents of interest first, followed by stations with higher expected levels of constituents of interest.

Based on field and site conditions, the procedures listed below may be modified in the field upon agreement of the field team leader and project management, after appropriate annotations have been made in the project-specific field logbook. If specialized sampling methods (e.g., Encore®) are to be used, refer to the manufacturer's recommended procedures. If methanol preservation is required, refer to Integral SOP SL-08 on methanol preservation of soil samples. Record all pertinent information in the Integral field logbook, subsurface soil field collection form, or boring log (as appropriate).

## EQUIPMENT AND SUPPLIES REQUIRED

- Subsurface sampling equipment (e.g., hand auger, direct-push drill rig [e.g., Geoprobe®], backhoe, stainless-steel spade) (consult project-specific field sampling plan [FSP] for kind of equipment to be used for a specific field event)
- Large stainless steel mixing bowl and spoon
- Laboratory-supplied sample containers, insulated coolers, and ice
- Chain-of-custody forms, custody seals, sample labels
- Resealable plastic bags (e.g., Ziploc®)
- Camera
- Tape measure
- Logging table
- 6-mil visqueen and duct tape for covering the logging table
- Aluminum foil



ED_004850_00001502-01025

- 55-gallon drums for decontamination waters and excess soil (separate drums for liquid and solid wastes) if required by the project-specific FSP
- Field logbook, subsurface soil field collection form, and/or soil boring form, and pens
- Project-specific FSP and health and safety plan (HSP)
- Personal protective equipment (PPE) (safety glasses, steel-toed boots, nitrile gloves, and any other items required by the project-specific HSP)
- Photoionization detector (PID), if required by the project-specific FSP or HSP
- Global positioning system (GPS), if required by the project-specific FSP
- Decontamination equipment.

## HAND AUGER SAMPLER

The following procedures are designed to be used during the general operation of a hand auger sampler. The procedures listed below may be modified in the field upon agreement of the field team leader and drill operators, based on field and site conditions, after appropriate annotations have been made in the field logbook.

1. Locate the sample station as directed in the project-specific FSP. Place sample labels on the sample container prior to filling in accordance with Integral's SOP on sample labeling (SOP AP-04).
2. Place plastic sheeting adjacent to the sampling location.
3. Advance the hand auger into subsurface soil.
4. Empty soil from the first interval (as specified in the project-specific FSP) from the hand auger into a decontaminated stainless steel bowl and cover the bowl with aluminum foil. Continue advancing the hand auger until the next appropriate sample interval has been completed.
5. Screen the soil sample for volatile organic compounds (VOCs) using a PID if required by the project-specific FSP.
6. Photograph each interval with depth and site markers visible in the photograph, if applicable.
7. Log the soils in accordance with SOP SL-04 (*Field Classification of Soils*).
8. If VOC samples are required (see project-specific FSP), collect them prior to homogenizing (i.e., mixing) the sample. Collect the VOC sample (with a minimum of disturbance) by placing the sample into the container with no headspace and sealing it tightly. If an Encore® sampling device is specified in the project-specific FSP, follow the sample collection guidelines provided by the manufacturer.



ED_004850_00001502-01026

9. (a) If the soil sample is to be a discrete sample (see project-specific FSP), collect soil from the hand auger using a decontaminated stainless-steel spoon and place the sample into a decontaminated stainless-steel bowl. Homogenize the soil to a consistent color and texture.

   (b) If additional sample volume is required to perform the analyses specified in the project-specific FSP, place multiple soil samples collected from nearby locations (it is important to keep the distance between multiple soil borings as close as possible; the maximum distance will be specified in the project-specific FSP) from the same depth interval into a composite sample in a single decontaminated stainless-steel bowl. When a sufficient volume of soil has been obtained, homogenize all of the soil in the bowl to a consistent color and texture using a decontaminated spoon.

10. Discard rocks found in the homogenized soil that are greater than 0.5 in. in diameter after positively identifying them, determining their percentage contribution to the homogenized soil volume, and noting it in the field notebook.

11. Remove samples of the homogenized soil from the compositing bowl and place in the appropriate size sample container. Fill the sample container with soil to just below the container lip, and seal the container tightly.

12. Decontaminate all sampling equipment in accordance with SOP SL-01 and the project-specific FSP.

13. Repeat the process described above for all subsequent sample intervals.

14. Complete the appropriate field books, field data sheets, and quality assurance and quality control (QA/QC) documentation. Record any deviations from the specified sampling procedures or any obstacles encountered.

15. Backfill the borehole with remaining hand auger soil cuttings or place the cuttings in a properly labeled 55-gallon drum, as specified in the project-specific FSP. If soil cuttings are placed in a 55-gallon drum, backfill the borehole with bentonite hole plug pellets and hydrate the pellets with potable water.

16. Mark the sampling location with a wire flag, wooden stake, metal rebar, or flagging, as appropriate. Collect GPS coordinates of the sample location if specified in the project-specific FSP.

## DIRECT-PUSH DRILL RIG

The following procedures are designed to be used during the general operation of direct-push drill rig (e.g., Geoprobe®). The procedures listed below may be modified in the field upon agreement of the field team leader and drill operators, based on field and site conditions, after appropriate annotations have been made in the field logbook. The direct-push drill rig will be operated by a licensed drilling contractor.



ED_004850_00001502-01027

The direct-push drilling technique hydraulically pushes tools into the ground to collect soil samples. Direct-push drilling techniques can be used to collect soil samples to depths of 30–100 ft, depending on drilling conditions at the site. In addition to soil sample collection, direct-push techniques can be used to collect soil gas samples, reconnoiter groundwater samples, and install small-diameter monitoring wells.

Soil samples can be collected using two types of Macrocore® samplers, open tip and closed tip. These samplers are typically either 4 ft long by 1.5 in. inside diameter (i.d.) or 5 ft long by 2.5 in. i.d. These samplers have a tubular design and utilize acetate liners to collect the soil samples. The following sections of this SOP describe how to collect soil samples using open-tip and closed-tip Macrocore® samplers.

## Open-Tip Sampler

The open-tip sampler is typically used in soils that are cohesive (e.g., stiff silts and clays), where the soil boring is stable and stays open when the sampler and rods are removed from the ground.

1. Ensure all underground utilities are cleared prior to initiating drilling activities.
2. Position the direct-push drill rig over the sample station and remove any surface material that will interfere with sampling. Note in the field logbook any surface material that is removed prior to sampling.
3. Determine the interval to be sampled and install a new clean liner into the open tip Macrocore® sampler.
4. Push the sampler to the bottom of the appropriate sample interval.
5. Retract the rods and Macrocore® sampler.
6. After the Macrocore® sampler has been brought to the surface, remove the liner from the sampler, cap both ends of the liner, and inspect it.
7. After the soil sample is judged to be acceptable, label the sample liner with the station identifier, depth interval, and soil orientation (i.e., arrow pointing toward uppermost soil interval).
8. Place the capped sample liner on a new piece of aluminum foil on the logging table and split the liner open with a hook or utility knife. Process the sample in accordance with the "General Sampling Procedures" listed below.
9. Repeat Steps 2–8 for each subsequent sample interval.



ED_004850_00001502-01028

## Closed-Tip Sampler

The closed-tip sampler is typically used to collect soil samples that are noncohesive (e.g., sandy materials), where the soil boring is unstable and collapses when the rods and sampler are removed from the ground.

1. Ensure all underground utilities are cleared prior to initiating drilling activities.
2. Position the direct-push drill rig over the sample station and remove any surface material that will interfere with sampling. Note in the field logbook any surface material removed prior to sampling.
3. Determine the interval to be sampled and install a drive point and a new clean liner into the closed-tip Macrocore® sampler.
4. Push the rods and sampler to the top of the appropriate sample interval.
5. Retract the rods to release the drive point.
6. Push the sampler to the bottom of the appropriate sample interval.
7. Retract the rods and Macrocore® sampler.
8. Once the soil sample has been brought to the surface, remove the liner from the sampler, cap both ends of the liner, and inspect it.
9. After the soil sample is judged to be acceptable, label the sample liner with the station identifier, depth interval, and soil orientation (i.e., arrow pointing toward uppermost soil interval).
10. Place the capped sample liner on a new piece of aluminum foil on the logging table and split the liner open with a hook or utility knife. Process the sample in accordance with the "General Sampling Procedures" listed below.
11. Repeat Steps 2–10 for each additional sample interval.

## General Sampling Procedures

1. After the liner has been split open, screen the soil sample for VOCs using a PID if required by the project-specific FSP.
2. Log the soils in accordance with SOP SL-04 (*Field Classification of Soils*).
3. Photograph each section of the soil boring with appropriate orientation, depth, and site markers visible in the photograph, if specified in the project-specific FSP.



ED_004850_00001502-01029

4. If VOC samples are required (see project-specific FSP), collect them prior to sample removal from the liner. Collect the VOC sample (with a minimum of disturbance) by placing the sample into the container with no headspace and seal it tightly. If an Encore® sampling device is specified in the project-specific FSP, follow the sample collection guidelines provided by the manufacturer.
5. Remove the soil from the liner using a decontaminated stainless-steel spoon and place the soil in a decontaminated compositing bowl and thoroughly mix and homogenize the sample using a decontaminated spoon until the color and texture are consistent throughout.
6. (a) If the soil sample is to be a discrete sample (see project-specific FSP), collect soil from the liner using a decontaminated stainless-steel spoon and place the sample into a decontaminated stainless-steel bowl. Homogenize the soil to a consistent color and texture.

   (b) If additional sample volume is required to perform the analyses specified in the project-specific FSP, place multiple soil samples collected from nearby locations (it is important to keep the distance between multiple soil borings as close as possible; the maximum distance will be specified in the project-specific FSP) from the same depth interval into a composite sample in a single decontaminated stainless-steel bowl. When a sufficient volume of soil has been obtained, homogenize all of the soil in the bowl to a consistent color and texture using a decontaminated spoon.
7. Discard rocks found in the homogenized soil that are greater than 0.5 in. in diameter after positively identifying them, determining their percentage contribution to the homogenized soil volume, and noting it in the field notebook.
8. Remove samples of the homogenized soil from the compositing bowl and place in the appropriate size sample container. Fill the sample container with soil to just below the container lip, and seal the container tightly.
9. Repeat the process described above for subsequent sample intervals.
10. Complete the appropriate field books, field data sheets, and QA/QC documentation. Record any deviations from the specified sampling procedures or any obstacles encountered.
11. Backfill the borehole with remaining direct-push sampler cuttings or place the cuttings in a properly labeled 55-gallon drum, as specified in the project-specific FSP. If soil cuttings are placed in a 55-gallon drum, backfill the borehole with bentonite grout (mixed to the manufacturer's specifications) or bentonite hole plug pellets and hydrate the pellets with potable water.
12. Mark the sampling location with a wire flag, wooden stake, metal rebar, or flagging, as appropriate. Collect GPS coordinates of the sample location if specified in the project-specific FSP.



ED_004850_00001502-01030

13. Decontaminate all sampling equipment in accordance with SOP SL-01 and the project-specific FSP.

## Test Pit Excavations

The following procedures are to be used during the excavation of pits with construction equipment (i.e., backhoe or track-hoe) prior to soil sampling operations. Adhere to all requirements of the site-specific HSP for this specific activity. The procedures listed below may be modified in the field upon agreement of the field team leader and project management, based on field and site conditions, after appropriate annotations have been made in the field logbook.

1. Locate the sample station as directed in the project-specific FSP. Ensure all underground utilities have been cleared prior to initiating excavation activities. Place sample labels on all sample containers prior to filling in accordance with Integral's SOP for sample labeling (SOP AP-04).
2. Select the appropriate orientation for the excavation, basing it on the judgment of the field team leader, backhoe operator, and onsite conditions. Sampling personnel **MUST** remain in visual contact with the backhoe operator at all times, and out of possible "pinch zones" or areas where heavy equipment may move or swing.
3. Place plastic sheeting from the edge of the proposed excavation leading away for a sufficient distance to the proposed temporary stockpile location so that the excavated soil does not slough back into the pit.
4. Begin pit excavation.
5. Continue excavation of the pit to the required depth. If pit entry is necessary, this depth will not exceed 4 ft from the ground surface. Never enter a trench or pit if conditions are unstable. Excavate the proper pit exit trenches, shoring, and sloping to prevent accidental burial of sampling crew, and to meet or exceed all OSHA Construction Standards (29 CFR § 1926; Attachment 201-2) for entrance by sampling personnel. If pit entry is not necessary for sampling activities, pit depth can exceed 4 ft below ground surface. Instruct the backhoe operator to scrape material evenly along an exposed face to collect (to the extent practicable) a representative sample of the soils across the entire face in the bucket. Collect soil samples from the middle of the backhoe bucket.
6. Screen the soil sample for VOCs using a PID if required by the project-specific FSP.
7. Photograph each interval with depth and site markers visible in the photograph, if applicable.
8. Log the test pit soils in accordance with SOP SL-04 (*Field Classification of Soils*).



ED_004850_00001502-01031

9. If VOC samples are required (see project-specific FSP), collect them prior to homogenizing (i.e., mixing) the sample. Collect the VOC sample (with a minimum of disturbance) by placing the sample into the container with no headspace and seal it tightly. If an Encore® sampling device is specified in the project-specific FSP, follow the sample collection guidelines provided by the manufacturer.
10. Collect soil using a decontaminated stainless-steel spoon or disposable sampling tool (depending on project-specific requirements; see FSP), which has been evenly removed from the face of the trench wall or from the bucket, and place the sample into a decontaminated stainless-steel bowl. Homogenize the soil to a consistent color and texture.
11. Discard rocks found in the homogenized soil that are greater than 0.5 in. in diameter after positively identifying them, determining their percentage contribution to the homogenized soil volume, and noting it in the field notebook.
12. Remove samples of the homogenized soil from the compositing bowl and place them in the appropriate size sample container. Fill the sample container with soil to just below the container lip and seal it tightly.
13. Decontaminate all sampling equipment in accordance with SOP SL-01 and the project-specific FSP.
14. Repeat the process described above for all subsequent sample intervals.
15. Complete all pertinent field logbooks, field data sheets, and QA/QC documentation. Record any deviations from the specified sampling procedures or any obstacles encountered.
16. Mark the sampling location with a wire flag, wooden stake, metal rebar, or flagging, as appropriate. Collect GPS coordinates of the sample location if specified in the project-specific FSP. Photograph sample location and document in the logbook.
17. Backfill the test pit with the excavated soils. Depending on historical site data (see project-specific FSP), the plastic sheeting will either be disposed of as garbage or it will be drummed and sent to a hazardous waste landfill.



ED_004850_00001502-01032

# STANDARD OPERATING PROCEDURE (SOP) SW-01

# DECONTAMINATION OF SURFACE WATER SAMPLING EQUIPMENT

## SCOPE AND APPLICATION

This SOP defines and standardizes Integral's methods for decontamination of field sampling equipment for collecting surface water samples to ensure sample integrity and minimize contamination during sample handling.

This SOP utilizes and augments the procedures outlined in the San Francisco Estuary Institute's *Field Sampling Manual for the Regional Monitoring Program for Trace Substances* (David et al. 2001), *Interagency Field Manual for the Collection of Water-Quality Data* (USGS various dates), and U.S. Environmental Protection Agency (EPA) Method 1669, *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels* (USEPA 1996). Clean sampling techniques designed for trace metals will be used for the collection of filtered and unfiltered water samples.

Samples may be analyzed for organic compounds, metals, nutrients, and conventional analytes for the surface water sampling events, according to the project-specific sampling and analysis plan (SAP).

To prevent cross-contamination of samples, all reusable surface water sampling equipment will be decontaminated before each use. Decontamination of field sampling equipment can be done in the field or in a commercial laboratory. Depending on the project's complexity and analytical reporting limits (see project-specific SAP), sampling equipment may need to be decontaminated at a qualified laboratory. It is strongly discouraged to decontaminate sampling equipment in the field due to the high risk of contamination. Thorough decontamination procedures should be followed under controlled conditions at the laboratory. However, it is necessary to perform certain decontamination steps in the field.

Set up a decontamination station onsite in a clean location upwind of sampling locations, or perform decontamination in the field office, under a laboratory hood if available. Store decontaminated equipment away from contaminated areas and in a manner that will prevent recontamination prior to use.

When handling decontamination chemicals, follow all relevant procedures outlined in the site-specific health and safety plan.



ED_004850_00001502-01033

## EQUIPMENT AND REAGENTS REQUIRED

Equipment required for decontamination includes the following, depending on the target analyte and sampling equipment:

- Plastic brushes with rigid bristles
- Properly labeled squirt bottles
- 5-gal plastic bucket
- Tap water
- Alconox®, Liquinox® detergent, or equivalent
- Pesticide-grade decontamination solvents (e.g., ethanol and methanol, according to the project-specific SAP, as the solvents may vary by EPA region or state)
- Nitric acid (5 percent)
- Hydrochloric acid (10 percent) if nutrients are being analyzed
- Deionized water (analyte-free; received from testing laboratory)
- Sealable waste container equipped with a funnel
- 1 gal sealable plastic bags
- 2.5 L amber glass bottles.

## DECONTAMINATION PROCEDURES

Decontamination methods vary depending on whether the samples collected will be analyzed for conventional analytes, organic chemicals, or trace metals.

### Conventional Analytes and First Use

The following procedure is used when sampling for conventional analytes such as chloride, sulfate, sodium, and calcium. It is also used for new equipment and for equipment that is being used for the first time at a site. Conventional analytes have the simplest decontamination procedure because they tend to be highly soluble in water and detergent solutions, and do not tend to sorb significantly to the surface of the sampling equipment.

For collection of lake water samples at different depths from the same location, equipment needs to be rinsed only with site water three times between stations following an initial decontamination. Similarly, for collection of samples from rivers where stations are close to one another spatially and temporally, only a site-water rinse is necessary. The steps are as follows:

1. Rinse the equipment thoroughly with tap water.



ED_004850_00001502-01034

2. Pour a small amount of Alconox® (or similar product) into a 5 gal bucket and fill it with tap water. Using a plastic brush with rigid bristles, scrub each piece in the detergent solution.
3. Rinse the equipment with tap water to remove all detergent (some detergents contain surfactants that are analytes) and set aside to drain.
4. Rinse the equipment three times with site water immediately prior to collecting the sample.

## Organic Chemicals

The following procedure is used for decontaminating equipment (e.g., Kemmerer sampler) used to collect surface water that will be analyzed for organic chemicals. Two organic solvents are used in the procedure. The first is miscible with water (e.g., ethanol) and is intended to scavenge water from the surface of the sampling equipment and allow the equipment to dry quickly. Make sure that the solvent ordered is anhydrous or has a very low water content (i.e., <1 percent). The second organic solvent is hydrophobic (e.g., methanol) and is intended to dissolve any organic chemicals on the surface of the equipment.

The exact solvents used for a given project may vary by EPA region or state (see project-specific SAP). The choice of solvents also depends on the material the equipment is made from (e.g., acetone cannot be used on polycarbonate), and the ambient temperature (e.g., hexane is too volatile in hot climates). In addition, although methanol and hexane are sometimes slightly more effective than other solvents, their use is discouraged because of toxicity to sampling personnel. The decontamination procedure is as follows:

1. Rinse the equipment thoroughly with tap or site water.
2. Pour a small amount of Alconox® (or similar product) into a 5 gal bucket and fill it with tap or site water. Using a plastic brush with rigid bristles, scrub each piece in the detergent solution.
3. Rinse the equipment with tap or site water and set aside to drain.
4. Rinse the equipment with ethanol dispensed from a squirt bottle and let the excess solvent drain into a waste container equipped with a funnel (ethanol acts primarily as a drying agent, but also works as a solvent for some organic contamination). Rinse the inside of the sampling equipment that comes in contact with sample water. Set the equipment in a clean location and allow it to air dry. In cold temperatures, it may take a long time for equipment to dry. In this case, it is important to remove all water from the surface by thoroughly rinsing with a more volatile solvent such as acetone. In hotter temperatures, use a less volatile water solvent (e.g., isopropanol).



ED_004850_00001502-01035

5. Rinse the air-dried equipment with methanol dispensed from a squirt bottle and let the excess solvent drain into the waste container. Methanol acts as the primary solvent, but it is insoluble with water. If water beading occurs, it means that the equipment was not thoroughly rinsed with ethanol or the equipment was not given sufficient time to dry completely. Rinse the inside of the sampling equipment that comes in contact with site water. In hotter climates, use a less-volatile solvent such as methanol. When the equipment has been rinsed thoroughly, set it in a clean location and allow the solvent to evaporate before storing or using it.
6. Close the solvent waste container when not in use and store it in a secure place.
7. Transfer the waste to empty solvent bottles and dispose of it at a licensed facility.

## Trace Metals

In addition to the following decontamination procedures, personnel collecting water samples must be aware of other sources of contamination. Sources commonly encountered in the field include lead batteries used to power pumps, metal objects such as tools, and gasoline cans. To the extent possible, these items should be removed from the sample collection area and the sampling equipment, and anyone collecting the samples should avoid handling these items beforehand. Wear vinyl clean-room gloves (e.g., Oak class 100, powder free) when handling sampling equipment that will be used to collect surface water samples for trace metals analysis. Discard gloves between stations or if they come into contact with any materials known or likely to be contaminated.

The following procedures should be used for decontaminating equipment used to collect surface water samples for trace metals (e.g., Teflon™ tubing, Teflon™ churn splitter, connectors and adapters made of Teflon™ or other similar material, or plastic stands used for holding sample tubing). This procedure is not intended for containers in which samples will be stored and/or shipped to the laboratory for analysis.

1. Rinse the equipment thoroughly with tap or site water.
2. Pour a small amount of Alconox® (or similar product) into a 5 gal bucket and fill it with tap or site water. Using a plastic brush with rigid bristles, scrub each piece in the detergent solution. Fill bottles about halfway with detergent solutions and shake for a few minutes. Pump the detergent solution through any tubing for a few minutes. Small parts can be placed in large-mouth jars that have tight lids and shaken with the detergent solution.
3. Rinse the equipment with tap water to remove all detergent (detergents will neutralize the nitric acid) and set it aside to drain.



ED_004850_00001502-01036

4. Clean all equipment surfaces that come into contact with water samples using a 5 percent nitric acid solution for at least 30 minutes. Place small items, such as Teflon™ water intakes, in plastic containers filled with 5 percent nitric acid. Fill sampling containers/bottles with 5 percent nitric acid solution and allow to stand. Cover the containers and keep them away from potential contamination sources.
5. Either pump acid solution through tubing, or leave it static in the tubing for the same duration.
6. Drain all equipment thoroughly and flush with at least three volumes of laboratory deionized water (not deionized water from the grocery store).
7. Drain thoroughly and flush with at least three volumes of site water before collecting a sample.

## PROCEDURES USED TO DECONTAMINATE SAMPLING DIAPHRAGM PUMPS

The following procedure is used for samples to be analyzed for trace metals and conventional analytes. Two types of pumps are commonly used for collecting water samples, peristaltic and diaphragm. For peristaltic pumps, only the tubing needs to be cleaned according to the above procedure. It is best to keep precleaned short lengths of tubing for each station when using the peristaltic pump. For diaphragm pumps, the procedure is as follows:

1. Using two short pieces of tube on the pump, place both ends in a 1-gal container with detergent solution and circulate the solution through the system for 2 minutes.
2. Purge the system with about 1 gal of laboratory deionized water, keeping the outflow tubing over a waste bucket. Do not recirculate this solution. Repeat the 1 gal deionized water purge.
3. Connect the two ends of the short tubes with a decontaminated plastic coupler and keep it sealed until sampling time.
4. When ready to sample, remove the short tubing protecting the inlet of the pump, connect the tubing used for sampling to the pump, and purge the system with site water for 2 minutes, or with enough water to rinse the entire system (i.e., pump head and tubing) immediately before collecting the sample.

## REFERENCES

David, N., D. Bell, and J. Gold. 2001. Field sampling manual for the regional monitoring program for trace substances. San Francisco Estuarine Institute, San Francisco, CA.



ED_004850_00001502-01037

USEPA. 1996. Method 1669 – Sampling ambient water for trace metals at EPA water quality criteria levels. U.S. Environmental Protection Agency, Office of Water Engineering and Analysis Division (4303). Washington, DC.

USGS. [various dates]. National field manual for the collection of water-quality data: U.S. Geological Survey techniques of water-resources investigations, Book 9, Chaps. A1-A9. http://pubs.water.usgs.gov/twri9A. Accessed February 5, 2008. http://water.usgs.gov/owq/FieldManual/index.html#Citation. U.S. Geological Survey.



ED_004850_00001502-01038

# STANDARD OPERATING PROCEDURE (SOP) SW-04

# SURFACE WATER SAMPLING USING A PERISTALTIC PUMP

## SCOPE AND APPLICATION

This SOP defines and standardizes the methods for collecting surface water samples from freshwater or marine environments using a peristaltic pump and Teflon™ tubing.

This SOP utilizes and augments the procedures outlined in the *San Francisco Estuary Institute's Field Sampling Manual for the Regional Monitoring Program for Trace Substances* (David et al. 2001), the *Interagency Field Manual for the Collection of Water-Quality Data* (USGS various dates), and *U.S. Environmental Protection Agency (EPA) Method 1669, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels* (USEPA 1996). The goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by different programs that follow EPA guidelines.

By following this SOP, surface water can be collected with a high level of sample integrity and minimal contamination during sample handling. The trace clean sampling method described in this SOP can be used to collect surface water for filtered and unfiltered water analysis, trace metals analysis, analysis of organic compounds, and analysis of conventional analytes, such as total suspended solids, dissolved organic carbon, and total dissolved solids.

## STATION ACCESS

Prior to entering select areas such as private beaches or embayments, or nearing docks, it may be necessary to acquire property access permission from the landowner. Be sure to secure such permission, including any written agreements, in advance of the sampling program.

## STATION LOCATION

When collecting near-bottom surface water samples, take care to avoid resuspending sediments in the water column, which could affect the sample being collected or samples to be collected at other downstream stations. To avoid resuspended sediment interference in the sample being collected, always approach stations from downstream. Avoid sampling near eddies that may circulate water from the sampling location to upstream of the sampling location. To avoid interference from resuspended sediment at other stations, begin collecting samples with the most downstream station and continue upstream.



ED_004850_00001502-01039

Collect near-surface water samples at least 6 in. below the surface–air interface or surface water microlayer to avoid collecting non-representative compounds such as transient dust particles and thin oil films, unless otherwise instructed.

Collect water samples from areas that are representative of the surface water body conditions. A station that is located away from immediate point sources (e.g., tributaries and industrial and municipal effluents) is preferred for collecting surface water samples unless sampling is designed to assess these sources. Representative samples can usually be collected in portions of the surface water body that have a uniform cross section and flow rate. Because mixing is influenced by turbulence and water velocity, select a site immediately downstream of a riffle area (e.g., fast flow zone) to ensure good vertical mixing.

Sample tributaries as near the mouth as is feasible. However, consider the impact of the downstream receiving water body on the tributary flow and sediments. The downstream body may decrease water velocity (causing suspended solids to settle) or create eddies (causing mixing of the two waters). The downstream water body may change the water quality (e.g., salinity), temperature, or turbidity in the tributary near its mouth. It is important to determine how far upstream the tributary is influenced by the downstream water body, and then establish a sampling point with a reasonable distance upstream from that boundary.

Pay attention to intakes and outflows within lagoons or settling ponds, which may cause localized concentrations that are not representative of general conditions. Sample locations adjacent to structures (e.g., banks, piers) may also have biased characteristics as a result of flow or release of substances from the structure. Note these kinds of confounding factors in the field logbook. For ponds and lakes that may be vertically stratified, use a multi-parameter water quality meter to collect depth profiles throughout the water body to aid in selecting appropriate sampling points and depths.

## SUMMARY OF METHOD

To collect surface water samples for standard chemical and conventional analyses, use a peristaltic pump with an extended sampling tube lowered to the desired depths (see project-specific sampling and analysis plan [SAP]). Two kinds of sampling devices may be used to obtain the water samples, depending upon the project's needs. The near-surface water polyvinyl chloride (PVC) sampling structure (water sampler) has a polyurethane-coated weight suspended from the bottom of the structure to maintain it in an upright position (Figure 1a).

A near-bottom water sampler has a weighted landing base designed to keep the sampling tube at a fixed distance from the bottom (e.g., 30 cm, or 12 in.) and prevent the intake from coming in contact with the sediment (Figure 1b). Both types of water samplers keep the tubing intake pointing into the current with the help of a vane. The vane can be removed if the water is



ED_004850_00001502-01040

quiescent. Additional equipment, such as a multi-probe or underwater video camera, may be mounted on the PVC structure.

At each station, when either a near-surface or a near-bottom water sampler is deployed, attach the Teflon™ tubing to the vane with zip ties and place the water intake approximately 10 ft from the bow of the boat with the aid of an A-frame or davit. Keeping the boat facing the current, lower the water sampler unit to the appropriate depth with the help of a hydraulic or electric winch. Using a peristaltic pump, direct the outflow from the sampling tube into either a polycarbonate (for inorganic analyses) or glass or stainless-steel (for organic analyses) composite mixing container (Figure 2). Pump equal volumes of water into each large, pre-cleaned 10- or 20 L mixing container (depending on the project-specific needs) that is equipped with a Teflon™-coated magnetic stirring bar, and place them over a magnetic stir table. Use the containers for mixing and compositing samples for subsequent chemical analysis.

Following sample compositing in the mixing container, fill appropriate sample bottles (see project-specific SAP) using a second peristaltic pump, with the outflow directed into the sample bottle. If enough water volume is available, hold the sample bottle near the pump outlet, rinse the sample container one or two times, discard the rinsate, and then fill the sample bottle. Be aware that laboratory bottles are pre-cleaned and this rinsing option is not mandatory if water volume is an issue. Collect field rinsate blanks to ensure that sampling containers are not a source of contamination. If preservatives are present in the sample bottle, then omit the rinsing step. Cap and label the sample containers, and place them inside a cooler to store at approximately 4±2 °C.

Two types of surface water samples may be collected: unfiltered and filtered. For filtered metals and dissolved organic carbon samples, place the 0.45-µm filter (or project-specific pore size filter; see project-specific SAP) in-line near the tubing outlet to filter samples immediately before the water is discharged into the sample bottle (Figure 2). In general, filter samples for total suspended solids (TSS) and total dissolved solids (TDS) at the laboratory (see project-specific SAP).

Use the same technique described above to collect water for compositing surface water collected at horizontally integrated near-surface and near-bottom stations.

## EQUIPMENT AND REAGENTS REQUIRED

This section describes the general types of required equipment and reagents. Attachment 1 provides a detailed supply and equipment list. Additional equipment may be required depending upon project-specific needs.

Use one or two peristaltic pumps at each sampling station (near-surface and near-bottom) for collecting surface water samples. To collect unfiltered and filtered split samples from the mixing containers, use the same pump that is used to fill the mixing containers. Use a sample



ED_004850_00001502-01041

processing and preservation chamber (i.e., workbox) made of PVC pipes and 6-mil plastic sheeting to house stir plate(s), a peristaltic pump, sampling bottles, and ancillary equipment. Place a polycarbonate, glass, or stainless-steel mixing container (10 or 20L) on the stir plate. Each mixing container is equipped with a 3-in.-long Teflon™-coated stir bar at the bottom and a lid containing inflow, outflow, and vent Teflon™ spouts (Figure 2). For each sampling station, assemble a filtering kit (laboratory precleaned 0.45-µm filter with C-Flex™ and Teflon™ tubing placed in a double Ziploc™ bag) and attach it to a peristaltic pump and mixing containers. If necessary, attach a precleaned 10-µm prefilter inline to prolong the life of the 0.45-µm filter. You will need the following equipment:

- Peristaltic pump
- Surface water parameter multimeter capable of measuring pH, reduction/oxidation (redox) potential, temperature, specific conductance, turbidity, and dissolved oxygen
- PVC pipes and plastic sheeting
- Polycarbonate (inorganic analyses) and/or glass or stainless-steel (organic analyses) mixing containers (see project-specific SAP for analyte list)
- Sample tubing (type and length are site-dependent)
- Stir plate with Teflon™-coated stir bar
- 0.45-µm filter with C-Flex™ and Teflon™ tubing (if needed; see project-specific SAP to determine if filtered samples are required)
- Water Sampling Log forms (attached)
- Sample tags/labels and appropriate documentation (e.g., chain-of-custody forms)
- Insulated cooler(s), chain-of-custody seals, Ziploc® bags
- Sample containers with preservative, coolers, and blue ice or equivalent.

## PROCEDURES

The sampling team should comprise three people. Two are needed to conduct the sampling and a third must keep track of sample logging and processing. In addition, the third person may be responsible for collecting the surface water quality parameters.

### Equipment Preparation

Bring enough decontaminated sampling tubing and filtering kits to the field to avoid performing decontamination procedures between stations. Each participating laboratory is responsible for preparing its equipment prior to the sampling cruise. Predesignated commercial laboratories will decontaminate sample tubing, mixing containers, and sampling bottles according to their specific SOPs.



ED_004850_00001502-01042

Note: Decontamination of large amounts of sampling equipment requires several days, if not weeks, to be ready for sampling. Contract agreements with commercial laboratories and scheduling decontamination work may require several weeks to months. Initiate this critical step as early as possible.

The main components of the peristaltic pump sample collection system are as follows:

- **Processing and Preservation Chamber**—Build a workbox with ¾-in. PVC tubing and cover it with a 6-mil plastic sheet in order to contain the peristaltic pump sampling equipment and conduct the subsampling from the carboys. Leave one side of the workbox open for placing sampling equipment and sample containers. Wash all components with Alconox™ and rinse with tap water. To secure the receiving Teflon™ tubing and filter cartridge, use stands and clamps made of non-metallic components or resin-coated stainless steel, which have been washed with soap, rinsed in tap water, washed in acid, and rinsed with distilled/deionized water.
- **Water Sampler**—The water sampler device for near-surface sampling should be made of PVC tubing with a polyurethane-coated 50-lb weight at the bottom to keep the sampler in the vertical position (Figure 1a) (Note: To reduce potential drag at the water surface, do not include a base on the near-surface sampling device.) The near-bottom sampling device should also be made of PVC tubing and have a polypropylene vane, constructed with a weighted base (Figure 1b). Both sampling devices should be attached to the boat by a Technora™ or Kevlar™ rope. Figure 1b shows the sampling device with a YSI water quality multimeter and underwater camera attached to it. Figure 1b also shows how the Teflon™ tubing is positioned on the vane and the relationship of the inlet to the water sampler. The vane works to keep the water intake into the flow and elevated at a constant height from the bottom. Prior to commencement of sampling activities, wash all components with Alconox™ and rinse with tap water.
- **Water Quality Meter**—Use a YSI 650/6600 multi-probe (newer model or similar) for measuring surface water parameters, such as temperature, pH, dissolved oxygen, conductivity, oxidation-reduction potential (ORP), and turbidity. Attach it to the water samplers as shown in Figures 1a and 1b. The unit will come pre-calibrated from the laboratory and will be checked daily for proper functioning and drift. However, the must be calibrated daily for certain parameters such as pH, conductivity, ORP, and dissolved oxygen If possible, install a YSI unit on each water sampler (i.e., near-surface and near-bottom) if both are deployed at the same time. A YSI unit installed on the near-bottom water sampler can also take an initial near-surface measurement at the beginning and at the end of the sampling event, therefore avoiding the cost of having to install an additional YSI unit on the near-surface water sampler. The proper handling of the multi-probe is described in detail in SOP SW-06. Except for the probe sensor, wash all components with soap (Alconox™) and rinse with tap water. Because



ED_004850_00001502-01043

this equipment will not be in the pathway with the surface water being collected, there is no need for a thorough decontamination.

Take the following steps to set up the surface water collection system:

1. Assemble and secure the water samplers to either the A-frame or a davit.
2. Determine the correct position of the sampling station, have the captain anchor the vessel into the current at the sample site, and switch off the engines. If anchoring is not possible and the engine must be on, make sure the water intake tubing is always facing into the current.
3. Set up a clean area for the workboxes. Set workboxes on a secure table or bench top onboard the sampling vessel to house stir plate(s) and a small peristaltic pump in each workbox. Provide enough space inside the workboxes for a stand to hold the outlet tubing and filter (if necessary; see project-specific SAP) and to collect surface water and processing sample bottles (Figure 3).
4. Place stirring plate(s) inside the workbox and the mixing container(s) on top of the plate. Check each mixing container (a polycarbonate container for inorganic analytes and a glass or stainless-steel container for organics) to ensure:
   - Containers were properly wrapped by the laboratories and are free of rips or holes that may have occurred during shipment to the field.
   - Each container contains a 3-in. stir bar at the bottom.
   - All components such as inflow and outflow tubing have been properly assembled in the laboratory (e.g., one end of the outflow tubing should be touching the bottom inside the container), and that they are intact and securely placed on the cap.
5. Attach the outlet tubing "kits" (i.e., Unit # 3) to the mixing containers (Figure 2). The kits are composed of 10-cm C-Flex™ tubing, 0.5-m Teflon™ tubing, 30-cm C-Flex™ tubing, and 30-cm Teflon™ tubing, placed sequentially.
6. Place the small peristaltic pump inside each of the workboxes.
7. Place a stand inside the workboxes and secure each tubing outlet from both mixing containers with clamps (Figure 3).



ED_004850_00001502-01044

8. Attach Teflon™ tubing (collecting end) to 30-cm C-Flex™ tubing and 1-m Teflon™ tubing, sequentially, and then connect these interconnected pieces of tubing to a mixing container (polycarbonate for inorganics and glass or stainless steel for organics). Clamp the C-Flex™ tubing section firmly into place inside the large peristaltic pump head, which is placed outside the workbox. (Note: The length of the Teflon™ tubing will vary depending on project-specific requirements and water depth at a given station. For example, 4 m of Teflon™ tubing could be used for near surface sampling and 25 m could be used for near-bottom sampling)
9. Attach the intake part of the Teflon™ tubing to the vane of the near-surface sampler (Figure 1a) or to the vane of the near-bottom sampler (Figure 1b). Take care not to remove the protective cap from the tip of the sample collection tube until the sampling device is ready for submersion.
10. Secure the pump and pump speed controller, and connect them to the vessel's power source with an extension cord. If vessel power is not available, use the pump's battery power supply.
11. To limit sediment suspension during near-bottom sampling, tether a submersible, underwater video camera to the boat and attach it to the sampling device vane to reveal when the sampling device touches bottom.

## Sample Collection

Take the following steps to collect and process the surface water samples:

1. Remove the protective cap from the sampling tube and lower the sampler gently below the water surface.
2. To sample water near the surface, submerge the sample tubing inlet approximately 1 m (3 ft) below the surface of the water column (consult project-specific SAP for exact sampling water depth).
3. To sample water near the bottom, submerge the sample tubing inlet approximately 3 m (9 ft) above the bottom (consult project-specific SAP for required distance) with the help of the A-frame or davit. If it is necessary to sample surface water at a fixed depth from the bottom, adjust the vane height on the sampler while the sampler rests on the bottom surface. The vane will maintain the sample tubing inlet into the current at a constant depth between 30 cm (12 in.) and 1 m (3 ft) above the sediment–water interface.



ED_004850_00001502-01045

4. Begin collecting measurements of water quality parameters at each depth using the water quality meter (e.g., YSI, Hydrolab, Horiba). Set data collection intervals according to data needs. If a vertical water column profile is needed, set the multi-probe to collect data every 1 second for a high-resolution profile. If sampling a vertically integrated water column with several round trips to the bottom, reset the multi-probe to collect data at time intervals relative to the sampling time period after the initial high resolution profile. For example, if sampling a vertically integrated water column during a period of 2 hours, set the multi-probe to record data every 1 second for the first roundtrip to the bottom and then reset to record data every 5 minutes for the subsequent roundtrips until sampling is complete. If collecting surface water at a stationary location for more than 1 hour, and no major changes in water quality are expected, set the multi-probe to collect data every 15 minutes.
5. Note: Failure to adjust the multi-probe for data collection according to sampling periods can result in data loss. That is, if the multi-probe memory bank is quickly filled early in a long sampling period, no additional data will be stored in the memory bank for the remaining sampling time.
6. Record the water quality measurements on the Water Sampling Log forms every 15 minutes during sample collection. If the surface water sample collection is completed within 15 minutes, then collect water quality parameters at least three times: at the beginning, middle, and end of sample collection.
7. Switch the pump on and pump surface water through the sample tubing and into the mixing containers. Once the water reaches one-third of the container's volume, turn on the stir plates.
8. Turn off the pump once the mixing containers have been filled to 1 in. below the inflow spout or when sufficient volume has been collected to fill all of the sample bottles at a given station.
9. Place the C-Flex section of the outflow tubing kit from the first container to be sampled inside the small peristaltic pump head and clamp firmly.
10. Before turning on the small pump, make final adjustments to the stand, holding the outflow spout as close as possible to the sample bottle opening, but without touching the inside of the bottle.
11. Fill container to the "neck" with unfiltered sample water.
12. After collecting the unfiltered samples, attach the 0.45-µm filter cartridge (or appropriate pore size filter) to the sample tubing outlet and secure it to the stand with a clamp (consult project-specific SAP to determine if filtered samples are required). Drain the storage solution inside the filter, and flush the entire sample tubing and filter assembly with sample water. Discard this first "rinse" of sample water.



ED_004850_00001502-01046

13. After rinsing the filter and sample tubing, fill the sample bottle to the "neck" with filtered sample water. (Note: If dissolved constituents are being analyzed [per the project-specific SAP], then discard the 0.45-µm filtration cartridge after each sampling site.)
14. As soon as a sample container is filled, turn off the peristaltic pump and label the container. Include the date, time, project name or number, sample ID, type of analysis required, and sampler initials on the label (see SOP AP-04).

Once a surface water sample container is properly closed and labeled, place it inside a cooler containing wet or blue ice and store it at approximately 4°C. Store all samples in coolers with ice on board the vessel and transfer them to the field laboratory (if applicable) at the end of the sampling day.

## Water Quality Measurements

If specified in the project-specific SAP, measurements of physical and chemical water parameters may need to be collected at surface water stations. Several physical and chemical water parameters are best measured in the field because of the unstable nature of the parameter or because the information is needed to direct further sampling. It is frequently preferable to perform these analyses in the field, especially if the samples will not be immediately transported to the analytical laboratory (pH, in particular, should be measured in the field if feasible). In addition, measurements of temperature and transparency can be accurately collected only in the field.

It is always best to place the water quality meter directly into the surface water body at the station location at the desired water depth instead of collecting a sample and measuring parameters in a container. However, if this is not possible, use a plastic bucket to collect samples for water quality analyses (e.g., pH, temperature, and conductivity). Rinse a clean bucket twice with the water from the station prior to measuring water quality parameters.

The name(s) of the person(s) making the measurement and the field equipment used to make that measurement must be recorded in the field logbook and on any field forms used during the sampling event. Equipment maintenance and calibration records must be kept in logbooks and field records so that the procedures are traceable.

## Sample Handling

Gloved hands are required for sample collection and handling, as described above. Field staff will wear appropriate non-contaminating, disposable, powderless nitrile gloves during the entire sampling operation. Change gloves frequently, usually with each change in task (wearing multiple layers of gloves allows rapid glove changes).

Gloved hands are required for all operations that involve equipment that comes into contact with the sample, including the following activities:



ED_004850_00001502-01047

- Handling the sample bottle
- Handling the discharge end of the sample tube or line
- Setting up working space inside the processing and preservation chambers
- Setting up the equipment (i.e., the sample bottles, mixing containers, and the filtration and preservation equipment) inside the chambers
- Working inside the chambers during collection, processing, and preservation
- Handling the filter (if needed)
- Changing the chamber covers as needed.

Ungloved hands take care of all operations that involve contact with potential sources of contamination, including the following activities:

- Working exclusively exterior to the processing and preservation chambers
- Preparing a clean workspace (inside boat)
- Preparing and operating the sampling equipment, including the pumps and discrete samplers, peristaltic pump switch, pump controller, and manifold system
- Handling the generator or other power supply for samplers
- Handling the tools, such as hammers, wrenches, keys, locks, and sample-flow manifolds
- Handling the single or multi-parameter instruments for field measurements
- Setting up and checking the field-measurement instruments
- Measuring and recording the water depths and field measurements.

Store all samples in coolers with ice at approximately 4°C on board the vessel and transfer them to the field laboratory (if applicable) at the end of the sampling day. The sampling team leader is responsible for maintaining sample integrity throughout the sampling event.

If storage freezers or refrigeration units are available at the field laboratory, monitor these units daily to ensure temperature compliance. Each unit will have a separate log form containing date, time, and temperature information.

Avoid contaminating samples by handling the sample containers with clean gloves and transferring the samples into clean refrigerators (or clean coolers) immediately after the samples have been brought back from the field. Always wear disposable, powderless nitrile gloves when handling samples. This includes any and all sample handling that may occur during sample packing and shipping (see SOP AP-01).



ED_004850_00001502-01048

## RELATED SOPS

- Pack and ship all surface water samples in accordance with procedures outlined in SOP AP-01.
- Record field activities in accordance with procedures outlined in SOP AP-02.
- Maintain sample custody in accordance with procedures outlined in SOP AP-03.

## REFERENCES

David, N., D. Bell, and J. Gold. 2001. Field sampling manual for the Regional Monitoring Program for Trace Substances. San Francisco Estuarine Institute, San Francisco, CA.

USEPA. 1996. Method 1669 – Sampling ambient water for trace metals at EPA water quality criteria levels. U.S. Environmental Protection Agency, Office of Water Engineering and Analysis Division (4303). Washington, DC.

USGS. [various dates]. National field manual for the collection of water-quality data: U.S. Geological Survey techniques of water-resources investigations, Book 9, Chap. A1-A9. Available online at http://pubs.water.usgs.gov/twri9A. U.S. Geological Survey. Accessed February 5, 2008, at http://water.usgs.gov/owq/FieldManual/index.html#Citation.



ED_004850_00001502-01049

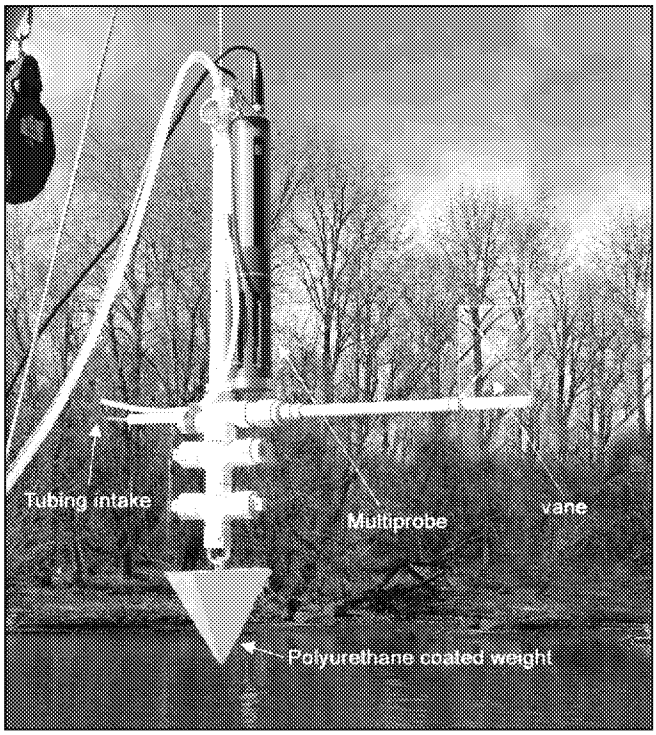



Figure 1a. Near-Surface Water Sampler

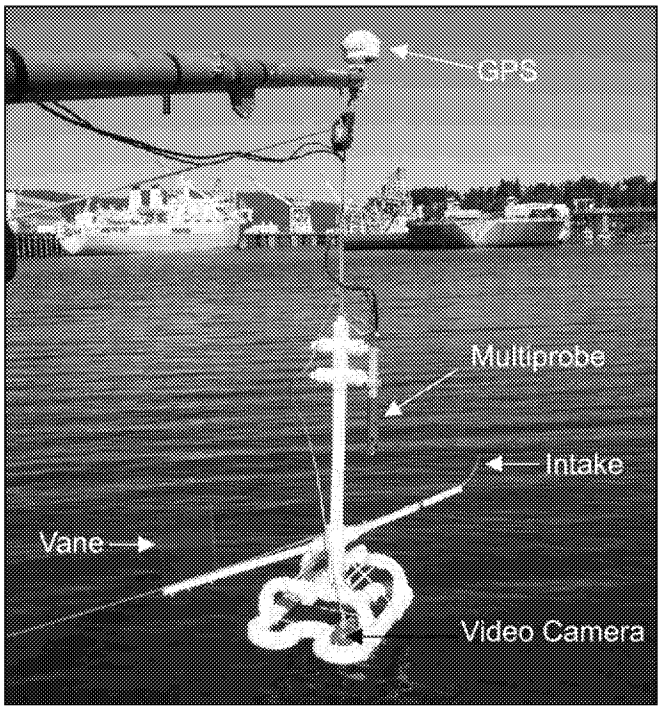



Figure 1b. Near-Bottom Water Sampler



ED_004850_00001502-01050

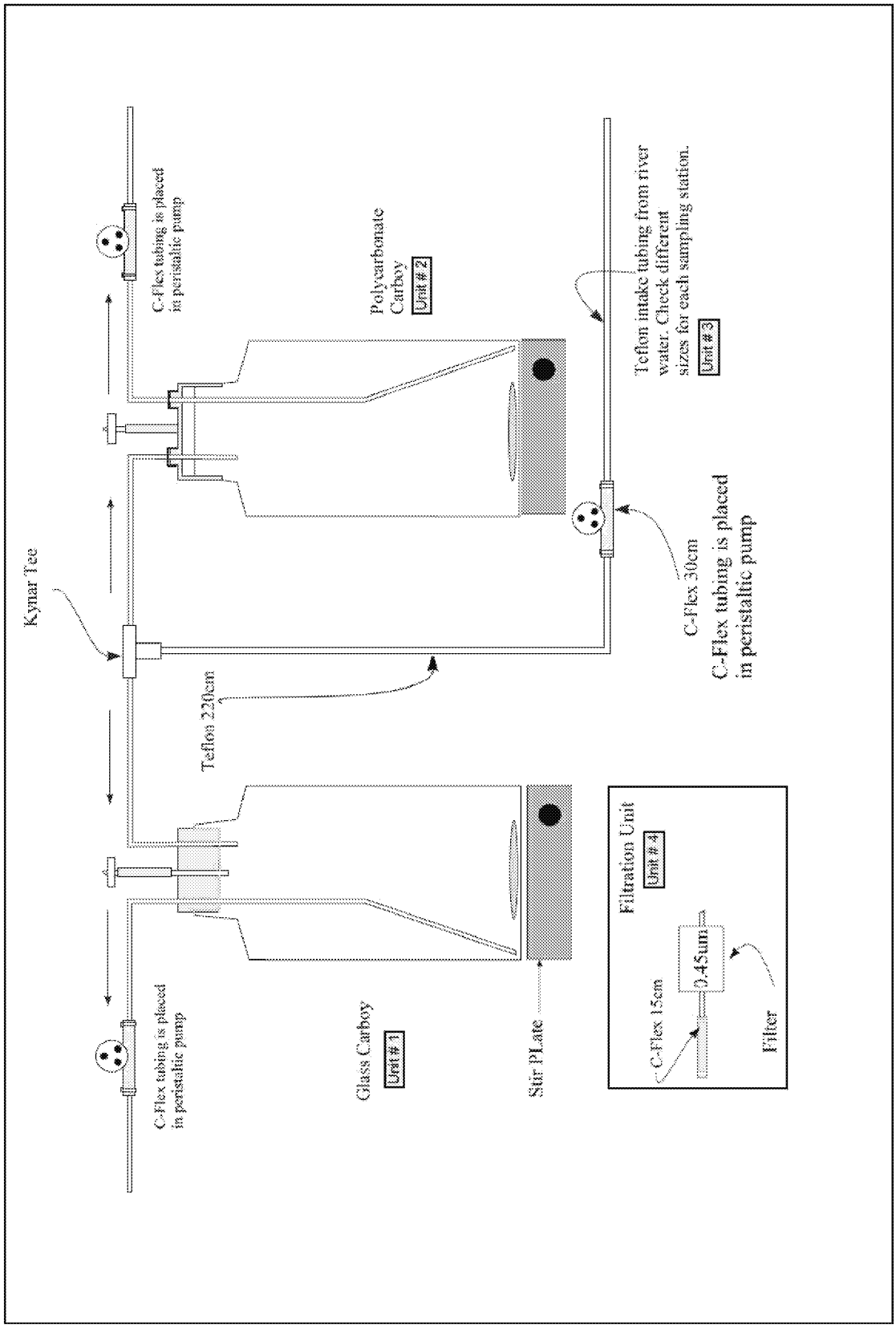



Figure 2. Peristaltic Pump Sampling Apparatus



ED_004850_00001502-01051

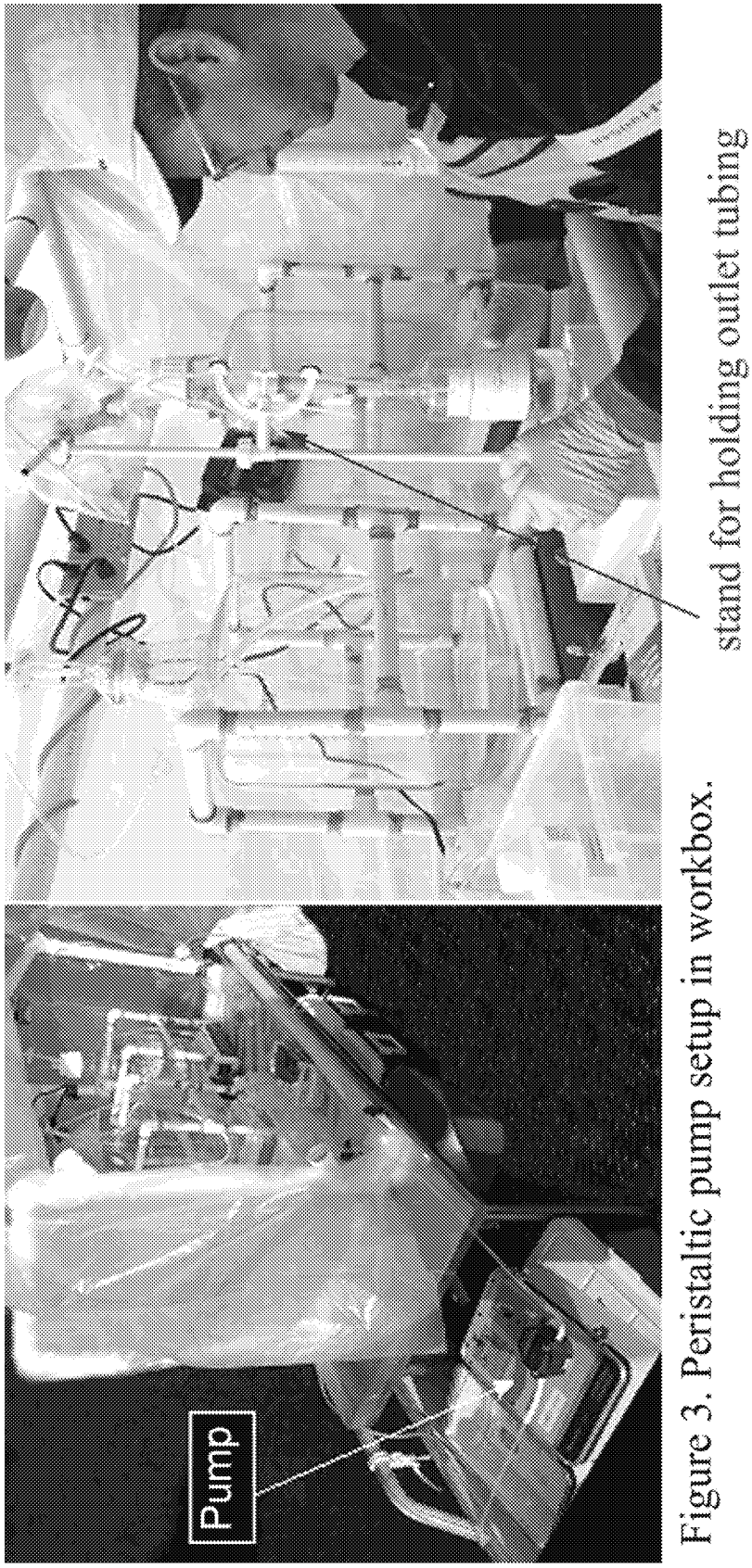



Figure 3. Peristaltic pump setup in workbox.



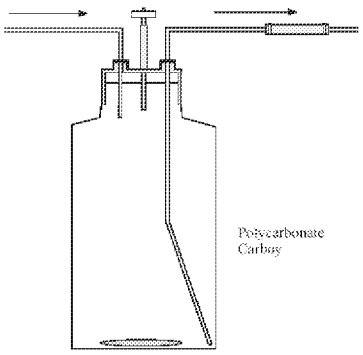
ED_004850_00001502-01052

## ATTACHMENT 1. CHECKLIST OF SUPPLIES FOR SURFACE WATER SAMPLING WITH PERISTALTIC PUMP

All sampling equipment described here will be sent to Battelle Marine Laboratories at Sequim, Washington, or other approved laboratory for decontamination and assembly prior to sampling. Each unit below shall be wrapped in plastic bags and clearly labeled on the outside in large letters.

### UNIT #1

*For polycarbonate carboys*




**Teflon**

| | |
|---|---|
| 50 cm | for inflow from Kynar tee into carboy |
| 140 cm | for outflow from carboy to small peristaltic pump |
| 60 cm | for outflow from small peristaltic pump to sample bottle |

**C-Flex**

| | |
|---|---|
| 6 cm | for connecting air filter on carboy (additional internal tubing is not needed) |
| 30 cm | for connecting outflow tubing from carboy to tubing for filling sample bottles |

**Other**

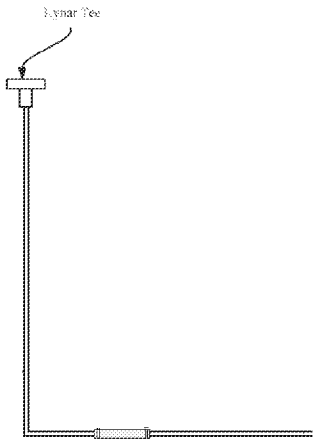
3-in. stir bar
Vacu-guard filter
2 small plastic zip-ties for C-Flex tubing

The total number of bags labeled UNIT #1 will depend on the number of sampling stations per specific sampling event.



ED_004850_00001502-01053

## UNIT #2




*From sample intake tubing to large peristaltic pump to carboys*

**Teflon**

| | |
|---|---|
| 220 cm | for inflow from large peristaltic pump to Kynar tee |

**C-Flex**

| | |
|---|---|
| 30 cm | for connecting Kynar tee and inflow tubing to variable lengths of sampling intake tubing |

**Other**

| | |
|---|---|
| Kynar tee | for connecting carboys to intake tubing<br>Variable lengths of sampling intake tubing (station dependent) to large peristaltic pump |

**Teflon**

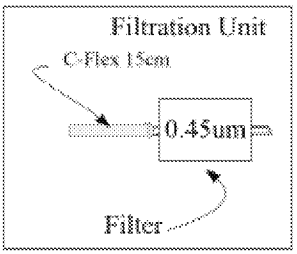
| | |
|---|---|
| 40 to 100 m | for near-bottom sampling at transect stations |
| 8 m | for near-surface water sampling at any station |
| 15 m | for near-bottom sampling at shallow stations |

The total number of bags labeled UNIT #2 will depend on the number of sampling stations per specific sampling event.

## UNIT #3

*Set of one filter in line*

**C-Flex**




| | |
|---|---|
| 15 cm | for connecting the filter to the outflow from small peristaltic pump to sample bottle |

**Filter**

| | |
|---|---|
| 0.45 μm | Whatman POLYCAP 36 TF |

**Other**

Small plastic zip-tie for C-Flex tubing

Loose small plastic zip-tie (extra zip-tie to be placed in bag to connect to carboy outflow)

The total number of bags labeled UNIT #3 will depend on the number of sampling stations per specific sampling event.



ED_004850_00001502-01054

# YSI WATER QUALITY PARAMETERS SAMPLE LOG

Survey _____ Crew _____ Date _____

| Station | Time | Temp (C) | Conduc-tivity (µS/cm) | DO (mg/L) | Depth (m) | pH | ORP (mV) | Turbidity (NTU) | Comments/Observations |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |



ED_004850_00001502-01055

# STANDARD OPERATING PROCEDURE (SOP) SW-05

# SURFACE WATER SAMPLING USING GRAB SAMPLERS

## SCOPE AND APPLICATION

This SOP describes methods for sampling surface water from freshwater bodies (e.g., creeks, rivers, lakes, ponds) or from estuarine and marine systems (e.g., estuaries, embayments, open ocean). These methods were developed based on Greenberg et al. (1985) and USEPA (1991). Not all of the sampling methodologies discussed in this SOP may be required for a given project. The specific sample collection techniques and associated sampling equipment will be detailed in the project-specific sampling and analysis plan (SAP).

## STATION ACCESS

Prior to entering select areas, it may be necessary to acquire property access permission from the landowner. Access permission must be acquired in advance of the sampling program and may require a written agreement. Surface water stations may be accessed by boat, wading, or standing on the shore or other structure (e.g., bridge) and extending a sampling device into the water body.

## STATION LOCATION

When sampling in proximity to the bottom of a water body, surface water samples must be collected in a manner that avoids resuspending sediments into the sample being collected or samples that will be collected at other downstream or downcurrent stations. Therefore, if it is necessary to enter the water to sample (i.e., wade), care must be taken to avoid resuspending sediment into the water column. To avoid resuspended sediment interference in the sample being collected, stations should always be approached from downstream. Avoid sampling near eddies that may circulate water from the sampling location to upstream of the sampling location. To avoid interference from resuspended sediment at other stations, samples should be collected beginning with the most downstream station and continuing in an upstream direction.

Water samples should be collected in areas that are representative of the surface water body conditions. A station that is located away from immediate point sources (e.g., tributaries and industrial and municipal effluents) is preferred for collecting surface water samples unless



ED_004850_00001502-01056

sampling is designed to assess these sources. Representative samples can usually be collected in portions of the surface water of a river that have a uniform cross-section and flow rate. Because mixing is influenced by turbulence and water velocity, the selection of a site immediately downstream of a riffle area (e.g., fast flow zone) will ensure good vertical mixing.

Whenever possible, a depth-integrated sample (as well as a width-integrated sample) should be collected from flowing water bodies. This is particularly true for data that will be used in mass balance calculations. When sampling is performed to assess the effects of a tributary or discharge on receiving water chemistry, some calculations may be needed prior to sampling to estimate appropriate distances downstream and across the stream to characterize concentrations. It is common for streams to be incompletely laterally mixed for downstream distances of 50 times the stream width, or more. Guidance on mixing rates can be found in *Mixing in Inland and Coastal Waters* (Fischer et al. 1979).

Tributaries should be sampled as near the mouth as is feasible. However, it is important to select the sample location taking into consideration the impact that the downstream receiving water body has on the tributary flow and sediments. The downstream body may affect the tributary by decreasing water velocity (causing suspended solids to settle) or by eddies (causing mixing of the two waters). The downstream water body may change the water quality (e.g., salinity), temperature, or turbidity in the tributary near its mouth.

Attention must be given to identifying intakes and outflows within lagoons or settling ponds, which may cause localized concentrations that are not representative of general conditions. Sample locations adjacent to structures (e.g., banks, piers) may also have biased characteristics as a result of flow or release of substances from in-water structures. These kinds of possible confounding factors should be noted in the field logbook. For ponds, lakes, and large rivers that may be vertically stratified, a multi-parameter water quality meter can be used to collect depth profiles throughout the water body to aid in the selection of appropriate sampling points and depths.

## SURFACE WATER SAMPLE COLLECTION

Appropriate surface water sampling techniques and equipment are designed to minimize effects on the chemical and physical integrity of the sample. Different kinds of surface water sampling techniques and equipment are discussed in the following sections. The project-specific SAP should be consulted to determine the appropriate surface water sampling techniques and associated sampling equipment.

In general, if both surface water and sediment samples are to be collected from the same location, the surface water samples should be collected first. Every attempt should be made to keep floating debris from entering the sample bottles, which could result in unrepresentative analytical data. Sample collection when the flow depth is minimal (i.e., less than a few inches) will require special consideration to prevent sediment disturbance. If water depth is shallow



ED_004850_00001502-01057

and sampling equipment will come into contact with the sediment surface, then a small excavation in the stream bed to create a "sump" for sample collection may be permissible, but it should be prepared well in advance of the sample collection event to allow sediment to settle. This technique should be considered very carefully because digging a depression may expose the surface water to other possible contaminants and natural compounds such as sulfides, phosphates, and ammonium. In addition, certain sediment types will crumble as a hole is dug up and will not support enough depth for bottle dipping. A peristaltic pump may be needed (consult project-specific SAP and field conditions).

As mentioned above, surface water samples shall be collected moving in an upstream or upcurrent direction, in accordance with the following procedure:

1. Immediately after collecting the sample, record the temperature, dissolved oxygen, pH, turbidity, and specific conductance using a water quality meter (e.g., YSI, Horiba®, or equivalent) and following the manufacturer's specifications.
2. If stipulated in the project-specific SAP, collect a water depth measurement at every surface water station.
3. Target analytes, container types, and preservatives are specified in the project-specific SAP. In general, when collecting surface water samples for a variety of analyses, collect them in the following order:
   - Samples for analysis for volatile organic compounds (VOCs)

     Note: When collecting samples for VOC analysis, let the water flow down the side of the sample container to minimize aeration. Hold caps in hand to minimize contamination of sample. Fill all VOC sample containers to the top. A positive meniscus at the top of the container will help ensure that no air is trapped inside when cap is screwed down on the container. No air bubbles should be trapped in the sample when the container is sealed. VOC sample bottles must be checked after filling to ensure no air bubbles are present. Invert the bottle and lightly tap it to release any bubbles beneath the cap. If an air bubble is present, the VOC sample must be retaken using a fresh bottle.
   - Samples for analysis for dissolved gases and total organic carbon
   - Samples for analysis of semivolatile organic compounds
   - Samples for analysis of metals and cyanide
   - Samples for analysis of major water quality cations and anions
   - Samples for radionuclides.



ED_004850_00001502-01058

4. Collect quality assurance and quality control (QA/QC) samples (i.e., duplicate, equipment rinsate, trip blank, laboratory matrix spike, and laboratory matrix spike duplicate, as applicable) at the same time by filling all bottles from the same flow. The number and types of QA/QC samples are specified in the project-specific SAP.
5. Label sample bottles with the date, sample number, time, sampler's name, and type of preservative, as described in the project-specific SAP and in accordance with SOP AP-04. Sample bottles must be placed in a cooler and on ice to keep the sample cool (4°C). Samples must be cooled continuously from time of collection to the time of receipt at the laboratory, as described in SOP AP-01.
6. Complete sample logs, labels, custody seals, and chain-of-custody forms. Record sample information in the field notebook. The depth in the water column where the sample is collected *must* be recorded in the field logbook.

## Dipping Using Sample Analysis Bottle

In some cases, water is collected directly from the water body into the bottle that is sent to the laboratory for analysis. This surface water sampling technique is appropriate only if a composite sample is not required for analysis (i.e., only filling one sample bottle per station). If compositing is required, then a decontaminated churn splitter or mixing container will need to be used (see discussion below).

When collecting samples in a riverine environment, approach the station from downstream of the sampling location and face upstream to collect the sample without disturbing the sediment. Using a bottle attached to a dip stick or wearing nitrile gloves to hold the bottle, quickly immerse the inverted sample bottle through the surface of the water to the desired sampling depth and then tilt the opening of the bottle upstream to fill. If possible, samples should be collected approximately one-third of the distance from the surface to the bottom, and the sample bottle should be completely submerged. Note: If collection is done too slowly, the film at the surface of the water will be collected; water must be collected from below the air–water interface.

Be careful not to displace the preservative from a pre-preserved sample container (e.g., VOC vial). If water is needed to fill bottles that contain preservative, then collect water with a clean bottle and pour this water into the sample bottle that contains the preservatives.

## Specific Depth Interval Sampler

If surface water samples are required from a specific depth, a standard Kemmerer, GO-FLO™, Niskin bottle, or Van Dorn sampler, or plastic tubing with a peristaltic pump may be used. The Kemmerer, GO-FLO™, and Niskin bottle samplers are stainless steel or acrylic cylinders with closures at each end that leave the ends of the sampler open while being lowered in a vertical position through the water column to allow free passage of the water through the



ED_004850_00001502-01059

cylinder. The Van Dorn sampler is similar in construction, but is lowered in a horizontal position through the water column. In each case, the sampler is lowered to the desired depth and a messenger is sent down a rope or cable that causes the sampler to close. The sampler is then raised to the surface. Water is removed through a valve to fill sample bottles. If the sampler needs to be reused during the sampling event (e.g., at different stations), then the sampler must be decontaminated between stations.

Note: The analyte list in the project-specific SAP should be reviewed prior to sample collection to determine if a Teflon™-coated sampler is required.

## GO-FLO™ Bottle Sampler

GO-FLO™ bottle samplers are fabricated by General Oceanics Inc. 1295 N.W. 163rd Street, Miami, Florida 33169 USA. The specific model depicted here is a 20 L GO-FLO™ 1080 series (General Oceanics, http://www.generaloceanics.com/genocean/1080.htm).

**Description**: Close-open-close operation. Opens automatically (hydrostatic pressure activated) at approximately 10 m (33 ft), and then flushes until closed by standard GO Devil messengers (Model 1000-MG) individually, serially, or sequentially by remote command with Model 1015 Rosette multi-bottle array, or with Model AR1015 Acoustic Command Control. (See data sheet 1015-12/85.) Inert gas can be injected into bottle to force retrieved sample out of sampling valve, directly through filter system. The GO-FLO™ sampling bottle avoids sample contamination at the surface, internal spring contamination, loss of sample on deck (internal seals), and exchange of water from different depths.

**Material**: Rigid PVC tube section, ball valve, handles and cable clamp blocks. Delrin stopcocks and push rod. Stainless steel cable clamp bolts. Latex external spring, Viton and silicone O-ring seals. Monofilament nylon and Kevlar lanyards.

**Inert Gas Connection:** Dual-purpose air vent pressure release valve with standard 9/16-18 thread for connecting inert gas line. (Operation requires additional fitting - part S1080-AFIT.)

**Closure:** Ball valve with Viton and silicone seals.

**Health and Safety**: All hands on deck must be wearing appropriate personal protective equipment (i.e., hard hats, personal flotation device, steel-toed boots, and gloves) (Figure 1). People in charge of handling the GO-FLO™ bottle must have read the instruction manual and be familiar with the proper use of the sampling equipment, must have read the project-specific health and safety plan, and must have participated in a safety meeting debrief on the hazards associated with sampling equipment of the specific research vessel used for that project.



ED_004850_00001502-01060

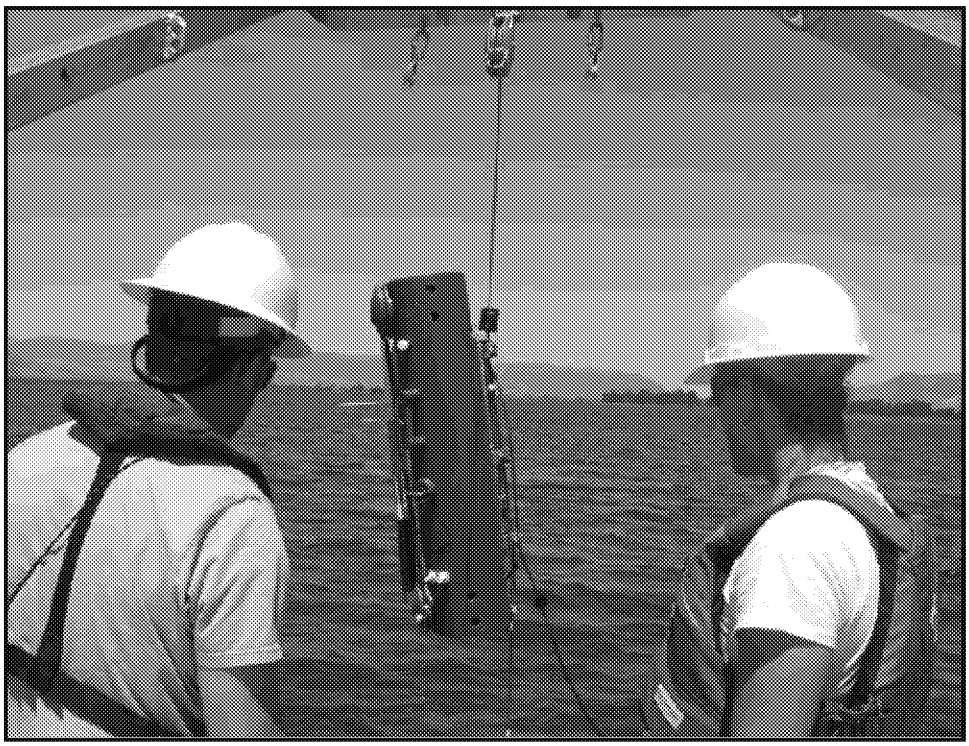


Figure 1. Proper Personal Protective Equipment

**Trace Metal Analyses**: If trace metal analyses are required, the interior of the GO-FLO™ bottle must be Teflon™ coated. Decontamination procedures for trace metals are described in Mason and Sullivan (1996) and are outlined in SOP SW-15 for laboratory decontamination and SOP SW-01 for field decontamination. Decontaminated GO-FLO™ bottles must be wrapped in plastic bags to prevent any contamination from airborne dust particles or exhaust fumes from power generators and boat engines. Additional plastic bags or clean nitrile gloves must be wrapped around the sampling spigots and removed only at the last minute before deployment. A non-metallic wire (e.g., Technora™, Kevlar™) must be spooled on a winch that will deploy the GO-FLO™ bottle. The non-metallic wire must be rated to safely support the weight of a bottle filled with water plus ancillary equipment such as bottom weight, water quality multiprobe meter, underwater video camera, and stainless steel frame if multiple bottles are deployed at the same time. Prior to the collection of water samples, GO-FLO™ bottles are checked for defects and to ensure the opening and closing mechanisms are operational.

**Pre-deployment Checks**: The bottle must be secured in a transport box or shipping crate that can also be used as a secure platform for deployment and retrieval of the unit. The GO-FLO™ bottles are pre-cocked before deployment. During the cocking procedure, the GO-FLO™ bottle is either placed on a clean plastic sheet/bag on the floor or handheld if it is a small volume bottle (i.e., less than 20 L). The cocking procedure consists of the following:



ED_004850_00001502-01061

- Rotate the bungee cord attached to the ball valve so that the plastic ball string is loose. Figure 2 shows how the bungee cord is wrapped around the ball valve wheel in order to loosen tension on plastic ball string. In this instance, residual water flows out of the bottle.

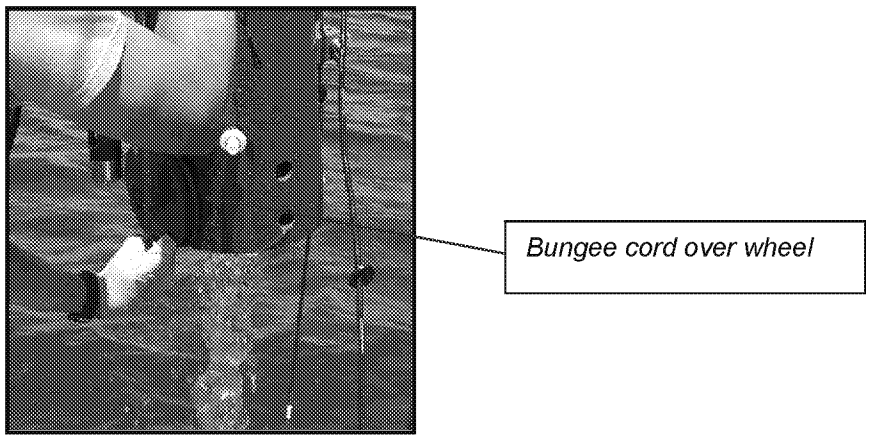



Figure 2. Release Tension on Ball Valve

- Position the plastic balls on the string around the pressure release valve and pull the pressure release valve outward locking the two plastic balls between the valve and the U-shaped stainless steel wire located on the middle of the bottle just below one of the PVC handles (Figure 3).

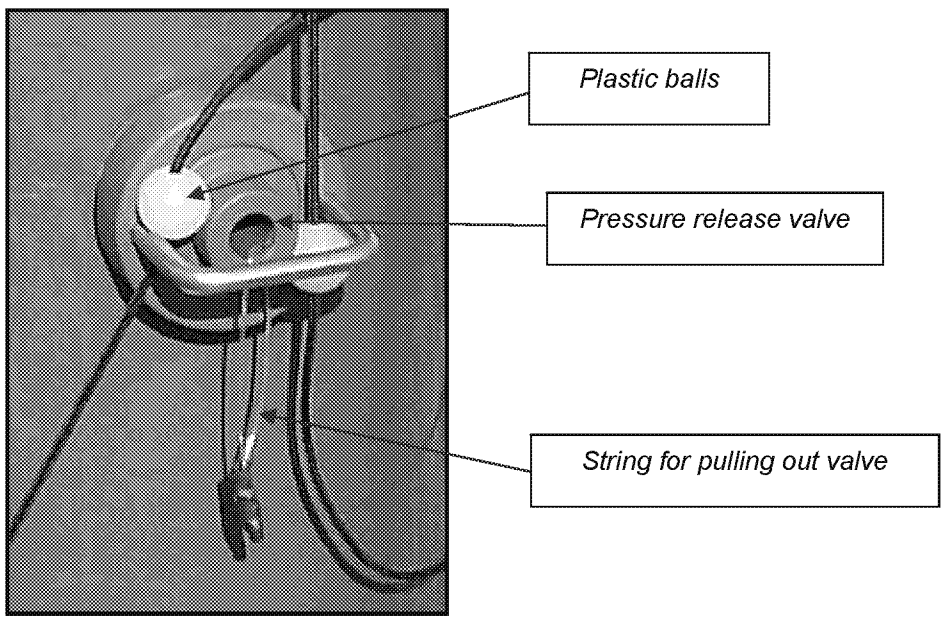



Figure 3. Pressure Release Valve in Cocked Position



ED_004850_00001502-01062

- Rotate the bungee cord attached to the ball valve back so that both the string and the cord are under tension (Figure 4).

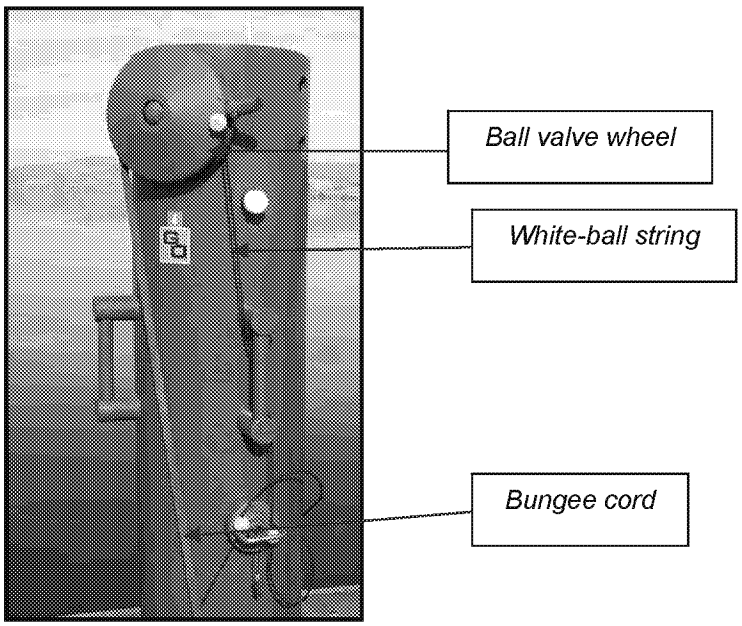



Figure 4. Bungee Cord on Cocked Position

- Perform the following checks to ensure the GO-FLO™ sampler has been properly cocked.
  - Push the pressure release valve and ensure the balls' valves move to the open position.
  - Press the push rod release mechanism to release the string, which should cause the bottle to close (Figure 5).

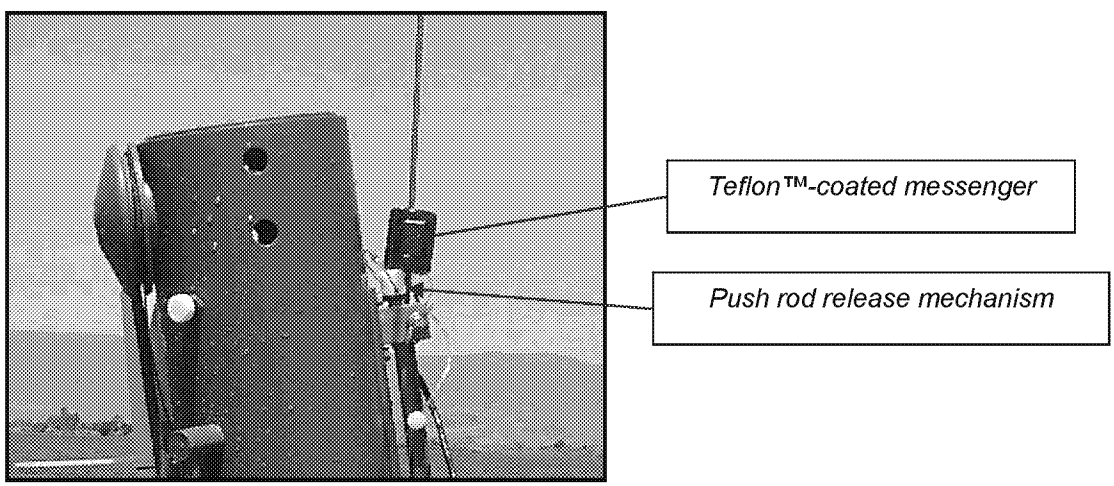



Figure 5. Push Rod Triggering Mechanism with Messenger Deployed



ED_004850_00001502-01063

- Recock the bottle after this check as described earlier.
- Check that vent valve is turned all the way in and that sampling spigots are pulled out and white flange twisted away from release pin before deployment (Figure 6).

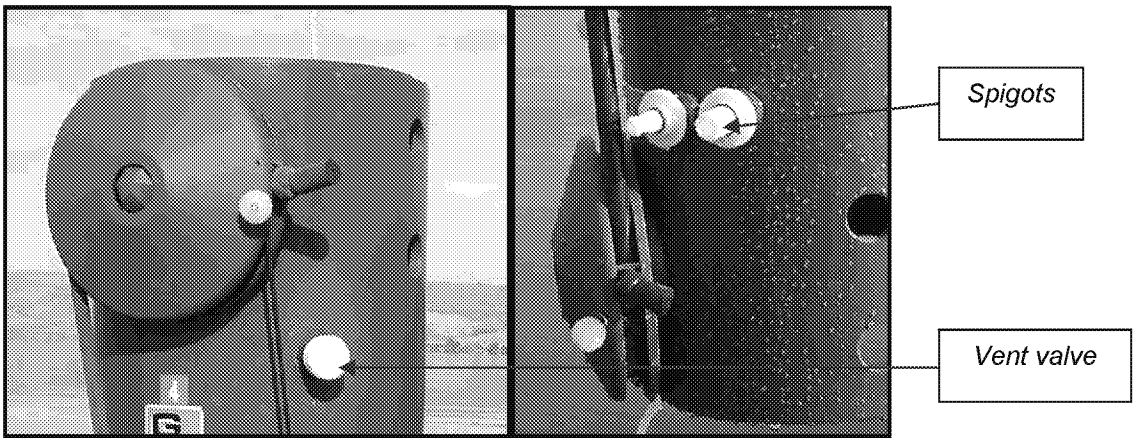



Figure 6. Vent Valve at Top End of Bottle and Sampling Spigots at Bottom End of Bottle

**Deployment**: Before deploying the sampler, make sure any ancillary equipment, such as multiprobe (Figure 7) and underwater video camera, is attached to the bottle and a non-metallic or polyurethane-coated weight (approximately 100 lb) is attached to the end of the Kevlar line. The weight is lifted overboard and at least 10 m of line is let out prior to the GO-FLO™ bottle attachment depending on water depth. If near bottom sampling is required, the distance between the GO-FLO™ bottle and the bottom weight must be adjusted.

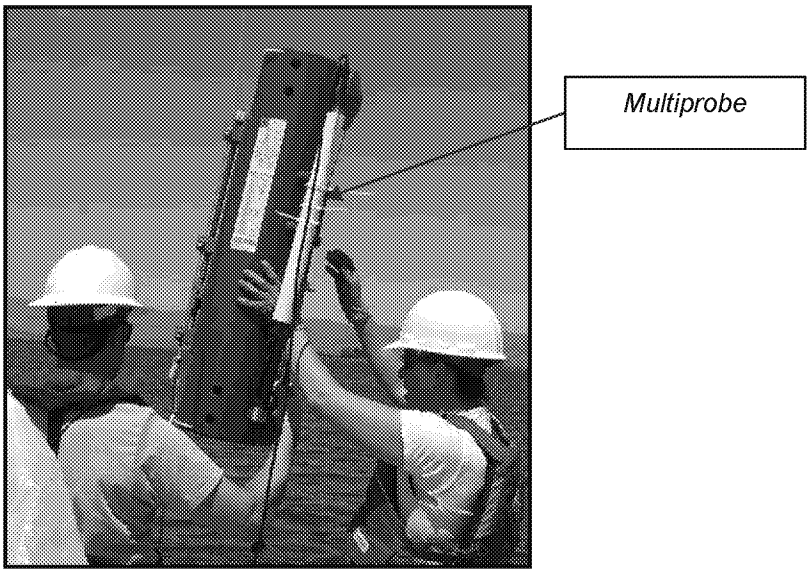



Figure 7. GO-FLO™ Bottle with Multiprobe Attached to Handle prior to Deployment



ED_004850_00001502-01064

Quickly lower the bottle down into the water to about 15 m so that the pressure valve is activated to open the two ball valves at each end of the bottle when the bottle reaches a water depth of 10 m. If the bottle is lowered too slowly, water will seep into the bottle and the pressure gradient between the inside of the bottle and the outside water column will not be sufficient to trigger the valves open. Bubbles should rise to the surface as the pressure release valve opens the GO-FLO™ underwater. Bubbles rising to the surface are indicative that the bottle is in the open position. If bubbles are not seen, it is possible that the bottle has not opened, although bubbles sometimes cannot be seen because of light scattering or choppy water surface. The bottle can be raised slowly to just beneath the water surface so that personnel looking over the side can see if the bottle has opened. If the bottle is not visible, do not bring it above the surface. If it is in the open position, contact with air or surface water oily microlayer can contaminate the lining of the bottle. If the water is rough or turbid, it is better to assume the bottle is open. After verifying that the bottle is open, lower it to the desired sampling depth. Attach the messenger to the line and release it. The messenger will trigger the bottle closed. Wait for the messenger to reach the bottle, before retrieving the GO-FLO™ bottle. When the bottle is retrieved to deck level, the person who attached the bottle to the line will disengage it, carry or slide it with the help of the winch, and secure it to the designated clean workspace. Once in the clean workspace, the GO-FLO™ bottle is placed upright and the air release valve is opened and the sample is decanted or pumped into the sample containers (Figure 8). Trace metal clean sampling procedures will be used that follow the EPA clean-hands technique (USEPA 1996) and SOP SW-04 instructions.

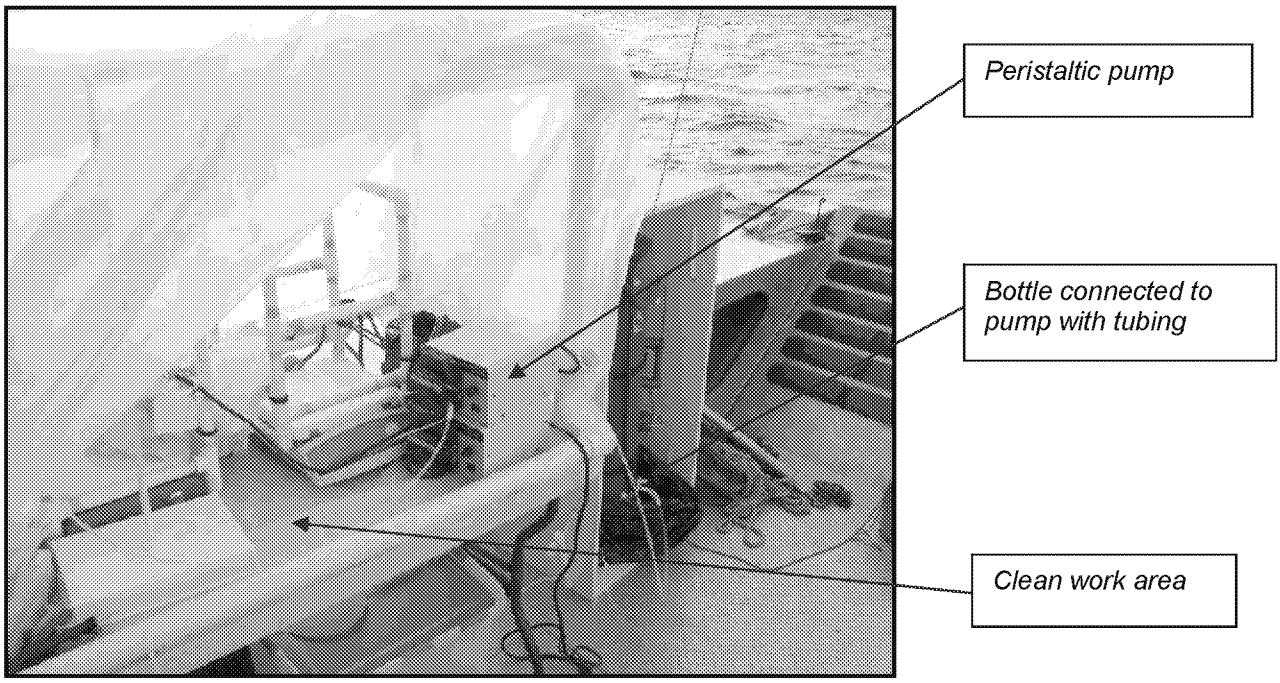



Figure 8. Typical Setup for Sampling with Peristaltic Pump



ED_004850_00001502-01065

## FIELD FILTRATION

In some cases, field filtration may be required (recommended for inorganic compound analysis). If applicable, attach a new, disposable filter cartridge (typically 0.45 μm) to the discharge line. Filtered water should be introduced directly into the appropriate sample container. Alternate field filtration methods may be specified in the project-specific SAP. Note: Although not recommended, the laboratory can filter the samples if the samples are NOT preserved and are filtered within 24 to 48 hours of collection.

## WATER QUALITY MEASUREMENTS

If specified in the project-specific SAP, physical and chemical water parameters may need to be collected at surface water stations. Several physical and chemical water parameters are best measured in the field because of the unstable nature of the parameter or because the information is needed to direct further sampling. It is frequently preferable to perform these analyses in the field, especially if the samples will not be immediately transported to the analytical laboratory (pH, in particular, should be measured in the field if feasible). In addition, measurements of temperature and transparency can be collected accurately only in the field.

It is always best if the water quality meter is placed directly into the surface water body at the station location at the desired water depth instead of being placed into the container in which the sample is collected. However, if this is not possible, a clean plastic bucket can be used to collect samples for water quality analyses (e.g., pH, temperature, and conductivity). The bucket should be rinsed twice with the water from the station prior to measuring water quality parameters.

The name(s) of the person(s) making the measurement and the field equipment used to make that measurement must be recorded in the field logbook. Equipment maintenance and calibration records must be kept in logbooks and field records so that the procedures are traceable.

## RELATED SOPS

- Record all field activities in accordance with procedures outlined in SOP AP-02.
- Package and ship surface water samples in accordance with procedures outlined in SOP AP-01.
- Maintain sample custody in accordance with procedures outlined in SOP AP-03.



ED_004850_00001502-01066

## REFERENCES

Fischer, H.B., E.J. List, R.C.Y. Koh, J. Imberger, and N.H. Brooks. 1979. *Mixing in inland and coastal waters.* Academic Press. New York.

Greenberg, A.E., R.R. Trussell, and C.S. Clesceri (eds). 1985. *Standard methods for the examination of water and wastewater*. 16th Edition. American Public Health Association, Washington, DC. p. 37.

Mason, R.P., and K.A. Sullivan. 1996 Standard operating procedure for site selection and sampling for mercury in Lakewater. Chesapeake Biological Laboratory University of Maryland. Solomans, MD. June 26, 1996.

USEPA. 1991. Environmental investigations standard operating procedures and quality assurance manual. U.S. Environmental Protection Agency, Region 4, SESD, Athens, GA. 424 pp.



ED_004850_00001502-01067

# STANDARD OPERATING PROCEDURE (SOP) SW-06

# MEASUREMENT OF SURFACE WATER FIELD PARAMETERS

This SOP is based on the procedures outlined in *Field Measurements: U.S. Geological Survey Techniques of Water-Resources Investigations* (Wilde various dates).

## SCOPE AND APPLICATION

Information and general instructions for field measurement of water quality parameters (pH, Eh [oxidation-reduction potential, ORP], specific conductance, dissolved oxygen, and temperature) are presented below. Because the types and complexity of water quality meters available vary widely, calibration and measurement procedures should be conducted in accordance with manufacturer's recommendations for the specific meters used. The following information describes general procedures for the measurement of water quality parameters. Where possible, sampling should be conducted first in areas expected to be least affected by constituents of interest, followed by increasingly affected areas.

## EQUIPMENT AND REAGENTS REQUIRED

- Water quality parameter multimeter or meters specific to parameters of interest (i.e., temperature, dissolved oxygen, pH, transparency, turbidity, salinity, specific conductance, and ORP)
- Calibration solutions and deionized distilled water.

## PROCEDURES

Before any calibration takes place, allow the probe and all calibration solutions to acclimate to the ambient field temperature along for at least 1 hour.

Calibrate the meter(s) in the field at the beginning of each day of field or laboratory work when water quality parameters will be measured. If feasible, meters must be checked for drift with calibration standards after every 4 hours of continuous use. Otherwise, a final check must be done at the end of the sampling event. If drift is evident, recalibrate.



ED_004850_00001502-01068

1. Calibrate meter(s) in accordance with manufacturer's instructions using fresh (unused) calibration buffers and standards for each sensor.
2. Check slope reading with specifications (in operating manual) to verify slope is within the manufacturer's specified range.
3. Thoroughly rinse a 500-mL beaker or 8-oz jar with sample water. Discard sample water.
4. Rinse electrodes with sample water to acclimate them.
5. Fill beaker with fresh sample water.
6. Immerse electrodes in sample while swirling the sample, if needed, to provide thorough mixing. Turn on meter(s). If a flow-through cell is used, install probes and connect sample water to bottom port of flow-through cell, directing sample water up through the cell, exiting through the top port. Direct effluent tubing back in the water or into an appropriate container for storage and handling.
7. When the readings have stabilized, record the measurements displayed on the meter. It is important to determine that the correct units and unit scale are displayed on the meter and recorded for each parameter measured. Record and correct any problems encountered during measurement.
8. If available, field measurement results should be compared to previous measurements for quality control.

Several physical and chemical water parameters are best measured in the field because of the unstable nature of the parameter or because the information is needed to direct further sampling. It is frequently preferable to perform these analyses in the field, especially if the samples will not be immediately transported to the analytical laboratory (pH, in particular, should be measured in the field, if feasible). In addition, measurements of temperature and transparency can be collected accurately only in the field. Eight parameter measurements for water are described in the following sections of this SOP.

## Temperature

Measure water temperature with either an alcohol or digital thermometer. It is recommended that mercury thermometers not be used to avoid possible breakage and introduction of mercury into the environment and to remove a source of possible contamination to samples collected for the analysis of mercury. Measure temperature as soon as the sample is collected to obtain a measurement that is an accurate representation of the *in situ* sample temperature. All instruments used to measure temperature should be traceable to a National Institute of Standards and Technology temperature reference. In the case of digital thermometers, follow the calibration procedure recommended by the manufacturer, if provided. Multiprobes in



ED_004850_00001502-01069

general contain a temperature probe; check these probes against a calibrated thermometer before use. For more detailed procedures, see discussion in Wilde (2006).

## Dissolved Oxygen

Dissolved oxygen may be measured in the field by either a dissolved oxygen polarographic-membrane type sensor or a luminescent type sensor. Dissolved oxygen can also be measured by a field-portable Winkler titration kit.

It is recommended that calibration be done at temperatures that are at least within 10ºC of the ambient water temperature. The smaller the temperature difference is between the environmental water and the calibration chamber, the more accurate the calibration will be.

When using static samples (i.e., water sample collected in a container), protect samples from absorbing oxygen from the atmosphere by using a low or zero-headspace container. If using a meter and probe, calibrate the system according to the manufacturer's procedure prior to use with a zero oxygen standard and a second standard of known oxygen content. Check the second standard by performing a Winkler titration. Other probes are calibrated by percent oxygen saturation in an enclosed container with a small amount of water. When measuring dissolved oxygen with certain polarographic-membrane probe in water samples held inside zero-headspace containers, swirl or stir samples constantly until the reading stabilizes and the measurement is recorded. Stirring the sample is not necessary if a luminescent-sensor is used. For other probes, immerse the probe in the water column and monitor a constant measurement (dynamic measurement) until the readings are stabilized. Once the readings stabilize, record the oxygen concentration readings manually or digitally. For more detailed procedures, see discussion in Lewis (2006).

## pH

The pH of a water column sample can be measured in the field using a pH meter. Calibrate the meter according to manufacturer's specifications with at least two standards of known pH. The pH of these standards should bracket the expected pH at the sampling site. For example, if the pH at the sampling site is expected to be basic (pH 7 to 14), standards of pH 7.00 and 10.00 should be used to calibrate the meter. The pH of the buffer solution is temperature dependent. That is, pH 10 buffers change more per unit change in temperature than do pH 4 buffers. The temperature of buffer solutions must be measured, and temperature-correction factors must be applied before calibration adjustments are made. Calibration and operating procedures differ with instrument systems—check the manufacturer's instructions. If pH measurements at the sampling site do not fall within the initial calibration range, the meter should be recalibrated with appropriate standards and sample pH remeasured for those samples that fell outside the calibration range. For more detailed procedures, see discussion in Wilde et al. (2006).



ED_004850_00001502-01070

## Transparency

Water column transparency is measured with a Secchi disk, which is a weighted, black-and-white or all-white disk that is lowered into the water body on a calibrated rope or line.

Always perform these measurements from the side of the boat that faces away from the sun. Lower the disk slowly until it is no longer visible and then raise it until it is visible again. Record the depth, measured from the water surface, in feet or meters. The all-white disk may be preferable when the water transparency is high. However, either disk is acceptable to use.

## Turbidity

Turbidity can be measured in the field on static water samples contained in jars with a field-portable nephelometer (turbidity meter) or *in situ* with a turbidity probe mounted in a multiprobe device. Calibrate the meter prior to use with at least two standards of different but known turbidity (in nephelometric turbidity units, or NTUs). The two standards should bracket the range of turbidity measurements expected at the sampling site.

Perform field analysis for turbidity on static water samples as soon as possible after collection. If immediate analysis is not possible, agitate the sample prior to analysis to resuspend any settled solid material. If the sample temperature increases, air bubbles may form and cause erroneous values.

When performing field analysis for turbidity *in situ*, monitor the turbidity probe constantly with a remote display and record data manually or digitally.

For more detailed procedures, see Anderson (2005).

## Conductivity or Salinity

Salinity can be measured in the field with a salinometer, and conductivity with a conductivity meter. There are two types of conductivity sensors as described below.

- **Contacting-type sensors with electrodes**—Electrodes contained in a dip cell can be suspended in the sample. The cell constant is the distance between electrodes (in centimeters) divided by the effective cross-sectional area of the conducting path (in square centimeters). A cell constant is chosen on the basis of the expected conductivity. The greater the cell constant, the greater the conductivity that can be measured.
- **Electrodeless-type sensors**—Conductivity is measured by inducing an alternating current in a closed loop of solution, and measuring the magnitude of the current. Measuring errors in this type of electrode are minimized because sensors do not have issues with electrode polarization or electrode fouling.



ED_004850_00001502-01071

Calibrate the conductivity meter prior to use in accordance with the manufacturer's directions using a standard of known conductivity. The conductivity of the standard should be close to the expected value at the sampling site. When measuring a sample for conductivity, swirl or stir the sample until the meter is stabilized and a measurement is recorded. For more detailed procedures, see Radtke et al. (2005).

Salinity can be automatically calculated from conductivity, temperature, and barometric pressure readings in the same multiprobe and displayed on the meter of most models. Salinity may also be calculated from the measured conductivity and temperature of a sample according to Standard Method 2520B (APHA 1998). Gross salinity measurements may also be taken with a field-portable refractometer. This instrument provides salinity measurements with an accuracy of 1 to 2 parts per thousand. For more detailed procedures, see APHA (1998).

## ORP or Eh

ORP or Eh may be measured in the field with an inert metal electrode and read relative to a reference electrode that is immersed in the same medium. For most multiprobe units, the inert metal electrode is a button or ring made of platinum and the Ag/AgCl reference electrode is the same one connected to the pH probe. The readout of the sensor is a voltage (relative to the reference electrode), with positive values (e.g., + 300 mV) indicating an oxidizing environment (ability to accept electrons) and negative values (e.g., –300 mV) indicating a reducing environment (ability to donate electrons) (YSI 2005).

ORP and Eh are the same parameters in that both measure the potential of the medium to transfer electrons. However, the ORP reference electrode is made of different material than the Eh standard hydrogen electrode; therefore, a voltage offset needs to be taken into account when converting ORP measurements to Eh values.

More detailed explanation on the theoretical concept, voltage offset conversions, method limitations and interferences can be found in the attached YSI Tech Note (YSI Environmental 2005) and in Nordstrom and Wilde (2005).

## REFERENCES

Anderson, C.W. 2005. Turbidity (version 2.1): U.S. Geological Survey techniques of water-resources investigations, Book 9, Chap. A6., Section 6.7. Available at: http://water.usgs.gov/owq/FieldManual/Chapter6/Section6.7_v2.1.pdf.

APHA. 1998. *Standard methods for the examination of water and wastewater.* 20th Edition. L.S. Clesceri, A.E. Greenberg, and A.D. Eaton (eds). American Public Health Association, Washington, DC.



ED_004850_00001502-01072

Lewis, M.E. 2006. Dissolved oxygen (version 2.1): U.S. Geological Survey techniques of water-resources investigations, Book 9, Chap. A6, Section 6.2, Available at: http://water.usgs.gov/owq/FieldManual/Chapter6/6.2_v2.1.pdf.

Nordstrom, D.K., and F.D. Wilde. 2005. Oxidation-reduction potential (version 1.2): U.S. Geological Survey techniques of water-resources investigations, Book 9, Chap. A6, Section 6.5. Available at: http://water.usgs.gov/owq/FieldManual/Chapter6/6.5_v_1.2.pdf.

Radtke, D.B., J.V. Davis, and F.D. Wilde. 2005. Specific electrical conductance (version 1.2): U.S. Geological Survey techniques of water-resources investigations, Book 9, Chap. A6, Section 6.3. http://water.usgs.gov/owq/FieldManual/Chapter6/Final508Chapter6.3.pdf.

Wilde, F.D. (ed.). [various dates]. Field measurements: U.S. Geological Survey techniques of water-resources investigations, Book 9, Chap. A6. (Chapter sections are cited by author and date.) Available at: http://pubs.water.usgs.gov/twri9A6/.

Wilde, F.D. 2006. Temperature (version 2.0): U.S. Geological Survey techniques of water-resources investigations, Book 9, Chap. A6, Section 6.1. Available at: http://water.usgs.gov/owq/FieldManual/Chapter6/6.1_ver2.pdf.

Wilde, F.D., E. Busenberg, D.B. Radtke, and S.A. Rounds. 2006. pH (version 1.3): U.S. Geological Survey techniques of water-resources investigations, Book 9, Chap. A6, Section 6.4. Available at: http://water.usgs.gov/owq/FieldManual/Chapter6/6.4_ver1.3.pdf.

YSI Environmental. 2005. Measuring ORP on YSI 6-Series Sondes: Tips, cautions and limitations. Tech Note 0201 T608. Available at: https://www.ysi.com/DocumentServer/DocumentServer?docID=YSI_T608.



ED_004850_00001502-01073

# ATTACHMENT 1. MEASURING ORP ON YSI 6-SERIES SONDES: TIPS, CAUTIONS AND LIMITATIONS

# Measuring ORP on YSI 6-Series Sondes: Tips, Cautions and Limitations

## Introduction and Basic Theory

As described in *Standard Methods for the Examination of Water and Wastewater* (Section 2580 B.), ORP is a potentiometric measurement in which the potential (or tendency) of the medium for electron transfer is sensed by an inert metal electrode and read relative to a reference electrode that is immersed in the same medium. This determination can also be referred to as a "redox" measurement (combination of REDuction and OXidation). For most multiparameter monitoring systems, the inert metal electrode is a button or ring made of platinum and the reference electrode is the same one associated with the pH sensor, usually Ag/AgCl. The readout of the sensor is a voltage (relative to the reference electrode), with positive values (e.g., + 300 mV vs. Ag/AgCl) indicating an oxidizing environment (ability to accept electrons) and negative values (e.g. -300 mV) indicating a reducing environment (ability to furnish electrons).

The determination of ORP is particularly worthwhile in water which contains a relatively high concentration of a redox-active species, e.g., the salts of many metals ($Fe^{2+}$, $Fe^{3+}$) and strong oxidizing (chlorine) and reducing (sulfite ion) agents. Thus, ORP can sometimes be utilized to track the metallic pollution in ground or surface water or to determine the chlorine content of wastewater effluent. However, ORP is a nonspecific measurement, i.e., the measured potential is reflective of a combination of the effects of all the dissolved species in the medium. Because of this factor, the measurement of ORP in relatively clean environmental water (ground, surface, estuarine, and marine) has only limited utility unless a predominant redox-active species is known to be present. Users should thus be careful not to "over-interpret" ORP data unless specific information about the site is known.

## ORP vs. Eh: Calibration of ORP Sensors

Many users of YSI 6-series sondes that make field or laboratory redox measurements have questions about the difference between ORP and Eh. In essence, the two parameters are the same in that both quantify the potential of the medium to transfer electrons -- the difference is the reference electrode (and thus the voltage offset) against which the potential of the platinum sensor is reported. Eh is defined as a voltage reading vs. the Standard Hydrogen Electrode (SHE), while ORP is a much less specific term in which the measurement can be made relative to any practical or theoretical reference electrode, such as Ag/AgCl, calomel, or SHE. Generally, it is not easy to use the SHE in laboratory or field measurements and thus redox readings are made using either the Ag/AgCl or calomel reference electrodes, with Ag/AgCl being more popular in multiparameter water quality instrumentation. Thus, Eh is usually not determined directly. However, the voltages obtained as ORP readings vs. non-SHE electrodes can easily be converted into Eh values by two mechanisms:

- Adding (or subtracting) an offset voltage to the ORP readings obtained vs. a practical reference electrode to account for the fixed difference between the SHE and the other reference system. The offset voltage can easily be obtained for several practical reference electrodes in Table 2580: II of the section of Standard Methods on ORP. For example, the potential of Zobell solution vs. the Ag/AgCl reference electrode using 4 M KCl is +228 mV while the same solution read vs. the SHE is +428 mV. Therefore to convert ORP readings taken under these conditions to Eh, simply add 200 mV to the ORP voltage. For example, ORP readings of +150 and -172 mV translate to Eh values of +350 and +28 mV, respectively.
- Using the instrument software to automatically add the offset voltage to the ORP readings as they are displayed or logged. This method is implemented during calibration of the ORP sensor in YSI 6-series sondes. For example, when calibrating an instrument with Zobell solution that has an ORP reading of 228 versus the YSI reference electrode, enter 428 mV at the calibration prompt instead of 228. After the calibration is confirmed, 200 mV (the difference between Ag/AgCl and SHE reference electrodes) will automatically be added to all displayed and logged ORP values, effectively converting them to Eh with no further correction needed. The software in YSI 6-series sondes is likely to interpret the entry of the higher voltage value as an "out of range" calibration error and provide a warning to this effect. As long as the user is knowledgeable about the procedure, the error can be "overridden" with no ill effects.

## Effect of Temperature

The temperature of the water for which ORP is being determined will affect the voltage output of the sensor. This factor definitely needs to be taken into account for calibration and should be considered when reporting field ORP values.

*(continued)*



ED_004850_00001502-01075

For calibration, the following table can be used when using Zobell solution, the YSI-recommended standard. Thus, if the Zobell calibration standard is at 15° C instead of 25° C, enter 241 mV at the calibration prompt instead of 228 mV (the 25° C value which is commonly quoted).

| Temperature, C | Zobell Solution Value, mV vs. Ag/AgCl (4 M KCl) |
|---|---|
| -5 | 267.0 |
| 0 | 260.5 |
| 5 | 254.0 |
| 10 | 247.5 |
| 15 | 241.0 |
| 20 | 234.5 |
| 25 | 228.0 |
| 30 | 221.5 |
| 35 | 215.0 |
| 40 | 208.5 |
| 45 | 202.0 |
| 50 | 195.5 |

The user may be able to locate similar temperature-dependence data in the literature for other ORP standards such as Light's Solution and quinhydrone standards in pH buffers.

Temperature will also clearly have an effect on field readings, but, in this case, the variation is usually not definable since the temperature effect depends on the dissolved species responsible for the ORP reading, and these species are usually not known exactly for environmental water. For this reason, ORP readings on YSI 6-series sondes are **not** temperature compensated in any manner. The user must remember that ORP variation in field water could be due to temperature changes rather than analyte compensation. Usually, however, gross changes in ORP (>100 mV) are not due to the effect of temperature.

## Confirming ORP Response

Unlike pH, YSI 6-series sondes only allow a single point calibration for ORP, i.e., an offset adjustment as described above. This is almost always adequate if the ORP sensor has been maintained properly. However, some users like to confirm that their ORP system tracks changes in ORP correctly, in the same way that a pH sensor responds to immersion in pH 7 and pH 10 buffers.

To check the "slope" and response characteristics of the ORP sensor, YSI recommends that the user purchase item number B125 (ORP Calibration Kit) from the manufacturer of one of our ORP sensors:

Sensorex
Tel. +1 714 895 4344
Fax. +1 714 894 4839
Email. info@sensorex.com
Web. www.sensorex.com

The kit contains solid quinhydrone which, when added to the supplied buffers, yields two solutions with well-defined, but different, ORP values.

## Problems with ORP Sensors

Although based on relatively simple theory, ORP is, unfortunately, also a measurement that can show more problems than other water quality sensors with regard to consistency between different instruments and overall accuracy. In addition, these issues are further complicated in that their extent is likely to depend on both the condition of the sensor and the makeup of the water being tested. The most common problem reported with regard to ORP determination in environmental water is that readings from various instruments (sometimes with exactly the same sensor type and electronics) differ by a significant margin (50-100 mV) even though the sensors are in the same container of water. To make the problem more perplexing, all of the sensors show identical readings in an ORP standard such as Zobell solution. The exact explanation for this paradox is sometimes elusive, but there are at least three possible reasons for its occurrence.

- First, ORP sensors can show a slow response in environmental water if the platinum button of the probe has been contaminated with extraneous material. Common contaminants include hard water deposits, oil/grease, or other organic matter. If the platinum electrodes in the above example are variably contaminated, then some of them (the more contaminated) will be likely to approach potentiometric equilibrium slower. Under this scenario, if left long enough all the sensors would read the same. However, it might take days for the contaminated sensors to reach their final value, and, therefore, they appear in the time frame of a sampling experiment (< 1 hour), to be different. Naturally, if the electrode contaminant is redox-active, either in itself or because it contains redox-active impurities, the reading from that sensor will exhibit erroneous readings that may never change unless the contaminant is removed.

*(continued)*



ED_004850_00001502-01076

- Second, in clean environmental water, there may be very few redox-active species present, and those that are present may be in very low concentration. In many cases, the concentration can be so low that the redox influence of the species is effectively below the detection limit of the method. Under these conditions, the readings will have questionable meaning and could show this type of variation described above. Note that the ORP reading variance associated by this scenario is likely to be exacerbated if any of the electrodes is also contaminated as described above.
- Third, the makeup of the surface composition of the electrode may not be ideal for the measurement in the medium under investigation. While "platinum" ORP electrodes are primarily composed of the metal itself (in a neutral state), it is well known that the surface of the electrode (where the redox action takes place) is coated to varying extents with a molecular layer of platinum oxide (PtO). The Pt/PtO ratio can change over time, depending on the medium in which the probe is stored, and thus the surface of the electrode actually possesses its own potential that can be variable. If this surface potential is similar to the ORP potential of the medium, then electrode response can be sluggish. The cleaning procedure recommended later in this document will result in a surface characterized by a low Pt/PtO ratio and one that possesses a very positive potential. This should be suitable for most environmental measurements.

The fact that similar or identical ORP sensors read differently in environmental water yet the same in Zobell solution is due to the fact that the concentration of redox-active species (ferricyanide/ferrocyanide for Zobell) is much greater in the standards. This higher concentration usually "swamps out" the inconsistencies related to detection limit problems (caused by low amounts of redox-active species) and response time issues (caused by electrode contamination), thus all sensors respond rapidly and read within the YSI specification of +/- 20 mV when in standards.

If you observe inconsistency between different sensors or experience ORP readings which seem unusual for the water being tested with your YSI 6-series multiparameter instrument, YSI recommends the following steps to identify and/or correct the problem:

First, make certain that the pH sensor is functioning properly. The reference electrode of the sonde is common to both pH and ORP sensors and, therefore, if both pH and ORP sensors are malfunctioning this is likely to be the source of the problem. Reference electrode problems usually appear as either total failure or as a slow response in both pH and ORP readings. If a reference electrode problem is suspected, test the ORP sensor in a standard and make certain that it is within 20-30 mV of the predicted value. If reference electrode performance is indicated, clean the sensor according to the instructions shown below and then retest.

Second, if the sensor performs well in the ORP standard, remove the probe from the sonde and carry out the sequential cleaning process documented in the next section.

## ORP Electrode Cleaning

The following procedure will result in removal of many common contaminants from the platinum ORP electrode. Fouling of the electrode can, however, be deployment-specific, and some contaminants from polluted water may not be dissolved by this method. The use of other solvents and reagents may be possible, but they must be selected carefully so as not to damage the reference electrode or pH glass of the combination sensors nor to leach or dissolve the CPVC body of the probe itself. Consult YSI Customer Service before using cleaning methods other than those documented below.

YSI recommends that the user perform the cleaning/reconditioning operation in the order indicated. Performance can be rechecked at the conclusion of each major section (A, B, and C) and the cleaning discontinued if, at that point, the performance problem has been corrected.

***Procedure A***

1. Soak the probe for 10-15 minutes in clean water containing a few drops of commercial dishwashing liquid.
2. Wipe the platinum button or ring by rubbing with a cotton swab soaked in the cleaning solution. CAUTION: For 6565 probes, be certain not to damage the glass bulb of the combination sensor during this process.
3. Rinse the probe in clean water, wipe with a cotton swab saturated with clean water, and then re-rinse with clean water.

***Procedure B***

1. Soak the probe for 20-30 minutes in one molar (1 M) hydrochloric acid (HCl). This reagent can be purchased from most laboratory supply dealers. Be sure to follow the safety instructions supplied with the reagent.
2. Wipe the platinum button by rubbing with a cotton swab soaked in the acid. CAUTION: For 6565 probes, be certain not to damage the glass bulb of the combination sensor during this process.
3. Rinse the probe in clean water, wipe with a cotton swab saturated with clean water, then rerinse with clean water.

*(continued)*



ED_004850_00001502-01077

***Procedure C***

1. Soak the probe for approximately 1-2 hours in a 1 to 1 dilution of commercially available chlorine bleach.
2. Rinse the probe with clean water and then soak for at least 1 hour in clean water to remove residual bleach from the reference junction. **CAUTION**: If removal of the chlorine bleach is incomplete, this cleaning reagent can seep into either your calibration standards or measurement media and cause erroneous ORP readings until it is dissipated. Always err on the side of caution in the chlorine bleach removal. Soaking the probe in clean water for periods of time longer than 1 hour can do no harm, however, lesser soaking times can cause problems.
3. Dry the sonde port and probe connector with compressed air and apply a very thin coat of O-ring lubricant to all O-rings before re-installation of the probe. After the probe is reinstalled, place the sensors in Zobell solution and make certain that observed ORP readings stabilize within a few minutes and remain stable for 15-20 minutes.

## Typical ORP Data in Standards and Freshwater

| | Zobell Reading | | |
|---|---|---|---|
| Probe # | Initial | 1 hour | After Testing |
| 1 | 228 | 228 | 233 |
| 2 | 227 | 226 | 227 |
| 3 | 227 | 227 | 228 |
| 4 | 224 | 224 | 228 |
| 5 | 227 | 227 | 228 |

*Table 1. ORP sensor performance in Zobell Solution.*

Experiments have been performed at YSI to demonstrate the typical performance of YSI ORP sensors in both standards and in freshwater. Five (5) new 6565 sensors were taken from stock and placed directly into Zobell solution at 22° C. As shown in Table 1 below, all sensors read within 4 mV of each other. The sensors were left in the Zobell solution for 1 hour and the values recorded again. Finally, the sensors were retested in Zobell solution after the entire regimen of testing described below was completed. The values were basically unchanged, demonstrating the stability of the sensor in redox buffer.

The sensors were then rinsed and soaked in DI water and then transferred to tap water that had been diluted with deionized water to a specific conductance of 290 uS/cm and saturated with air. The ORP readings were recorded 1 minute after transfer and then again after 2.5 hours in the low-to-medium conductivity water. Note that all readings are fairly close at 1 minute, with probe 5 showing a somewhat more positive reading. Note also that the discrepancy between probe 5 and the others increased slightly after longer-term exposure to the water sample. Cleaning the ORP platinum sensor of probe 5 with clean water and a cotton swab resulted in a decrease of the reading to 207

| | ORP Reading | |
|---|---|---|
| Probe # | 1 minute | 2.5 hours |
| 1 | 138 | 178 |
| 2 | 143 | 161 |
| 3 | 132 | 177 |
| 4 | 135 | 169 |
| 5 | 166 | 221 |

*Table 2. ORP sensor performance in 290 uS/cm natural water.*

mV -- significantly closer to the other sensors. Finally, note that all readings increased by an average of about 40 mV after longer-term exposure to the natural water. This stabilization pattern, along with some variation in probe readings, is likely to occur with all ORP sensors when used in environmental water samples. The difference in behavior between Zobell solution and the water sample is striking and demonstrates that a lower accuracy specification must be tolerated in natural water samples than in buffers. (Note that the YSI accuracy specification of +/- 20 mV refers to readings taken in redox standards.) See Table 2 for the data described in this experiment.

The sensors were then cleaned using the 1 M HCl treatment described above, soaked in DI water to remove all acid traces, and then placed back into the 290 uS/cm natural water sample. ORP readings were taken 5 minutes after placing the probes in the water. The calibration of the sensors was then checked in Zobell solution the probes returned to the natural water sample, and the readings recorded after 5 minutes. Results are shown in Table 3.

| Probe # | Water Sample 5 minutes post cleaning | Zobell Solution Calibration check | Water Sample 5 minutes post cal check |
|---|---|---|---|
| 1 | 195 | 233 | 186 |
| 2 | 188 | 227 | 183 |
| 3 | 214 | 228 | 184 |
| 4 | 197 | 228 | 184 |
| 5 | 280 | 228 | 230 |

*Table 3. ORP sensor performance in 290 uS/cm natural water after cleaning sensors with 1 M HCl.*

*(continued)*



ED_004850_00001502-01078

Note the following from the data in Table 3:

- The results in the natural water sample are about the same after the cleaning as before -- probe #5 is still significantly higher than the other 4 that are fairly tightly bunched.
- Even after multiple exposures to standards, the natural water sample, and 1 M HCl, the probes (including probe #5) all read effectively the same in Zobell solution.
- Although the effect is relatively minor, the water sample readings are somewhat dependent on the previous reagent to which the probes were exposed. Note that the results are more consistent and slightly lower overall after the probes had been in Zobell solution (column 3) than after they had been in 1 M HCl (column 1).

Most users would consider the performance of probes 1-4 in natural water acceptable in terms of their consistency with one another, but might wonder why probe 5 always seems to read somewhat more positive than the other sensors except in Zobell solution where it has the same reading. Although difficult to prove, the difference is most likely due to a different Pt/PtO ratio on the surface of probe 5. Consistent with this hypothesis, the final experiments indicate that probe 5 responds to ORP changes and that its ORP reading in natural water becomes closer to those of the other four sensors after longer-term exposure to this medium.

In the final testing, the probes were placed in a sodium sulfite solution, a reducing environment that should produce a decrease in the ORP readings. As shown in Table 4, this effect was indeed observed. The probes were then carefully cleaned and returned to the natural water sample for 18 hours and then the ORP values recorded to conclude the test protocol. These final values are found in Table 4.

| Probe # | Sodium Sulfite Solution, after 5 minute exposure | Natural Water, after 18 hour exposure |
|---|---|---|
| 1 | 135 | 196 |
| 2 | 125 | 174 |
| 3 | 140 | 207 |
| 4 | 120 | 195 |
| 5 | 95 | 218 |

*Table 4. ORP sensor performance in sodium sulfite solution and after long-term exposure to natural water.*

YSI would consider Probe 5 as an acceptable sensor for use with our 6-series sondes for the following reasons even though it reads an average of 50 mV different from the other sensors tested:

- The sensor responds quickly and shows the proper reading in Zobell solution;
- The sensor's reading in natural water is not radically different (>100 mV) from the other sensors and becomes closer after extended exposure to this medium;
- The sensor tracks changes in ORP properly.

## Summary

The determination of ORP in environmental water can provide valuable insight into the sample as long as there is a significant concentration of a redox-active species present. However, in the absence of these species, ORP can be a significantly less exact measurement than for most other sensors found in YSI 6-series sondes. The inexactness is usually due to contamination of the electrode surface (either physically or chemically), but can also be due to the lack or low concentration of redox active agent in the environmental water.

The quoted accuracy specification for the YSI ORP sensor (+/- 20 mV) refers to redox- standards, such as Zobell solution, and not to environmental water of variable, and usually unknown, content. In many cases, the +/- 20 mV specification will be met in natural water, but it cannot be guaranteed.

Periodic maintenance of your YSI ORP sensor (6032 or 6565) will increase your field consistency and accuracy, but may not overcome all problems.

The value of ORP in determining the content of environmental water is greatly enhanced if the user has some knowledge or history of the site.

*For additional information please contact*
***YSI Environmental***
*Tel.+1 937 767 7241*
*US 800 897 4151*
*Fax +1 937 767 1058*
*Email. environmental@ysi.com*
*Web. www.ysi.com*



ED_004850_00001502-01079

# ELM SOPs

# STANDARD OPERATING PROCEDURES

# AND QUALITY CONTROL MANUAL

# FOR THE

- **OAKTON WD-35615-SERIES pH/mV/TEMPERATURE METER**

- **YSI MODEL 55 DISSOLVED OXYGEN AND TEMPERATURE METER**

- **YSI MODEL 30 CONDUCTIVITY, SALINITY AND TEMPERATURE METER**

**ENVIRONMENTAL LIABILITY MANAGEMENT, INC.**

**LABORATORY IDENTIFICATION No. 18004**

**SEPTEMBER 2003**

## TABLE OF CONTENTS

**1. pH METER ..... 1**

1.1. Introduction ..... 1
1.2. Preparation ..... 1
1.3. Calibration ..... 1
1.4. Measurements ..... 2
1.5. Quality Control ..... 3
1.6. Memory And Data Input ..... 4
1.7. Electrode Care and Maintenance ..... 4
1.8. Error Messages/Troubleshooting ..... 5

**2. DISSOLVED OXYGEN METER ..... 6**

2.1. Introduction ..... 6
2.2. Preparation ..... 6
2.3. Calibration ..... 6
2.3.1. Weekly/Monthly ..... 6
2.3.2. Each Use ..... 7
2.4. Measurements ..... 7
2.5. Quality Control ..... 8
2.6. Probe Care and Maintenance ..... 9
2.7. Error Messages/Troubleshooting ..... 9

**3. CONDUCTIVITY METER ..... 10**

3.1. Introduction ..... 10
3.2. Preparation ..... 10
3.3. Calibration ..... 10
3.3.1. Annually ..... 10
3.3.2. Each Use ..... 11
3.4. Measurements ..... 11
3.5. Quality Control ..... 12
3.6. Electrode Care and Maintenance ..... 14
3.7. Error Messages/Troubleshooting ..... 14

**4. SALINITY METER ..... 14**

4.1. Introduction ..... 14
4.2. Preparation ..... 15
4.3. Calibration ..... 15

4.4. Measurements ..... 16
4.5. Quality Control ..... 17
4.6. Electrode Care and Maintenance ..... 18
4.7. Error Messages/Troubleshooting ..... 18

LIST OF ATTACHMENTS


| | |
|---|---|
| Attachment A: | Operating Instructions Manuals |
| Attachment B: | Relevant Excerpts from N.J.A.C. 7:18, June 2001 (and as amended through September 2002) "Regulations Governing the Certification of Laboratories and Environmental Measurements" |
| Attachment C: | Material Safety Data Sheets |
| Attachment D: | Agency Correspondence |
| Attachment E: | Laboratory Work Sheets |

# 1. pH METER

## 1.1. Introduction

The Oakton WD Meter can measure pH values from -2.00 to 16.00, with an accuracy of ± 0.01 pH. The resolution of the meter can be pre-set to 0.01 or 0.1 pH. The Oakton Operating Instructions manual is also available for review regarding all functions of this meter.

## 1.2. Preparation

Ensure the batteries (4 AAA) are installed properly, or insert/attach the AC adapter.

1. Insert pH electrode into top of meter. Ensure connector is dry and clean.
2. Insert the electrode into the opening of the holder until the housing touches the top of the holder.
3. Align and secure the two holders together, then attach the holders to the meter.
4. The default setting for the resolution of the meter is 0.01 pH. It can also be set to 0.1 pH.
5. Distilled water should be available for rinsing the electrode between each analyses.

## 1.3. Calibration

1. Each day before use, perform a **2 point calibration** using selected standard buffers solutions that bracket the expected sample range.
2. Select pH mode. Rinse the electrode with distilled water. **Do not wipe to dry the electrode**.
3. Dip the electrode into the selected buffer, and press CAL/MEAS. The primary display will show the measured reading, while the smaller display will indicate the pH of the standard buffer solution.
4. Press the MI and the MR key to display the selected buffer option.
5. When the READY indicator is displayed, the measured pH value is stabilized.

6. Press CON to confirm the calibration. Note: The OR indicator flashes if the selected buffer is not within $\pm$ 0.50 pH from the measured pH value.

7. Repeat steps 1 through 6 for the second selected buffer solution to complete the calibration.

8. Press CAL/MEAS to return to the measurement mode.

9. Do not reuse buffer solutions after calibration.

10. Each time a calibration is performed, the data must be recorded on the Laboratory Work Sheet (Attachment E), and dated and signed by the analyst performing the calibration.

11. The pH meter shall be checked after calibration by reading pH buffer standards of pH 4.00, 7.00 and/or 10.00 and recording the actual readings.

### 1.4. Measurements

1. The electrode can be hand held or attached to the meter holder for one-hand operations.

2. Collect each sample in a clean, quart size jar and note the time on the Laboratory Work Sheet. Samples must be analyzed within 15 minutes of collection.

3. Decant an aliquot of the sample into a clean, wide mouth container.

4. Dip the electrode into the sample and completely immerse the glass bulb. Stir the electrode gently to homogenize the sample.

5. When the reading stabilizes, the READY indicator will display.

6. To hold a measurement, simply press the HOLD key, and record the measurement and time on the Laboratory Work Sheet. Press HOLD again to release the held value.

7. Rinse the electrode and the wide mouth container with distilled water.

8. Perform a duplicate analysis for each sample collected by repeating steps 3 through 6.

9. Rinse the electrode and the wide mouth container with distilled water between each sample analyses.

### 1.5. Quality Control

1. Distilled water shall have at a minimum, resistivity values between 0.5 to 2.0 megohms-cm (2.0 to 0.5 micromhos/cm.) at 25 degrees C. Preferably, distilled water should have resistivity values greater than 1.0 megohms-cm (less than 1.0 micromhos/cm) at 25 degrees C. Containers of distilled water should be capped when not in use and should be capped immediately after each use.

2. Analytical reagent grade (AR) chemicals should be used for most analyses.

   - Stock and working standard solution shall be checked each day the pH meter is in use for signs of decomposition, including but not limited to discoloration, formation of precipitates, and concentration change due to evaporation.

   - All solutions shall be properly labeled with identification of the compound, concentration, solvent, date, and analyst who prepared the solution.

3. All glassware should be washed in a warm detergent solution, and thoroughly rinsed first in tap water and then in distilled water. The glassware shall be air dried and properly stored prior to use. This cleaning procedure is sufficient for most analytical needs.

4. Batteries will be checked each day when the pH analyses meter is use, and replaced when necessary.

5. The electrode and dedicated sample bottle will be rinsed with distilled water between each analyses.

6. Standard buffer solutions will be used within the appropriate expiration dates. Expired solutions will be disposed immediately in accordance with NJDEP disposal procedures.

7. A duplicate pH measurement should be taken for each sample collected to verify the accuracy of the method.

8. If the pH meter is in use for more than a three hour period, the pH of a third buffer shall be checked once every three hours. If the pH differs by more than +/- 0.2 pH units from the standard buffer value, the meter shall be recalibrated.

9. All quality control data and records shall be recorded on the Laboratory Work Sheet. Such retained data shall include but shall not be limited to, the results of and the raw data generated by Proficiency Sample analyses, and routine calibration reports.

### 1.6. Memory And Data Input

1. The MI key inputs data into the memory. Five sets of data can be stored for each mode.

2. Press MR each time to recall each reading.

3. To exit Memory Recall, press CAL/MEAS to return to the measurement mode.

### 1.7. Electrode Care and Maintenance

1. The pH electrode bulb should be stored wet by using the protective rubber cap filled with the electrode storage solution, or a buffer solution of 1/100 part of saturated KCL, with a pH value of 4. Never use distilled water for storage.

2. Rinse the electrode and reference junction in distilled water after each measurement. Never wipe dry.

3. Clean the electrode every one to three months in accordance with the Operating Instructions manual page 20, which provides specific cleaning instructions dependent on the deposits or problems.

4. If the electrode has dehydrated, soak it for 30 minutes in a 2M -4M KCL solution.

### 1.8. Error Messages/Troubleshooting

1. Page 21-22 of the Operating Instructions manual outlines typical problems which may arise while using the pH meter.

## 2. DISSOLVED OXYGEN METER

### 2.1. Introduction

The YSI Model 55 Handheld Dissolved Oxygen System simultaneously displays temperature in °C and dissolved oxygen in either milligrams per liter (mg/L) or percent (%) air saturation. Temperature can be measured from -5 to 45°C ± 0.4°C, dissolved oxygen mg/L from 0 to 20 mg/L ± 0.3 mg/L, and dissolved oxygen % air saturation from 0 to 200% ± 2% air saturation.

### 2.2. Preparation

1. Ensure that batteries are installed properly (6 AA alkaline batteries).

2. Turn on the instrument by pressing the **ON/OFF** button; the liquid crystal display (LCD) should come on.

3. Remove the probe from the calibration chamber and inspect the probe for a dry, loose, wrinkled, damaged or fouled membrane, and for air bubbles in the electrolyte reservoir. Refer to pages 8-10 of the Operating Instructions manual to replace the membrane and electrolyte solution should any abnormalities be found.

4. Put 6 to 8 drops of distilled water onto the sponge in the calibration chamber. Turn the instrument over and allow excess water to drain out of calibration chamber. The wet sponge creates a saturated-air environment for the probe which is necessary for calibration, transport, and storage of the probe. Replace the probe into the calibration chamber.

### 2.3. Calibration

#### *2.3.1. Weekly/Monthly*

1. The meter is tested using an EPA accepted, modified Winkler Method[1] (azide modification) at least once a month depending upon usage. If the meter is to be used in more than one

---

[1] LaMotte Company Water Quality Test Kit for Dissolved Oxygen; Model EDO, Code 7414

week during a month, additional Winkler Method calibrations will be performed, such that usage of the meter falls within one week of a Winkler Method testing.

2. Results are recorded on a Laboratory Work Sheet.

#### *2.3.2. Each Use*

1. Each day before use, ensure that the sponge inside the calibration chamber is wet and that the probe is functional (see Section 2.2.3 above). Insert the probe into the chamber.

2. Turn on the instrument and wait for the dissolved oxygen and temperature readings to stabilize (usually takes a few minutes).

3. Use two fingers to press the two up and down keys at the same time.

4. The LCD will prompt you to enter the local altitude in hundreds of feet. Use the arrow keys to increase or decrease the altitude (e.g., enter 2 for 200 feet).

5. When the proper altitude appears on the LCD, press the **ENTER** key once to view the calibration in the lower right of the LCD; and a second time to move to the salinity compensation procedure.

6. The LCD will prompt you to enter the approximate salinity of the water in parts per trillion. Use the arrow keys to increase or decrease the salinity compensation, then press the **ENTER** key.

After the instrument is calibrated, press the **MODE** key to move back and forth from reading dissolved oxygen in the mg/L or % air saturation display. Use the LIGHT key to activate the back-light of the instrument.

### 2.4. Measurements

1. Collect each sample in a clean, quart size jar and note the time on the Laboratory Work Sheet. Samples must be analyzed within 15 minutes of collection.

2. Decant an aliquot of the sample into a clean, wide mouth container.

3. Insert the probe into the sample container.

4. Stir the sample continuously; this can be achieved by rapidly moving the probe through the sample.

5. Use the **MODE** key to transfer the display between the dissolved oxygen mg/L and % air saturation readings.

6. Rinse the probe and the wide mouth container with distilled water.

7. Perform a duplicate analysis for each sample collected by repeating steps 2 through 6.

8. Rinse the probe and the wide mouth container with distilled water between each sample analyses.

### 2.5. Quality Control

1. Distilled water shall have at a minimum, resistivity values between 0.5 to 2.0 megohms-cm (2.0 to 0.5 micromhos/cm.) at 25 degrees C. Preferably, distilled water should have resistivity values greater than 1.0 megohms-cm (less than 1.0 micromhos/cm) at 25 degrees C. Containers of distilled water should be capped when not in use and should be capped immediately after each use.

2. Analytical reagent grade (AR) chemicals should be used for most analyses.

   - Stock and working standard solution shall be checked each day the meter is in use for signs of decomposition, including but not limited to discoloration, formation of precipitates, and concentration change due to evaporation.

   - All solutions shall be properly labeled with identification of the compound, concentration, solvent, date, and analyst who prepared the solution.

3. All glassware should be washed in a warm detergent solution, and thoroughly rinsed first in tap water and then in distilled water. The glassware shall be air dried and properly stored prior to use. This cleaning procedure is sufficient for most analytical needs.

4. Batteries will be checked each day when the meter is use, and replaced when necessary.

5. The probe and dedicated sample bottle will be rinsed with distilled water between each analyses.

6. Standard buffer solutions will be used within the appropriate expiration dates. Expired solutions will be disposed immediately in accordance with NJDEP disposal procedures.

7. A duplicate measurement should be taken for each sample collected to verify the accuracy of the method.

8. All quality control data and records shall be recorded on the Laboratory Work Sheet. Such retained data shall include but shall not be limited to, the results of and the raw data generated by Proficiency Sample analyses, and routine calibration reports.

### 2.6. Probe Care and Maintenance

1. Turn meter off.

2. Rinse the probe with clean water.

3. Ensure that calibration chamber sponge is moistened with distilled water and that the probe is functional. Refer to pages 8-10 of the Operating Instructions manual to replace the membrane and electrolyte solution should any abnormalities be found. Place probe into the calibration chamber.

### 2.7. Error Messages/Troubleshooting

Page 13-15 of the Operating Instructions manual outlines typical problems which may arise while using the meter.

# 3. CONDUCTIVITY METER

## 3.1. Introduction

The YSI Model 30 Handheld Conductivity, Salinity and Temperature System simultaneously displays temperature and one of three parameters: conductivity, temperature compensated conductivity,[2] or salinity. Conductivity can be measured from 0 to 200 microsiemens[3] per centimeter (mS/cm) ± 0.5% full scale, salinity from 0 to 80 parts per thousand (ppt) ± 0.1 ppt, and temperature from -5 to 95 degrees Celsius (°C) ± 0.1°C.

## 3.2. Preparation

1. Ensure that batteries are installed properly (6 AA alkaline batteries).

2. Turn instrument on by pressing and releasing the **ON/OFF** button, the display should come on. The instrument will activate all segments of the display for a few seconds. A self-test procedure follows and lasts several more seconds. The cell constant will display after the self-test. The temperature will be displayed in the lower right corner of the display when the instrument is ready to take a reading.

## 3.3. Calibration

### *3.3.1. Annually*

1. The meter is calibrated using a meter with platinum electrodes.

2. A five point calibration curve is established using potassium chloride standards.

3. The cell constant is recorded on a Laboratory Work Sheet.

---

[2] The temperature compensated conductivity measurement automatically adjusts the reading to a calculated value which would have been read if the sample had been at a certain reference temperature. When this temperature is specified to be 25°C, the temperature compensated conductivity is defined as specific conductivity.

[3] siemen = unit of electrical conductance; the reciprocal of an ohm; the equivalent to a mho.

### *3.3.2. Each Use*

1. Each day before use, select a calibration solution (potassium chloride solution) which is most similar to the sample to be measured (for fresh water, choose a 1 mS/cm conductivity standard).

2. Place at least 3 inches of solution in a clean glass container.

3. Insert probe into the container deeply enough to completely cover the oval shaped hole on the side of the probe. Suspend the probe at least ¼ inch from the bottom of the container.

4. Allow at least 60 seconds for temperature reading to become stable.

5. Move the probe vigorously from side to side to dislodge air bubbles from the electrodes.

6. Press the up and down arrow keys simultaneously.

7. The **CAL** symbol will appear at the bottom of the display, the instrument is now in the calibration mode.

8. Use the up or down arrow key to adjust the reading on the display until it matches the value of the calibration solution that was used. When the display matches the calibration solution value, press the **ENTER** key once. The word **SAVE** will flash across the display to indicate the calibration value has been accepted.

### 3.4. Measurements

1. Collect each sample in a clean, quart size jar and note the time on the Laboratory Work Sheet. Samples must be analyzed within 15 minutes of collection.

2. Decant an aliquot of the sample into a clean, wide mouth container.

3. Insert probe into the container deeply enough to completely cover the oval shaped hole on the side of the probe. Try to not allow the probe to touch any solid surfaces.

4. The instrument is autoranging and may take up to 5 seconds to find the correct range. During the range search, the instrument will appear to freeze on a given reading for a few seconds, then once the range is located, will pinpoint the exact reading on the display. The display may also switch to **00.0** for a second or two during a range search before it selects the proper range.

5. Shake the probe vigorously to dislodge any air bubbles around the probe before taking the measurement.

6. Press the **MODE** key to change display for the three different readings: conductivity, specific conductivity, and salinity. Conductivity and specific conductivity have the same units, however, when specific conductivity is displayed, the °C symbol will flash on and off. The symbol will not flash when conductivity is displayed.

7. Rinse the probe and the wide mouth container with distilled water.

8. Perform a duplicate analysis for each sample collected by repeating steps 2 through 7.

9. Rinse the probe and the wide mouth container with distilled water between each sample analyses.

The operations manual should be consulted for setting the reference temperature as well as other advanced operations for this instrument.

### 3.5. Quality Control

1. Distilled water shall have at a minimum, resistivity values between 0.5 to 2.0 megohms-cm (2.0 to 0.5 micromhos/cm.) at 25 degrees C. Preferably, distilled water should have resistivity values greater than 1.0 megohms-cm (less than 1.0 micromhos/cm) at 25 degrees C. Containers of distilled water should be capped when not in use and should be capped immediately after each use.

2. Analytical reagent grade (AR) chemicals should be used for most analyses.

3. Stock and working standard solution shall be checked each day the meter is in use for signs of decomposition, including but not limited to discoloration, formation of precipitates, and concentration change due to evaporation;

4. All solutions shall be properly labeled with identification of the compound, concentration, solvent, date, and analyst who prepared the solution;

5. All glassware should be washed in a warm detergent solution, and thoroughly rinsed first in tap water and then in distilled water. The glassware shall be air dried and properly stored prior to use. This cleaning procedure is sufficient for most analytical needs.

6. Batteries will be checked each day when the meter is use, and replaced when necessary.

7. The probe and dedicated sample bottle will be rinsed with distilled water between each analyses.

8. Standard buffer solutions will be used within the appropriate expiration dates. Expired solutions will be disposed immediately in accordance with NJDEP disposal procedures.

9. A duplicate measurement should be taken for each sample collected to verify the accuracy of the method.

10. All quality control data and records shall be recorded on the Laboratory Work Sheet. Such retained data shall include but shall not be limited to, the results of and the raw data generated by Proficiency Sample analyses, and routine calibration reports.

### 3.6. Electrode Care and Maintenance

ALWAYS RINSE THE CONDUCTIVITY CELL WITH CLEAN WATER AFTER EACH USE.

To clean the conductivity cell:

1. Dip the cell in cleaning solution and agitate for two to three minutes.
2. Use the nylon brush to dislodge any particulates from inside the electrode chamber.
3. Repeat steps 1 and 2 until cell is completely clean.
4. Store the conductivity cell in the meter storage chamber.

### 3.7. Error Messages/Troubleshooting

1. Page 19 of the Operating Instructions manual outlines typical problems which may arise while using the meter.

## 4. SALINITY METER

### 4.1. Introduction

The YSI Model 30 Handheld Conductivity, Salinity and Temperature System simultaneously displays temperature and one of three parameters: conductivity, temperature compensated

conductivity,[4] or salinity. Conductivity can be measured from 0 to 200 microsiemens[5] per centimeter (mS/cm) ± 0.5% full scale, salinity from 0 to 80 parts per thousand (ppt) ± 0.1 ppt, and temperature from -5 to 95 degrees Celsius (°C) ± 0.1°C. Salinity is a calculation done by the instrument electronics, based upon the conductivity and temperature reading.

### 4.2. Preparation

1. Ensure that batteries are installed properly (6 AA alkaline batteries).

2. Turn instrument on by pressing and releasing the **ON/OFF** button, the display should come on. The instrument will activate all segments of the display for a few seconds. A self-test procedure follows and lasts several more seconds. The cell constant will display after the self-test. The temperature will be displayed in the lower right corner of the display when the instrument is ready to take a reading.

### 4.3. Calibration

1. It is not necessary to perform a separate calibration for salinity once the instrument has been calibrated for conductivity. A check against a salinity standard (50mS/cm salinity) is sufficient.

2. Place at least 3 inches of standard in a clean glass container.

3. Insert probe into the container deeply enough to completely cover the oval shaped hole on the side of the probe. Suspend the probe at least ¼ inch from the bottom of the container.

4. Allow at least 60 seconds for temperature reading to become stable.

---

[4] The temperature compensated conductivity measurement automatically adjusts the reading to a calculated value which would have been read if the sample had been at a certain reference temperature. When this temperature is specified to be 25°C, the temperature compensated conductivity is defined as specific conductivity.

[5] siemen = unit of electrical conductance; the reciprocal of an ohm; the equivalent to a mho.

5. Move the probe vigorously from side to side to dislodge air bubbles from the electrodes.

6. Press and release the MODE key to change the display for the three different readings: conductivity, specific conductivity, and salinity. When salinity is displayed the large number will be immediately followed by ppt.

7. Rinse the probe and container with distilled water.

### 4.4. Measurements

1. Collect each sample in a clean, quart size jar and note the time on the Laboratory Work Sheet. Samples must be analyzed within 15 minutes of collection.

2. Decant an aliquot of the sample into a clean, wide mouth container.

3. Insert probe into the container deeply enough to completely cover the oval shaped hole on the side of the probe. Try to not allow the probe to touch any solid surfaces.

4. The instrument is autoranging and may take up to 5 seconds to find the correct range. During the range search, the instrument will appear to freeze on a given reading for a few seconds, then once the range is located, will pinpoint the exact reading on the display. The display may also switch to **00.0** for a second or two during a range search before it selects the proper range.

5. Shake the probe vigorously to dislodge any air bubbles around the probe before taking the measurement.

6. Press the **MODE** key to change display for the three different readings: conductivity, specific conductivity, and salinity. When salinity is displayed the large numbers are followed by a ppt.

7. Rinse the probe and the wide mouth container with distilled water.

8. Perform a duplicate analysis for each sample collected by repeating steps 2 through 7.

9. Rinse the probe and the wide mouth container with distilled water between each sample analyses.

The operations manual should be consulted for setting the reference temperature as well as other advanced operations for this instrument.

### 4.5. Quality Control

1. Distilled water shall have at a minimum, resistivity values between 0.5 to 2.0 megohms-cm (2.0 to 0.5 micromhos/cm.) at 25 degrees C. Preferably, distilled water should have resistivity values greater than 1.0 megohms-cm (less than 1.0 micromhos/cm) at 25 degrees C. Containers of distilled water should be capped when not in use and should be capped immediately after each use.

2. Analytical reagent grade (AR) chemicals should be used for most analyses.

3. Stock and working standard solution shall be checked each day the meter is in use for signs of decomposition, including but not limited to discoloration, formation of precipitates, and concentration change due to evaporation;

4. All solutions shall be properly labeled with identification of the compound, concentration, solvent, date, and analyst who prepared the solution;

5. All glassware should be washed in a warm detergent solution, and thoroughly rinsed first in tap water and then in distilled water. The glassware shall be air dried and properly stored prior to use. This cleaning procedure is sufficient for most analytical needs.

6. Batteries will be checked each day when the meter is use, and replaced when necessary.

7. The probe and dedicated sample bottle will be rinsed with distilled water between each analyses.

8. Standard buffer solutions will be used within the appropriate expiration dates. Expired solutions will be disposed immediately in accordance with NJDEP disposal procedures.

9. A duplicate measurement should be taken for each sample collected to verify the accuracy of the method.

10. All quality control data and records shall be recorded on the Laboratory Work Sheet. Such retained data shall include but shall not be limited to, the results of and the raw data generated by Proficiency Sample analyses, and routine calibration reports.

### 4.6. Electrode Care and Maintenance

ALWAYS RINSE THE CONDUCTIVITY CELL WITH CLEAN WATER AFTER EACH USE.

To clean the conductivity cell:

1. Dip the cell in cleaning solution and agitate for two to three minutes.

2. Use the nylon brush to dislodge any particulates from inside the electrode chamber.

3. Repeat steps 1 and 2 until cell is completely clean.

4. Store the conductivity cell in the meter storage chamber.

### 4.7. Error Messages/Troubleshooting

1. Page 19 of the Operating Instructions manual outlines typical problems which may arise while using the meter.

# ATTACHMENT B2

## FIELD FORMS

# CHAIN OF CUSTODY/LABORATORY ANALYSIS REQUEST FORM

Page _____ of _____ Turn Around Requested: _____

| Report to: | Phone: | | | | Analyses Requested | | | | | | | | | | Notes/Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Company: | Fax: | | | | | | | | | | | | | | |
| Address: | Proj Name: | | | | | | | | | | | | | | |
| City: | Proj Number: | | | | | | | | | | | | | | |
| State: | Sampler: | | | | | | | | | | | | | | |
| Zipcode: | | | | | | | | | | | | | | | |
| Sample ID | Sample Date | Sample Time | Sample Matrix | No. Containers | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |

| Relinquished: (Signature) | Received by: (Signature) | Special Instructions/Notes | |
|---|---|---|---|
| Printed name: | Printed name: | | |
| Company: | Company: | | Number of Coolers: |
| | | | Cooler Temp(s): |
| Date: Time: | Date: Time: | | COC Seals Intact? |
| | | | Bottles Intact? |

integral

411 S 1st Avenue, Suite 550
Seattle, WA 98104
(206) 230-9600

**Log of Borehole:**

Project Name:

Project Number:

Logged by:

Date:

Page of

| SAMPLE INFORMATION | | | | | | | | | Depth to water: Initial_____ Completion_____ Soil Description (USCS group name, minor components, color, moisture, additional descriptions) |
|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Tag # | Time | Sample Depth | % Recov. | PID (ppm) | Sheen | Depth (Feet) | Symbol | |

Drilling Contractor:

Drilling Method/Equipment:

Sampling Equipment:

Start/End Time:

Latitude:

Longitude:

Notes:

Location Sketch

| | **FIELD CHANGE REQUEST** | Project Number: |
|---|---|---|
| | | |

Field Change No.
Page _____ to

Project Number:
Project Name:

CHANGE REQUEST
Applicable Reference:
Description of Change:

Reason for Change:

Impact on Present and Completed Work:

Requested by:
Date: ____/____/

(Field Scientist)

Acknowledged by:
Date: ____/____/

(Field Task Leader)

FIELD OPERATIONS MANAGER RECOMMENDATION

Recommended Disposition:

Recommendation by:
Date: ____/____/

(Sampling and Analysis Coordinator)

PROJECT MANAGER APPROVAL

Final Deposition:

Approved/Disapproved by:
Date: ____/____/

(CERCLA Coordinator)

**CORRECTIVE ACTION RECORD**

Page ___ of

Audit Report No. :_____ Date:

Report Originator:

Person Responsible for Response:

DESCRIPTION OF PROBLEM:

Date and Time Problem Recognized: _____ By:

Date of Actual Occurrence: _____ By:

Analyte: _____ Analytical Method:

Cause of Problem:

CORRECTIVE ACTION PLANNED:

Person Responsible for Corrective Action:

Date of Corrective Action:

Corrective Action Plan Approval: _____ Date:

DESCRIPTION OF FOLLOW-UP ACTIVITIES:

Person Responsible for Follow-up Activities:

Date of Follow-up Activity:

Final Corrective Action Approval: _____ Date:

integral consulting inc.

# SURFACE SEDIMENT/SOIL COLLECTION FORM

Project Name:_____ Project No. _____ Page:_____

Date:_____ Crew:_____

Weather:_____

Sampling Method:_____

Time:_____ Station: _____ Replicate:_____ Acceptable grab: ☐ Yes ☐ No

Bottom Depth:_____ Penetration Depth:_____ RPD Depth:_____

Analyses before homogenization: ☐ VOC ☐ Sulfides ☐ Other

Sample ID:_____

Type: ☐ cobble ☐ gravel ☐ sand C M F ☐ silt clay ☐ organic matter ☐ wood/shell fragments

Color: ☐ drab olive ☐ gray ☐ black ☐ brown ☐ brown surface

Odor: ☐ none ☐ slight ☐ moderate ☐ strong ☐ sulfidic ☐ petroleum ☐ other

Comments:

Time:_____ Station: _____ Replicate:_____ Acceptable grab: ☐ Yes ☐ No

Bottom Depth:_____ Penetration Depth:_____ RPD Depth:_____

Analyses before homogenization: ☐ VOC ☐ Sulfides ☐ Other

Sample ID:_____

Type: ☐ cobble ☐ gravel ☐ sand C M F ☐ silt clay ☐ organic matter ☐ wood/shell fragments

Color: ☐ drab olive ☐ gray ☐ black ☐ brown ☐ brown surface

Odor: ☐ none ☐ slight ☐ moderate ☐ strong ☐ sulfidic ☐ petroleum ☐ other

Comments:

Time:_____ Station: _____ Replicate:_____ Acceptable grab: ☐ Yes ☐ No

Bottom Depth:_____ Penetration Depth:_____ RPD Depth:_____

Analyses before homogenization: ☐ VOC ☐ Sulfides ☐ Other

Sample ID:_____

Type: ☐ cobble ☐ gravel ☐ sand C M F ☐ silt clay ☐ organic matter ☐ wood/shell fragments

Color: ☐ drab olive ☐ gray ☐ black ☐ brown ☐ brown surface

Odor: ☐ none ☐ slight ☐ moderate ☐ strong ☐ sulfidic ☐ petroleum ☐ other

Comments:

Time:_____ Station: _____ Replicate:_____ Acceptable grab: ☐ Yes ☐ No

Bottom Depth:_____ Penetration Depth:_____ RPD Depth:_____

Analyses before homogenization: ☐ VOC ☐ Sulfides ☐ Other

Sample ID:_____

Type: ☐ cobble ☐ gravel ☐ sand C M F ☐ silt clay ☐ organic matter ☐ wood/shell fragments

Color: ☐ drab olive ☐ gray ☐ black ☐ brown ☐ brown surface

Odor: ☐ none ☐ slight ☐ moderate ☐ strong ☐ sulfidic ☐ petroleum ☐ other

Comments:

# The ELM Group, Inc. - Groundwater Sampling Field Data Log

SITE: | MONITORING WELL ID:

PROJECT #: | WELL PERMIT #: | DTW (BEFORE PUMP PLACEMENT): FT BTOC

DATE: | WELL DEPTH (FT): | DTW (AFTER PUMP PLACEMENT): FT BTOC

SAMPLER: | WELL DIAMETER (IN): | COLUMN HEIGHT (FT):

WEATHER: | SCREENED INTERVAL (FT): | CASING VOLUME (GAL): 1X: 3X: 5X:

PUMP INTAKE DEPTH (FT): | PURGE METHOD:

PUMP TYPE: | SAMPLE METHOD:

PID READINGS (ppm): BACKGROUND: BELOW OUTER CAP: BELOW INNER CAP: Page of

| TIME | PURGING | SAMPLING | pH | SPEC COND (mS/cm) | TURBIDITY (NTU) | DISSOLVED OXYGEN (mg/L) | TEMP (°C) | ORP (mV) | PURGE RATE (mL/min) | DEPTH TO WATER (FT BTOC) | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| *3-5 minutes btw rdgs* | | | *+/- 0.1* | *+/- 3%* | *+/- 10%* | *+/- 10%* | *+/- 3%* | *+/- 10 mV* | *< 500 ml/min* | *Δ < 0.3 FT* | *Low Flow Parameters* |

COMMENTS:

METER SOURCE: MODEL #:

VENDOR #: SERIAL #:

SAMPLE TIME:

ANALYSIS: ELM NJDEP Lab Certification #: 18004 Checked By: Date:

GW Field Data Log.xls/Revised 12_2011

ED_004850_00001502-01109