Quality Assurance Project Plan

Confederated Salish & Kootenai Tribes
Brownfield Project

Quality Assurance Project Plan

December 2005

MAXIM TECHNOLOGIES
A DIVISION OF TETRA TECH, INC.

Osprey
Environmental Consulting

MAXIM Technologies
A DIVISION OF TETRA TECH, INC.

Handout 08B

FINAL

QUALITY ASSURANCE PROJECT PLAN
FOR
ENVIRONMENTAL SITE ASSESSMENTS
CONFEDERATED SALISH & KOOTENAI TRIBES BROWNFIELD PROJECT

Project Manager/Coordinator: Natalie J. Morrow, Maxim

Signature/Date

Assistant Project Manager/QA Officer: Becky Dupuis, Osprey

Signature/Date 12/12/05

U.S. EPA Project Manager: Stephanie Wallace

Signature/Date 12/21/05

CSKT Brownfield Coordinator: Marlene McDanal

Signature/Date 12/12/05

CSKT Division Manager of Environmental Protection: Richard Janssen

Signature/Date 12-12-05

FINAL

QUALITY ASSURANCE PROJECT PLAN
FOR
ENVIRONMENTAL SITE ASSESSMENTS
CONFEDERATED SALISH & KOOTENAI TRIBES BROWNFIELD PROJECT

Prepared for:

Natural Resources Department
Confederated Salish & Kootenai Tribes
301 Main Street
Polson, Montana 59860

Prepared by:

Maxim Technologies
Missoula, Montana

Osprey Environmental Consulting
Polson, Montana

DECEMBER 2005

TABLE OF CONTENTS

Page

LIST OF APPENDICES

LIST OF ACCRONYMS

%R	Percent Recovery
ACM	Asbestos Containing Materials
ACBM	Asbestos Containing Building Materials
AHERA	Asbestos Hazardous Emergency Response Act
bgs	Below Ground Surface
C	Completeness
CERCLA	Comprehensive Environmental Response Compensation Liability Act
CLP	Contract Lab Program
COPCs	Contaminants of Potential Concern
CSKT	Confederated Salish & Kootenai Tribes
DQO	Data Quality Objectives
EPA	United States Environmental Protection Agency
ESA	Environmental Site Assessment
GPS	Global Positioning Satellite
HASP	Health and Safety Plans
HEPA	High Efficiency Particulate Air
HUD	Housing and Urban Development
LBP	Lead-Based Paint
LCS	Laboratory Control Sample
MCL	Maximum Contaminant Level
MDEQ	Montana Department of Environmental Quality
MS	Matrix Spike
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NESHAP	National Emission Standards for Hazardous Air Pollutants
NOAA	National Oceanic and Atmospheric Administration
OSHA	Occupational Safety and Health Administration
P	Number of measurements/data points planned
PAH	Polynuclear aromatic hydrocarbon
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PCBs	Polychlorinated Biphenyls
PLM	Polarized Light Microscopy
PQL	Practical Quantitation Limit
PRG	Preliminary Remediation Goal
QA	Quality Assurance
QA/QC	Quality Assurance and Quality Control
QAPP	Quality Assurance Project Plan
QC	Quality Control
OSHA	Occupational Safety and Health Adminstration

RBSLs	Risk-Based Screening Level
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
SAPs	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SMCL	Secondary Maximum Contaminant Level
SQuiRT	Screening Quick Reference Tables
SSL	Soil Screening Level
SVOC	Semi-volatile organic compound
V	Number of valid measurements/data points obtained
VOC	Volatile organic compound

1.0 INTRODUCTION

Maxim Technologies (Maxim) and Osprey Environmental Consulting (Osprey) prepared this Quality Assurance Project Plan (QAPP) for the Confederated Salish & Kootenai Tribes (CSKT) to guide quality assurance and quality control (QA/QC) procedures for completion of Brownfield environmental site assessments (ESAs). An EPA Brownfield Assessment grant is funding the completion of ESAs for this project.

This QAPP is a comprehensive document that may be adapted to site assessments as the CSKT identifies sites for investigation. Assessment activities may involve the collection and analysis of surface soil, subsurface soil, sediment, groundwater, surface water, asbestos containing materials (ACM), or lead-based paint (LBP) samples to evaluate environmental conditions on Brownfield sites. Phase I ESAs will be completed prior to implementation of subsequent assessment activities on each site to guide the assessment work. Upon completion of site assessment, a report will be prepared providing the results of each field investigation, data evaluation, and recommendations for remedial actions and/or further assessment, as needed. Analytical results of samples collected during assessments will be evaluated for precision, accuracy, representativeness, and completeness.

There are several organizations directly participating in this project. These include, CSKT, United States Environmental Protection Agency (EPA), Maxim, Osprey, and site owners, if other than CSKT. Other potential stakeholders include the public. Effective project management will ensure that stakeholders agree upon a well-defined assessment approach and that sufficient data is collected to make decisions related to site cleanup and development. The sections in this introduction present the project organization and define the responsibilities of various project participants.

This section also describes data quality objectives (DQOs) for the assessments (overall goals of the project), defined to guide identification of specific tasks that will be used to collect the data necessary to support decision-making.

1.1 PROJECT ORGANIZATION

The overall project manager for grant-funded activities is Mr. Richard Janssen, Brownfield grant manager for CSKT. Ms. Marlene McDanal is the Brownfield coordinator and technical manager for the CSKT. Ms. Natalie Morrow of Maxim is the Project Manager for this Project and will coordinate site assessment work. Figure 1 (Appendix A), and the description below, summarize project personnel and their associated responsibilities for the project.

CSKT Division Manager of Environmental Protection – Richard Janssen

Responsibilities: Coordination of project team, notification budgeting, grant management, and review of planning documents and reports.

CSKT Brownfield Coordinator – Marlene McDanal

Responsibilities: Coordination and oversight of the project team and review of planning documents and reports.

EPA Project Manager – Stephanie Wallace, EPA

Responsibilities: Reviews all project planning documents and plans; assesses site eligibility; insures compliance with EPA requirements and guidance.

Project Manager/Coordinator – Natalie Morrow, Maxim

Responsibilities: Project coordination and liaison with CSKT, EPA, and consulting team members; assist in field planning; problem solving and decision making; and quality assurance during project activities and documents; review and preparation of project documents. Reviews all chain-of-custody forms and analytical data and ensures analytical data meet current standards for accuracy and precision.

Assistant Project Manager, Quality Assurance Officer – Becky Dupuis, Osprey

Responsibilities: Project coordination; assists in field planning; problem solving and decision making; quality assurance during project activities and preparation of documents. Reviews all chain-of-custody forms and analytical data and ensures analytical data meet current standards for accuracy and precision.

Health & Safety Officer – Jerry Armstrong, Maxim

Responsibilities: Ensures work crews comply with health and safety requirements.

1.2 PROJECT OBJECTIVES

Maxim and Osprey will complete ESAs on CSKT designated sites for investigation and possible remediation.

The objectives of the Brownfield assessments are to:

- Complete an assessment of the recognized environmental conditions identified at each site during the Phase I ESAs.
- Develop Sampling and Analysis Plans (SAPs) to guide Phase II ESA activities at each site.
- Gather sufficient data to prepare a remedial action plan for each site and/or recommend further assessment activities.

1.2.1 Project Schedule

This Brownfield project involves completing ESAs of sites designated by CSKT. Figure 2 presents an example tentative project schedule for upcoming Phase II assessment activities at three sites already selected by CSKT. Additional project schedules will be created at the beginning of each new work order or new contract that outlines the tentative start and end timeframes for particular assessment and various project tasks and tentative deadlines for project deliverables. Specific project tasks, such as public outreach, will be identified in the work order and/or contract with CSKT.

The actual project schedule will depend on several factors, such as approval of the QAPP, identification and ranking of the Brownfield sites for assessment, completion and approval of the site-specific SAP and Health and Safety Plan (HASP). The schedule will also depend upon the date assessment activities commence; unanticipated field and weather conditions, the need for further assessment; additional requirements by EPA and CSKT, and the length of the EPA and CSKT review and comment period. The actual duration of the project may exceed the time shown in the project schedules.

1.2.2 Project Description

The project consists of completing ESAs to evaluate contaminant impacts to surface soil, subsurface soil, sediment, groundwater, and surface water, and impacts from ACM, and/or LBP. Activities involved in each ESA will depend on the site investigated and the recognized environmental conditions identified during the Phase I ESA.

Maxim and Osprey will prepare a SAP for each site identified for a Phase II assessment. The SAP will include a site description, site history, purpose and objectives of the assessment, investigation methods, and analytical objectives. In addition, each SAP will define the DQOs for the project. Standard Operating Procedures (SOPs) are provided in this QAPP; however, additional SOPs may be needed, depending on the Phase II assessment activities planned. Any additional SOPs required for completion of the work will be provided in the site-specific SAPs. Site-specific sampling plans will be prepared for each project prior to implementation of field assessment work.

The EPA and CSKT will approve this QAPP and all site-specific SAPs prior to implementation of field investigation activities. Following implementation of the SAP and receipt of field and analytical data, Maxim and Osprey will prepare an assessment report. The report will include the results of the assessment, an evaluation and discussion of the results, and recommendations for further assessment and/or remediation.

1.3 DATA QUALITY OBJECTIVES

DQOs for the CSKT Brownfield ESAs were developed to ensure data quality and to define procedures for data collection. In addition, site-specific DQOs will be identified and specified in each SAP. DQOs were developed following the recommendations in EPA guidance documents (EPA 1994 and 1998). The DQO process allows Maxim and Osprey to determine the level of data quality required for specific data collection activities and to estimate the costs associated with the activities.

1.3.1 Problem Statement

The CSKT is interested in resolving potential contamination issues associated with several sites on the Flathead Reservation. During development of each site-specific SAP, Maxim and Osprey will identify contaminants of potential concern (COPCs) that originate from past and/or current use of the site or practices on adjacent properties. Media affected by COPCs at the sites may include surface soil, subsurface soil, sediment, surface water, groundwater, and/or building materials. The collection of other samples, such as background samples and soil gas samples will be evaluated for each site and discussed in each individual SAP. Not all sites will have the same affected media or COPCs. Each SAP will identify the COPCs affecting each type of media at the site. Possible COPCs for the CSKT Brownfield sites include:

- Petroleum hydrocarbons;
- Polynuclear aromatic hydrocarbons (PAHs)
- Volatile organic compounds (VOCs)
- Semi-volatile organic compounds (SVOCs)
- Polychlorinated Biphenyls (PCBs)
- Pesticides
- Herbicides
- Metals
- ACM
- LBP
- Soil gas (i.e. methane)

1.3.2 Decision Statement

Site assessments will involve collecting environmental data to support cleanup alternatives and/or redevelopment for each site. Cleanup alternatives will likely focus on cleanup or removal of routes of exposure to contamination by human and ecological receptors. To assess the feasibility of cleanup and/or redevelopment at the different sites, Maxim and Osprey will evaluate available data and make decisions based on the following decisions statements:

- Are there portions of the site that will not require any assessment or cleanup prior to redevelopment and/or continued use?
- Are there building materials that contain asbestos or lead-based paint at levels requiring abatement to prevent over exposure or that should be removed prior to building demolition?
- Do some portions of the site contain contaminants above cleanup levels that would preclude residential, commercial, and/or recreational redevelopment or have the potential to affect human health and/or the environment?

1.3.3 Decision Inputs

Data required to address the decision statements may include physical and chemical characteristics of surface soil, subsurface soil, sediment, surface water, groundwater, asbestos, lead-based paint, and soil gas. Where enough data are available, data requirements also may include estimating contaminant waste volumes, and in the case of groundwater contamination, plume spatial and temporal variability. If data are available from previous investigations, Maxim and Osprey will use it to develop the SAP and final decisions with respect to cleanup if the data is of acceptable quality. All data collected and evaluated during assessment will be compared to applicable state and Federal screening levels and standards. Specific decision inputs are summarized in the table below.

DECISION INPUTS

DATA COLLECTION TYPE, DATA PARAMETERS, AND DATA USES		
Source Materials	**Typical Data Parameters**	**Data Uses**
Surface Soil	Petroleum hydrocarbons, PAHs, PCBs, VOCs, SVOCs, pesticides, herbicides, and/or metals.	Identify discrete contamination areas and evaluate potential risk to human health and the environment. Contaminant concentrations will be compared to residential and commercial/industrial screening levels.
Subsurface Soil	Petroleum hydrocarbons, PAHs, PCBs, VOCs, SVOCs, pesticides, herbicides, and/or metals.	Identify discrete contamination areas and evaluate potential risk to human health and the environment. Contaminant concentrations will be compared to residential and commercial/industrial screening levels.
Sediment	Petroleum hydrocarbons, PAHs, PCBs, VOCs, SVOCs, pesticides, herbicides, and/or metals.	Identify contamination of sediment and evaluate potential sources and the potential risk to human health and the environment. Contaminant concentrations will be compared to National Oceanic and Atmospheric Administration (NOAA) freshwater sediment standards.
Groundwater	Petroleum hydrocarbons, VOCs, PAHs, PCBs, SVOCs, pesticides, herbicides, and/or metals, and groundwater flow direction.	Contaminant concentrations, source areas, contaminant extent, and evaluate whether the data exceeds Montana Department of Environmental Quality (MDEQ) WQB-7 and federal drinking water quality standards, and/or EPA Region 9 tap water PRGs.
Surface Water	Petroleum hydrocarbons, PAHs, PCBs, VOCs, SVOCs, pesticides, herbicides, and/or metals. *Total hardness.	Contaminant concentrations, source areas, contaminant extent, and evaluate whether there are exceedances of CSKT and federal water quality standard. *Total hardness is analyzed to evaluate surface water quality standards for select metals.
Building Materials	Asbestos and Lead-Based Paint	Contaminant concentrations, source areas, contaminant extent, and evaluate whether there are MDEQ, Occupational Safety and Health Administration (OSHA), EPA and Housing and Urban Development (HUD) standard exceedances.
Soil Gas	Petroleum hydrocarbon vapors, vapors from volatile organic compounds, and methane.	Use as a site-screening tool to direct subsurface investigation and remediation activities.

1.3.4 Study Boundary

The study boundary for each site will vary. As Brownfield sites are determined Maxim and Osprey will work with CSKT to define each site boundary.

1.3.5 Decision Rule

Several different statistical parameters and regulatory standards will be used to evaluate data collected during the Brownfield assessments. These include the following:

- Grab sample concentrations in groundwater and surface water will be used to evaluate the contribution of specific site sources to overall water quality and risks to human health and the environment.

- Grab and/or composite sample concentrations in surface soil and sediment samples and grab samples of subsurface soil will be used to assess potential risks presented to human health and the environment.

- Materials testing for LBP and ACM will help determine salvage disposal or abatement options for building materials necessary to protect human health.

Sample contaminant concentrations will be compared to established risk-based standards. Risks, and need for corrective action, will be evaluated based on a comparison of a sample concentration by media of concern to an applicable state or federal risk-based standard for varying site reuse scenarios.

Maxim and Osprey will compare groundwater analytical results to Montana Numeric Water Quality Standards (Circular WQB-7; MDEQ 2004c) and federal maximum contaminant levels (MCLs), secondary maximum contaminant levels (SMCLs) will be used for screening and cleanup evaluation. In addition, EPA tap water risk-based concentration (RBCs) will be used for screening purposes only. Surface water results will be compared to CSKT surface water quality standards.

Soil analytical results will be compared to Montana Tier 1 Risk-Based Screening Levels (RBSLs), EPA Region IX Preliminary Remediation Goals (PRGs; EPA 2002), and EPA Soil Screening Levels (SSLs; EPA 1996). National Oceanic & Atmospheric Administration (NOAA) Screening Quick Reference Table (SQUIRT) freshwater sediment standards (NOAA 1999) will be compared to sediment sample results. Asbestos content in samples of suspect materials will be compared to applicable MDEQ, OSHA and EPA standards, and lead samples of building materials to applicable EPA Resource Conservation and Recovery Act, HUD and OSHA standards. Appendix C provides tables with the analytical method detection limits and screening levels and standards.

A comparison of site data to screening levels will be completed to guide remedial alternatives analysis and/or recommendations for further site assessment activities at each site. If the Brownfield assessment work indicates that groundwater and/or soil is impacted at concentrations above the applicable screening levels and standards for a particular site reuse, then further assessment, remediation, or a site-specific risk assessment may be required. If the site is to be used for recreational purposes, site-specific cleanup goals will need to be developed for recreational exposures since EPA Region IX PRGs do not exist for this type of exposure.

1.3.6 Tolerable Limits of Decision Errors

Decision errors are incorrect conclusions about a site caused by using data that are not representative of site conditions due to sampling or analytical error. Limits on decision error are typically established to control the affect of sampling and measurement errors on decisions regarding a site, thereby minimizing the likelihood that an incorrect decision is made. Sites included in this project will likely be accessible to the public. The null hypothesis is that a site is contaminated. A false positive decision error is one that decides a site is clean when, in actuality, it is not clean. A false negative decision error is one that decides a site requires cleanup when, in actuality, it requires no cleanup. False positive and negative decision errors should be minimized as much as possible during this Brownfields project.

Formal limits on decision error are not necessary in areas where the goal of the assessment is to define the boundaries of known contamination (EPA 1998). This QAPP identifies specific field and laboratory methods and sampling strategies that minimize sampling error. The total study error will be minimized by collecting an appropriate number of environmental samples deemed necessary by the assessment team that are intended to represent the range of concentrations present at each site in question. The sampling program is designed to reduce sampling error by specifying an adequate number and distribution of samples to meet project objectives.

Table 1 includes a list of media to sample during these Phase II ESAs and appropriate analytical methods. This QAPP specifies methods and protocols to reduce both field and laboratory error. It also specifies the requirements for collection of field quality control (QC) samples to facilitate assessment of data accuracy and precision. In addition, the individual SAP for each site will be prepared that specifies the sampling and analytical methods and protocols to reduce field error.

1.3.7 Sampling Design

An individual SAP will be prepared that outlines the assessment design for each site. The SAP will specify sampling protocols, analytical methods and the types and numbers of samples to be collected during these assessments. The assessment design will be based on a review of historic data and/or previous investigations completed at each site. The general sampling design for various media is described below. As described in Section 1.3.1, not all environmental media will be sampled at each site.

Surface soil and sediment sampling – Surface soil and sediment sample results will be used to evaluate concentrations of COPCs at the site(s) and/or at a background location away from the site(s). Results will also be used to identify potential direct routes of exposure and risks based on chemical type and concentration and site reuse scenarios. Surface soil is defined as soil less than 2 feet below ground surface (bgs).

Subsurface soil sampling – Subsurface soil sample results will be used to evaluate concentrations of COPCs in subsurface soil at the site(s). Results will also be used to identify direct and indirect routes of exposure and human-health risk, based on contaminant type and concentrationand potential site reuse scenarios. Subsurface soil is defined as soil greater than 2 feet bgs.

Surface water and Groundwater sampling – Surface and groundwater sample results will be used to assess water quality with respect to human health risk and potential use scenarios.

Soil gas – Soil gas sample results will be used as a site-screening tool to direct subsurface investigation, remediation activities, and redevelopment planning.

Building materials sampling – ACM and LBP sample results will be used to assess potential risk to human health, evaluate remedial alternatives, and/or for demolition and disposal activities.

2.0 MEASUREMENT DATA ACQUISITION

The following section describes tasks related to data acquisition. This includes the sampling process, quality control procedures and requirements, equipment operation, data management, and record keeping.

2.1.1 Sampling Process

Field personnel will collect one or more of the following types of samples during the Brownfields assessments: surface soil, subsurface soil, sediment, surface water, groundwater, ACM, LBP, and/or soil gas.

Sample collection will likely include the use of drill rigs, hand tools, sediment samplers, peristaltic pumps, low-flow or submersible groundwater sampling pumps and equipment, and meters for the collection of field parameters. Samples will be handled under standard preservation and chain-of-custody procedures. Analytical methods required for the field investigations are listed in Table 1 (Appendix B) and will be re-specified in each individual SAP, depending on the analytical requirements needed for the project. Table 2 (Appendix B) presents a summary of sampling media and appropriate SOPs. Appendices C and D provide sample preservation information and the analytical laboratory quality assurance manual, respectively. SOPs are included in Appendix E.

2.1.2 Quality Control

QC samples will include both field and laboratory samples, as described below.

Field Quality Assurance/Quality Control Sampling

Five types of field QC samples will be collected during the Brownfield assessments: field duplicates, matrix spike/matrix spike duplicates, field blanks, trip blanks, and rinsate blanks. The purpose of analyzing QC samples is to meet DQOs specified in Section 1.3, above. Table 3 (Appendix B) presents a summary of the field QA/QC objectives. Each QC sample type is discussed below.

<u>Duplicates and Matrix Spikes/Matrix Spike Duplicates</u>

Field duplicate soil, sediment, groundwater, surface water, and building material samples will consist of blind field duplicates collected at a frequency of one field duplicate and one matrix spike/matrix spike duplicate (MS/MSD) for every 20 field samples collected per media for the purposes of determining project sample precision. For example, if 22 field sediment samples and five surface water field samples are collected, two field sediment duplicates and one surface water duplicate will be collected. The purpose of duplicate collection is to evaluate analytical precision. Field duplicates will be submitted as blind duplicates to the laboratory. The field duplicate samples will be containerized and preserved consistent with the field sample, and analyzed for the same constituents as the field sample.

<u>Blanks</u>

Field blank and equipment rinsate blank samples will be collected/prepared in the field and samples will be analyzed for the same parameters as the field samples. Field blank samples will be prepared by pouring de-ionized water in sample bottles to verify that the field conditions and procedures do not introduce contamination to samples. Field blanks will be prepared and analyzed for the contaminants of concern on the site. Equipment rinsate blank will be prepared and submitted for laboratory analysis by

rinsing de-ionized water over decontaminated sampling equipment and collecting the rinsate in sampling bottle.

One equipment rinsate blank will be analyzed per sampling event per set of sampling tools used in the field (i.e., one set may include a trowel, stainless steel bowl, and shovel). Analyses will depend on the sample collected just prior to collection of the equipment rinsate blank. Field and equipment rinsate blank samples will be analyzed along with the field samples. Laboratory data from the field blanks will be used to verify that the de-ionized water does not contain target analytes and that the decontamination procedures are adequate in removing any contamination.

Trip blank samples will be prepared in the laboratory and will consist of de-ionized water. One trip blank will accompany each cooler containing samples with volatile constituents. The trip blanks will be shipped to the sampling office, transported to the field by the sampling crew, and returned to the laboratory along with the field samples for analysis. The trip blanks will be analyzed for the same volatile constituents as the volatile field samples (i.e., VOCs). Analytical data obtained from the trip blanks will be used to determine if analytes are introduced to field samples during sample transport.

Laboratory Quality Assurance/Quality Control

Laboratory quality control procedures are contained in Appendix D.

2.1.3 Equipment Operation, Calibration, and Standardization

All field and laboratory equipment will be operated, maintained, calibrated, and standardized in accordance with EPA and manufacturer's recommended procedures. Maxim's applicable SOPs that specify field equipment operation, maintenance, calibration, and standardization procedures are contained in Appendix E. Table 1 and the individual SAPs prescribe the analytical methods that will be used at each site. The selected analytical method(s) define QC requirements and how the laboratory must analyze each sample. Appendix D contains the laboratory manuals for Northern Analytical, Inc. in Billings, Montana; Energy Laboratories, Inc. in Billings, Montana; and Anatek Labs, Inc. in Moscow, Idaho. Other laboratories may be required for specialized analyses. The site-specific SAPs will identify the analytical laboratory that will be used for the project.

2.1.4 Data Management

Data from each of the five sites will be managed as separate projects in separate files. Analytical data will be provided to Maxim and Osprey in both electronic and hard copy. Hard copy reports will be stored in the project files. Analytical laboratory data for the project will be downloaded directly into a Microsoft Access or Excel database from electronic-formatted laboratory data. Maxim and Osprey will manually enter field parameter measurements into the database. Daily backups will be created prior to entry of new data in the database to prevent loss of data during the data reduction process. Any electronic survey or global positioning satellite (GPS) data will be archived in the same manner as electronic analytical data.

Field descriptions of lithologic characteristics, observations, and other site data will be entered onto appropriate field forms during the field investigation and filed in designated project files in Maxim's office in Missoula, Montana. The QA Officer will maintain quality control of data transfer into the database by verifying the accuracy of a minimum of 10% of the entries placed in the database.

2.1.5 Documents and Records

The QA Officer will be responsible for ensuring that project personnel have the current versions of the SAP and QAPP and other project planning documents. The Maxim project manager will maintain project files and project documents in Maxim's Missoula office.

3.0 ASSESSMENT AND OVERSIGHT ELEMENTS

The Project Coordinator and Quality Assurance Officer will be responsible for assessment and oversight of project activities. The CSKT Project Coordinator will be updated at the end of each sampling event and be provided with a summary of project activities to date. On a monthly basis, the Project Coordinator will provide CSKT with a written project status report.

An internal audit of field procedures may be performed by the Quality Assurance Officer. If completed, the internal audit will include a review of procedures selected for the sampling program, a review of the QA/QC samples required, and a review of training requirements. The laboratory is required to have written procedures addressing internal QA/QC as specified in the Comprehensive Environmental Response Compensation Liability Act (CERCLA) Contract Lab Program (CLP) protocol.

Corrective actions will be taken immediately upon identification of potential problems with data acquisition or measurement. Field equipment malfunctions will be identified immediately and corrected by the field team leaders. Corrective actions will be documented in the field notes. Laboratory equipment malfunctions are handled by chemists according to EPA analytical method specifications. Laboratory QC samples (calibration samples, method blanks, matrix spike samples, laboratory control samples, and laboratory duplicates) will be handled according to EPA analytical method specifications and the Contract Lab Program protocol. Laboratory corrective actions will be included on analytical laboratory reports.

4.0 DATA REVIEW, VERIFICATION, AND VALIDATION

4.1.1 Data Reduction

Data reduction, the result of grouping similar QC samples and calculating and reporting their recoveries, will be performed on laboratory data while still in the laboratory. Maxim and Osprey personnel will work directly with the laboratory's data QA Officer who will review all analytical data associated with each sample. Maxim will receive all QA/QC reports from the analytical laboratory.

The types of laboratory QC data reviewed will include calibration standards, calibration verification, laboratory controls, laboratory duplicates, and laboratory spikes. When EPA methods are used, the applicable data reduction procedures called for in the EPA methods will be used. The assessment reports will include the raw data and a summary of QC data reduction.

4.1.2 Data Review

The ability of data to meet DQOs is evaluated with a precision, accuracy, representativeness, completeness, and comparability (PARCC) statement. A PARCC statement is generated during data evaluation. The following sections define the terms used in the PARCC statement.

4.1.3 Precision

Precision is the amount of scatter or variance that occurs in repeated measurements of a particular analyte. Precision acceptance and rejection for this project will be based on the relative percent difference (RPD) of the field duplicates. Maxim and Osprey will evaluate analytical results for the field and duplicate soil and groundwater samples using the RPD between the two samples when both values of the field/duplicate pair are greater than five times the practical quantitation limit (PQL) for a given analyte.

The RPD is given by:

$$RPD\ (\%) = \frac{2\,|S_1 - S_2|}{S_1 + S_2} \times 100$$

where: | | = absolute value of $S_1 - S_2$
S_1 = measured field sample concentration; and
S_2 = measured duplicate sample concentration.

When duplicate analysis results exceed 35% RPD for aqueous solutions and 50% RPD for soil/sediment, and the sample is greater than five times the PQL, all results for the analyte exceeding the RPD in the sample delivery group will be considered estimated. The range of acceptable RPDs for precision is presented in Table 4 (Appendix B).

4.1.4 Accuracy

Accuracy is defined as the ability of the analytical procedure to determine the actual or known quantity of a particular substance in a sample. Accuracy acceptance or rejection will be based on the percent recovery (%R) of the matrix spike (MS) for water and soil samples, and will be based on the percent recovery of the laboratory control sample (LCS) for solid samples. To determine accuracy, the %R for

each matrix spike or LCS will be compared to the acceptable range as specified in the applicable laboratory method. Equipment and laboratory blanks may also be analyzed to quantify artifacts introduced during sampling, transport or analysis that may affect the accuracy of the data. In addition, initial and continuing calibration results may be used to verify that the sample concentrations are accurately measured by the analytical instrument.

The percentage recovery for MS samples is given by:

$$\text{Recovery (\%)} = \frac{A - B \times 100}{T}$$

Where: A = measured concentration of the spiked sample;
B = concentration of unspiked sample; and
T = amount of spike added.

The percent recovery for surrogate standards and LCSs are given by:

$$\text{Recovery (\%)} = \frac{A}{T} \times 100$$

Where: A = measured concentration of the surrogate or LCS; and
T = known concentration.

Field sample results associated with percent recoveries outside acceptable limits will be considered estimated. Field sample results associated with percent recoveries of less than 50% will be considered rejected, as recommended by EPA (2004a and 2004b). An overall assessment of accuracy will be made upon completion of the project. Overall accuracy will be stated as the mean %R. Because of the small number of matrix spike and laboratory control samples anticipated, no confidence interval will be calculated. The range of acceptable accuracy is presented in Table 4 (Appendix B).

4.1.5 Representativeness

The objective in addressing representativeness is to assess whether information obtained during the investigation accurately represents site conditions. Laboratory water blanks, field blanks, and rinsate blanks are used to assess representativeness. Field results associated with contaminated blanks will be considered estimated, with a high bias, when the field sample result is greater than the practical quantification limit but less than five times the contaminant concentration, as recommended in EPA (2004a and 2004b).

If a laboratory blank contains detectable levels of common laboratory contaminants, then the sample results will be considered as positive only if the concentrations in the sample exceed 10 times the maximum amount detected in any blank. If the concentration in the sample is less than 10 times the blank concentration, we will conclude that the chemical was not detected in the sample and will consider the blank-related concentrations of the chemical to be the quantification limit for the chemical in that sample. If all samples contain levels of a common lab contaminant at less than 10 times the contamination noted in the blank, then the analyte will be eliminated from the set of sample results.

4.1.6 Completeness

The objective in addressing completeness is to assess whether enough data have been collected and enough data are valid to meet the investigation needs. Completeness is assessed by comparing the number of valid sample results to the number of samples collected. The completeness goal of the project is 90%.

Percentage completeness (C) is given by:

$$C\ (\%) = \frac{V}{P} \times 100$$

Where: V = number of valid measurements/data points obtained; and
P = number of measurements/data points planned.

4.1.7 Comparability

The objective in addressing comparability is to assess whether one set of data can be compared to another set of data. Comparability is assessed by determining if an EPA-approved analytical method was used, if values and units are sufficient for the database, if specific sampling points can be established and documented, and if field collection methods were similar.

4.1.8 Data Validation and Evaluation

Data validation consists of completing a review of data using the raw analytical data. The laboratory will validate raw laboratory data using EPA Contract Laboratory Program (CLP) National Functional Guidelines (EPA 2004a and EPA 2004b) and according to specific analytical method requirements. Data evaluation consists of completing a review of laboratory analytical reports that have already had internal laboratory validation of raw data. The objective of data validation and evaluation is to identify any unreliable or invalid laboratory measurements and qualify data for interpretive use. For this project the analytical laboratory will perform data validation on raw analytical data prior to preparing a final analytical report. Once the laboratory has prepared and submitted a final analytical report project personnel will complete an evaluation of the data. The data evaluation will include review of field QA/QC data and additional review of qualifiers assigned to the data by the analytical laboratory. Additional qualifiers will be assigned to the data as necessary based on, but not limited to, precision and accuracy of results, blank contamination, and holding time exceedances. Table 5 (Appendix B) presents the data qualifiers that will be assigned to results, as necessary.

Project personnel will complete data evaluation checklists. The checklists provide a guide for review of the laboratory and field procedures and data collected. The review will evaluate whether the following were completed according to SAP/QAPP requirements, EPA guidelines and/or method specifications:

- Chain-of-custody procedures;
- Cooler temperatures;
- Holding times;

- Laboratory QA/QC (method blanks, control samples, duplicates, MS/MSD); and,
- Field QA/QC (sample handling, duplicates, and field and equipment blanks).

Knowing the limitations of the data assists the data user when making interpretations. Data with limitations are usable for evaluation as long as the limitations are considered. Data evaluation of other field data (pH meter and specific conductivity meter) is not possible because these data have very limited statistical control limits. Professional judgment is required and will be used to assess the impact of field QC on the overall quality and usability of the field data.

4.1.9 Data Reconciliation

Data reconciliation is performed in the office after data validation is complete. Data reconciliation is the generation of the PARCC statement that assesses the data relative to meeting the DQOs. Maxim will perform this reconciliation as part of the data evaluation and completion of the data evaluation checklist. Using the PARCC statement as a basis, reconciliation of data evaluation will be done by comparing evaluation results with project objectives. If data user requirements are not met, the Maxim project manager and quality assurance manager will confer with the CSKT on how issues will be resolved and how limitations of the data will be reported.

5.0 REFERENCES

National Oceanic and Atmospheric Administration (NOAA), 1999. NOAA Screening Quick Reference Tables (SQUIRT), Dated September 1999.

Montana Department of Environmental Quality (MDEQ), 2004c. Circular WQB-7, Numeric Water Quality Standards, Planning, Prevention, and Assistance Division - Water Quality Standards Section, Helena, January, 2004.

United States Environmental Protection Agency (EPA), 1991. Preliminary Assessment. Prepared by Karlton Culig of Ecology and Environment, dated October 11, 1991. Document #TDDF08-9106-05, PAN# FMT00091PAA; CERCLIS ID# MTD 982572430.

United States Environmental Protection Agency (EPA), 1994. Guidance for the Data Quality Objectives Process. United States Environmental Protection Agency Quality Assurance Management Staff, Final, September. EPA/600/R-96/055.

United States Environmental Protection Agency (EPA), 1996. Soil Screening Guidance: User's Guide. Solid and Hazardous Waste, Superfund, United States Environmental Protection Agency. EPA540/R-96/018.

United States Environmental Protection Agency (EPA), 1998. Quality Assurance Guidance for Conducting Brownfields Site Assessment. United States Environmental Protection Agency, Office of Solid Waste and Emergency Response, dated September 1998. EPA/540-98/038.

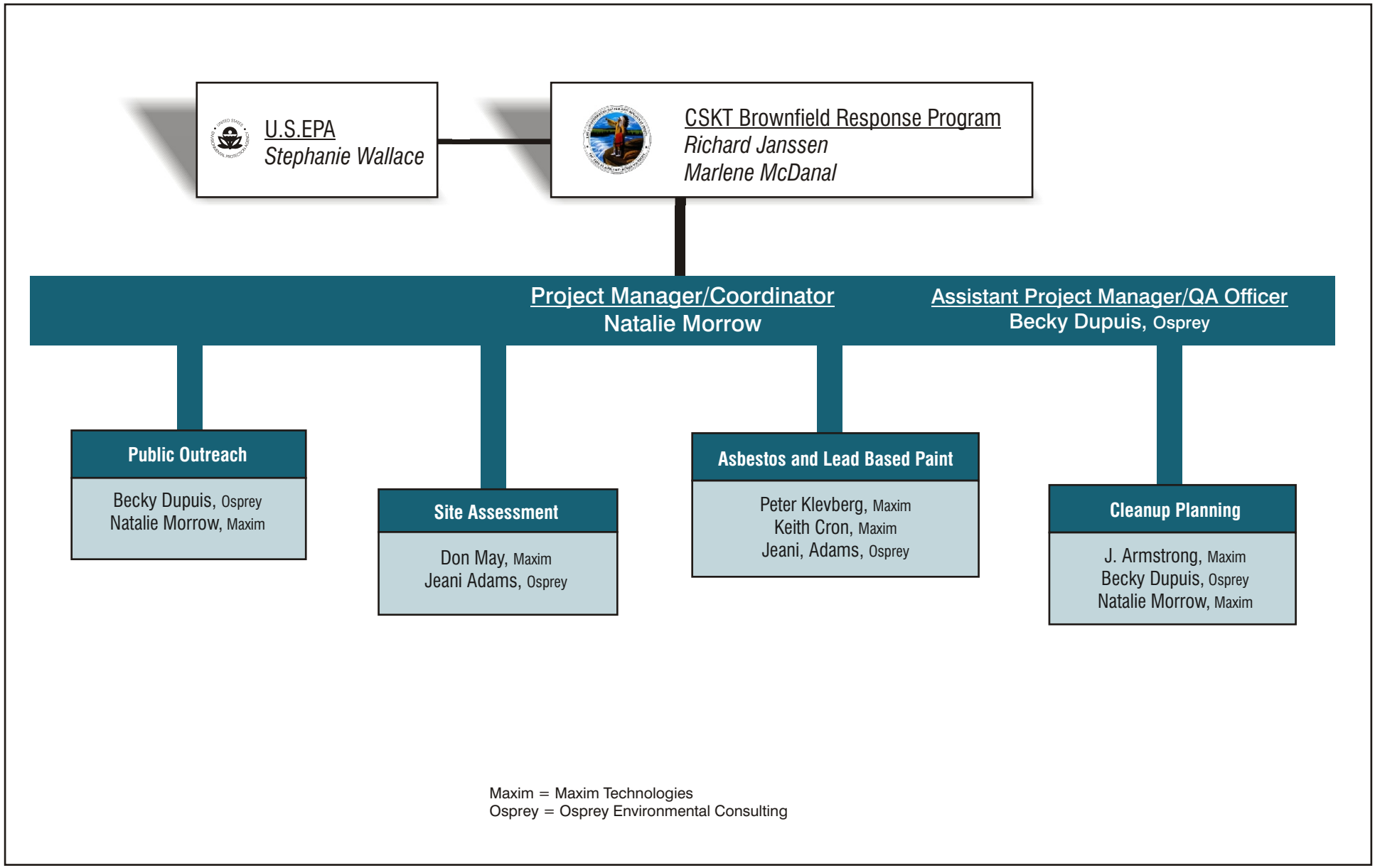
United States Environmental Protection Agency (EPA), 2002. Region 9 Preliminary Remediation Goals Table, 2002 Update. U.S. Environmental Protection Agency, Region IX, San Francisco. October.

United States Environmental Protection Agency (EPA), 2004a. Draft Final, USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. OSWER 9240.1-45, EPA 540-R-04-004. Dated July 2004.

United States Environmental Protection Agency (EPA), 2004b. Draft, USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review. OSWER 9240.1-44, EPA 540-R-04-001. Dated June 2004.

APPENDIX A

FIGURES

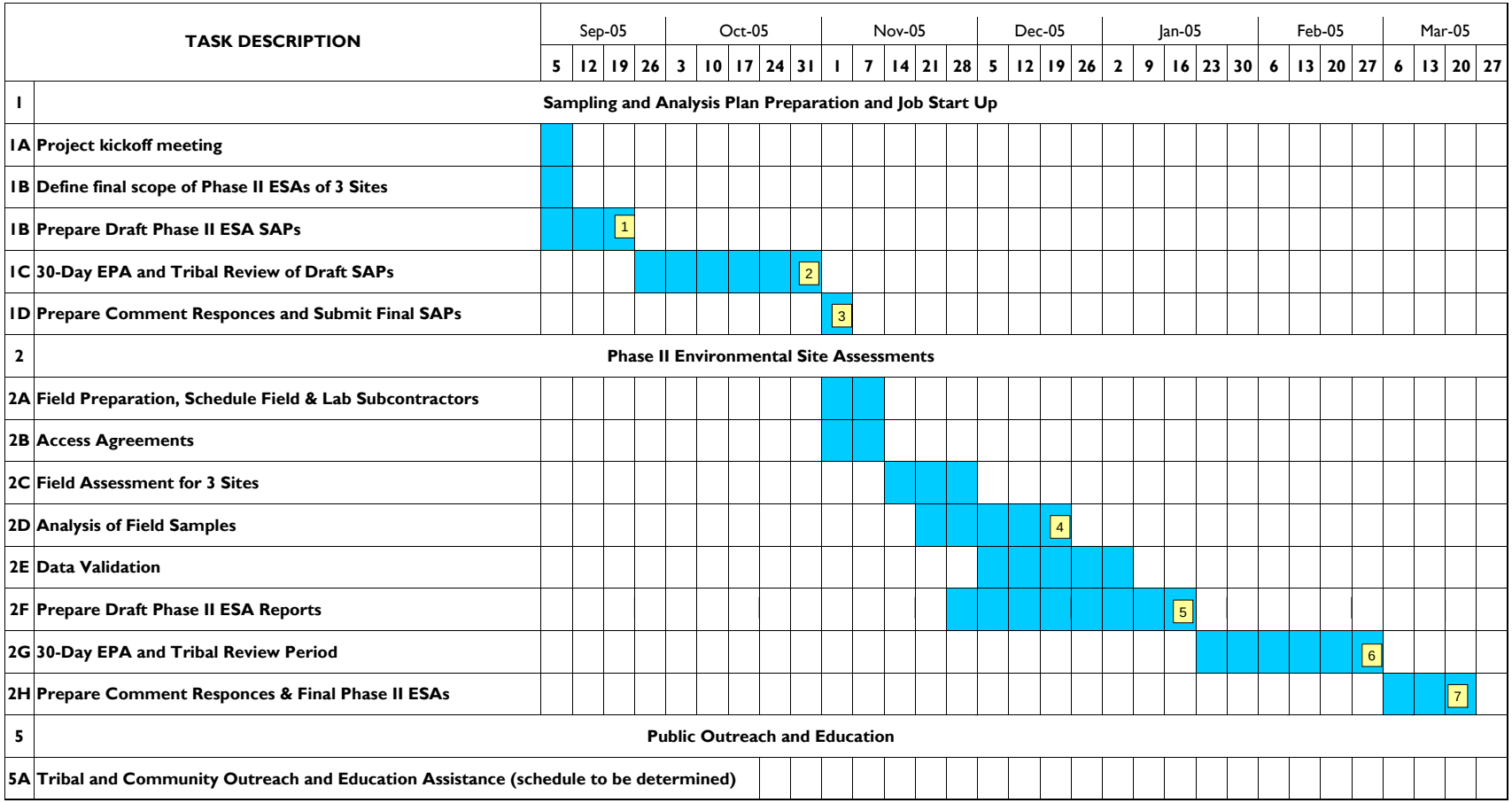


MAXIM

Personnel Organizational Chart
Brownfield Project
Confederated Salish & Kootenai Tribes
FIGURE 1

EXAMPLE OF A PROPOSED SCHEDULE

Phase II Environmental Assessments for 3 Sites Selected by CSKT
Confederated Salish & Kootenai Tribes



Deliverables	Proposed Completion Date
1: Submit draft Phase II SAPs	9/21/2005
2: Receive Tribal Comments on SAPs no later than	10/31/2005
3:Submit Final SAPs	11/4/2005
4: Receive lab reports no later than	12/20/2005
5: Submit draft Phase II ESAs-Approx. 3 weeks after receipt of final lab reports	1/18/2006
6: Receive Tribal Comments on Phase I ESAs no later than	3/1/2006
7: Submit comment responses & final Phase II ESAs	3/20/2006

Note: Proposed schedule will be updated per project.

Example of a Proposed Schedule
Brownfield Project
Confederated Salish Kootenai Tribes
FIGURE 2

APPENDIX B

TABLES

TABLE 1
SAMPLING MEDIA AND ANALYTICAL METHODS

Sampling Media	Analytical Parameters	Analytical Methods
Soil and Sediment	Extractable Petroleum Hydrocarbons (EPH)	MADEP-EPH-98
	Volatile Petroleum Hydrocarbons (VPH)	MADEP-VPH-98
	VOCs	EPA 8260B
	SVOCs (includes PAHs)	EPA 8270C
	Organic Pesticides (and PCBs)	EPA 8081A
	Nitrogen and Phosphorous Containing PCBs	EPA 8270C
	Herbicides	EPA 8151
	PCBs	EPA 8082
	Metals	EPA 6010B (Mercury by 7471)
	Toxicity Characteristic Leaching Procedure	EPA 1311
Groundwater and Surface Water	Extractable Petroleum Hydrocarbons	MADEP-EPH-98
	Volatile Petroleum Hydrocarbons	MADEP-VPH-98
	VOCs	EPA 8260B
	SVOCs (includes PAHs)	EPA 8270C
	Organic Pesticides (and PCBs)	EPA 8081A
	Nitrogen and Phosphorous Containing PCBs	EPA 8270C
	Herbicides	EPA 8151
	PCBs	EPA 8082
	Metals	EPA 6020 (Mercury by 7470A)
	*Total Hardness (total calcium and magnesium)	EPA 6010
Building Materials	ACM	PLM asbestos – EPA 600/R-93/116
	Lead-Based Paint:	Method in 24 CFR Part 35 (HUD)
	XRF Lead	EPA 6010
	Total Lead	EPA 1311
	TCLP Lead	

VOCs = Volatile Organic Compounds
SVOCs = Semi-volatile Organic Compounds
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Biphenyls
ACM = Asbestos Containing Materials
PLM = Polarized Light Microscopy
MADEP = Massachusetts Department of Environmental Protection
EPA = United States Environmental Protection Agency
*Total hardness used to calculate surface water quality standards for select metals to assess affects to aquatics

TABLE 2
SAMPLING PROCESSES

Sampling Process	Standard Operating Procedures (see Appendix E)
Soil and Sediment Sampling	10, 11, 12, 22, 24, 27
Surface Water Sampling	3, 5, 6, 7, 8, 9, 10, 11, 12
Groundwater Sampling	5, 6, 7, 8, 9, 10, 11, 12, 16, 17, 18, 20, EPA low-flow purge method
Asbestos	46
Lead-based Paint	23, 47

TABLE 3
FIELD QA/QC SAMPLE OBJECTIVES

QC Sample	Purpose	Frequency	QA Objective
Field Duplicate	Measure analytical precision	1 per every 20 samples	Precision (See Section 4.0): 50% RPD for soil/waste 30% RPD for water
Matrix Spike/Matrix Spike Duplicate	Measure analytical accuracy.	1 per every 20 samples	Precision (See Section 4.0): 50% RPD for soil/waste 30% RPD for water
Equipment Rinsate Blanks	Quantify artifacts introduced during sampling, decontamination, transport, from ambient air, in decontamination water supply, or analysis of samples – measure of accuracy and representativeness	1 per sampling event per media (1 soil and 1water)	Target analytes not detected
Field Blank	Quantify artifacts introduced during sampling, transport, from ambient air, in decontamination water supply, or analysis of samples – measure of accuracy and representativeness	1 per sampling event.	Target analytes not detected.
Trip Blanks	Quantify artifacts introduced during sampling, transport, or analysis of samples and in laboratory water supply – measure of accuracy and representativeness	1 per cooler containing samples with volatile constituents	Target analytes not detected

RPD = Relative Percent Difference, it is used to evaluate precision (see Section 4.0)
QA/QC= Quality Assurance/Quality Control

TABLE 4
PRECISION, ACCURACY, AND COMPLETENESS REQUIREMENTS

Type	Precision		Accuracy		Completeness
	Solid	Water	Solid	Water	
Field/Duplicate	50%	35%	75%-125%	75%-125%	90%
Laboratory Duplicate	Method Specific	Method Specific	Lab and analyte specific	Lab and analyte specific	
Laboratory Surrogate	NA	NA	Lab and analyte specific	Lab and analyte specific	

NA = Not Applicable

TABLE 5
RESULTS AND QUALIFIERS

Qualifier	Result
<	The analyte was analyzed for but not detected at or above the PQL used for the method.
U	The material was analyzed for but was not detected above the level of the associated value. The associated value is the PQL.
J	The associated value is an estimated quantity.
B	The analyte was detected at or above the PQL in a field and/or laboratory blank.
R	The data are rejected and unusable.

APPENDIX C

SAMPLE PRESERVATION, ANALYTICAL METHODS, AND REPORTING LIMITS

TABLE C-1
SAMPLE PRESERVATION REQUIREMENTS

Parameter	Preservation	Holding Time	Container Type & Sample Volume
Acidity	Cool, 4°C	14 days	P/G 200 mls
Alkalinity	Cool, 4°C	14 days	P/G 200 mls
Ammonia Nitrogen	Cool, 4°C, H_2SO_4 to pH <2	28 days	P/G 50 mls
BTEX, water	Cool, 4°C, HCl to pH <2	14 days	2 - 40 ml VOA vials no headspace
BTEX, soil	Cool, 4°C	14 days	Glass, 100 grams minimal headspace
Biochemical Oxygen Demand	Cool, 4°C	48 hours	P/G 1000 mls
Bromide	Cool, 4°C	28 days	P/G 100 mls
Cations (Ca, Mg, Na, K)	HNO_3 to pH <2	6 months	P/G 100 mls
Chemical Oxygen Demand	Cool, 4°C, H_2SO_4 to pH <2	28 days	P/G 200 mls
Chloride	Cool, 4°C	28 days	P/G 100 mls
Color	Cool, 4°C	48 hours	P/G 100 mls
Cyanide	Cool, 4°C, NaOH to pH<2	14 days	P/G 500 mls
Diesel Range Organics, water	Cool, 4°C, HCl to pH <2	7 days to extraction, 40 days to analysis	Glass, 1000 mls
Diesel Range Organics, soil	Cool, 4°C	14 days to extraction, 40 days to analysis	Glass, 100 grams
EDB and DBCP	Cool, 4°C, HCl to pH <2	28 days	2 - 40 ml VOA vials, no headspace
Electrical Conductivity	Cool, 4°C	28 days	P/G 100 mls
Fluoride	Cool, 4°C	28 days	P/G 100 mls
Gasoline Range Organics, water	Cool, 4°C, HCl to pH <2	14 days	2 - 40 ml VOA vials, no headspace
Gasoline Range Organics, soil	Cool, 4°C	14 days	Glass, 100 grams minimal headspace
Halogens, total	none	none given	Glass, 10 grams, minimal headspace
Herbicides by 8150, water	Cool, 4°C	7 days to extraction, 40 days to analysis	Glass, 1000 mls
Herbicides by 8150, soil	Cool, 4°C	14 days to extraction, 40 days to analysis	Glass, 100 grams
Hexavalent Chromium	Cool, 4°C	24 hours	P/G 200 mls
Iodide	Cool, 4°C	24 hours	P/G 200 mls
Kjeldahl Nitrogen, total	Cool, 4°C, H_2SO_4 to pH <2	28 days	P/G 100 mls
Metals, dissolved (except mercury)	Filter, then HNO_3 to pH <2	6 months	P/G 500 mls
Metals, dissolved (except mercury)	HNO_3 to pH <2	6 months	P/G 500 mls
Mercury	HNO_3 to pH <2	28 days	P/G 200 mls
Nitrate+Nitrite	Cool, 4°C, H_2SO_4 to pH <2	28 days	P/G 100 mls
Nitrite	Cool, 4°C	48 hours	P/G 100 mls
Odor	Cool, 4°C	24 hours	Glass, 200 mls

TABLE C-1
SAMPLE PRESERVATION REQUIREMENTS

Parameter	Preservation	Holding Time	Container Type & Sample Volume
Oil and Grease	Cool, 4°C, H_2SO_4 to pH <2	28 days	Glass, 1000 mls
Organic Carbon, Total	Cool, 4°C, HCl to pH <2	28 days	Glass, 100 mls
Organic Nitrogen	Cool, 4°C, H_2SO_4 to pH <2	28 days	P/G 100 mls
Ortho Phosphate	Cool, 4°C	48 hours	P/G 100 mls
Oxygen, Dissolved	call laboratory Fix O_2 on site	analyze immediately	Glass, 300 mls no headspace
Pesticides/PCBs by 8080, water	Cool, 4°C	7 days to extraction, 40 days to analysis	Glass, 1000 mls
Pesticides/PCBs by 8080, soil	Cool, 4°C	14 days to extraction, 40 days to analysis	Glass, 100 grams
pH	Cool, 4°C	24 hours	P/G 100 mls
Phenolics	Cool, 4°C, H_2SO_4 to pH <2	28 days	Glass, 1000 mls
Phosphorus, total	Cool, 4°C, H_2SO_4 to pH <2	28 days	P/G 100 mls
Total Extractable Petroleum Hydrocarbons ('TEH)	Cool, 4°C, HCl to pH <2	28 days	P/G 1000 mls
Semivolatiles by 8270, water	Cool, 4°C	7 days to extraction, 40 days to analysis	Glass, 1000 mls
Semivolatiles by 8270, soil	Cool, 4°C	14 days to extraction, 40 days to analysis	Glass, 100 grams
Solids, settleable	Cool, 4°C	48 hours	P/G 1000 mls
Solids, total, TDS, TVS, TS, TSS	Cool, 4°C	7 days	P/G 1000 mls
Sulfate	Cool, 4°C	28 days	P/G 200 mls
Sulfide	Cool, 4°C, Zinc Acetate + NaOH to pH>9	7 days	P/G 500 mls
Sulfite	Cool, 4°C, 1 ml EDTA solution per 100 mls, call lab	analyze immediately	P/G 200 mls, minimal headspace, avoid aeration
Surfactants	Cool, 4°C	48 hours	P/G 500 mls
Turbidity	Cool, 4°C	48 hours	P/G 100 mls
Volatile Organics	Cool, 4°C, HCl to pH <2	14 days	3 - 40 ml VOA vials, no headspace

TABLE C-2

SOIL

LABORATORY PRACTICAL QUANTITATION LIMITS FOR SOIL COMPARED TO SOIL SCREENING LEVELS AND PRGs

Analyte	MDL	PQL	SSL	PRG		RBSL (Subsurface Soil)			RBSL (Surface Soil)					
			DAF10	res	ind	<10' GW	10-20' GW	>20'	<10' GW		10-20' GW		>20'	
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	res	comm.	res.	comm	res	comm.
RCRA Metals (6010B and 7471B (Hg))														
Arsenic	0.3	2	10	0.4	1.6									
Barium	0.4	10	820	5,400	67,000									
Cadmium	0.3	2	4	37	450									
Chromium	0.6	10	20	210	450									
Lead	1.0	10	none	400	800									
Mercury (7471B)	0.005	0.2	none	23	310									
Silver	0.8	10	20	390	5,100									
Selenium	4	10	3	390	5,100									
VOLATILE ORGANIC COMPOUNDS (8260B)														
Allyl chloride	0.0003	0.025		17	180									
Acrylonitrile	0.0016	0.05		0.21	0.49									
Benzene	0.0002	0.005	**0.02**	0.64	1.4	0.05	0.1	0.2	0.05	0.1	0.1	0.1	0.2	0.2
Bromobenzene	0.0002	0.005		28	92									
Bromochloromethane	0.0006	0.005												
Bromodichloromethane	0.0003	0.005	0.30	0.82	1.8									
Bromoform	0.0007	0.005	0.40	62	220									
Bromomethane	0.0024	0.005	0.10	3.9	13									
n-Butylbenzene	0.0005	0.005		240	240									
sec-Butylbenzene	0.0004	0.005		220	220									
t-Butylbenzene	0.0003	0.005		390	390									
Carbon disulfide	0.0001	0.025	20	360	720									
Carbon tetrachloride	0.0007	0.005	0.03	0.25	0.55									
Chlorobenzene	0.0002	0.005	0.70	150	530									
Chloroethane	0.0009	0.005		3.0	6.5									
Chloroform	0.0003	0.005	0.30	0.22	0.47									
Chloromethane (mehtyl chloride)	0.0009	0.005		47	160									
2-Chlorotoluene	0.0008	0.005												
4-Chlorotoluene	0.0009	0.005												
Dibromochloromethane	0.0004	0.005	0.20	1.1	2.6									
1,2-Dibromo-3-chloropropane	0.0011	0.025		0.46	2.0									
1,2-Dibromoethane	0.0007	0.005		0.032	0.073									
Dibromomethane	0.0005	0.005												
Dichlorodifluoromethane	0.0002	0.005		94	310									
1,2-Dichlorobenzene	0.0002	0.005	9	600	600									
1,3-Dichlorobenzene	0.0005	0.005		530	600									
1,4-Dichlorobenzene	0.0003	0.005	1.0	3.4	7.9									
1,1-Dichloroethane	0.0001	0.005	10	510	1,700									
1,2-Dichloroethane	0.0006	0.005	0.01	0.28	0.60									
1,1-Dichloroethene	0.0006	0.005	0.03	120	410									
c-1,2-Dichloroethene	0.0003	0.005	0.20	43	150									
t-1,2-Dichloroethene	0.0002	0.005	0.30	69	230									
1,2-Dichloropropane	0.0005	0.005	0.01	0.34	0.74									
1,3-Dichloropropane	0.0006	0.005	**0.002**	0.78	1.80									
2,2-Dichloropropane	0.0003	0.005												
1,1-Dichloropropene	0.0003	0.005												
c-1,3-Dichloropropene	0.0003	0.005												
t-1,3-Dichloropropene	0.0001	0.005												
t-1,4-Dichloro-2-butene	0.0006	0.025		**0.0079**	**0.018**									
Ethylbenzene	0.0003	0.005	7	400	400	10	40	60	10	10	40	40	60	60
Ethylmethacrylate	0.0002	0.025		140	140									
Hexachlorobutadiene	0.0010	0.005	1	6.2	22									
Isopropylbenzene	0.0004	0.005												
Isopropyltoluene	0.0004	0.005												
Iodomethane	0.0009	0.025												

TABLE C-2

SOIL

LABORATORY PRACTICAL QUANTITATION LIMITS FOR SOIL COMPARED TO SOIL SCREENING LEVELS AND PRGs

Analyte	MDL	PQL	SSL	PRG		RBSL (Subsurface Soil)			RBSL (Surface Soil)					
			DAF10	res	ind	<10' GW	10-20' GW	>20'	<10' GW		10-20' GW		>20'	
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	res	comm.	res.	comm	res	comm.
Methylene chloride	0.0003	0.025	**0.01**	9.1	21									
Methy-tert-butyl ether	0.0004	0.005		32	70	0.1	0.2	0.3	0.1	0.1	0.2	0.2	0.3	0.3
Methacrylonitrile	0.0004	0.05		2.1	8.4									
Methyl methacrylate	0.0012	0.05		2,200	2,700									
Naphthalene	0.0019	0.025				9	30	50	9	9	30	30	50	50
n-Propylbenzene	0.0004	0.005		240	240									
Pentachloroethane	0.0003	0.025												
Styrene	0.0005	0.005	2	1,700	1,700									
1,1,1,2-Tetrachloroethane	0.0007	0.005		3.2	7.3									
1,1,2,2-Tetrachloroethane	0.0004	0.005	**0.002**	0.41	0.93									
Tetrachloroethane	0.0009	0.005												
Toluene	0.0005	0.005	6	520	520	10	40	60	10	10	40	40	60	60
1,2,3-Trichlorobenzene	0.0010	0.005												
1,2,4-Trichlorobenzene	0.0007	0.005	3	62	220									
1,1,1-Trichloroethane	0.0004	0.005	1	1,200	1,200									
1,1,2-Trichloroethane	0.0002	0.005	0.009	0.73	1.6									
Trichloroethene	0.0005	0.005	0.03	0.053	0.11									
Trichlorofluoromethane	0.0005	0.005		390	2,000									
1,2,3-Trichloropropane	0.0023	0.005		0.034	0.076									
1,2,4-Trimethylbenzene	0.0005	0.005		52	170									
1,3,5-Trimethylbenzene	0.0003	0.005		21	70									
Vinyl acetate	0.0027	0.05	80	430	1,400									
Vinyl chloride	0.0006	0.005	0.007	0.079	0.075									
m&p-Xylene	0.0007	0.005												
o-Xylene	0.0003	0.005												
Total Xylenes	0.0009	0.01	100	270	420	200	200	200	20	80	20	80	20	80
Acetone	0.0037	0.1	8	14,000	54,000									
Methyl ethyl ketone	0.0036	0.1		22,000	110,000									
4-Methyl-2-pentanone	0.0012	0.1		5,300	47,000									
2-Hexanone	0.0016	0.1												
Hexachloroethane	0.0009	0.005	0.20	35	120									
POLYNUCLEAR AROMATIC HYDROCARBONS (8270C)														
Acenaphthene	0.03	0.3	290	3,700	29,000	200	500	800	200	200	500	500	600	800
Acenaphthylene	0.03	0.3												
Anthracene	0.02	0.3	5,900	22,000	100,000	4,000	10,000	20,000	3,000	4,000	3,000	10,000	3,000	20,000
Benzo[a]anthracene	0.02	0.3	0.8	0.62	2.1	10	40	70	0.8	6	0.8	6	0.8	6
Benzo[a]pyrene	0.02	0.3	4	**0.062**	**0.21**	3	10	20	**0.08**	0.6	**0.08**	0.6	**0.08**	0.6
Benzo[b]fluoranthene	0.06	0.3	2	0.62	2.1	50	200	200	0.8	6	0.8	6	0.8	6
Benzo[g,h,i]perylene	0.04	0.3												
Benzo[k]fluoranthene	0.03	0.3	20	6.2	21	500	2,000	2,000	8	60	8	60	8	60
Chrysene	0.01	0.3	80	62	210	1,000	5,000	8,000	80	600	80	600	80	600
Dibenzo [a,h] anthracene	0.04	0.3	0.80	**0.062**	0.21	6	20	20	**0.08**	0.6	**0.08**	0.6	**0.08**	0.6
Fluoranthene	0.03	0.3	2,100	2,300	22,000	1,000	4,000	5,000	400	1,000	400	4,000	400	5,000
Fluorene	0.02	0.3	280	2,700	26,000	200	600	900	200	200	400	600	400	900
Indeno (1,2,3-c,d) pyrene	0.04	0.3	7	0.62	2.1	10	40	60	0.8	6	0.8	6	0.8	6
Naphthalene	0.02	0.3	40	56	190	9	30	50	9	9	30	30	50	50
Phenanthrene	0.02	0.3												
Pyrene	0.03	0.3	2,100	2,300	29,000	5,000	7,000	7,000	300	5,000	300	6,000	300	6,000
2-Methylnaphthalene	0.02	0.3												
VOLATILE PETROLEUM HYDROCARBONS (MADEP-VPH-98)														
Benzene	0.007	0.03	0.02	0.64	1.4	0.05	0.1	0.2	0.05	0.05	0.1	0.1	0.2	0.2
Ethylbenzene	0.009	0.05	7	400	400	10	40	60	10	10	40	40	60	60
Toluene	0.008	0.05	6	520	520	10	40	60	10	10	40	40	60	60
Xylene m&p	0.03	0.10												
Xylene, o	0.008	0.05												

TABLE C-2

SOIL

LABORATORY PRACTICAL QUANTITATION LIMITS FOR SOIL COMPARED TO SOIL SCREENING LEVELS AND PRGs

Analyte	MDL	PQL	SSL	PRG		RBSL (Subsurface Soil)			RBSL (Surface Soil)					
			DAF10	res	ind	<10' GW	10-20' GW	>20'	<10' GW		10-20' GW		>20'	
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	res	comm.	res.	comm	res	comm.
Xylene total	0.04	0.15	100	270	420	200	200	200	20	80	20	80	20	80
MTBE	0.008	0.03		32	70	0.10	0.2	0.3	0.1	0.1	0.2	0.2	0.3	0.3
Naphthalene	0.006	0.10	40	56	190	9	30	50	9	9	30	30	50	50
C9-C10 Aromatics	0.06	1				8	30	40	8	8	10	30	10	40
C5-C8 Aliphatics	3	5				100	100	100	10	50	10	50	10	50
C9-C12 Aliphatics	0.6	5				500	500	500	70	300	70	300	70	300
EXTRACTABLE PETROLEUM HYDROCARBONS (MADEP-EPH-98)														
Total Extractable Hydrocarbons	2	10												
C9-C18 Alipatics	5	10				1000	1000	1000	100	600	100	600	100	600
C19-C36 Aliphatics	1	10				5000	5000	5000	2500	5000	2500	5000	2500	5000
C11-C22 Aromomatics	2	10				100	400	600	70	100	70	300	70	300
ORGANIC PESTICIDES, METHOD (8081A)														
Aldrin	0.0005	0.003	0.2	0.029	0.10									
a-BHC	0.0003	0.003	0.003	0.09	0.36									
b-BHC	0.0006	0.003	0.001	0.32	1.3									
d-BHC	0.0003	0.003												
g-BHC	0.0003	0.003	0.005	0.44	1.7									
a-Chlordane (chlordane-technical)	0.0003	0.003	5	1.6	6.5									
g-Chlordane (chlordane-technical)	0.0004	0.003	5	1.6	6.5									
Dieldrin	0.0005	0.007	**0.002**	0.03	0.11									
DDD	0.0006	0.007	8	2.4	10									
DDE	0.001	0.007	30	1.7	7									
DDT	0.0005	0.007	20	1.7	7									
Endosulfan I	0.0002	0.003	9	370	3,700									
Endosulfan II	0.001	0.007	9	370	3,700									
Endo-sulfate	0.0006	0.007												
Endrin	0.0006	0.007	0.5	18	180									
Endrin Ald.	0.001	0.007												
Endrin Ketone	0.001	0.007												
Heptachlor	0.0003	0.003	10	0.11	0.38									
Hept. Epox.	0.0004	0.003	0.3	0.053	0.19									
Methoxychlor	0.0038	0.033	80	310	3,100									
Toxaphene	0.004	0.066	20	0.44	1.6									
HERBICIDES (8151A)														
Pentachlorophenol	0.003	0.010	0.01	3.0	9.0									
NITROGEN AND PHOSPHORUS CONTAINING PESTICIDES (8270C)														
Bromacil	---	0.33*												
Chlorpropham	---	0.33*												
Metolachlor	---	0.33*												
Norflurazon	---	0.33*		2,400	25,000									
Alachlor	---	0.33*		6.0	21									
Diphenamid	---	0.33*		1,800	18,000									
Pebulate	---	0.33*		3,100	31,000									
Fenarimol	---	0.33*												
Vernolate	---	0.33*												
Metribuzin	---	0.33*		1,500	15,000									
Triadimefon	---	0.33*												
Butylate	---	0.33*		3,100	31,000									
Simazine	---	0.33*		4.1	14									
Simetryn	---	0.33*												
Prometryn	---	0.33*		240	2,500									
Fenamiphos	---	0.33*		15	150									
Dichlorvos	---	0.33*		1.70	5.9									
Atrazine	---	0.33*		2.2	7.8									
Ethoprop	---	0.33*												

TABLE C-2

SOIL

LABORATORY PRACTICAL QUANTITATION LIMITS FOR SOIL COMPARED TO SOIL SCREENING LEVELS AND PRGs

Analyte	MDL	PQL	SSL	PRG		RBSL (Subsurface Soil)			RBSL (Surface Soil)					
			DAF10	res	ind	<10' GW	10-20' GW	>20'	<10' GW		10-20' GW		>20'	
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	res	comm.	res.	comm	res	comm.
Terbufos	---	0.33*		1.5	15									
Diazinon	---	0.33*		55	550									
Fluridone	---	0.33*		4,900	49,000									
MGK 264	---	0.33*												
Terbacil	---	0.33*		790	8,000									
Carboxin	---	0.33*		6,100	62,000									
Tricyclazole	---	0.33*												
Napropamide	---	0.33*		6,100	62,000									
Butachlor	---	0.33*												
Molinate	---	0.33*		120	1,200									
EPTC	---	0.33*		1,500	15,000									
Cycloate	---	0.33*												
Hexazinone	---	0.33*		2,000	20,000									
Atraton	---	0.33*												
Prometon	---	0.33*		920	9,200									
Ametryn	---	0.33*		550	5,500									
Terbutryn	---	0.33*		61	620									
Propazine	---	0.33*		1,200	12,000									
Methyl paraoxon	---	0.33*												
Mevinphos	---	0.33*												
Stirofos	---	0.33*												
Disulfoton	---	0.33*		2.4	25									
Tebuthiuron	---	0.33*		4,300	43,000									
Merphos	---	0.33*		1.8	18									
Pronamide	---	0.33*		4,600	46,000									

* - estimated

MDL -method detection limit

PQL -method practical quantitation limit

µg/kg - micrograms per kilogram

mg/kg - milligrams per kilogram

SSL - EPA Region 9 soil screening level with DAF of 10

PRG - EPA Region 9 preliminary remediation goal

RBSL - Risk based screening level provided by Montana Department of Environmental Quality.

res - residential

comm - commercial

DAF - Dilution Attenuation Factor

ind - industrial

GW - groundwater

Blank cells indicate soil goal or screening levels is not available

Bolded and shaded cells indicate that the value for this SSL, PRG, or RBSL is below the PQL, therefore if the compound is detected additional evaluation may be necessary.

TABLE C-3

GROUNDWATER

LABORATORY PRACTICAL QUANTITATION LIMITS FOR WATER COMPARED TO MDEQ GROUNDWATER QUALITY STANDARDS

Analyte	MDL ug/l	PQL ug/l	EPA Region 9 Tap Water PRG ug/l	EPA National Primary Drinking Water Standard (MCL) ug/l	MDEQ WQB-7 Groundwater Standard (MCL, HA, PP, RBSLs) ug/l	WQB-7 Required Reporting Limit[2] ug/l
VOLATILE ORGANIC COMPOUNDS (8260B)						
Allyl chloride	0.04	5	10			
Acrylonitrile	0.22	10	**0.039**		**0.59**	20
Benzene	0.05	1	**0.35**	5	5	**0.5**
Bromobenzene	0.07	1	20			
Bromochloromethane	0.19	1				
Bromodichloromethane	0.08	1	**0.18**		5.6	**0.5**
Bromoform	0.17	1	8.5		40	**0.5**
Bromomethane	0.22	1	8.7		48	**0.5**
n-Butylbenzene	0.08	1	240			
sec-Butylbenzene	0.06	1	240			
t-Butylbenzene	0.04	1	240			
Carbon disulfide	0.06	5	1,000			
Carbon tetrachloride	0.17	1	**0.17**	5	3	**0.5**
Chlorobenzene	0.03	1	160	100	100	**0.5**
Chloroethane	0.73	1	120	100		
Chloroform	0.08	1	6.2		60	**0.5**
Chloromethane	0.10	1	1.5			
2-Chlorotoluene	0.08	1				
4-Chlorotoluene	0.08	1				
2-Chloroethyl vinyl ether	0.36	10				
Dibromochloromethane	0.13	1	**0.13**		4.1	**0.5**
1,2-Dibromo-3-chloropropane (DBCP)	0.27	5	**0.048**	**0.2**	**0.2**	**0.05**
1,2-Dibromoethane	0.12	1	**0.0056**		**0.005**	**0.5**
Dibromomethane	0.15	1				
Dichlorodifluoromethane	0.03	1	390		1,000	**0.5**
1,2-Dichlorobenzene	0.05	1	370		600	10
1,3-Dichlorobenzene	0.05	1	180		400	10
1,4-Dichlorobenzene	0.05	1	**0.50**		75	10
1,1-Dichloroethane	0.07	1	810			
1,2-Dichloroethane	0.19	1	**0.12**	5	4	**0.5**
1,1-Dichloroethene	0.08	1	340	7	7	**0.5**
c-1,2-Dichloroethene	0.08	1	61	70	70	**0.5**
t-1,2-Dichloroethene	0.08	1	120	100	100	**0.5**
1,2-Dichloropropane	0.06	1	**0.16**	5	5	
1,3-Dichloropropane	0.16	1				
2,2-Dichloropropane	0.10	1				
1,1-Dichloropropene	0.06	1				
c-1,3-Dichloropropene	0.09	1			2	**0.5**
t-1,3-Dichloropropene	0.16	1			2	**0.5**
t-1,4-Dichloro-2-butene	0.23	5				
Ethylbenzene	0.05	1	1,300	700	700	**0.5**
Ethylmethacrylate	0.18	5	550			
Hexachlorobutadiene	0.08	1	**0.86**		4.4	10
Isopropylbenzene	0.06	1				
Isopropyltoluene	0.04	1				
Iodomethane	0.07	5				
Methylene chloride	0.22	5	**4.3**		5.7	**0.5**

TABLE C-3

GROUNDWATER

LABORATORY PRACTICAL QUANTITATION LIMITS FOR WATER COMPARED TO MDEQ GROUNDWATER QUALITY STANDARDS

Analyte	MDL ug/l	PQL ug/l	EPA Region 9 Tap Water PRG ug/l	EPA National Primary Drinking Water Standard (MCL) ug/l	MDEQ WQB-7 Groundwater Standard (MCL, HA, PP, RBSLs) ug/l	WQB-7 Required Reporting Limit[2] ug/l
Methy-tert-butyl ether	0.16	1	11		30[3]	
Methacrylonitrile	0.26	10	**1,400**			
Methyl methacrylate	0.15	10				
Naphthalene	0.08	5	6.2		100	10
n-Propylbenzene	0.08	1	240			
Pentachloroethane	0.15	5				
Styrene	0.04	1	1,600	100	100	**0.5**
1,1,1,2-Tetrachloroethane	0.12	1	**0.43**			
1,1,2,2-Tetrachloroethane	0.16	1	**0.055**		1.7	**0.5**
Tetrachloroethene	0.07	1	0.1	5	5	**0.5**
Toluene	0.04	1	720	1,000	1,000	**0.5**
1,2,3-Trichlorobenzene	0.05	1				
1,2,4-Trichlorobenzene	0.07	1	7.2	70	70	**0.5**
1,1,1-Trichloroethane	0.04	1	3,200	200	200	**0.5**
1,1,2-Trichloroethane	0.13	1	0.20	5	5	**0.5**
Trichloroethene	0.07	1	0.028	5	5	**0.5**
Trichlorofluoromethane	0.22	1	1,300		10,000	**0.5**
1,2,3-Trichloropropane	0.08	1	0.0056			
1,2,4-Trimethylbenzene	0.05	1	12			
1,3,5-Trimethylbenzene	0.06	1	12			
Vinyl acetate	0.53	10	410			
Vinyl chloride	0.08	1	**0.02**	2	2	**0.5**
m&p-Xylene	0.11	1	210	10,000	10,000	1.5
o-Xylene	0.07	1	210	10,000	10,000	1.5
Total Xylenes	0.14	2	210	10,000	10,000	1.5
Acetone	1.30	20	5,500			
Methyl ethyl ketone	0.20	20	7,000			
4-Methyl-2-pentanone	0.27	20				
2-Hexanone	0.16	20				
Hexachloroethane	0.10	1	4.8		19	10
VOLATILE PETROLEUM HYDROCARBONS (MADEP-VPH-98)						
Benzene	0.08	1	**0.35**	5	5	**0.5**
Ethylbenzene	0.08	1	1,300	700	700	**0.5**
Toluene	0.09	1	720	1,000	1,000	**0.5**
Xylene m&p	0.3	2	210	10,000	10,000	**1.5**
Xylene, o	0.09	1	210	10,000	10,000	1.5
Xylene total	0.4	3	210	10,000	10,000	**1.5**
MTBE	0.1	2	11		30[3]	
Naphthalene	0.08	2	6.2		100	10
C9-C10 Aromatics	2	20			50	
C5-C8 Aliphatics	23	100			400	
C9-C12 Aliphatics	17	100			400	
EXTRACTABLE PETROLEUM HYDROCARBONS (MADEP-EPH-98)						
Total Extactable Hydrocarbons	88	200				
C9-C18 Aliphatics	88	200			400	
C19-C36 Aliphatics	79	200			1,000	
C11-C22 Aromatics	84	200			300	

TABLE C-3

GROUNDWATER

LABORATORY PRACTICAL QUANTITATION LIMITS FOR WATER COMPARED TO MDEQ GROUNDWATER QUALITY STANDARDS

Analyte	MDL ug/l	PQL ug/l	EPA Region 9 Tap Water PRG ug/l	EPA National Primary Drinking Water Standard (MCL) ug/l	MDEQ WQB-7 Groundwater Standard (MCL, HA, PP, RBSLs) ug/l	WQB-7 Required Reporting Limit[2] ug/l
PESTICIDES (8081A)						
Aldrin	0.004	0.1	**0.004**		**0.02**	0.2
a-BHC	0.006	0.1	0.011		**0.039**	**0.1**
b-BHC	0.007	0.1	0.037		0.14	**0.1**
d-BHC	0.005	0.1			0.14	**0.1**
g-BHC	0.004	0.1	0.052		0.19	**0.1**
a-Chlordane	0.009	0.1	0.19	2	0.3	0.4
g-Chlordane	0.007	0.1	0.19	2	0.3	0.4
Dieldrin	0.009	0.2	**0.0042**		**0.02**	**0.02**
DDD	0.009	0.2	0.28		**0.0083**	**0.01**
DDE	0.02	0.2	**0.20**		**0.0059**	**0.01**
DDT	0.02	0.2	**0.20**		**0.0059**	**0.06**
Endosulfan I	0.006	0.1	220		110	**0.015**
Endosulfan II	0.02	0.2	220		110	**0.024**
Endo-sulfate	0.02	0.2			110	**0.05**
Endrin	0.009	0.2	11	2	2	0.3
Endrin Aldehyde	0.03	0.2			2	**0.025**
Endrin ketone	0.03	0.2				
Heptachlor	0.006	0.1	**0.015**	0.4	**0.08**	0.2
Heptachlor Epoxide	0.005	0.1	**0.0074**	0.2	**0.04**	**0.1**
Methoxychlor	0.07	1	180		40	1
Toxaphene	0.07	1	**0.061**		0.3	1
HERBICIDES (8151A)						
Pentacholorophenol	0.01	0.04	**0.56**	1	1	0.05
POLYNUCLEAR AROMATIC HYDROCARBONS (8270C SIM)						
Anthracene	0.03	0.1	1,800		2,100	0.2
Acenaphthylene	0.02	0.1				0.25
Acenaphthene	0.03	0.1	370		420	10
Benzo(a)anthracene	0.04	0.1	**0.092**		0.48	0.25
Phenanthrene	0.03	0.1				0.25
Fluoranthene	0.04	0.1	1,500		280	10
Fluorene	0.02	0.1	240		280	0.25
Pyrene	0.03	0.1	180		960	0.25
Benzo [a] anthracene	0.02	0.1	**0.092**		0.48	0.25
Chrysene	0.04	0.1	9.2		48	0.25
Benzo [b] fluoranthene	0.57	0.1	**0.092**		0.48	0.25
Benzo [k] fluoranthene	0.04	0.1	0.92		4.79	0.25
Benzo [a] pyrene	0.01	0.1	**0.0092**	0.2	**0.048**	0.2
Indeno (1,2,3-c,d) pyrene	0.04	0.1	**0.092**		**0.044**	0.5
Dibenzo [a,h] anthracene	0.04	0.1	**0.0092**		**0.048**	0.5
Benzo [g,h,i] perylene	0.04	0.1				10
Naphthalene	0.03	0.1	6.2		100	10
METALS (200.8 / 6020; mercury 245.1 / 7470A)						
Arsenic - Total	0.03	3	**0.045**	10 (as of 1/23/06)	20	**3**
Arsenic - Dissolved	0.02	3	**0.045**	10 (as of 1/23/06)	20	**3**
Barium - Total	0.1	3	2,600	2,000	2,000	5
Barium - Dissolved	0.03	5	2,600	2,000	2,000	5

TABLE C-3

GROUNDWATER

LABORATORY PRACTICAL QUANTITATION LIMITS FOR WATER COMPARED TO MDEQ GROUNDWATER QUALITY STANDARDS

Analyte	MDL ug/l	PQL ug/l	EPA Region 9 Tap Water PRG ug/l	EPA National Primary Drinking Water Standard (MCL) ug/l	MDEQ WQB-7 Groundwater Standard (MCL, HA, PP, RBSLs) ug/l	WQB-7 Required Reporting Limit[2] ug/l
Cadmium - Total (chromium IV)	0.01	0.1	18	5	5	**0.1**
Cadmium - Dissolved (chromium IV)	0.06	1	18	5	5	**0.1**
Chromium - Total	0.1	1	110	100	100	**1**
Chromium - Dissolved	0.06	1	110	100	100	**1**
Iron - Total (200.7 /6010B)	7	10	11,000	300[1]	300[1]	10
Iron - Dissolved (200.7 / 6010B	3	10	11,000	300[1]	300[1]	10
Lead - Total (SMCL)	0.09	3		15	15	**3**
Lead - Dissolved (SMCL)	0.006	3		15	15	**3**
Lead (tetrahedral)	0.09	3	0.0036			
Manganese - Total (SMCL)	0.4	5	880	50[1]	50[1]	**5**
Manganese - Dissolved (SMCL)	0.02	5	880	50[1]	50[1]	**5**
Mercury - Total	0.1	0.2	11	2	2	1
Mercury - Dissolved	0.04	0.2	11	2	2	1
Silver - Total	0.04	3	180	100[1]	100	**3**
Silver - Dissolved (SMCL)	0.01	3	180	100[1]	100	**3**
Selenium - Total (SMCL)	0.1	1	180	50	50	**1**
Selenium - Dissolved	0.1	1	180	50	50	**1**

1 = Secondary Maximum Contaminant Level, based on aesthetic properties

2 = "The Required Reporting Value (RRV) is the MDEQs best determination of a level of analysis that can be achieved in routing sampling. It is based on levels actually achieved at both commercial and government laboratories in Montana using acceptable methods.

3 = value based on taste and odor thresholds fiven in EPA 822-f-97-008, December 1997.

MDL -method detection limit

PQL -method practical quantitation limit

MCL = Maximum Contaminant level

HA = Health Advisory

PP = Priority Pollutant

RBSLs = Risk-Based Screening Levels

µg/l - micrograms per liter

EPA MCL - EPA Maximum contaminant level

EPA Region 9 Tap Water PRG = EPA Region 9 Tap Water Preliminary Remediation Goal

MDEQ WQB-7 - MDEQ Circular WQB-7 groundwater quality standard (January 2004)

Blank cells indicate water quality standard is not available

Bolded and shaded cells indicate that the value for this water quality standard and/or RRV is below the PQL, therefore if the compound is detected additional evaluation may be necessary.

APPENDIX D

LABORATORY QUALITY ASSURANCE MANUALS

ANATEK LABS, INC.

MOSCOW, IDAHO

Anatek Labs, Inc.

Quality Assurance Plan

1282 Alturas Drive
Moscow, ID 83843
(208) 883-2839

504 E Sprague Ave. #D
Spokane, WA 99202
(509) 838-3999

Revision No. 4

September 27, 2004

Approvals:

Mike Pearson
Lab Director

_____ Date:_____

John Coddington
Lab Manager, Moscow

_____ Date:_____

Kathy Sattler
Lab Manager, Spokane

_____Date:_____

Gene Solomon
QA Officer

_____ Date:_____

Signature Page (1)

Anatek Labs, Inc.

The undersigned have read this Quality Assurance Plan and understand the requirements set forth in it. By signing this document, these individuals acknowledge their responsibility to follow the procedures outlined. The annual review of this manual is mandatory for all employees and will be construed as training for all matters contained within.

Mike Pearson _____ Initials: _____ Date: _____
Lab Director

Gene Solomon _____ Initials: _____ Date: _____
QA Officer

John Coddington _____ Initials: _____ Date: _____
Lab Manager, Moscow

Kathy Sattler _____ Initials:_____ Date:_____
Lab Manager, Spokane

Name: (Please Print)	Signature:	Initials:	Date:

Table of Contents

Page

Tables, Figures, and Appendices in separate document

Tables

Figures

Appendices

Introduction

Anatek Labs, Inc. has integrated many Quality Assurance (QA) practices into its measurement activities. These QA practices are designed to generate high quality data in an efficient and cost effective manner. Anatek Labs, Inc. has a laboratory-wide Quality Assurance (QA) Program designed to assess and monitor the ongoing quality of the testing performed in its facilities. Its purpose is to identify and correct problems as they occur and, if possible, to determine in advance potential problem areas and institute measures for their resolution. The Quality Assurance Committee will oversee all QA activities to assure the accurate, reliable and prompt reporting of testing results. This document describes Anatek Labs, Inc.'s Quality Assurance Plan as it relates to operations within the laboratory.

This QA Plan addresses all the minimum required elements described in the Guidelines and Specifications for Preparing Quality Assurance Program Plans (QAMS-004 / 80), interim Guidelines and Specifications For Preparing Quality Assurance Project Plans (QAMS-005 / 80) and Guidance on Preparation of Laboratory Quality Assurance Plans (EPA 910 / 9-92-0332).

Quality Assurance Policy Statement

It is the policy of Anatek Labs, Inc. that there shall be sufficient Quality Assurance activities conducted to ensure that all data generated and processed will be scientifically valid and of known and documented quality. All data generated by Anatek Labs, Inc., unless acknowledged and authorized by the submitting party, will be of known precision and accuracy and legally defensible. Quality assurance activities are designed in the most cost-effective fashion possible without compromising data quality objectives. The laboratory staff adheres to the requirements and specifications stated in this Quality Assurance Plan. All data reported meets the applicable requirements for NELAC, EPA and/or any State specific methods used. For specific method requirements refer to SOPs, current EPA methods, Standard Methods 20th Edition or state specific methods.

Policy on Waste, Fraud and Abuse

Under no circumstances is the willful act or fraudulent manipulation of analytical data condoned. Such acts are to be reported immediately to management for appropriate corrective action. Reported acts will be assessed on an individual basis, resulting actions will be consistent with Anatek Labs, Inc. Policies and could result in dismissal.

Falsification of data in any form will not be tolerated. While much analytical data is subject to professional judgment and interpretation, outright falsification, whenever observed or discovered, will be documented and appropriate remedies and punitive measures will be taken toward those individuals responsible.

Fraud Prevention & Detection

Anatek Labs, Inc. actively works to insure that the data it produces is of the highest quality and legally defensible. At a minimum, 10% of all data packets generated are QA reviewed by the QAU. If discrepancies are found management is notified. Blind samples are prepared annually or as needed to check for fraud. If an employee is found to have committed a fraudulent act they will be dismissed.

Code of Ethics/Conduct

The Anatek Organization is a team and each team member is expected to maintain a certain level of professionalism. Employees are expected to perform their duties with excellence, to contribute to an environment where their co-workers can efficiently perform their duties and maintain focus on the overall benefit of the Anatek team. The penalties for violating the Code of Ethics can range from verbal to loss of position. No person at Anatek Labs, Inc. will in any way be put under undo pressure, financial or other, to complete their assigned tasks.

Confidentiality Policy Statement

All client information at Anatek Labs, Inc. is considered confidential. No information will be given out without the express verbal or written permission of the client. All reports generated will be held in the strictest of confidence and issued only to the client. The exceptions to this policy would be those mandated by law. (e.g. Positive *E. coli* in public water systems that are required to be reported to State Regulatory Agencies.) All employees of Anatek Labs, Inc., will at all times adhere to this policy. In the event Anatek Labs goes out of business or ownership is transferred

all records will be dealt with according to client instructions. Data belonging to clients that are no longer available will be destroyed in the event the lab goes out of business or transferred in the case of new ownership.

New Work Policy

It is the policy of Anatek Labs, Inc. to never turn away customer requests. The lab is constantly expanding its abilities by seeking new certifications, purchasing new equipment and hiring quality personnel. If Anatek Labs is unable to perform a particular analysis we will find a certified lab to subcontract the job to. The above policy is at the discretion of the Lab Director and is subject to change.

Quality Assurance Program Management and Implementation

Overall responsibility for quality assurance lies with the Laboratory Director. The primary QA management of the laboratory rests with the Laboratory Manager. To provide technical assistance to the Laboratory Manager, a QA Officer is appointed by the Laboratory Director. The QA Officer is granted sufficient resources to ensure the proper execution of the QA Plan and to recommend and implement specific QA policies and procedures. A Quality Assurance Committee exists to further facilitate adherence and development of QA policies and procedures.

QA Committee

The Quality Assurance Committee is comprised of the QA Officer, the Laboratory Manager and the Laboratory Director. The QA Committee is responsible for overseeing lab-wide QA Plan implementation and addressing QA complaints or concerns brought to its attention from internal or external sources. The QA Committee directs the efforts of the QA Officer and enforces any necessary corrective actions. The QA Committee shall convene if needed to assess and / or address lab-wide QA concerns and any actions taken by the QA Officer. Any QA complaints or problems that are received from outside the laboratory will be referred to the committee in order to resolve such issues.

QA Officer

The QA Officer is appointed by the Laboratory Director to oversee specific QA policy and procedure development, implementation, and adherence of Anatek Labs, Inc.. The QA Officer is responsible for auditing internal operations and ensuring compliance with QA criteria established by this QA Plan and other documented policies and procedures. The QA Officer assesses all QA systems on an annual basis. Results of all findings are documented and corrective action recommendations, if any, are submitted to the QA Committee, Laboratory Manager and affected staff members.

The QA Officer is responsible for documentation and evaluation of specific policies and procedures. Standard Operating Procedures are kept on file documenting specific procedures employed to ensure the validity and acceptability of data generated at Anatek Labs. The QA Officer is responsible for ordering quality control materials applicable to the procedures employed within the Laboratory. Materials purchased for Quality Control purposes are received with a Certificate of Authenticity from the manufacturer. Certificates are kept on file for review if necessary. The QA Officer is responsible for coordinating and reporting for all performance evaluation samples to maintain proper accreditation/certification. The QA officer is responsible for maintaining/updating certifications and accreditations. Unsatisfactory Proficiency Testing / Performance Evaluation results, defined as less than 100%, are reviewed and corrective action plans are developed accordingly.

Laboratory Organization, Responsibilities and Personnel Qualifications

All employees maintain a copy of all training certificates and diplomas on file with certificates of capability for each method they perform. Organizational charts for Anatek Labs, Inc. are shown in Figures 1 & 3.

Laboratory Director

The Laboratory Director is responsible for overall technical direction and business leadership of Anatek Labs, Inc.. The Laboratory Director is responsible for the implementation and evolution of QA policy and SOP's within the laboratory, based on the current market, technological advances in equipment, and methods.

The Laboratory Director is a direct liaison to the Corporation's Board of Directors (BOD) and must attend a BOD meeting at least once a year, or as necessary to discuss equipment purchases, managerial changes, contracts, and major SOP and QA changes.

All Laboratory Managers, Systems Managers, and Service Engineers report directly to the Laboratory Director.

The Laboratory Director is required to attend managerial and/or staff meetings at which the topic of QA is discussed. These meetings will be held as often as necessary or at the direction of the Laboratory Director.

The Laboratory Director is required to act as Laboratory Manager, Systems Manager, and/or Service Engineer if these positions are not filled for any reason.

The Laboratory Director must have a minimum BS in a science or engineering field and 5 years of managerial experience in an environmental laboratory or an equivalent combination of education and experience.

QA Officer

The QA Officer is a member of Anatek Labs, Inc. QA Committee and designated by the Laboratory Director. The QA Officer is responsible for auditing QA activities to ensure compliance with the QA Plan on an annual basis. The QA Officer is responsible for preparing reports of audit findings and recommending, developing, and implementing corrective action plans in cooperation with the Laboratory Manager. The QA Officer will develop, implement, and maintain Standard Operating Procedures appropriate to the procedures employed within Anatek Labs, Inc. The QA Officer will review and approve all QA activities associated with specific monitoring projects prior to the initiation of the project. The QA Officer will identify and procure resources needed to meet QA requirements. The QA Officer is responsible for ensuring all Regulatory Agency requirements are met.

The QA Officer must have a minimum BS in a science or engineering field and two years experience in quality assurance or an equivalent combination of education and experience.

Laboratory Manager

The Laboratory Manager is responsible for overseeing the daily operations of Anatek Labs, Inc. and the Organic Technical Staff. The Laboratory Manager is responsible for coordinating the activities within the laboratory with the overall goal of efficiently producing high quality data in a reasonable time.

In events where employee scheduling or current workload is such that new work cannot be incorporated without missing holding times or data quality objectives, the Laboratory Manager has authority to refuse samples, modify employee scheduling, or re-schedule projects.

Additionally, the Lab Manager will provide technical support to customers.

The Laboratory Manager is responsible for the maintenance of standards and materials in accordance with the QA plan, to ensure uninterrupted operation of the laboratory.

The Laboratory Manager reports directly to the Laboratory Director and acts as interim Director during extended absence of the Laboratory Director.

All Section Managers and Analysts report directly to the Laboratory Manager.

The Laboratory Manager, in coordination with the Section Managers, QC/QA Managers, and Laboratory Director, is responsible for determining in which QA Proficiency Programs the laboratory will participate, and which accreditations the laboratory will pursue. It is the responsibility of the Laboratory Manager to ensure that the laboratory sections perform the tasks necessary to complete the proficiency testing required to maintaining certification and accreditation

The Laboratory Manager is required to attend managerial and/or staff meetings at which the topic of QA is discussed.

The Laboratory Manager can act as Analyst or Section Manager if, for any reason, the positions are not filled.

The Laboratory Manager must have a minimum BS in a science or engineering field and 2 years of managerial experience in an environmental laboratory, or an equivalent combination of education and experience.

Inorganic Supervisor

The Inorganic Supervisor is responsible for overseeing and assisting Inorganic Technical Staff in their daily duties. The Inorganic Supervisor assures adherence to Standard Operating Procedures and Quality Assurance activities. The Inorganic Supervisor should be a Chemist II or III.

The Inorganic Supervisor must have a minimum BS in a science or engineering field and 2 years of laboratory experience, or an equivalent combination of education and experience.

Microbiology Supervisor

The Microbiology Supervisor is responsible for quality microbiological results by maintaining the laboratory microbiology program and services within the framework of the lab QA guidelines. He/She is responsible for maintaining certifications and training/supervising the microbiology technicians.

Microbiology Supervisor must have at least two years experience performing microbiological analysis in an environmental laboratory.

Chemistry Supervisor

The Chemistry Supervisor is responsible for overseeing and assisting Chemistry Technical Staff in their daily duties. The Chemistry Supervisor assures adherence to Standard Operating Procedures and Quality Assurance activities. The Chemistry Supervisor should be a Chemist III.

The Chemistry Supervisor must have a minimum BS in a science or engineering field and 2 years of Laboratory experience, or an equivalent combination of education and experience.

Technical Staff (Chemists, Lab Technicians, etc.)

Chemist (I, II, III)

The Chemist is responsible for the analysis of samples and the generation of high quality data in accordance with the laboratory SOP's and QA/QC guidelines in a reasonable time as prescribed by laboratory standard turnaround schedules or as directed by the Laboratory Director or Laboratory Manager.

The Chemist is responsible for making sure all data generated by he/she is entered into the appropriate database in the correct manner and that raw data packs are signed and archived properly.

The Chemist reports daily to the Laboratory Manager and will inform the Lab Manager as to the material needs of the laboratory, specifically pertaining to analyses performed by the Chemist.

Additional duties of the Chemist may include, but not be limited to preparation of samples for analysis, maintenance of lab equipment, and providing technical assistance to lower level laboratory staff. The Senior Chemist in the laboratory may be asked to perform supervisory duties as related to operational aspects of the laboratory. In the event that this is required for any reason, these supervisory duties will be assigned by the Lab Manager and/or Lab Director. The Chemist may perform all of the duties of Laboratory Technician.

The position of Chemist is a full time or part time hourly position and may be divided into three levels, Chemist I, II, and III. Chemist I must have the equivalent of a Bachelors degree in Chemistry or a closely related science. Additionally, Chemist II must have at least 2 years of environmental or closely related lab experience. Chemist III must have a Bachelors degree plus 5 years of environmental or closely related lab experience.

Laboratory Technician/Microbiology Technician

The Laboratory Technician (chemistry or microbiology) is responsible for providing support in the form of sample analyses, sample preparation, and general lab maintenance. This may include tasks such as filling out daily maintenance logs, chemical inventories, and laboratory cleaning (glassware, etc).

The Laboratory Technician reports to the Laboratory Manager or the Microbiology Supervisor in the case of Microbiology Technician.

The Laboratory Technician may be divided into three levels, Technician I, II and III. Lab Technician I must have a high school diploma or GED. Lab Technician II must have at least 1 year of experience in an environmental lab or equivalent secondary education. Lab Technician III must have a bachelor's degree in chemistry or closely related science or equivalent work experience.

Staff

Systems Administrator

The Systems Administrator is responsible for overseeing all information systems infrastructure. Infrastructure is defined as all hardware including computer workstations, servers and IT support equipment plus all laboratory equipment that interfaces with the network or database as well as all software and applications resident on the system.

The Systems Administrator reports directly to the Laboratory Director. The Systems Administrator must have a minimum BS in a computer science or information technology field or an equivalent combination of education and experience.

Office Administrator

The Office Administrator is responsible for all phases of customer service including but not limited to answering telephones, assisting customers with Anatek Labs forms, distributing sample kits, and receiving samples from walk-in customers.

The Office Administrator is responsible for: invoicing customers, processing payments, invoices and packing slips, paying A/P invoices, payroll, payroll taxes, federal and state taxes, issuance of purchase orders, and deposits.

The Office Administrator is responsible for all Human Resource management including insurance and 401K.

The Office Administrator must have a minimum AA in Business Administration, Accounting or other relevant field and 5 years experience in office administration/supervision or an equivalent amount of education and experience.

Sample Custodian, Shipping/Receiving

The Sample Custodian is responsible for the log-in and tracking of all samples throughout the laboratory. The sample custodian is additionally responsible for tracking of all samples sent to sub labs. All shipping and receiving is done/monitored by the sample custodian, to include sampling kits, trip blanks and prepreserved sample battles. The sample custodian takes customer orders and insures that incoming samples are correct. If a discrepancy is noted the sample custodian will contact the customer to resolve any questions or problems. The sample custodian is an integral part of the customer service team.

The Sample Custodian must have a High School diploma or equivalent.

Facilities, Equipment and Services

Anatek Labs, Inc. was founded in 1992. Anatek Labs, Inc. is a full service environmental testing laboratory serving the Inland Empire and the Pacific Northwest.

A listing of major analytical equipment used at Anatek Labs, Inc. can be found in Tables 1a & 1b.

Sample Procedures (Sample Collection, Storage, Handling and Acceptability)

All samples sent to Anatek Labs, Inc. are received, logged in and distributed by the Sample Custodian. Samples that are unsatisfactory are not analyzed unless authorized by the customer. Any such sample will be noted on the Chain of Custody form and with a qualifying statement on the final report noting unsatisfactory sample submission. Corrective measures to ensure proper specimen collection and /or handling on future sample sets will be supplied to the customer (s).

Collection

Samples must adhere to requirements for container, preservation and holding times described in Table 2. For a complete summary of sample containers, Preservation Methods and Holding Times see Table 2. Consult the Standard Operating Procedure, EPA SW-846 Manual on Test Methods for Evaluating Solid Waste, the Federal Register on EPA Test Methods Determining Contaminants in municipal and industrial wastes, Standard Methods or other appropriate documentation for specific instructions on sample collection.

Sample Containers

Most sampling containers are supplied to the customer by the laboratory. Containers are generally used only once and discarded. Some analytical methods utilize containers of a type that is conducive to recycling. In these cases, containers are cleaned according to Standard Operating Procedures to ensure cleanliness. Samples must not be exposed to interfering materials. Consult the laboratory for the proper container material and size for a specific analysis or project. If the samples are collected and stored for transport in inappropriate types of containers, the Laboratory may not be able to accurately quantify the amount of the desired components. In this case resampling may be required.

Preservation Methods

All samples should be preserved according to the type of matrix, analysis required and data objectives. If the samples are not properly preserved the analytical results may be inaccurate due to loss by volatilization and/or degradation. Anatek Labs, Inc. provides sample containers with appropriate preservatives already in the container, when possible. Table 2 contains information on appropriate preservation methods.

Transportation

Samples should be transported to the laboratory by the fastest means possible.

Hand Delivery

Personal delivery is preferred, as it is the most secure. A Chain-of-Custody record must accompany the transfer of the sample with the identification information if results will potentially be used as evidentiary. The field sampler is responsible for the proper packaging and dispatch of their samples. This responsibility includes sample preservation and the completion of all necessary documents concerning custody.

Shipped Samples

A sealed container should be used to ship samples via a common carrier. Samples within these containers should also be properly sealed, identified and accompanied by appropriate paperwork such as a Chain-of-Custody record or a test request form. The Laboratory will retain all bills of lading for use to supplement the accompanying Chain-of-Custody documentation.

Sample Acceptability

Samples received after holding times have expired, in inappropriate containers, or lacking appropriate preservative measures are generally not accepted for testing. Occasionally, a customer will request that a sample be processed even if it is received in an unacceptable condition. In such a case, testing will only proceed after the customer has provided written or verbal acknowledgement of the unacceptable status of the sample and authorized continued testing. Further, a comment, narrative, or explanation of possible negative effects of unacceptable sample submission is placed on the report or attached as a more detailed description.

Sample Logging and Tracking

Standard Operating Procedures have been established for the receiving of samples into the laboratory (SOP's ALI-02 & ALI-18). These procedures ensure that samples are received and properly logged into the laboratory, and that all associated documentation, including chain of custody forms, are complete and consistent with the samples received. Documentation of all sample storage is maintained in order to preserve the integrity of the samples.

Samples delivered to the lab are received by a designated Sample Custodian(s). Verification of sample integrity by the Sample Custodian includes the following activities:

- Assessment of custody seal presence/absence, location and signature
- Temperature of sample containers upon receipt
- Chain-of-Custody documents properly completed (entries in ink, signature present, etc.)
- Sample containers checked for integrity (broken, leaking, etc.)
- Sample is clearly marked and dated (bottle labels complete with required information)
- Appropriate containers (size, type) are received for the requested analyses
- Sample container labels and/or tags agree with chain of custody entries (identification, required analyses, etc.)
- Assessment of proper sample preservation (if inadequate, corrective action is employed)
- VOC containers are inspected for the presence/absence of bubbles (No assessment of proper preservation is performed for VOC containers at time of receipt, preservation is checked after analysis to avoid loss of sample)

Any anomalies or discrepancies observed during the initial assessment are recorded on the chain of custody documents and/or in the LIMS sample tracking software. Potential problems with a sample shipment are addressed by contacting the client and discussing the pertinent issues. When a satisfactory resolution has been reached by coordination with the client, the log-in process may commence and analysis may begin. Any changes on documentation resulting from these discussions are documented and authorized directly by the customer. During the log-in process, each sample is given a unique laboratory code and an analysis request form is generated. The analysis request contains client information, sample descriptions, sample matrix information, required analyses, sample collection dates and analysis due dates and other pertinent information.

Facility Security and access is important in maintaining the integrity of samples received at Anatek Labs, Inc.. Access to the laboratory is limited to authorized personnel except for the sample receipt area that is manned during business hours.

Samples are stored appropriate to the analysis requested until they undergo analysis. Anatek Labs, Inc. stores samples in one of many refrigerators, freezers or other storage locations, depending on the type of analysis and the matrix of the sample. Anatek Labs, Inc. has several refrigerators for storage of samples. These refrigerators are segregated by matrix type (soil or water) and method of analysis. Drinking water, wastewater and soil samples are segregated and placed in separate refrigerators. The samples are further separated into dedicated refrigerated storage of VOC samples. A walk-in refrigerator is used for sample archival. Anatek Labs, Moscow also has sub-zero freezers capable of storing samples at -20^{o} C: These are primarily used for tissue and sediment samples requiring specialized storage conditions. An additional freezer provides additional frozen storage capacity for miscellaneous samples. The temperature of each sample storage unit used at Anatek Labs, Inc. is monitored daily during operations and the data recorded in a file for future reference. Continuous-graph temperature recorders have also been placed in the -20^{o}C freezer to provide a permanent, continuous record of the storage conditions to which samples are exposed. An alarm is sounded on the freezer and to an outside monitoring company in the event of freezer failure.

Samples and sample extracts are retained for up to 6 (six) weeks then disposed of unless other arrangements have been made in advance. All samples are either returned to the client or disposed of according to approved disposal practices.

Logging

Samples are assigned a unique laboratory identification number. All samples are assigned a number with the following format: YYM-ZZZZ-XX
Where:

YY = year (02 = 2002)
M = D or X (D = drinking water, X = all other samples)
ZZZZ = sample batch
XX = sample number

I.E.: 02D-0001-01 would be the first sample of the first batch for drinking water in the year 2002

Tracking

Samples are tracked by their individual log numbers. As testing is completed the LIMS is updated and the data archived.

Sample Custody and Legal Defensibility

Anatek Labs, Inc. routinely tests samples used as legal evidence. A primary consideration for the legal credibility of analytical data is the ability to demonstrate that samples were obtained, reached the laboratory and analyzed without improper alteration or contamination. Samples whose testing results may become evidentiary utilize Chain-of-Custody protocol where evidence of sample collection, shipment, laboratory receipt and laboratory custody until disposal are documented. Chain-of-Custody forms document how physical custody of a particular sample is maintained, how custody is transferred and the identity of individuals responsible for sample collection, shipping, receipt, analysis, storage and disposal. Chain-of-Custody protocol is not automatically initiated due to the accompaniment of a Chain-of-Custody form. In most instances, Chain-of-Custody forms function only as a sample receipt form and initiate normal, standard sample handling procedures. Formal Chain-of-Custody protocol must be initiated at the specific request of the sample submitter.

The Sample Custodian is responsible for receiving Chain-of-Custody linked samples. Upon receipt of these samples, the Sample Custodian immediately inspects the documentation and the samples to ensure the integrity of the sample shipping container, sample bottles, custody seals and cooler temperature upon receipt. Samples received in broken or leaking containers are noted on the Chain-of-Custody form and specific instructions for the lab are then requested of the submitter. If discrepancies between accompanying documentation and information on labels or sample containers exist, clarification is requested from the submitting party in writing and a notation is placed on the Chain-of-Custody form explaining the discrepancy.

After receipt in the laboratory, samples are logged into the internal tracking system. Samples are stored in appropriate refrigerators according to matrix until analyzed. After analysis samples are stored for up to six weeks in designated areas in the walk-in refrigerator.

Collection

All samples should be collected using standard field sampling techniques. The sample container should be labeled with the following information:

1. Date and time of collection
2. Source of sample
3. Preservative used (if any)
4. Name of person collecting sample
5. Sample ID and project name

When appropriate, the container should be sealed so that it cannot be opened without disrupting the seal. Gummed tape or another type of sealant is recommended. The person collecting the sample should date and initial the seal, particularly across the junction of the tape to ensure a tamper-proof seal.

Pertinent data concerning each sample should be entered into a field log book. This information may be used to refresh the memory in the event that the collector is summoned as a witness.

The sample should be kept in the custody of the collector or a designated custodian. A sample is in a persons custody if:

1. It is in one's physical possession, or
2. It is in one's view after being in one's physical possession, or
3. It has been placed into a locked area to which the custodian retains the key.

Calibration Procedures and Frequency

All equipment and instruments used at Anatek Labs, Inc. are operated, maintained and calibrated according to the manufacturer's guidelines and recommendations, as well as to criteria set forth in the applicable analytical methodology. Personnel who have been properly trained in these procedures perform operation and calibration. Documentation of calibration information is maintained in data archives (see SOP ALI-14 Data Archiving) or Instrument Activity Logs (IAL's). Brief descriptions of the calibration procedures for our major laboratory equipment and instruments are described below.

Temperature Control Devices

Temperatures are monitored and recorded for all of our temperature-regulating devices including ovens, incubators and refrigerators when in use. Record files are kept which contain recorded temperatures, identification and location of equipment, acceptance criteria and the initials of the technician who performed the checks. All thermometers are checked annually against a National Institute of Standards and Technology (NIST) certified thermometer.

Analytical Balances

Analytical balances are serviced on an annual basis by a professional metrology organization. New certificates of calibration for each balance are issued to the laboratory on an annual basis. The calibration of each analytical balance is checked daily with Class S or S-1 weights. As needed, the balances are recalibrated using the manufacturer's recommended operating procedures. Records are kept that contain the recorded measurements, identification and location of equipment, acceptance criteria and the initials of the technician who performed the checks.

Water Purification System

There are a variety of water purification systems used at Anatek Labs, Inc.. A filtration system is in place to provide deionized water throughout the Laboratory. The system is monitored and provides a purity of at least 1 mega ohm (up to approximately 18 mega ohms). When purity falls below 1 mega ohm, the system is serviced by Culligan (Moscow) or King Soft Water (Spokane) and new filters are installed. Additionally there is a filter system that provides 18 mega ohm purity water. The specifications, preventative maintenance schedules and other information for particular water purification systems are explained in detail in the applicable Standard Operating Procedure.

Analytical Instrumentation

Each instrument utilized at Anatek Labs, Inc. is calibrated against traceable standards. Standard Operating Procedures are used to document the procedure for ensuring traceability of stock reference materials. Standard Operating Procedures also specify specific instrument settings, calibration concentrations and frequency, instrument linear ranges, specific required QA/QC measures and a number of other related technical issues.

Analytical Procedures

Analytical Standard Operating Procedures are based upon methods appearing in a variety of publications. Most commonly, procedures are adopted from EPA publications, "Methods for Chemical Analysis of Water and Wastes", 1983: " Test Methods for Evaluating Solid Waste: SW-846", 1987, 3rd edition, or "Standard Methods for the Examination of Water and Wastewater" 20th edition. Refer to Table 3 for a listing of the test procedures utilized at Anatek Labs, Inc.

Data Generation – Data Reduction, Validation and Reporting

Data Reduction

Test results are calculated manually and electronically as specified in the method-specific SOP, ALI-05. Formulae are contained in the manual testing procedures and algorithms are contained in software controlled procedures. All data and calculations are verified by the analyst and posted to summary reports or the computer system for review by the Laboratory Manager.

Verification / Validation

Some procedures utilize additional visual confirmation and validation of values obtained electronically in the form of strip charts or other printouts. Where possible verification is made using interrelated analytes, i.e., the concentration of one analyte theoretically cannot exceed the concentration of another. Validation in gas chromatography is accomplished through the use of two dissimilar columns or the use of one or more compound specific detectors.

Data quality indicators such as blank results, duplicate reproducibility (Precision), matrix spike and quality control sample recoveries (Accuracy), and known sample or project histories are checked to verify result validity. Refer to the individual method SOP's for acceptability criteria.

Timely Report

Samples are typically tested consecutively as received unless holding times or special arrangement require expedited testing schedules. All testing is scheduled so that accepted holding times can be met.

Reporting Results

The analyst generating the test results posts them to manual worksheets, the computer tracking system and/or summary reports depending upon the analysis. A final report is generated after all testing for a particular sample is completed and the Laboratory Manager reviews, signs and dates the reports for distribution to the customer and any regulatory agency requiring copies.

Internal Quality Control

An Internal Quality Control program has been designed to ensure systematic in-house production of high quality analytical data. The objectives of this program are:

1. To provide a measure of the precision of analytical methods;
2. To maintain a continuing assessment of the accuracy, precision and completeness of individual analyses performed in the laboratory;
3. To identify methods that are weak and provide a source of research problems to overcome these deficiencies and weaknesses;
4. To detect training needs within the analytical group;
5. To provide a permanent record of instrument performance as a basis for validating data and projecting repair and replacement needs;
6. To upgrade the overall quality of laboratory performance.

Precision

Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability or random error in sampling, sample handling and in laboratory analysis. The American Society of Testing and Materials (ASTM) recognizes two levels of precision: ***repeatability*** – the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory, with the same apparatus, under constant operating conditions and, ***reproducibility*** - the random error associated with measurements made by different test operators in different laboratories, using the same method but different equipment to analyze identical samples of test material. At Anatek Labs, Inc. our "within batch" precision is measured through the use of replicate samples of QC analyses and is expressed as the relative percent difference

(RPD) between replicate measurements. The "Batch to Batch" precision is calculated from the variance observed in results from analysis of standard solutions of laboratory control samples from multiple analytical batches.

Accuracy

Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Accuracy is determined by calculating the mean value of results from ongoing analyses of standard reference materials, standard solutions, and laboratory-fortified blanks. In addition, laboratory-fortified (i.e. matrix spike) samples are also measured; this indicates the accuracy or bias in the actual sample matrix. Accuracy is expressed as percent recovery (%Rec.) of the measured value, relative to the true or expected value. If a measurement process produces results whose mean is not the true or expected value, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis (e.g. extraction efficiencies) or caused by an artifact of the measurement system (e.g. contamination). Anatek Labs, Inc. utilizes several quality control samples and independent calibration verification standards. Because bias can be positive or negative and because several types of bias can occur simultaneously, only the net, or total, bias can be evaluated in a measurement.

Completeness

Completeness is a measure of the amount of valid data that is obtained, compared to the amount that is expected. For the purposes of this plan, completeness is calculated by dividing the number of samples having valid data by the total number of samples in the project, expressed as a percentage. Anatek Labs, Inc.'s objective for completeness is 100%.

The specific types, frequencies and processes for quality control sample analysis are described in detail in method-specific standard operating procedures. These sample types and frequencies are described below. In addition, a number of other quality control processes that may impact analytical results are also described below.

Standard Operating Procedures (SOP's) and Laboratory Notebooks

Anatek Labs, Inc. maintains a database of SOP's for use in both technical and administrative functions. SOP's are written following the format and content requirements described in the SOP for preparation of SOP's (ALI-01). Each SOP has been reviewed and approved by a minimum of two authorities, the Laboratory Manager and the QA Officer. All SOP's undergo a documented annual review to make sure current practices are described. The QA Officer maintains a comprehensive list of current SOP's. The document control process ensures that only the most currently prepared version of SOP is being used for guidance and instruction. The QA Manual, SOP's, standards preparation logbooks, run logbooks, et al., are all considered crucial to consistent operations at Anatek Labs, Inc. and all analysts are instructed on the proper usage of each. Anatek Labs, Inc. maintains a current file, accessible to all laboratory staff, of the promulgated methodology used to perform analyses as well as this QA Plan and applicable Standard Operating Procedures. (For specific IAL procedures refer to SOP ALI-15.)

Deviation from Standard Operating Procedures

Anatek Labs, Inc. recognizes that occasionally a modification to a Standard Operating Procedure may be necessary. In such cases, a written record of the deviation is retained with the sample data and if the deviation affects the data integrity an appropriate data qualifier comment is noted on the analytical report. An example of this would include a special preparative step or procedure not normally performed but perhaps mandated by special matrix concerns.

Modified Procedures

Anatek Labs, Inc. strives to perform published methods as described in the referenced documents. If there is a material deviation from the published method, the method is cited as a "Modified" method in the analytical report. Modifications to the published methods are listed in the standard operating procedure. Standard operating procedures are available to analysts and are also available to our clients for review, especially those for "Modified" methods. Client approval is obtained for the use of "Modified" methods prior to the performance of the analysis.

Analytical Batch

The basic unit for analytical quality control is the analytical batch. The definition that Anatek Labs, Inc. has adopted for the analytical batch is listed below. The overriding principle for describing an analytical batch is that all

the samples in a batch, both field samples and quality control samples, are to be handled exactly the same way, and all of the data from each analysis is to be manipulated in exactly the same manner.

The minimum requirements of an analytical batch are:

1. The number of (field) samples in a batch is not to exceed that specified in the Standard Operating Procedure for the procedure being employed.
2. All (field) samples in a batch are typically of the same matrix.
3. The QC samples to be processed with the (field) samples typically include:
    a. Method Blank (a.k.a. Laboratory Reagent Blank)
    Function: Determination of Laboratory contamination
    b. Laboratory Control Sample (a.k.a. Laboratory Fortified Blank)
    Function: Assessment of method performance
    c. Matrix Spiked (field) Sample-when sufficient sample is supplied (a.k.a. Laboratory Fortified Sample Matrix)
    Function: Assessment of matrix problems
    d. Duplicate Matrix Spiked (field) Sample of Duplicate (field) Sample – when sufficient sample is supplied (a.k.a. Laboratory Duplicate)
    Function: Assessment of batch precision
4. A single lot of reagents is used to process the batch of samples.
5. Each operation within the analysis is performed by a single analyst/technician/chemist or by a team of analysts/technicians/chemists.
6. (Field) samples are assigned to batches commencing at the time that sample processing begins. For example: for analysis of metals, sample processing begins when the samples are digested. For analysis of organic compounds, it begins when the samples are extracted.
7. The QC samples are to be analyzed in conjunction with the associated field samples prepared with them.
8. Batch QC refers to the QC samples that are analyzed in a batch of (field) samples.
9. Specific project, program or method SOP requirements may be exceptions to these definitions. If project, program or method SOP requirements are more stringent than these laboratory minimum requirements, then the project, program or method SOP requirements will take precedence.

Method Blank (a.k.a. Laboratory Reagent Blank)

The method blank is either analyte-free water or analyte-free soil (when available), subjected to the entire analytical process. When analyte-free soil is not available, anhydrous sodium sulfate, organic-free sand or an acceptable substitute may be used instead. The method blank is analyzed to demonstrate that the analytical system itself is not contaminated with the analyte(s) being measured. The method blank results should be below the Method Reporting Limit (MRL) or, if required, less than the Method Detection Limit (MDL) for the analyte(s) being tested, otherwise, corrective action must be taken. At least one method blank is included with the analysis of every analytical batch as stated in the method Standard Operating Procedure.

Calibration Blanks

For some methods, calibration blanks are prepared along with calibration standards in order to create a calibration curve. Calibration blanks are free of the analyte of interest and, where applicable, provide the zero point of the calibration curve.

Continuing Calibration Blanks

Continuing calibration blanks (CCB's) are solutions of analyte-free water, reagent, or solvents that are analyzed in order to verify the system is contamination-free when continuing calibration standards are analyzed. The frequency of CCB analysis is either once every ten (10) samples or as indicated by the method, whichever is greater.

Calibration Standards

Calibration standards are solutions of known concentration prepared from primary standard solutions that are, in turn, prepared from stock standard materials. Calibration standards are used to calibrate the instrument response

with respect to analyte concentration. Standards are analyzed in accordance with the requirements stated in the particular method being used. Refer to Anatek Labs, Inc. SOP ALI-08 for policies regarding standards.

Initial (or Independent) Calibration Verification Standards

Initial (or Independent) calibration verification standards (ICV's) are standards that are analyzed after calibration with newly prepared standard(s) but prior to sample analysis, in order to verify the validity of the standards used in the calibration. Once it is determined that there is no systematic error in preparation of the calibration standard(s), they are considered valid standards and may be used for subsequent calibrations (as expiration dates and methods allow). The ICV standards are prepared from materials obtained from a source independent of that used for preparing the calibration standards. ICV's are also analyzed in accordance with method-specific requirements.

Continuing Calibration Verification Standards (CCV)

Continuing Calibration Verification Standards (CCV's) are midrange standards that are analyzed in order to verify that the calibration of the analytical system is still acceptable. The frequency of CCV analysis is indicated in the method Standard Operating Procedure.

Internal Standards

Internal Standards consist of known amounts of specific compounds that are added to each sample following sample preparation or extraction. Internal standards are generally used for procedures to correct sample results that have been affected by changes in instrument conditions or changes caused by certain matrix effects. The integrated area of the internal standard compared to the continuing calibration check standard should vary by no more than the limits specified in each method.

Surrogates

Surrogates are organic compounds that are similar in chemical composition and chromatographic behavior to the analytes of interest, but which are not normally found in environmental samples. Depending on the analytical method, one or more of these compounds is added to method blanks, calibration and check standards and samples (including duplicate, matrix spike samples, duplicate matrix spike samples and laboratory control samples) prior to extraction and analysis in order to monitor the method performance on each sample. The percent recovery is calculated for each surrogate and recovery is a measurement of the overall method performance. The percent recovery must meet the limits set forth in the SOP or determined from Control Charting.

Matrix Spikes (a.k.a. Laboratory Fortified Sample Matrix)

Matrix spiked samples are field samples to which a known amount of the target analyte (or analytes) has been added. The samples are then prepared and analyzed in the same analytical batch in exactly the same manner as routine samples. The spike recovery measures the effects of interferences caused by the sample matrix and reflects the accuracy of the method for the particular matrix in question. Spike recoveries are calculated as follows:

Percent Recovery = ((S – A) x 100) / T

Where:
S = The observed concentration of analyte in the spiked sample,
A = The analyte concentration in the original sample, and
T = The theoretical concentration of analyte added to the spiked sample.

Matrix spiked samples are prepared and analyzed at the levels and frequency noted in the Standard Operating Procedure for the particular analysis.

Laboratory Duplicates and Duplicate Matrix Spikes

Duplicates are additional replicates of samples that are subjected to the same preparation and analytical scheme as the original sample. Depending on the method of analysis, either a duplicate sample aliquot or a matrix spiked sample and duplicate matrix spiked sample (MS/MSD) are analyzed. The relative percent difference between duplicate analyses or between an MS and MSD is a measure of the precision for a given method and analytical batch. The relative percent difference (RPD) for these analyses is calculated as follows:

Relative Percent Difference = (S1 – S2) x 100 / S_{avg}

Where S1 and S2 = the observed concentrations of analyte in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike, and S_{avg} = the average of observed analyte concentrations in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike.

Duplicates or MS/MSD analyses are performed at the level and frequency outlined in the Standard Operating Procedure for the analysis being performed.

Duplicates or MS/MSD's are selected on the basis of volume or matrix. Samples with enough volume are selected unless a matrix problem is suspected in which case a sample with enough volume and an appropriate matrix is selected.

Laboratory Control Samples (a.k.a. Laboratory Fortified Blanks or Quality Control Samples)

The laboratory control sample (LCS) is an aliquot of analyte-free matrix to which known amounts of the target analyte(s) is (are) added. A standard reference material of known matrix type, containing certified amounts of target analytes, may also be used as a LCS. The LCS sample is prepared and analyzed in the same analytical batch, and in exactly the same manner as the other routine samples. Stock solutions used for LCS's are purchased or prepared independently of calibration standards. The percent recovery (% REC) of the target analytes in the LCS assists in determining whether the methodology is in control and whether the laboratory is capable of making accurate and precise measurements at the required reporting limit. Comparison of batch-to-batch LCS analyses enables the laboratory to evaluate batch-to-batch precision and accuracy. Acceptance criteria for LCS analyses are obtained through the use of control charts. A LCS is prepared and analyzed at a minimum frequency specified in the Standard Operating Procedure for the specific method being employed. If an insufficient quantity of sample is available to perform a laboratory duplicate or duplicate matrix spikes, occasionally a duplicate LCS will be prepared and analyzed.

Interference Check Samples

An interference check sample (ICS) is a solution containing interfering elements of known concentration that can be analyzed to verify background and inter-element correction factors in metals analyses.

Post Digestion Spikes

Post digestion spikes are samples prepared for metals analyses that have an analyte spike added to determine if matrix effects may be a factor in the results. The spike addition should produce a method-specified minimum concentration above the instrument detection limit. A post digestion spike is analyzed with each batch of samples and recovery criteria are specified for each method.

Source and Preparation of Standard Reference Materials

All analytical measurements generated at Anatek Labs, Inc. are performed using materials and/or processes that are traceable to a Standard Reference Material. Standard Operating Procedures are utilized to trace all quantitative and qualitative determinations to certified reference materials. All metrology equipment (analytical balances, thermometers, etc.) is calibrated using materials traceable to the National Institute of Standards and Technology (NIST) and maintained on a schedule to ensure accuracy.

All Sampling containers provided to the client by the laboratory are assured to be free of interfering contaminants by:

1. The container is purchased as pre-cleaned (Level 1) with certificates of analysis available for each bottle type; or
2. The container is cleaned by the laboratory using Standard Operating Procedures; or
3. The specific bottle type and manufacturer has been proven through study to be free of interfering materials; and/or
4. A blank is prepared with a surrogate bottle using laboratory reagent water at the time of sample collection to provide information on possible interferences or contamination resulting from the sample container.

Consumable materials routinely purchased by the laboratory (e.g. analytical standards) are purchased from nationally recognized, reputable vendors. Consumable primary stock standards are obtained from certified commercial sources or from sources referenced in a specific method. Supelco, Ultra Scientific, AccuStandard, Chem. Services, Inc., Aldrich Chemical Co., J.T. Baker, Spex, E.M. Science, Fisher Scientific, etc. are examples of the vendors used by Anatek Labs, Inc.. All reference materials that are received are recorded by the technical staff in the appropriate logbook(s) and are stored under conditions that provide maximum protection against deterioration and contamination. The logbook entry includes such information as an assigned logbook identification code, the source of the material (i.e. vendor identification), solvent (if applicable) and concentration of analyte(s), reference to the certificate of analysis and an assigned expiration date. In addition, the date that the standard is received in the laboratory is marked on the container. When the material container is opened for use the first time, the date of opening and the initials of the applicable analyst are also recorded on the container. Stock solutions and/or calibration standard solutions are prepared fresh as often as necessary according to Standard Operating Procedures. After preparation, all standard solutions are properly labeled as to analyte concentration, solvent, date, preparatory analyst and expiration date; these entries are also recorded in the appropriate logbook(s). Prior to introduction into the analytical system / process, all in-house prepared reference materials are verified with a second, independent source of the material. Once the reference material has been verified to be accurate, it may then be used for instrument calibration and subsequent quantitative purposes. In addition, the independent source of reference material is also used to check the calibration standards for signs of deterioration (i.e. Control or QC samples).

Control Charting

The generation of control charts is routinely performed at Anatek Labs, Inc. Refer to Appendix H for specific information on the generation and use of Control Charts,

Method Detection Limits

Method detection limits are determined for most analyses performed at Anatek Labs, Inc.. Refer to Appendix I for specific information on the development of MDL's.

Glassware Washing

Glassware washing and maintenance play a crucial role in the daily operation of a laboratory. The glassware used at Anatek Labs, Inc. undergoes a rigorous cleansing procedure prior to every usage. Refer to SOP ALI-03 and method specific SOP's for specific glassware cleaning procedures.

Temperature Record Keeping

A number of recording devices (thermometers) are utilized to track the acceptable performance of a number of crucial instruments. The following are instruments that are documented daily (during operations) and the associated acceptable average temperature limits:

Sample Archive	$0 – 4^0C$
Drinking water Storage	$0 – 6^0C$
Drinking water VOC Storage	$0 – 6^0C$
Non Drinking Water Storage	$0 – 6^0C$
Waste Water VOC Storage	$0 – 6^0C$

Balance Audit

Verification of balance accuracy is essential for providing accurate mass determinations. All balances are checked daily with Class S weights. Accuracy of measurement must be 99.9% or better. If determinations are outside the acceptance range, corrective actions are taken. Out of specification balances are removed from service until maintenance can be completed. The result of this determination is kept in the Daily Maintenance Log.

System and Performance Audits

Laboratory Evaluations and Audits are to be conducted under the authorization of the QA Committee and all findings and recommendations are submitted to the QA Committee for decisive action. System Audit requests are generated internally and externally. Internal audits are generally scheduled at the frequency noted under the type of review, however concerns brought to the attention of the QA Committee may necessitate an unscheduled systemic

review at the discretion of the QA Committee. External audit requests are referred to the QA Committee for authorization and scheduling of external auditors to review systems.

The following evaluations are performed at Anatek Labs, Inc.:

Management System Reviews (MSR's)

MSR's are external audits conducted at Anatek Labs, Inc.. Idaho Dept. of Health Bureau of Laboratories audits Anatek Labs, Inc. to assess the adequacy of the overall QA Plan. IDOH Bureau of Laboratories performs a rigorous on-site inspection of Anatek Labs, Inc.'s QA Plan, adequacy of facilities, Quality Control Records, Performance Evaluations, Standard Operating Procedures and Analyst abilities. IDOH Bureau of Laboratories prepares an audit report to Anatek Labs, Inc. and this report and any corrective actions plans are maintained at Anatek Labs, Inc.. Washington Department of Ecology does a complete inspection as well for WA Waste Water Certification. Anatek Labs, Inc. also makes the facilities available for customer or regulatory agency inspection of Management Systems as well. Anatek Labs, Inc.'s QA Committee reviews all MSR reports and recommendations. If reports indicate the necessity for corrective action, the QA Committee or its designee will prepare and implement a Corrective Action Plan. The Corrective Action Plan will itemize the specific action necessary to correct the deficiency and define the time frames and responsible parties for implementation and follow-up.

Technical System Audits (TSA's)

TSA's are both internal and external audits conducted at Anatek Labs, Inc.. Florida Dept. of Health (NELAP), Idaho Dept. of Health and WA Dept. of Ecology evaluate Anatek Labs, Inc.'s Technical systems. The above listed agencies review calibration records, sampling and measurement procedures, general lab cleanliness, support systems, equipment and facilities, maintenance and repair records, control charts and general operation of the lab. The inspecting agencies prepare audit reports to Anatek Labs, Inc. and these reports and all responses and corrective action plans are maintained at Anatek Labs, Inc.. Additionally, Anatek Labs, Inc. staff performs internal TSA's annually. The QA Officer performs an annual inspection of Standard Operating Procedures, Quality Control Records, Calibration Records, and Maintenance and Repair Records. TSA audit reports are prepared by the external auditor or QA Officer and given to the QA Committee or the analyst as appropriate (Reference SOP ALI-16). If a report indicates the necessity for corrective action a Corrective Action Plan will be prepared and implemented according to SOP ALI-07. The Corrective Action Plan will itemize the specific action necessary to correct the deficiency and define the time frames and responsible parties for implementation and follow-up. The results from all corrective action plans will be compiled and forwarded to management and/or the QA Committee as necessary.

Performance Evaluation (PE)

PE's are performed according to regulatory requirements for NELAP and the various testing regimens employed at Anatek Labs, Inc.. Anatek Labs, Inc. participates in at least two Water Supply (WS) and two Water Pollution (WP) Performance Evaluations annually. All PE Sample materials are procured from a NIST / NVLAP approved provider. Acceptable results for each analyte and method used to perform regulatory testing are demonstrated semi-annually. In the event that an unacceptable result is received for a particular analyte, corrective actions are employed. Blind studies are initiated on an annual basis by the lab to verify performance. Additionally double-blind studies are conducted at Anatek Labs, Inc. when initiated by customers.

IT Systems Auditing

IT Systems Auditing of Anatek Labs, Inc. is conducted both internally and externally. The external auditing is conducted by IDOH, WA DOE and FL DOH. The agencies review Anatek Labs, Inc.'s IT SOP's, IT documentation, access security and backup/restore plans during their inspections. Internal audits are performed at least once a year by Anatek Labs, Inc.'s QAU with assistance from IT personnel. The internal audits will inspect the network security, network throughput performance, server storage available, backup/restore plan testing and general documentation of the IT systems. An IT systems auditing report is prepared by the external auditor or QA Officer and given to the QA Committee. If a report indicates that corrective actions are necessary, a Corrective Action Plan will be prepare and implemented by IT personnel. The Corrective Action Plan shall specifically address the areas of deficiency and the actions to be taken.

Data Quality Audits (DQA's)

Peer review of acceptable blank results, QA/QC sample recovery, matrix spike and matrix spike duplicate recoveries, reproducibility of duplicate samples, and verification of sample calculations are performed on every analytical batch. Any errors or deviations from acceptable criteria are noted and data is returned to the generating analyst for correction. In the event that QA/QC criteria for a particular sample or batch of samples cannot be met, all associated sample reports are noted that QA/QC criteria were not met and may include other relevant discussions.

Corrective Action

Corrective Action is a function of the laboratory as a whole and is dependent on the nature of the problem. In general, corrective action may take several forms. Corrective action due to a performance or system audit report is initiated by the QA Committee and will result in a formal Corrective Active Plan. The QA Officer, Laboratory Manager, laboratory analyst or external customer may also initiate corrective actions.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If a quality control measure is found to be out of control, and the data is to be reported, all samples associated with the failed quality control measure shall be reported with an appropriate data qualifier. Failure to meet established analytical controls prompts corrective action. Corrective action may involve a review of the calculations, a check of the instrument maintenance and operation, a review of analytical technique and methodology and reanalysis of quality control and field samples. If a potential problem develops that cannot be solved directly by the responsible analyst, the Laboratory Manager or QA Officer may examine and pursue alternative solutions. In addition, an assessment will be made in order to ascertain if contact with the client is necessary.

Training & Personnel Qualifications

All personnel involved in any function affecting data quality will have sufficient training and technical expertise to effectively execute their job requirements. The laboratory evaluates all prospective job applicants for scientific knowledge and experience as noted in the job descriptions for the position considered.

In addition to prior work and educational experience, Anatek Labs, Inc. actively encourages its employees to expand and refine their job skills and knowledge through participation in a variety of educational programs. Time off is granted to attend seminars and training sessions put on by instrument manufacturers, regulatory agencies, professional business and scientific organizations, etc. Additionally Anatek Labs, Inc. conducts in house training on related topics. Anatek Labs, Inc. also encourages continuing education through a tuition reimbursement program.

A record of specialized training received by or given by the staff is kept in the Personnel Training logbook and in current CVs that can be found in appendix E.

Subcontracting of Laboratory Services

Analytical services may be subcontracted when the requested analyses are not performed by Anatek Labs, Inc.. Further, subcontracting of laboratory services are done only with the knowledge and approval of the client.

The acceptability of subcontracting laboratories is assessed using the following criteria:

1. The subcontracting laboratory is certified for the analysis requested if results are for regulatory purposes;
2. The subcontracting laboratory has an approved / audited Quality Assurance Plan or in the absence of an audit, the subcontracting laboratory has an established reputation for providing quality services;
3. The subcontracting laboratory agrees to perform and provide specific Quality Control measures outlined by the project manager or sample submitter;
4. The subcontracting laboratory agrees to retain records for a period of time no less than outlined by the project manager or sample submitter.

Preventive Maintenance

Preventive maintenance is a crucial element of Anatek Labs, Inc.'s Quality Assurance program. Qualified in-house personnel maintain instruments, such as GC/MS systems, spectrometers, analytical balances and gas and liquid chromatographs. All instruments are operated and maintained according to the instrument operating manuals. All

routine and special maintenance activities pertaining to the instruments are recorded in instrument activity logbooks (IAL's). The IAL's contain extensive information about the instruments used at the laboratory.

When an instrument is acquired at the laboratory, the following information is noted in a maintenance notebook specifically associated with the new equipment:

1. The equipment's serial number;
2. Date the equipment was received;
3. Date the equipment was placed into service;
4. Condition of equipment when received (new, used, reconditioned, etc.); and
5. Prior history of damage, malfunctions, modification or repair (if known).

Preventative maintenance procedures, frequencies, etc. are available for each instrument. They may be found in the various SOPs for routine methods performed on an instrument and may also be found in the operating or maintenance manuals provided with the equipment at the time of purchase. Responsibility for ensuring that routine maintenance is performed lies with the Laboratory Manager. The Laboratory Manager may perform the maintenance, assign the maintenance task to a qualified bench level analyst or acquire on-site manufacturer repair.

When performing maintenance on an instrument (whether preventive or corrective), additional information about the problem (attempted repairs, etc.) is also recorded in the IAL. Typical logbook entries include the following information:

1. Details and symptoms of the problem;
2. Repairs and/or maintenance performed;
3. Description and/or part number of replaced parts;
4. Source(s) of the replaced parts; and/or
5. The analyst's initials and date.

Waste Disposal

All samples received at Anatek Labs, Inc. remain in the ownership of the submitting party. Unless analysis of the samples demonstrate hazardous / regulated levels of contaminants, liquid samples are routinely disposed of by disposal in the sanitary sewer after adjustment to a pH specified by the local wastewater treatment facility. Solid samples are disposed of using the solid waste sanitation services. Samples demonstrated to be inappropriate (hazardous) to be disposed of by routine means are returned to the client for disposal / treatment at the original sampling location or retained in a manner consistent with mineral acid, solvent or other hazardous materials storage and disposal activities within Anatek Labs, Inc.

All mineral acids, solvents and other hazardous materials used in the daily operation of the laboratory are collected in designated areas until sufficient material is collected for cost-effective disposal at a licensed disposal facility.

Quality Document Control

All Standard Operating Procedures and Quality Assurance Plans are maintained under the control of the QA Officer. The QA Officer is responsible for maintaining all official / authorized versions of all Standard Operating Procedures and Quality Assurance Plans. There are three copies of each Standard Operating Procedure maintained as official: A master version, maintained in the possession of the QA Officer, a copy for the Laboratory Manager and a copy for the bench analyst(s). This QA Plan is maintained in the possession of the QA Officer and a copy is distributed to the Laboratory Manager. All Original signatures are maintained on the QA Officer's master copy. Any Copies or versions of these documents that are distributed outside the laboratory will not be controlled and updated during annual reviews.

All instrument activity log books and manuals are maintained by the analysts with the equipment. IAL's are periodically inspected by the QA Officer to ensure compliance with standard operating procedures (Refer to ALI-15). When full, IAL's are archived and retired with the piece of equipment.

Anatek Labs, Inc.

Quality Assurance Plan
Tables, Figures & Appendices

Anatek Labs, Inc.

Tables 1a & 1b

Instrument Inventory

Anatek Labs, Inc.

Table 1a

Instrument Inventory, Moscow

Make/Model	Type	Comments
OI Alpkem FS 3000	FIA	Flow Injection Analyzer
Varian 2100T Saturn	GC/MS	Tekmar Velocity XPT Purge and Trap, Volatile Organic Varian Archon Auto sampler
HP 5890/5972	GC/MS	Tekmar 3100 Purge and Trap, Tekmar SOLATek 72 autosampler
HP 4500	ICP/MS	CETAC ASX-500 Auto sampler
Agilent 7500C	ICP/MS	CETAC ASX-510 Auto sampler
Metrohm-Peak 761 Compact	IC	Ion Chromatograph w/ Model 788 Auto sampler
PSAnalytical 10.035 MM/G	CVAFS	Cold Vapor Atomic Fluorescence Spectrometry w/ PSAnalytical 20.200 auto sampler
Perkin Elmer 3100	Flame AAS	
HP 1100	HPLC	HP 1050 UV Detector, HP 1046A Fluorescence Detector Pickering PCX 5100 Post Column Reactor
HP 6890/5973	GC/MS	semi-volatile organics
Varian CP 3800/1200	Quadrupole GC/MS/MS	Pesticide/Herbicide/Semivolatile Organics
HP 6890 #1	GC	w/ dual micro ECD's, HP 7683 Auto sampler
HP 6890 #2	GC	w/ dual micro ECD's, HP 7683 Auto sampler
HP 6890	GC	w/ FID
Buck Scientific Model 404	Infra-red Spectrophotometer	
Fisher Scientific	Incubator	
CEM MDS-2100	Microwave Digester	
Blue M	Muffle furnace	
Gerhardt Vapodest	PKN Distiller	
Gerhardt Turbotherm	TKN Digester	12 place
Fisher Isotemp 300 Series	Drying oven	
Fisher Isotemp 100 Series	Drying oven	
Fisher Isotemp 737F	Drying oven	
Dionex ASE 200 #1	Accelerated Solvent Extractor	
Dionex ASE 200 #2	Accelerated Solvent Extractor	
Turbo Vap II #1	Concentration Workstation	
Turbo Vap II #2	Concentration Workstation	
Turbo Vap II #3	Concentration Workstation	
Spectro	X-Ray Fluorescence	sulfur analyzer
Midi-Vap 200	Distillation Apparatus	
Horizon	Oil & Grease	
Denver Instruments A-160	160 g balance	0.0001 g resolution
A & D	2100 g balance	0.01 g resolution
J2 Scientific Accuprep	GPC	

Anatek Labs, Inc.

Table 1b

Instrument Inventory, Spokane

Make/Model	Type	Comments
HP 5890 Series II	GC-MS #1	W/ OI4560 Sample Concentrator Purge and Trap, Volatile Organic Varian Archon Auto sampler
HP 5890 Series II	GC-MS #2	W/ Tekmar 3000 Purge and Trap, Tekmar autosampler
HP 5890 Series II	GC/ PID/FID #1	W/ Dynatech Precision Auto sampler, HP4560 Sample Concentrator Purge and Trap, HP4430 Lamp Power Supply
HP 5890 Series II	GC/ PID/FID #2	W/ Dynatech Precision Auto sampler, HP4560 Sample Concentrator Purge and Trap, HP4430 Lamp Power Supply
HP 5890 #1	GC/ ECD	W/ HP7673 Auto sampler
HP 5890 #2	GC/ ECD	W/ HP7673 Auto sampler
HP 5890	GC/ FID	W/ 6890 Auto sampler
Metrohm-Peak Compact 761	Ion Chromatograph	W/ Model 788 Auto sampler
Hach DR/3000	Spectrophotometer	
Hach 2100A Turbidimeter	Turbidity	
Dohrmann Phoenix 8000	TOC Analyzer	
Denver Instruments 225	pH Meter	
VWR SB40C Symphony	Conductivity	
YSI 5100	BOD Oxygen Meter	
Mitsubishi MCI Microcoulometer	TOX Analyzer	
Precision Scientific 25EM	Drying oven	
DX-58 American Scientific	Drying oven	
Precision Scientific	Waterbath	
Thermolyne Blue-M I42300	Incubator	
Market Forge Sterilematic STM-E	Autoclave	
IDEXX Quanti-tray 2X		

Analytical Balances

Make/Model	Capacity	Accuracy
Denver Instruments XS-410	410 g	± 0.01 g
Denver Instruments AB-160	160 g	± 0.0001 g
Denver Instruments APX-402	400 g	± 0.01 g

Refrigerated Storage

Capacity	General Use	Servicing
14.4 ft^3	Unanalyzed Samples	All refrigerators are temperature checked at least once daily.
3.6 ft^3	VOC Samples	In the case of refrigerator failure, an independent
2 ft^3	Microbiology media	refrigeration contractor is called.
14.4 ft^3	Standards	
500 ft^3	Analyzed Samples	

Anatek Labs, Inc.

Table 2

Summary of Analytical Parameters, Method, Sample Containers, Preservation Methods, Holding Times and Estimated Working time

Regulated Water Systems

keeping your water system compliant

VOLATILE ORGANIC ANALYSES

Analytical Parameter	Method	Sampling Container	Preservative	Holding	Estimated Time
Regulated & Unregulated Full List (add MTBE at no charge)	*EPA 524.2*	*2 x 40 mL amber vial*	*HCl pH<2*	*14 days*	10 working days
Single Volatile Compound (i.e. TCE OR MTBE, etc.)	*EPA 524.2*	*2 x 40 mL amber vial*	*HCl pH<2*	*14 days*	10 working days
Total Trihalomethanes (Total THM)	*EPA 524.2*	*2 x 40 mL amber vial*	*4 mg NH4CL*	*14 days*	10 working days
Trihalomethanes Potential (THMP)	*EPA 524.2*	*3 X 40 mL amber vial*		*14 days*	10 working days

SYNTHETIC ORGANIC ANALYSES

Analytical Parameter	Method	Sampling Container	Preservative	Holding	Estimated Time
Haloacetic acids	*SM6251B*	*2 x 40 mL amber vial*	*4 mg NH4CL*	*28 days*	15-20 working days
Total Organic Carbon (TOC)	*SM 5310 B*	*2 x 40 mL amber vial*	*H_2SO_4 pH<2*	*14 days*	10 working days
Phase II SOC's	*see below*	*see individual analyses below*		*14 days*	15-20 working days
Semivolatiles ID or MT lists WA list Extended List	*EPA 525.2*	*1 L amber glass*	*50 mg Sodium Sulfite*	*14 days*	15-20 working days
EDB/DBCP	*EPA 504.1*	*2 x 40 mL amber vial*	*3 mg Sodium Thiosulfate*	*14 days*	15-20 working days
Chlorinated Pesticides/PCB's	*EPA 508.1*	*1 L amber glass*	*50 mg Sodium Sulfite*	*14 days*	15-20 working days
Herbicides Regulated & Unregulated	*EPA 515.3*	*250 mL amber glass*	*20 mg Sodium Thiosulfate*	*14 days*	15-20 working days
Carbamates Regulated & Unregulated	*EPA 531.1*	*40 mL amber vial*	*4 mg Na Thiosulfate, MCAA*	*28 days*	15-20 working days
Phase V SOC's	*see below*	*see individual analyses below*		*14 days*	15-20 working days
Endothall	*EPA 548.1*	*250 mL amber glass*	*Sodium Thiosulfate*	*14 days*	15-20 working days
Glyphosate	*EPA 547*	*2 x 40 mL amber vial*	*Sodium Thiosulfate*	*14 days*	15-20 working days
Diquat	*EPA 549.2*	*125 mL HDPE*	*Sodium Thiosulfate*	*21 days*	15-20 working days
WA Short SOC's *Herbicide, Semivolatiles, Carbamates*		*see individual analyses above*		*14 days*	15-20 working days
Full SOC *SOC Phase II + Phase V: Herbicide, Semivolatiles, Carbamates, EDB/DBCP, Pesticides/PCB's, Endothall,Glyphostate, Diquat*		*see individual analyses above*		*14 days*	15-20 working days

SOC/VOC Package

Analytical Parameter	EPA Method	Sampling Container	Preservative	Holding	Estimated Time
Complete Phase II + V SOC & VOC	*various*	*see individual analyses above*		*14 days*	15-20 working days

SOC & VOC analytes are listed on the following pages

BACTERIOLOGICAL ANALYSES

Analytical Parameter	Method	Sampling Container	Preservative	Holding	Estimated Time
Coliform Presence/Absence	*SM9223B-PA*	*Sterile 125mL HDPE*	*Sodium Thiosulfate*	*30 hours*	3 working days
Coliform P/A as Count	*SM9223B-PA as 5 tube*	*Sterile 125mL HDPE*	*Sodium Thiosulfate*	*30 hours*	3 working days
Heterotrophic Plate Counts (HPC)	*SM 9215B*	*Sterile 125mL HDPE*	*Sodium Thiosulfate*	*N/A*	7 working days
Iron Bacteria	*SM 9240B*	*125 mL HDPE*		*30 hours*	7 working days
Coliform Bacteria Weekend*	add to standard fee	*** Please call in advance for availability**			
Coliform Bacteria Accelerated *	add to standard fee	More Bacteriological analyses available- see Bacteriological section.			

INORGANIC CONTAMINANTS

Analytical Parameter	Method	Sampling Container	Preservative	Holding	Estimated Time
Lead & Copper (Pb/Cu) Rule	*EPA 200.8*	*1 L HDPE*	*HNO_3 Lab Preserves*	*6 months*	10 working days
		for 10 Lead & Copper samples			
		for each sample when sending more than 10 Lead & Copper samples			
Anions	*EPA 300.0/SM 4500NO ^{3} F*	*125 mL HDPE*			10 working days
Nitrate/N, Nitrite/N,		**for first anion**		*48 hours for Nitrate or Nitrite*	
Sulfate, Fluoride, or Chloride		**for additional anions**		*28 days for Sulfate, Fluoride, or Chloride*	
Alkalinity	*SM 2320 B/EPA 310.1*	*125 mL HDPE*		*14 days*	10 working days
Ammonia	*SM 4500 NH3*	*250 mL HDPE*	*H_2SO_4 pH<2*	*28 days*	10 working days
Anionic Surfactants	*SM 5540 C*	*250 mL HDPE*		*ASAP*	10 working days
Chlorine – Total Residual	*SM 4500Cl-F*	*250 mL amber glass, No Headspace*		*ASAP*	10 working days
Color	*SM 2120 B*	*125 mL HDPE*		*ASAP*	10 working days
Conductivity	*SM 2510 A/ EPA 120.1*	*125 mL HDPE*		*ASAP*	10 working days
Cyanide	*4500-CN E*	*1 L HDPE*	*NaOH pH > 12*	*ASAP*	10 working days
Hardness	*SM 2340 B/ EPA 200.8*	*125 mL HDPE*		*ASAP*	10 working days
Hydrogen Sulfide	*4500-S^{2-} F*	*1 L HDPE*	*1 Tablet NaOH/L*	*ASAP*	10 working days
Iron	*EPA 200.8*	*125 mL HDPE*	*HNO_3 pH < 2*	*6 months*	10 working days
Corrosivity - Langlier	*Various*	*1 L HDPE*		*ASAP*	10 working days
Mercury by CVAA	*EPA 245.1*	*1 L HDPE*	*HNO_3 pH < 2*	*6 months*	10 working days
Metals (Single Metals)	*EPA 200.8*	*125 mL HDPE*	*HNO_3 pH < 2*	*6 months*	10 working days
		for first metal			
		for each additional metal			
Odor	*SM 2150 B*	*1 L HDPE*		*ASAP*	10 working days
pH	*SM 4500-H+ EPA 150.1*	*125 mL HDPE*		*ASAP*	7-10 working days
Silica/Silicon – Dissolved Only	*EPA 200.8*	*125 mL HDPE*		*6 months*	10 working days
Surfactants	*SM 5540 C*	*1 L amber glass*		*14 days*	10 working days
TDS	*SM 2540 C/EPA 160.1*	*1 L HDPE*		*7 days*	10 working days
Turbidity	*SM 2130 B/EPA 180.1*	*125 mL HDPE*		*48 hours*	10 working days

Regulated Water Systems

keeping your water system compliant

IOC TEST PACKAGES

Analytical Parameter	Sampling Container	Preservative	Holding	Estimated Time
Washington Complete IOC	*2 - 1 L HDPE's*	*NaOH for CN in 1L*	*48 hours*	10 working days
Arsenic, Barium, Cadmium, Chromium, Mercury, Selenium, Beryllium, Nickel, Antimony, Thallium, Nitrate/N, Nitrite/N, Fluoride, Cyanide, Iron, Manganese, Silver, Chloride, Sulfate, Zinc, Turbidity, Hardness, Conductivity, Color, TDS, Lead, Copper, Sodium, Aluminum, Silica, Ortho-Phosphate, Alkalinity, Ammonia-N, Calcium, Magnesium				
Idaho Complete IOC	*1 L HDPE*		*48 hours*	10 working days
Barium, Cadmium, Chromium, Mercury, Nitrate, Nitrite, Selenium, Nickel, Antimony, Beryllium, Thallium, Arsenic, Fluoride, Sodium, Aluminum, Ammonia/N, Calcium, Chloride, Copper, Hydrogen Sulfide, Iron, Lead, Magnesium, Manganese, Potassium, Silica (SIO3), Silver, Sulfate, Zinc, Color, Hardness, Odor, pH, Conductivity, Alkalinity, TDS, Langlier Index (Corrosivity), Surfactants, Turbidity(NTU)				
Idaho IOC Packages				
Arsenic & Sodium	*1 L HDPE*		*6 months*	10 working days
Fluoride	*1 L HDPE*		*28 days*	10 working days
Nitrate	*1 L HDPE*		*48 hours*	10 working days
Nitrate/Nitrite	*1 L HDPE*		*48 hours*	10 working days
Phase II IOC metals:				
(Barium, Cadmium, Chromium, Mercury, Selenium)	*1 L HDPE*		*28 days*	10 working days
Idaho Phase V IOC:	*1 L HDPE*		*6 months*	10 working days
(Nickel, Antimony, Beryllium, Thallium)				
Idaho Primary IOC package with cyanide waiver	*1 L HDPE*		*28 days*	10 working days
(Barium, Cadmium, Chromium, Mercury, Nitrate, Nitrite, Selenium, Nickel, Antimony, Beryllium, Thallium, Arsenic, Fluoride, Sodium)				
Idaho Secondary/Optional IOC package	*1 L HDPE*		*ASAP*	10 working days
(Aluminum, Ammonia/N, Calcium, Chloride, Copper, Hydrogen Sulfide, Iron, Lead, Magnesium, Manganese, Potassium, Silica (SIO3), Silver, Sulfate, Zinc, Color, Hardness, Odor, pH, Conductivity, Alkalinity, TDS, Langlier Index, Surfactants, Turbidity)				

TEST PACKAGES-Miscellaneous

Analytical Parameter	Method	Sampling Container	Preservative	Holding	Estimated Time
Spokane County:	various	*Sterile 125 mL HDPE*	*Sodium Thiosulfate*	*30 hours*	10 working days
Coliform Bacteria, Nitrate		*and 1 125 mL HDPE*			
fast turn arounds				*30 hours*	1 working day
fast turn arounds				*30 hours*	2 working days
Tri-County Area:	various	*1 Sterile 125 mL HDPE*	*Sodium Thiosulfate*	*30 hours*	10 working days
Coliform Bacteria, Nitrate, Lead, Arsenic		*and 1 125 mL HDPE*			
fast turn arounds				*30 hours*	1 working day
fast turn arounds				*30 hours*	2 working days
UCMR (List 1)	EPA 525.2, 515.3, 524.2, 314.0	*various- call for details*		*14 days*	15 -20 working days

Regulated Water Systems

keeping your water system compliant

SOC Analyte Lists

Herbicides- Idaho, Montana, & Washington EPA 515.3

Regulated				*Unregulated*		
Silvex	Dalapon	Picloram		2,4,5-T	Bentzon	
2,4-D	Pentachlorophenol	Dinoseb	Dicamba	2,4-DB	Dacthal	MCPA

Carbamates-Idaho, Montana, & Washington EPA 531.1

Regulated				*Unregulated*	
Aldicarb	Aldicarb sulfoxide	Oxamyl			
Aldicarb sulfone	Carbofuran	Methomyl		3-Hydroxycarbofuran	Carbaryl

Semivolatiles Idaho & Montana EPA 525.2/508

Semivolatiles EPA 525.2	Alachlor	Benzo[a]pyrene	Di(2-ethylhexyl)adipate	Hexachlorobenzene	Metalochlor	Simazine
	Atrazine	Butachlor	Di(2-ethylhexyl)phthalate	Hexachlorocyclopentadiene	Propachlor	
Chlor. Pest. EPA 508	Endrin	Methoxychlor	PCB's	Heptachlor	*Unregulated*	
	Lindane	Toxaphene	Chlordane	Heptachlor epoxide	Aldrin	Dieldrin

Semivolatiles Washington EPA 525.2/508/515.3

EPA Regulated		**EPA Unregulated**	**State Unregulated**			
Alachlor	Heptachlor epoxide	Aldrin	PAH:	Chrysene	OTHER:	
Atrazine	Hexachlorobenzene	Butachlor	Acenaphthene	Dibenz(a,h)anthracene	1,3-Dichlorobenzene	Endosulfan I
Benzo(a)pyrene	Heptachlor	Dieldrin	Acenaphthylene	Fluoranthene	4,4'-DDE	Malathion
Chlordane	Lindane	Metolachlor	Anthracene	Fluorene	4,4'-DDT	Parathion
Di(2-ethylhexyl)adipate	Methoxychlor	Metribuzin	Benzo(a)anthracene	Indeno(1,2,3-cd)pyrene	Bromacil	Prometon
Di(2-ethylhexyl)phthalate	PCB's	Propachlor	Benzo(b)fluoranthene	Naphthalene	Cyanizine	Terbacil
Dinoseb	Pentachlorophenol		Benzo(g,h,i)perylene	Pyrene	Disulfoton	Trifluralin
Endrin	Simazine		Benzo(k)fluoranthene	PHTHALATES:	Butylbenzyl phthalate	Diethyl phthalate
Hexachlorocyclopentadiene	Toxaphene				Di-n-butyl phthalate	Dimethyl phthalate

Semivolatiles 525.2 Extended list -Includes above Washington list & the following:						Endosulfan II
a-Chlordane	Cycloate	Merphos	Oxyfluorfen	Saffrole	b-BHC	Hexachloroethane
g-Chlordane	Dichlorvos	Methyl paraoxon	Pentachloronitrobenzene	Terbuphos	d-BHC	Isodrin
c-Nonachlor	Disulfoton sulfoxide	Mevinphos	Methyl parathion	Vernolate	Ametryne	Isopropalin
t-Nonachlor	Disulfoton sulfone	MGK-264	Norflurazon	Dimethoate	Benefin	Isosafrole
Ametryn	Ethoprop	Molinate	Pendamethalin	Isophorone	Dibenzofuran	N-Nitrosodi-n-propylamine
Atraton	Fenamiphos	Napropamide	2,4,6-Trichlorophenol	2-Chloronaphthalene	Diesel	
Butylate	Fenarimol	5-Hydroxydicamba	2,4-Dichlorophenol	4-Chlorophenyl phenyl ether	Diphenylamine	2-Methylnaphthalene
Carboxin	Fluridone	4-Nitrophenol	4-Chloro-3-methylphenol	4-Bromophenyl phenyl ether	Endosulfan sulfate	Baygon
Chlorpropham	Hexazinone	Oxadiazon	Profuralin	a-BHC	Endrin aldehyde	Methiocarb

VOC Analyte Lists

IDAHO/MONTANA Volatile Organics Regulated and Unregulated - EPA 524.2

EPA Regulated

Benzene	t-1,2-Dichloroethylene	p-Dichlorobenzene	Monohlorobenzene	1,2,4-Trichlorobenzene	Trichloroethylene	Total Trihalomethanes Bromodichloromethane
Carbon tetrachloride	1,2-Dichloroethane	Dichloromethane	Styrene	1,1,1-Trichloroethane	Toluene	Bromoform
1,1-Dichloroethylene	1,2-Dichloropropane	Ethylbenzene	Tetrachloroethylene	1,1,2-Trichloroethane	Vinyl chloride	Chloroform
c-1,2-Dichloroethylene	o-Dichlorobenzene				Xylenes	Dibromochloromethane

EPA Unregulated

Bromobenzene	s-Butylbenzene t-Butylbenzene	p-Chlorotoluene Dibromomethane	1,1-Dichloroethane 1,3-Dichloropropene	Hexachlorobutadiene	n-Propylbenzene	Trichloro-fluoromethane
Bromochloromethane	Chloroethane	m-Dichlorobenzene	2,2-Dichloropropane	Isopropylbenzene	1,1,1,2-Tetrachloroethane	1,2,3-Trichloropropane
Bromomethane	Chloromethane	Dichlorodi-fluoromethane	1,1-Dichloropropene	p-Isopropyltoluene	1,1,2,2-Tetrachloroethane	1,3,5-Trimethylbenzene
n-Butylbenzene	o-Chlorotoluene		1,3-Dichloropropane	Naphthalene	1,2,3-Trichlorobenzene	1,2,4-Trimethylbenzene

WASHINGTON Volatile Organics Regulated and Unregulated - EPA524.2

EPA Regulated

	Trichloroethylene	1,1,2-Trichloroethane	Total Xylenes	Bromoform	Dibromomethane	1,1,2,2-Tetrachloroethane
Vinyl Chloride	1,4-Dichlorobenzene	Tetrachloroethylene	m/p Xylenes(MCL for Total)	Chloromethane	1,3-Dichloropropane	o-Chlorotoluene
1,1-Dichloroethylene	Dichloromethane	Chlorobenzene	o-Xylene(MCL for Total)	Bromomethane	1,1,1,2-Tetrachloroethane	p-Chlorotoluene
1,1,1-Trichloroethane	trans-1,2-Dichloroethylene	Ethylbenzene	EPA Unregulated	Chloroethane	Bromobenzene	m-Chlorotoluene
Carbon Tetrachloride	cis-1,2-Dichloroethylene	Styrene	Chloroform	1,1-Dichloroethane	1,2,3-Trichloropropane	1,3-Dichloropropene
Benzene	1,2-Dichloropropane	1,2-Dichlorobenzene	Bromodichloromethane	2,2-Dichloropropane		
1,2-Dichloroethane	Toluene	1,2,4-Trichlorobenzene	Chlorodibromomethane	1,1-Dichloropropylene		

EPA Unregulated

cis-1,3-Dichloropropene	Bromochloromethane	1,3,5-Trimethylbenzene	sec-Butylbenzene	Naphthalene	EDB(Scan Confirm 504.1)
trans-1,3-Dichloropropene	Isopropylbenzene	tert-Butylbenzene	p-Isopropyltoluene	Hexachlorobutadiene	DBCP(Scan Confirm 504.1)
Fluorotrichloromethane	n-Propylbenzene	1,2,4-Trimethylbenzene	n-Butylbenzene	1,2,3-Trichlorobenzene	Dichlorodi-fluoromethane

Waste Water/RCRA Soil

quality and reliable analytical services

VOLATILE ORGANICS

Analytical Parameter	Matrix	Method	Sampling Container	Preservative	Holding	Estimated Time
Single Volatile Compound	water	*EPA 8260B*	*2 X 40 mL amber vial*	*HCl pH<2*	*14 days*	10-15 working days
(i.e. TCE OR MTBE, or BTEX)	soil		*4 oz glass*			
Volatile Halocarbons/	water	*EPA 8260B*	*2 X 40 mL amber vial*	*HCl pH<2*	*14 days*	10-15 working days
Chlorinated Solvents	soil		*4 oz glass*			
Volatile Organics	water	*EPA 8260B*	*2 X 40 mL amber vial*	*HCl pH<2*	*14 days*	10-15 working days
	soil		*4 oz glass*			

INORGANIC CONTAMINANTS

Analytical Parameter	Matrix	Method	Sampling Container	Preservative	Holding	Estimated Time
CYANIDE						
Total	water	*SM 4500 CN*	*1 L HDPE*	*NaOH pH>10*	*14 days*	10 working days
Total & Amenable	soil	*EPA 9010A*	*4 oz glass*			
Weak Acid Dissociable (WAD)	water	*SM 4500 CN*	*1 L HDPE*	*NaOH pH>10*	*14 days*	10 working days
Amenable to Chlorination	water	*SM 4500 CN*	*1 L HDPE*	*NaOH pH>10*	*14 days*	10 working days
Reactive	water	*EPA SW 846*	*1 L HDPE*	*NaOH pH>10*	*14 days*	10 working days
	soil	*EPA SW 846*	*4 oz glass*			
NITROGEN						
Nitrite ($N0_2$-N)	water	*EPA 300.0/*	*125 ml HDPE*		*48 hours*	10 working days
	soil	*SM 4500 NO3F*	*4 oz glass*			
Nitrate ($N0_3$-N)	water	*EPA 300.0/*	*125 ml HDPE*		*48 hours*	10 working days
	soil	*SM 4500 NO3F*	*4 oz glass*			
Ammonia (NH_3/N)	water	*SM 4500 NH3*	*500 ml HDPE*	*H_2SO_4 pH<2*	*28 days*	10 working days
	soil		*4 oz glass*			
Organic Nitrogen (TKN – NH_3)	water	*SM 4500 NH3*	*500 ml HDPE*	*H_2SO_4 pH<2*	*28 days*	10 working days
	soil	*SM 4500 N B/4500 NH3 C*	*4 oz glass*			
TKN (Total Kjeldahl Nitrogen)	water	*SM 4500 NH3*	*500 ml HDPE*	*H_2SO_4 pH<2*	*28 days*	10 working days
	soil	*SM4500 N B*	*4 oz glass*			
Total Nitrogen	water	*various*	*500 ml HDPE*		*48 hours*	10 working days
(N02 + NO3 + TKN)	soil		*4 oz glass*			
SOLIDS						
Total Dissolved Solids (TDS)	water	*SM 2540 C/EPA 106.1*	*1 L HDPE*		*ASAP*	10 working days
Total Solids	water	*SM 2540 B/EPA 106.3*	*1 L HDPE*		*ASAP*	10 working days
Total Suspended Solids (TSS)	water	*SM 2540 D/EPA 106.2*	*1 L HDPE*		*ASAP*	10 working days
Total Volatile Solids (TVS)	water	*EPA 106.4*	*1 L HDPE*		*7 days*	10 working days
	soil	*SM2540G*	*4 oz glass*			
Percent Solids	soil	*SM2540B*	*4 oz glass*		*N/A*	10 working days

INORGANIC CONTAMINANTS cont.

Analytical Parameter	Matrix	Method	Sampling Container	Preservative	Holding	Estimated Time
METALS (Prices include digestion fee)						
Single Metal Analysis	water	*EPA 200.8*	*500 mL HDPE*	*HNO_3 pH < 2*	*6 months*	10 working days
	soil	*EPA 6020*	*4 oz glass*			
			each additional metal			
Mercury Cold Vapor (CV)	water	*EPA 245.2*	*500 mL HDPE*	*HNO_3 pH < 2*	*6 months*	10 working days
	soil	*EPA 7471A*	*4 oz glass*			
Trace Mercury	water	*EPA 1631*	*Teflon*		*1 month*	1 month
	soil		*Ultra Clean 4 oz glass*			
Low Level Metals	water	*EPA 1638*	*Ultra Clean HDPE*		*6 months*	1 month
(Trace Metals)	soil		*Ultra Clean 4oz glass*			
			each additional metal			
Silica/Silicon – Dissolved	water	*EPA 200.8*	*250 ml HDPE*		*6 months*	10 working days
Hexavalent Chromium	water	*EPA 7196*	*500 mL HDPE*	*HNO_3 pH < 2*	*48 hours*	10 working days
	soil		*4 oz glass*			
Priority Pollutant Metals (13):	water	*EPA 6020/EPA 7471A*	*500 mL HDPE*	*HNO_3 pH < 2*	*6 months*	10 working days
Ag Be Cd Cr Cu Ni Sb Zn As Pb Se Tl Hg	soil	*EPA 3051/6020/7471A*	*4 oz glass*			
Target Analyte List (TAL) Metals:						
Al Ba Be Ca Cd Co Cr Cu Fe Mg Mn	water	*EPA 6020/EPA 7471A*	*500 mL HDPE*	*HNO_3 pH < 2*	*6 months*	10 working days
Ni K Ag Na Sb V Zn As Pb Se Tl Hg	soil	*EPA 3051/6020/7471A*	*4 oz glass*			
Total 8 RCRA Metals:	water	*EPA 6020/EPA 7471A*	*500 mL HDPE*	*HNO_3 pH < 2*	*6 months*	10 working days
Ag As Ba Cd Cr Pb Se Hg	soil	*EPA 3051/6020/7471A*	*4 oz glass*			
Washington Fertilizer Metals List						
As Cd Co Hg Mo Ni Pb Se Zn	water	*EPA 6020/EPA 7471A*	*500 mL HDPE*	*HNO_3 pH < 2*	*6 months*	10 working days
	soil		*4 oz glass*			
ANIONS (IONS)	water	*SM 4500/EPA 300.6*	*125 ml HDPE*			10 working days
	soil	*SM 4500/EPA 300.6*	*4 oz glass*			
Nitrate/N, Nitrite/N, Phosphate			***for each additional anion***		*48 hours*	
Fluoride, Chloride, Sulfate					*28 days*	

Waste Water/RCRA Soil

quality and reliable analytical services

INORGANIC CONTAMINANTS cont.

Analytical Parameter	Matrix	Method	Sampling Container	Preservative	Holding	Estimated Time
Alkalinity as $CaCO_3$	water	*SM 2320*	*500 ml HDPE*		*ASAP*	10 working days
	soil					
Biochemical Oxygen Demand (BOD)	water	*SM 5210 B*	*500 ml HDPE*		*30 hours*	7-10 working days
Cations-Anion Balance	water	*EPA 200.8/300.0*	*1 L HDPE*		*28 days*	10 working days
Cation Exchange Capacity	soil	*EPA 9081*	*4 oz glass*		*28 days*	10 working days
Chemical Oxygen Demand (COD)	water	*EPA 410.4*	*500 ml HDPE*	*H_2SO_4 pH<2*	*30 hours*	10 working days
Color	water	*SM 2120 B*	*250 ml HDPE*		*ASAP*	10 working days
Dissolved Oxygen	water	*SM5210B*	*250 ml glass*	*No Headspace*	*ASAP*	10 working days
Hardness as $CaCO_3$	water	*EPA 130.2/SM 2340 B*	*500 ml HDPE*		*ASAP*	10 working days
Hydrogen Sulfide	water	*SM 4500 S*	*500 ml HDPE*	*NaOH pH>10 No Headspace*	*ASAP*	10 working days
Fats, Oil & Grease	soil	*EPA 9070*	*4 oz glass*		*14 days*	10 working days
Fats, Oil & Grease (HEM)	water	*EPA 1664*	*1 L amber glass*	*HCl pH<2*	*14 days*	10 working days
Fats, Oil & Grease	water	*EPA 1664*	*1 L amber glass*	*HCl pH<2*	*14 days*	10 working days
(HEM w/Sil. Gel Clean-up)						
pH	water	*EPA 150.1*	*250 ml HDPE*		*ASAP*	10 working days
	soil	*EPA 9040 B/9045 C*	*4 oz glass*			
Phenolics (Total)	water	*EPA 420.1/9065*	*1 L amber glass*		*14 days*	10 working days
	soil	*EPA 9067*	*4 oz glass*			
Phosphorus	water	*SM 4500 PF*	*1 L amber glass*		*7 days*	10 working days
(orthophosphate - PO_4)	soil	*EPA 200.8/300.0*	*4 oz glass*			
Phosphorus (Total)	water	*SM 4500 PF*	*500 ml HDPE*	*H_2SO_4 pH<2*	*7 days*	10 working days
	soil		*4 oz glass*			
Salinity as NaCl	water		*125 ml HDPE*		*28 days*	10 working days
Specific Conductance (Conductivity)	water	*EPA 120.1*	*500 ml HDPE*		*ASAP*	10 working days
Specific Gravity	water	*ASTM D287*	*250 ml glass*		*NA*	10 working days
Sulfides-Total	soil	*EPA 9030A*	*4 oz glass*		*14 days*	10 working days
Surfactants (MBAS)	water	*SM 5540 C*	*1 L amber glass*		*14 days*	10 working days
Tannin & Lignin	water	*SM 5550 B*	*1 L HDPE*		*14 days*	10 working days
Total Organic Carbon (TOC)	water	*SM 5310 C*	*2 X 40 mL vial*	*H_2SO_4 pH<2*	*14 days*	10 working days
	soil	*EPA 9060*	*4 oz glass*			
Total Organic Halogens (TOX)	water	*EPA 9020*	*500 ml HDPE*	*H_2SO_4 pH<2*	*14 days*	10 working days
	soil	*EPA 90769/9023*	*4 oz glass*			
Turbidity	water	*EPA 180.1*	*125 ml HDPE*		*48 hours*	10 working days
Volatile Acids (Total, TVA)	water	*SM 5560 C*	*1 L HDPE*	*H_2SO_4 pH<2*	*14 days*	10 working days
	soil	*SM 5560 C*	*4 oz glass*			

BACTERIOLOGICAL ANALYSES

Analytical Parameter	Method	Sampling Container	Preservative	Holding	Estimated Time
Total Coliform Bacteria	*SM 9221 B*	*Sterile 125 ml HDPE*	*Sodium Thiosulfate*	*30 hours*	5 working days
Fecal Coliform Bacteria	*SM 9221 E*	*Sterile 125 ml HDPE*	*Sodium Thiosulfate*	*24 hours*	5 working days
Fecal Coliform + E. Coli	*SM 9221 E*	*Sterile 125 ml HDPE*	*Sodium Thiosulfate*	*30 hours*	5 working days
Coliform Bacteria Weekend (Call in advance for availability)			**More Bacteriological analyses available- see Bacteriological section.**		

SEMIVOLATILE ORGANICS

Analytical Parameter	Matrix	Method	Sampling Container	Preservative	Holding	Estimated Time
Carbamates/Pesticides	water	*EPA 8318*	*40 mL amber vial*	*Sodium Thiosulfate,MCAA*	*7 days*	15 working days
	soil		*4 oz glass*			
Carbonyl Compounds	water	*EPA 8315A*	*250 mL amber glass*		*3 days*	
	soil	*EPA 8315*	*4 oz glass*			
Chlorinated Herbicides	water	*EPA 8151A*	*1 L amber glass*		*7 days*	15 working days
	soil		*4 oz glass*		*14 days*	
EDB	water	*EPA 8011*	*250 mL glass*		*7 days*	15 working days
	soil		*4 oz glass-no headspace*		*14 days*	
Organochlorine Pesticides	water	*EPA 8081A/8270*	*1 L amber glass*		*7 days*	15 working days
	soil		*4 oz glass*		*14 days*	
Organophosphorus Pesticides	water	*EPA 8141/8270*	*1 L amber glass*		*7 days*	15 working days
	soil	*EPA 8141A*	*4 oz glass*		*14 days*	
PAH's	water	*EPA 8270C*	*1 L amber glass*		*7 days*	15 working days
	soil	*GC-MS EPA 8270*	*4 oz glass*		*14 days*	
	soil	*HPLC(trace) EPA8310*	*4 oz glass*		*14 days*	
PCB's	water	*EPA 8082*	*1 L amber glass*		*7 days*	15 working days
	soil		*4 oz glass*		*14 days*	
Percent Solids	soil		*4 oz glass*		*14 days*	15 working days
Phenols	water	*EPA 8270C*	*1 L amber glass*		*7 days*	15 working days
	soil		*4 oz glass*		*14 days*	
Phthalates	water	*EPA 8270C*	*1 L amber glass*		*7 days*	15 working days
	soil		*4 oz glass*		*14 days*	
Semivolatile Organics (Full List)	water	*EPA 8270C*	*1 L amber glass*		*7 days*	15 working days
	soil		*4 oz glass*		*14 days*	
Aldehydes	water	*EPA 8315A*	*250 ml amber glass*		*14 days*	15 working days
Triazine Pesticides	water	*EPA 619/8270*	*1 L amber glass*		*14 days*	15 working days
	soil		*4 oz glass*			
Single SOC (ie Atrazine)	water	*EPA 8270C*	*1 L amber glass*		*7 days*	15 working days
	soil		*4 oz glass*		*14 days*	

Waste Water/RCRA Soil

quality and reliable analytical services

SPECIALTY PESTICIDES

Analytical Parameter		Method	Sampling Container	Preservative	Holding	Estimated Time
Fluridone	water	*HPLC*	*500 mL HDPE*		*7 days*	15 working days
	soil		*4 oz glass*			
Chloropropham	water	*HPLC*	*8 oz amber glass*		*7 days*	15 working days
	soil		*4 oz glass*			
Glyphosate	water	*HPLC*	*8 oz amber glass*		*7 days*	15 working days
	soil		*4 oz glass*			
Pesticide Screen	water	*EPA 8270 Mod*	*1L amber glass*		*7 days*	15 working days
	soil		*4 oz glass*			
Pentachlorophenol	water	*EPA 8151*	*1L amber glass*		*7 days*	15 working days
	soil		*4 oz glass*			
Clopyralid						
Picloram						
And other specialty analyses		**Call for Quote**				

MISCELLANEOUS

Analytical Parameter	Method
SAMPLE PREP	
Digestion	*EPA 3050/3051/3005* *3010/200.0*
Filtration (0.45mm)	
Sample Compositing	
Acid Digestion	*EPA 310/3051*
Aliphatic/Aromatic Separation	*EPA 3611*
Bomb Combustion	*EPA 5050*
Gel-permeation cleanup	*EPA 3640*
Liquid-Liquid Extraction	*EPA 3520*
Microwave Digestion	*EPA 3015/3051*
PCB Cleanup	*EPA 3630 Modified*
Separatory Funnel Extraction	*EPA 3510*
Soxhlet Extraction	*EPA 3540*
Ultrasonic Extraction	*EPA 3550*
Particle Sizing by Sieve	
Dry Sieve	**per Sieve Size**

MISCELLANEOUS Cont.

Analytical Parameter	Matrix	Method	Sampling Container	Preservative	Holding	Estimated Time
Explosives & by-product	water	*EPA 8330/8095*	*1 L amber glass*		*7 days*	10-15 working days
Diphenylamine (DPA)	water	*EPA 641*	*40 ml amber vial*	*H_2SO_4 pH<2*	*7 days*	10 working days
Ethylene Glycol	water	*GC/FID*	*1 L amber glass*		*7 days*	10 working days
SOPP	water	*HPLC/MS/MS*	*40 mL amber vial*		*7 days*	10 working days
Ethoxyquin	water	*HPLC/MS/MS*	*40 mL amber vial*		*7 days*	10 working days
Thiabendazole (TBZ)	water	*EPA 641*	*40 mL amber vial*		*7 days*	10 working days
Volatile Acids	water	*GC/MS*	*1 L HDPE*	*H_2SO_4 pH<2*	*7 days*	10 working days
Chlorophyl A	water	*SM10200H*	*1 L amber glass*		*7 days*	10 working days
Nitrosamines	water	*EPA 607*	*1 L amber glass*		*7 days*	10 working days
Chlorinated Dioxins &/or Furans	water					

TEST PACKAGES

Analytical Parameter	Method	Sampling Container	Preservative	Holding	Estimated Time
Spokane Discharge Limits:				*14 days*	10 working days
FOG	*EPA 1664*	*1 L amber glass*	*HCl pH<2*		
CN	*SM 4500-CN*	*500 mL HDPE*	*NaOH pH>10*		
pH, Flashpoint, Reactivity	*Various*	*1 L amber glass*			
As Cd Cr Cu Pb Hg Ni Ag Zn	*EPA 200.8/245.1/236.1*	*500 mL HDPE*	*HNO3 pH<2*		
for advanced systems add ***BTEX***					
PRIORITY POLLUTANTS- Full List		***Call for sampling container instructions***		*14 days*	10 working days
BNA	*EPA 8270*				
OC Pesticides	*EPA 8081*				
Herbicides	*EPA 8151*				
Volatile Organics	*EPA 8260*				
Priority Pollutant Metals	*EPA 6020/200.8*				

Bacteriological Tests

BACTERIOLOGICAL ANALYSES

Analytical Parameter	Matrix	Method	Sampling Container	Preservative	Holding	Estimated Time
Coliform Presence/Absence	water	*SM 9223B-PA*	*Sterile 125mL HDPE*	*Sodium Thiosulfate*	*30 hours*	3 working days
Coliform P/A as Count	water	*SM 9223B-PA as 5 tube*	*Sterile 125mL HDPE*	*Sodium Thiosulfate*	*30 hours*	3 working days
Total Coliform by MPN/MTF	water	*SM 9221B*	*Sterile 125mL HDPE*	*Sodium Thiosulfate*	*30 hours*	7 working days
	soil		*4 oz glass jar*			7 working days
Fecal Coliform	water	*SM 9221B/SM 9221E*	*Sterile 125mL HDPE*	*Sodium Thiosulfate*	*30 hours*	7 working days
	soil		*4 oz glass jar*			7 working days
Total & Fecal Coliform	water	*SM 9221B*	*Sterile 125mL HDPE*	*Sodium Thiosulfate*	*30 hours*	7 working days
	soil		*4 oz glass jar*			7 working days
E. Coli by MPN/MTF	water	*SM 9221B/SM 9221E*	*Sterile 125mL HDPE*	*Sodium Thiosulfate*	*30 hours*	7 working days
	soil		*4 oz glass jar*			7 working days
Total, Fecal & E. Coli	water	*various*	*Sterile 125mL HDPE*	*Sodium Thiosulfate*	*30 hours*	7 working days
	soil		*4 oz glass jar*			7 working days
Heterotrophic Plate Counts (HPC)	water	*SM 9215B*	*Sterile 125mL HDPE*	*Sodium Thiosulfate*	*30 hours*	7 working days
Iron Bacteria	water	*SM 9240B*	*125 mL HDPE*		*30 hours*	7 working days
Aeromonas						
Salmonella						
Listeria						
Pseudomonas						

MISCELLANEOUS FEES

Coliform Bacteria Weekend*	add to standard fee	
Coliform Bacteria Accelerated *	add to standard fee	using 18 hour colilert

*Please call in advance for availability.

Oil/Hazardous Waste

Analytical Parameter	Matrix	Method	Sampling Container		Holding	Estimated Time
CORROSIVITY (pH)	liquid	*EPA 9040*	*500 ml HDPE*		*ASAP*	10 working days
	solid	*EPA 9045*	*4 oz clear glass*			
IGNITIBILITY (Flashpoint)		*EPA 1010*	*8 oz clear glass*		*14 days*	10 working days
REACTIVITY						
Cyanide - Reactive		*SW 846*	*1 Liter HDPE*		*14 days*	10 working days
Sulfide - Reactive		*SW 846*	*1 Liter HDPE*		*14 days*	10 working days
Reactive Cyanide and Sulfide		*SW 846*	*1 Liter HDPE*		*14 days*	10 working days
TOXICITY (Includes extraction price)			**first metal**			
TCLP Metal (Single metal)	liquid	*EPA 6020/3051/1311*	*1 L HDPE*		*7 days*	10 working days
	solid		*8 oz amber glass*			
TCLP 8 Metals	liquid	*EPA 200.8/1311*	*1 L HDPE*		*7 days*	10 working days
(Ag, As, Ba, Cd, Cr, Pb, Se, Hg)	solid		*8 oz amber glass*			
TCLP Volatiles		*EPA 8260/1311*	*8 oz amber glass*		*7 days*	15 working days
TCLP Semivolatiles		*EPA 8270/1311*	*8 oz amber glass*		*7 days*	15 working days
TCLP Pesticides		*EPA 8081/1311*	*8 oz amber glass*		*7 days*	15 working days
TCLP Herbicides		*EPA 8151/1311*	*8 oz amber glass*		*7 days*	15 working days
FULL TCLP ANALYSIS	solid	*various*	*2 x 8 oz amber glass*		*7 days*	15 working days
(8 metals, Volatiles, Semivolatiles,	liquid		*1 L amber glass &*			
Pesticides, Herbicides)			*2 X 40 mL amber vials*	*HCl pH<2*		
WASTE OIL						
Sulfur (Total)		*ASTM D2622*	*8 oz amber glass*		*14 days*	10 working days
BTU		*ASTM D240-92*	*8 oz amber glass*		*7 days*	10 working days
Viscosity		*ASTM D445*	*8 oz amber glass*		*14 days*	10 working days
Specific Gravity		*ASTM D287*	*8 oz amber glass*		*NA*	10 working days
Ethylene Glycol		*GC/FID*	*8 oz amber glass*		*14 days*	10 working days
Halogenated Volatiles		*EPA 8260 (8010 list)*	*8 oz amber glass*		*14 days*	10 working days
Ash		*ASTM D482*	*8 oz amber glass*		*14 days*	10 working days
Percent Moisture		*Karl Fischer Titration*	*8 oz amber glass*		*14 days*	10 working days
COMPLETE OIL ANALYSIS (includes all analyses below)			*8 oz amber glass*		*14 days*	10 working days
Total 4 Metals		*EPA 6020/3051*			*14 days*	10 working days
Total Chorine (TOX)		*EPA 9076*			*14 days*	10 working days
PCB's		*EPA 8082*	*2 mL vial if PCB only*		*14 days*	10 working days
Flashpoint		*EPA 1010*			*14 days*	10 working days

Analytical Parameter	Matrix	Method	Sampling Container	Preservative	Holding	Estimated Time
ASBESTOS	Bulk	*EPA 660/M4-82-020*	*100 grams, Ziploc bag*		*N/A*	5 working days
	Air	*PCM*	*100 grams*			10 working days
OTHER ANALYSES						
PCB's in Wipes		*EPA 8082*	*4 oz clear glass*	*In Hexane*	*14 days*	10 working days
F-List Solvent Scan		*EPA 8260/8270/8015*	*4 oz clear glass*	*No Headspace*	*14 days*	10 working days
Paint Filter Test		*EPA SW 846*	*4 oz clear glass*		*14 days*	10 working days
Lead in Air		*EPA 6020*	*Filter*		*14 days*	10 working days
Lead in Paint		*EPA 6020*	*10 grams, Ziploc bag*		*14 days*	10 working days

Underground Storage Tank (UST)

NORTHWEST TPH METHODS

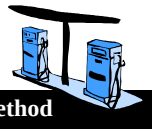
Analytical Parameter	Matrix	Method	Sampling Container	Preservative	Holding	Estimated Time
TPH-HCID *(Hydrocarbon Identification)*	soil	*EPA 8015 MOD*	*4 oz jar*		*14 days*	5-10 working days
	water		*1 L amber glass*		*7 days*	5-10 working days
TPH-D (Diesel)	soil	*EPA 8015 MOD*	*4 oz jar*		*14 days*	5-10 working days
	water		*1 L amber glass*		*7 days*	5-10 working days
TPH-Dx (Diesel & Waste Oil)	soil	*EPA 8015 MOD*	*4 oz jar*		*14 days*	5-10 working days
	water		*1 L amber glass*		*7 days*	5-10 working days
TPH-G (Gasoline)	soil	*EPA 8015 MOD*	*4 oz jar*		*14 days*	5-10 working days
	water		*2 X 40 mL amber vial*	*HCl Acid pH < 2*	*7 days*	5-10 working days
BTEX (Gasoline, JP-4)	soil	*EPA 8021/8260*	*4 oz jar*		*14 days*	5-10 working days
	water	*EPA 8260*	*2 X 40 mL amber vial*	*HCl Acid pH < 2*	*7 days*	5-10 working days
	air	*EPA 8260*	*Tedlar Bags*		*7 days*	5-10 working days
TPH-G/BTEX (Gasoline)	soil	*EPA 602-8021B*	*4 oz jar*		*14 days*	5-10 working days
	water	*or EPA 8260*	*2 X 40 mL amber vial*	*HCl Acid pH < 2*	*7 days*	5-10 working days
GAS TEST PACKAGE	soil	*various*	*4 oz jar*		*14 days*	5-10 working days
(BTEX, Napthalene, MTBE, EDB,	water		*2 X 40 mL amber vial*	*HCl Acid pH < 2*	*7 days*	5-10 working days
EDC, NWTPH-G, Hexane, Lead)			*& 125 mL HDPE*			
DIESEL TEST PACKAGE	soil	*EPA 8260/8270*	*4 oz glass*		*14 days*	5-10 working days
(PAH & BTEX)	water		*1 L amber glass &*		*7 days*	5-10 working days
			2 X 40 mL amber vial	*HCl Acid pH < 2*		
Volatile Petroleum (VPH)	soil	*GC/FID/PID*	*4 oz jar*		*14 days*	5-10 working days
(Aliphatic & Aromatic Fractions)	water		*2 X 40 mL amber vial*	*HCl Acid pH < 2*	*7 days*	5-10 working days
VPH, BTEX, MTBE, & Naphthalene	soil	*GC/FID/PID*	*4 oz jar*		*14 days*	5-10 working days
	water		*2 X 40 mL amber vial*	*HCl Acid pH < 2*	*7 days*	5-10 working days
Extractable Petroleum Hydrocarbons (EPH)	soil	*GC/FID*	*4 oz jar*		*14 days*	5-10 working days
(*Aliphatic & Aromatic Fractions)*	water		*1 L amber glass*		*7 days*	5-10 working days
PAH	soil	*EPA 8270*	*4 oz glass*		*14 days*	5-10 working days
Fuel Oil #4, JP-5	water		*1L amber glass*	*HCl Acid pH < 2*	*7 days*	5-10 working days
EPH + PAH	soil	*GC/FID*	*4 oz jar*		*14 days*	5-10 working days
	water	*GC/MS EPA 8270*	*500 mL Amber*	*HCl Acid pH < 2*	*7 days*	5-10 working days
PCB's	water	*EPA 8082*	*1 L amber glass*		*7 days*	15 working days
	soil		*4 oz glass*		*14 days*	
Volatile Halocarbons/8010 list/	water	*EPA 8260B*	*2 X 40 mL amber vial*	*HCl pH<2*	*14 days*	10-15 working days
Chlorinated Solvents	soil		*4 oz glass*			

IDAHO RBCA CLEAN-UP

Analytical Parameter	Matrix	Method	Sampling Container	Preservative	Holding	Estimated Time
RBCA Volatiles (Gasoline)	soil	*EPA 8260*	*4 oz glass*		*14 days*	5-10 working days
BTEX, MTBE, EDC, EDB, Naphthalene	water		*2 X 40 mL amber vial*	*HCl Acid pH < 2*	*7 days*	5-10 working days
RBCA Diesel-PAH's & BTEX	soil	*EPA 8260/8270*	*4 oz glass*		*14 days*	5-10 working days
Diesel Fuel Oil #2 & Kerosene	water		*1L amber glass &*		*7 days*	5-10 working days
			2 X 40 mL amber vial	*HCl Acid pH < 2*		
RBCA Waste Oil	soil	*EPA 8260/8270*	*4 oz glass*		*14 days*	5-10 working days
PAH's & Chlorinated Solvents	water		*1L amber glass &*		*7 days*	5-10 working days
			2 X 40 mL amber vial	*HCl Acid pH < 2*		
Chlorinated Solvents	soil	*EPA 8260*	*4 oz glass*		*14 days*	5-10 working days
(Volatile Halocarbons, 8010 list)	water		*2 X 40 mL amber vial*	*HCl Acid pH < 2*	*7 days*	5-10 working days
EDB in Water	water	*EPA 8011*	*2 X 40 mL amber vial*		*14 days*	5-10 working days
PAH's	soil	*EPA 8270*	*4 oz glass*		*14 days*	5-10 working days
Fuel Oil #4, JP-5	water		*1L amber glass*	*HCl Acid pH < 2*	*7 days*	5-10 working days

MONTANA UST CLEAN-UP

Analytical Parameter		Method	Sampling Container	Preservative	Holding	Estimated Time
GRO	soil	*EPA 8015*	*4 oz glass*		*14 days*	10 working days
	water		*2 X 40 mL amber vial*	*HCl Acid pH < 2*	*7 days*	10 working days
GRO + BTEX/MTBE	soil	*EPA 8015*	*4 oz glass*		*14 days*	10 working days
	water		*2 X 40 mL amber vial*	*HCl Acid pH < 2*	*7 days*	10 working days
DRO (EPH Screening)	soil	*EPA 8015*	*4 oz glass*		*14 days*	10 working days
	water		*1L amber glass*		*7 days*	10 working days
VPH (Massachusetts)	soil	*MA approved*	*4 oz glass*		*14 days*	10 working days
	water	*Method*	*2 X 40 mL amber vial*	*HCl Acid pH < 2*	*7 days*	10 working days
EPH (NO PAH) (Massachusetts)	soil	*MA approved*	*4 oz glass*		*14 days*	10 working days
	water	*Method*	*2 X 1L amber glass*		*7 days*	10 working days
PAH (Massachusetts)	soil	*EPA 8270*	*4 oz glass*		*14 days*	10 working days
	water		*2 X 1L amber glass*		*7 days*	10 working days
DRO + EPH	soil	*EPA 8015*	*4 oz glass*		*14 days*	10 working days
	water		*2 X 1L amber glass*		*7 days*	10 working days
DRO, EPH & PAH	soil	*MA apprvd Method*	*4 oz glass*		*14 days*	10 working days
	water	*& EPA 8270*	*2 X 1L amber glass*		*7 days*	10 working days



Underground Storage Tank (UST)

NATURAL ATTENUATION PARAMETERS

Analytical Parameter	Method	Sampling Container	Preservative	Holding	Estimated Time
DISSOLVED GASES					
Ethylene, Methane, Ethane	*GC/FID headspace*	*60 mL crimp top serum bottle*	H_2SO_4 *pH<2*	*14 days*	14 working days
Carbon Dioxide	*GC/FID headspace*	*60 mL crimp top serum bottle*		*14 days*	14 working days
Carbon Dioxide	*SM4500CO2C titration*	*1L glass amber (no headspace)*		*48 hours*	7 working days
IOC PARAMETERS					
Dissolved Fe and Mn	*EPA 200.8*	*125 mL HDPE*		*6 months*	10 working days
Ions (NO2, NO3, SO4, Cl)	*EPA 300.0*	*125 mL HDPE*		*48 hours*	10 working days
pH + Alkalinity	*SM2320*	*500 mL HDPE*		*ASAP*	10 working days

Anatek Labs, Inc.

Table 3

Analytical Test Methods

Drinking Water

EDB/DBCP/1,2,3-TCP Analysis by EPA Method 504.1
Herbicides Analysis by EPA Method 515.3
Volatile Organic Analysis by EPA Method 524.2
Semi-volatiles Analysis by EPA Method 525.2
Carbamates Analysis by EPA Method 531.1
Glyphosate Analysis by EPA Method 547
Dalapon/Endothall Analysis by EPA Method 548.1
Diquat/Paraquat Analysis by EPA Method 549.2
Haloacetic Acids Analysis by EPA Method 552/SM 6251B

Organic Methods

Pressurized Fluid Extraction By EPA Method 3545
Pesticides by EPA Method 608/8081A
PCBs by EPA Method 8082
Herbicides by EPA Method 8151A/615
Semivolatile Organic Compounds Analysis by GC/MS by EPA Method 8270C
Volatile Organic Analysis by EPA Method 8260
Explosives and Explosive By-products by EPA Method 8095
Explosives and Explosive By-products by EPA Method 8330
Carbamates/Urea Pesticide Analysis by HPLC-UV by EPA Method 8321A
Chlorophyl *a* Analysis by SM 10200H

Miscellaneous Methods

Orthophosphate (SM4500P-F) Flow Injection Analysis
Total Phosphorous/Ortho-Phosphate by EPA Method 365.3
Phenolics by Manual Colorimetry by EPA Method 420.1/9065
Ammonia Nitrogen (SM4500NH3-G) and TKN (SM4500NorgC) by flow Injection Analysis
Cation Exchange Capacity
pH by EPA Method 150.1
Alkalinity by EPA Method 310.1, Carbonate & Bicarbonate
Conductivity by EPA Method 120.1
Hardness – ICP by EPA Method 200.8
Trace Metal Analysis by EPA Method 200.8/6020
Ultra Trace Metal Analysis by EPA Method 1638

SOP	Analytical Test Method

Sodium Analysis by Flame AA by EPA Method 3111B and 7770
Trace Mercury Analysis by EPA Method 1631
Nitrate/N and Nitrite/N (SM4500NO3-F) Flow Injection Analysis
Ions (Nitrate, Nitrite, Chloride, Sulfate, Fluoride, Phosphate) By EPA Method 300.0
Ions (Bromate, Bromide, Chlorate, Chlorite) By EPA Method 300.1B
Turbidity by EPA Method 180.1
TSS by EPA Method 160.2 and TDS by EPA Method 160.1
Color (Platinum-Cobalt Method) by EPA Method 110.2
Total Volatile Solids by EPA Method 160.4
Total Volatile Acids by SM 5560 C
Anionic Surfactants by Method 5540 C
Tannin and Lignin by SM 5550 B
Reactive Cyanide and Reactive Sulfide by SW 846
Cyanide by Manual Colorimetry by EPA Methods 335.2/9010A
Weak Acid Dissociable Cyanide by Semi-Automated Colorimetry by 4500-CN-I
Total Cyanide by Semi-Automated Colorimetry by EPA Method 335.4/9012A

UST Petroleum Methods

TPH 418.1 Modified for Soils
TPH 418.1/413.2 for Water Samples
Gasoline Analysis by EPA Method 8015 (Modified)
TPH-D & HCID-NW TPH-D & NW TPH-HCID
Diesel Range Organics (DRO)
Extractable Petroleum Hydrocarbons (EPH) Massachusetts Method) and Diesel Range Organics (DRO)
Extractable Petroleum Hydrocarbons (EPH) (Washington Method)
Sulfur Analysis by EPA Methods 9030B and 9034
Flashpoint by EPA Method 1010
Hexane Extractable Material (FOG) by EPA Method 1664

Coliform and Bacteria

WMMO-MUG P/A Procedure
Verification of Positive MMO-MUG Samples
Heterotrophic Plate Count by Method 9215 B

Special

Quantitation of Clopyralid in Finished Compost

Anatek Labs, Inc.

Figures

Figure 1

Anatek Labs, Moscow Organizational Chart

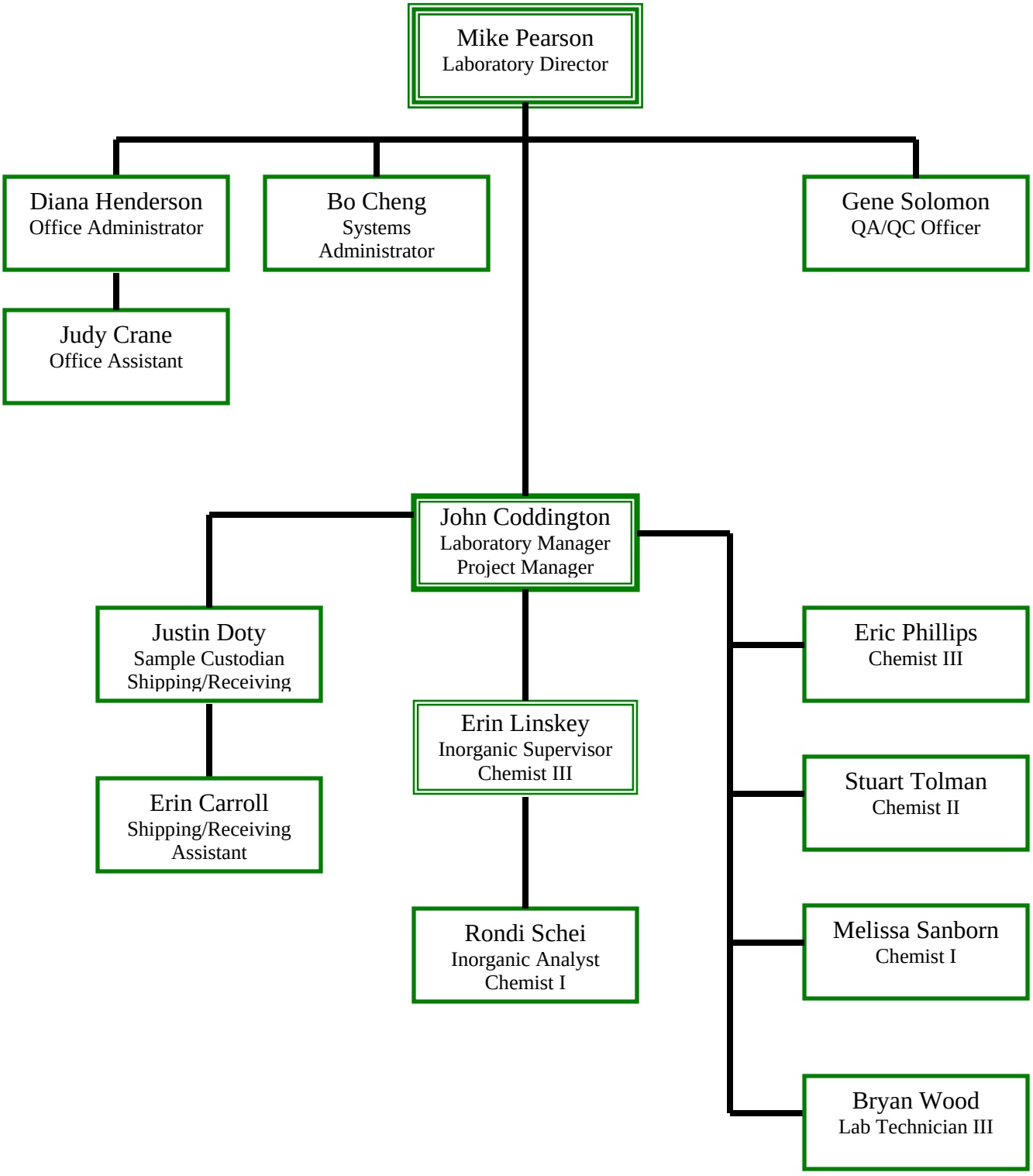


Figure 2

Anatek Labs, Moscow Personnel

Position	Employee	Degree
Laboratory Director	Mike Pearson	B.S Elec. Eng.
Laboratory Manager	John Coddington	Ph. D. Chemistry
Inorganic Supervisor (Chemist III)	Erin Linskey	B.S. Biology
Chemist III	Eric Phillips	B.S. Chemistry
Chemist II	Stuart Tolman	M.S. Food Science
Chemist I	Melissa Sanborn	B.S. Chemistry
Inorganic Analyst (Chemist I)	Rondi Schei	B.A. Chemistry
Laboratory Technician III	Bryan Wood	B.S. Biology
Systems Administrator	Bo Cheng	M.S. Information Technology Ph. D. Physics
QA Officer	Gene Solomon	B.A. Economics
Sample Custodian	Justin Doty	
Office Administrator	Diana Henderson	
Office Assistant	Judy Crane	
Shipping/Receiving Coordinator	Justin Doty	
Shipping/Receiving Assistant	Erin Carroll	

Figure 3

Anatek Labs, Moscow Floor Plan

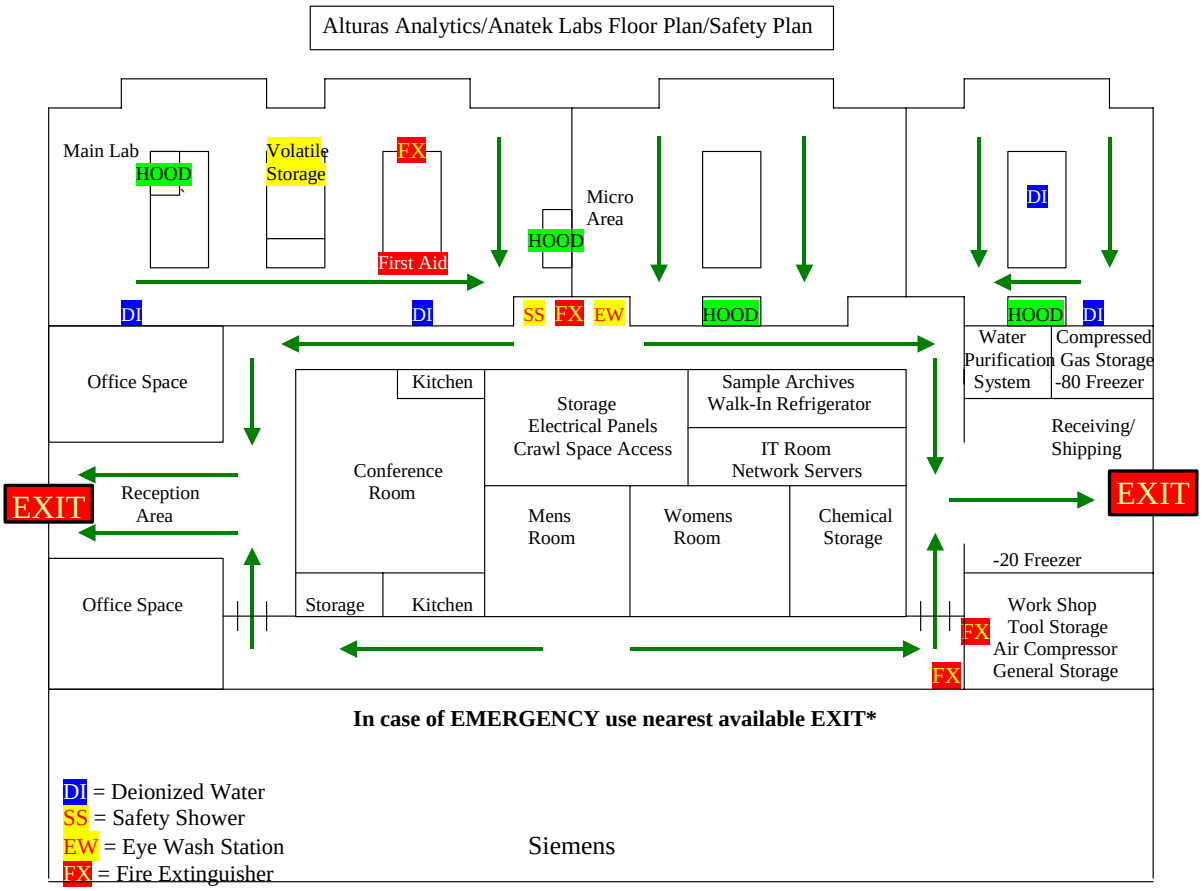


Figure 4

Anatek Labs, Spokane Organizational Chart

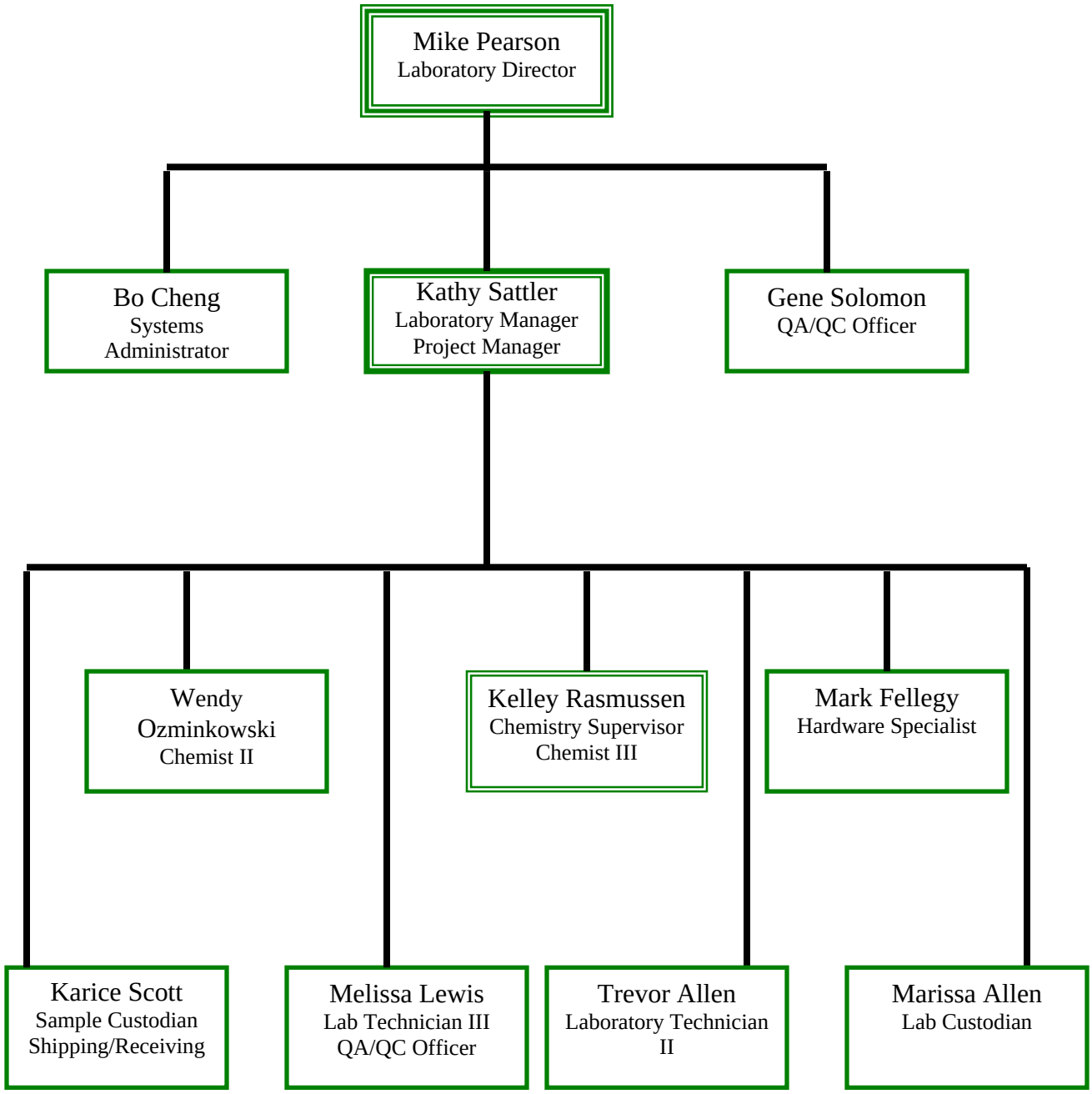


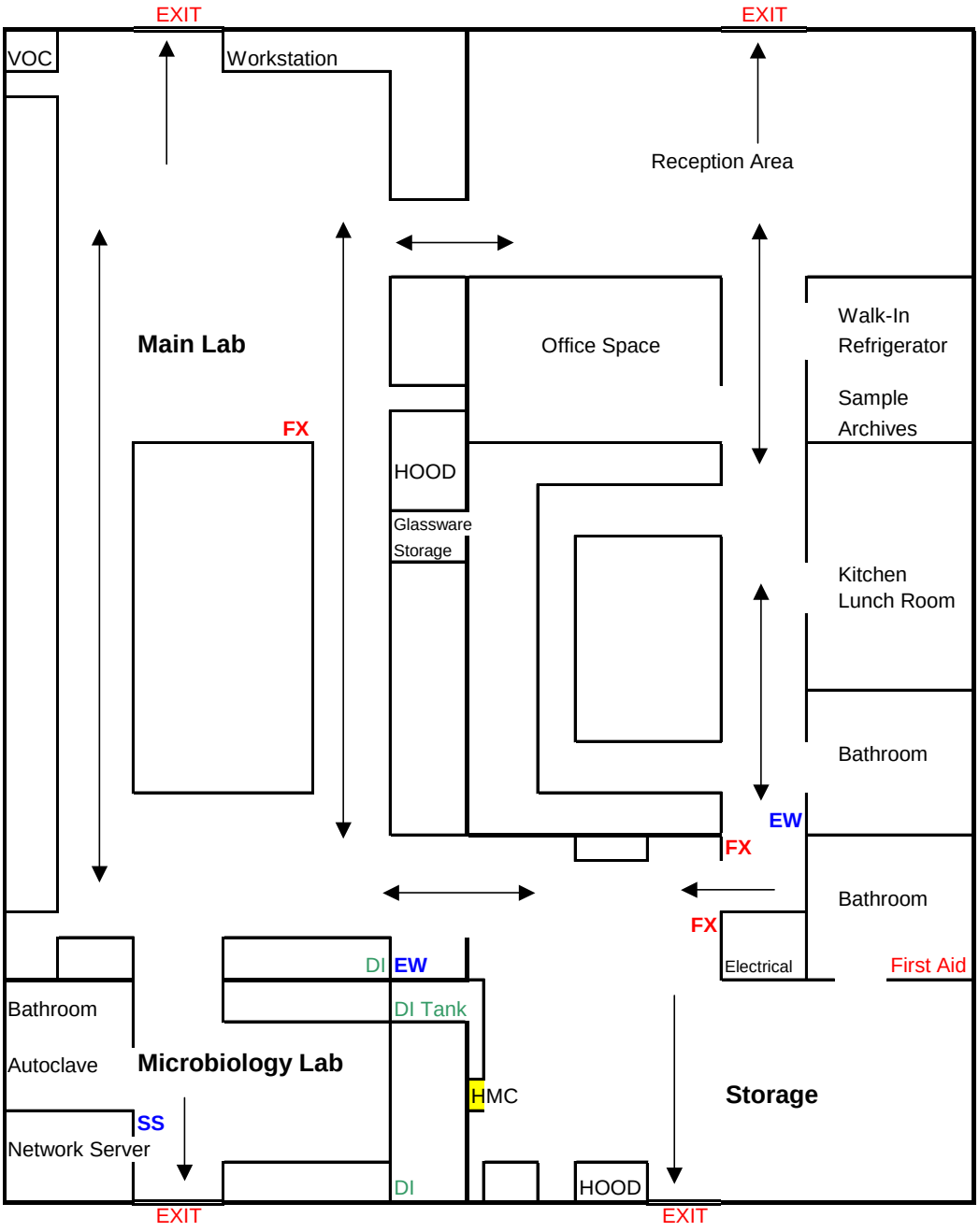
Figure 5

Anatek Labs, Spokane Personnel

Position	Employee	Degree
Laboratory Director	Mike Pearson	B.S Elec. Eng.
Laboratory Manager	Kathy Sattler	B.S. Microbiology
Chemistry Supervisor (Chemist III)	Kelley Rasmussen	B.S. Chemistry
Chemist II	Wendy Ozminkowski	B.S. Chemistry
Lab Technician III/ QA Officer	Melissa Lewis	B.S. G. Studies/Natural Sciences
Lab Technician II	Trevor Allen	B.S. Biochemistry (2006)
QA Officer (Moscow)	Gene Solomon	
Hardware Specialist	Mark Fellegy	
Systems Administrator	Bo Cheng	M.S. Information Technology Ph. D. Physics
Sample Custodian	Karice Scott	
Shipping/Receiving	Karice Scott	
Lab Custodian	Marissa Allen	

Figure 6

Anatek Labs, Spokane Floor Plan and Safety Plan



DI = Deionized Water
SS = Safety Shower
FX = Fire Extinguisher
EW = Eyewash Station
Hazardous Materials Cabinet

Anatek Labs, Inc.

Appendix A

Index of Standard Operating Procedures

Anatek Labs, Inc.
Standard Operating Procedures

Laboratory Director:
Mike Pearson

April 12, 2004

The SOP's contained herein are for the use of Anatek Labs Employees and are not to be removed from the premises without the prior approval of the Lab Director or Lab Manager. Original signed copies are maintained by the QA Officer. Any changes should be submitted to the QA Officer for implementation.

General (00)

ALI-01: Preparing and Maintaining Standard Operating Procedures
ALI-02: Sample Login, Handling and Custody
ALI-03: Glassware Cleaning
ALI-04: Waste Disposal
ALI-05: Data Entry
ALI-06: Complaints
ALI-07: Corrective Action Reports
ALI-08: Labeling, Logging and Storage of Standards and Commercial Reagents/Solvents
ALI-09: Instrument Maintenance and Calibration
ALI-10: Laboratory Safety
ALI-11: Data Handling
ALI-12: Laboratory Blind Samples
ALI-13: Personnel Training Records
ALI-14: Data Archiving
ALI-15: Instrument Activities Logbook
ALI-16: Internal Inspections and Reporting
ALI-17: Procedure for QA Audits of Instrument Activity Logs, IDC's & MDL's
ALI-18: Sample Receiving
ALI-19: Thermometer Calibration
ALI-20: IDEX Bottle Sterility Test
ALI-21: Customer Notification
ALI-22: Training
ALI-23: Shipping/Receiving
ALI-24: Performing Records Inspections

Office Manual (00)

ALI-OM-01: Customer Service
ALI-OM-02: Custodial Services
ALI-OM-03: Administrative Sample Handling Procedures

ALI-OM-04: Telephone Systems Procedures
ALI-OM-05: Mail Handling
ALI-OM-06: Purchasing
ALI-OM-07: Shipping
ALI-OM-08: Office Equipment
ALI-OM-09: Accounting
ALI-OM-10: Credit Accounts
ALI-OM-11: Employees

Analytical (000)

Drinking Water (100)

ALI-A-101: EDB/DBCP/1,2,3-TCP Analysis by EPA Method 504.1
ALI-A-102: Haloacetic Acids Analysis by SM 6251B
ALI-A-103: Organochlorine Pesticides and PCB's by EPA Method 505
ALI-A-104: Herbicides Analysis by EPA Method 515.3
ALI-A-105: Volatile Organic Analysis by EPA Method 524.2
ALI-A-106: Semi-volatiles Analysis by EPA Method 525.2
ALI-A-107: Carbamates Analysis by EPA Method 531.1
ALI-A-108: Glyphosate Analysis by EPA Method 547
ALI-A-109: Dalapon/Endothall Analysis by EPA Method 548.1
ALI-A-110: Diquat/Paraquat Analysis by EPA Method 549.2

Semi-volatile Non-volatile Non Drinking Water (200)

ALI-A-201: Pressurized Fluid Extraction By EPA Method 3545
ALI-A-202: Chlorophyl *a* Analysis by SM 10200H
ALI-A-203: Pesticides/PCB's by EPA Method 608/8081A/8082
ALI-A-204: Carbamates/Urea Pesticide Analysis by HPLC-UV by EPA Method 8321A
ALI-A-205: Herbicides by EPA Method 8151A/615
ALI-A-206: Semivolatile Organic Compounds Analysis by GC/MS by EPA Method 8270C
ALI-A-207: Volatile Organic Analysis by EPA Method 8260
ALI-A-208: Volatile Organic Analysis by EPA Method 624
ALI-A-209: Explosives and Explosive By-products by EPA Method 8330
ALI-A-210: Explosives and Explosive By-products by EPA Method 8095

Inorganic and Wet Chemistry (300)

ALI-A-301: Orthophosphate/Total Phosphorus (SM4500P-F) Flow Injection Analysis
ALI-A-302: Total Phosphorus by (SM4500P-E) Manual Colorimetry
ALI-A-303: Phenolics by Manual Colorimetry by EPA Method 420.1/SM5530C
ALI-A-304: Ammonia Nitrogen (SM4500NH3-G) and TKN (SM4500NorgC) by flow Injection Analysis
ALI-A-305: Cation Exchange Capacity of Soils by EPA Method 9081
ALI-A-306: Residual Chlorine by SM 4500Cl-G
ALI-A-307: Cyanide by Manual Colorimetry by EPA Methods 335.2/9010A
ALI-A-308: Weak Acid Dissociable Cyanide by Semi-Automated Colorimetry by 4500-CN-I
ALI-A-309: Total Cyanide by Semi-Automated Colorimetry by EPA Method 335.4/9012A/SM 4500 CN-E
ALI-A-310: pH by EPA Method 150.1
ALI-A-311: Alkalinity by EPA Method 310.1, /Carbonate & Bicarbonate
ALI-A-312: Conductivity by EPA Method 120.1
ALI-A-313: Hardness by SM 2340B
ALI-A-314: Trace Metal Analysis by EPA Method 200.8
ALI-A-315: Trace Metal Analysis by EPA Method 6020
ALI-A-316: Ultra Trace Metal Analysis by EPA Method 1638

ALI-A-317: Sodium Analysis by Flame AA by EPA Method 3111B and 7770
ALI-A-318: Trace Mercury Analysis by EPA Method 1631
ALI-A-319: Nitrate/N and Nitrite/N (SM4500NO3-F) Flow Injection Analysis
ALI-A-320: Ions (Nitrate, Nitrite, Chloride, Sulfate, Fluoride, Phosphate) By EPA Method 300.0
ALI-A-321: Ions (Bromate, Bromide, Chlorate, Chlorite) By EPA Method 300.1B
ALI-A-322: Turbidity by EPA Method 180.1
ALI-A-323: TSS by EPA Method 160.2 and TDS by EPA Method 160.1
ALI-A-324: Color (Platinum-Cobalt Method) by EPA Method 110.2
ALI-A-325: Total Volatile Solids by EPA Method 160.4
ALI-A-326: Total Volatile Acids by SM 5560 C
ALI-A-327: Anionic Surfactants by Method 5540 C
ALI-A-328: Tannin and Lignin by SM 5550 B
ALI-A-329: Reactive Cyanide and Reactive Sulfide by SW 846
ALI-A-330: Toxicity Characteristic Leaching Procedure by SW 846 Method 1311

UST Petroleum Methods (400)

ALI-A-401: TPH 418.1 Modified for Soils
ALI-A-402: TPH 418.1/413.2 for Water Samples
ALI-A-403: Determination of Carbonyl Compounds by HPLC EPA Method 8315A
ALI-A-404: Gasoline Analysis by EPA Method 8015 (Modified)/NW TPHG(X)
ALI-A-405: TPH-D & HCID-NW TPH-D & NW TPH-HCID
ALI-A-406: Diesel Range Organics (DRO)
ALI-A-407: Hexane Extractable Material (FOG) by EPA Method 1664
ALI-A-408: Extractable Petroleum Hydrocarbons (EPH) Massachusetts Method) and Diesel Range Organics (DRO)
ALI-A-409: Extractable Petroleum Hydrocarbons (EPH) (Washington Method)
ALI-A-410: Sulfur Analysis by ASTM D2622
ALI-A-411: Flashpoint by EPA Method 1010

Coliform and Bacteria (500)

ALI-A-501: SM 9223B-PA Procedure Quanti-tray
ALI-A-502: SM 9223B-PA Procedure
ALI-A-503: Heterotrophic Plate Count by Method 9215 B
ALI-A-504: Verification of Positive MMO-MUG samples

Special (600)

ALI-A-601: Quantitation of Clopyralid in Finished Compost

Anatek Labs, Inc.

Appendix B

Example of Sample Submission Form

Handout 08B

Anatek Labs, Inc.

Chain of Custody Record

1282 Alturas Drive, Moscow ID 83843 (208) 883-2839 FAX 882-9246
504 E Sprague Ste D, Spokane WA 99202 (509) 838-3999 FAX 838-4433

Anatek
Log-In #

Company Name:	Project Manager:
Address:	Project Name & # :
City: State: Zip:	Email Address :
Phone:	Purchase Order #:
Fax:	Sampler Name & phone:

Turn Around Time & Reporting

Please refer to our normal turn around times at:
http://www.anateklabs.com/services/guidelines/reporting.asp

__Normal
__Next Day*
__2nd Day*
__Other*_____

*All rush order requests must be prior approved.

__Phone
__Mail
__Fax
__Email

Provide Sample Description / List Analyses Requested / Note Special Instructions/Comments

Lab ID	Sample Identification	Sampling Date/Time	Matrix	# of Containers	Sample Volume	Preservative:										Special Instructions/Comments

	Printed Name	Signature	Company	Date	Time
Relinquished by					
Received by					
Relinquished by					
Received by					
Relinquished by					
Received by					

Lab Use Only

Received Intact?	YES	NO
Labels & Chain Agree?	YES	NO
Containers Sealed?	YES	NO

Describe_____

_____

_____

_____

_____Page _____ of _____

Anatek Labs, Inc.

Appendix C

Standard Operating Procedure
On
Standard Operating Procedures

Anatek Labs, Inc.
1282 Alturas Drive
Moscow, ID 83843

ALI –01 Standard Operating Procedure on Standard Operating Procedures
Effective Date: May 27, 2003
Supersedes: August 12, 2002

Standard Operating Procedure on Standard Operating Procedures

1. Purpose

The purpose of this document is to define procedures by which all Anatek Labs, Inc. Standard Operating Procedures are to be written, reviewed, distributed and stored.

2. Scope

This SOP applies to all activities relating to the generation, quality control, distribution and storage of ALI SOPs.

3. Definitions

SOP –Standard Operating Procedures
ALI-Anatek Labs, Inc.
Anatek- Anatek Labs, Inc.
ALI SOP Manager- An individual or individuals at Anatek Labs responsible for updating and maintaining SOPs. Management shall appoint these individuals. Currently the SOP manager is the QA Manager.

4. Procedure

4.1 Content, Format, Numbering, Dating, Paper and Storage of SOPs

Content

All ALI General SOPs will contain the following sections:

a. Purpose—Statement of the objectives of the SOP
b. Scope—Statement of the coverage and limitation of the SOP
c. Procedure—Description of the steps in the procedure where applicable

All ALI Analytical Method SOPs should contain the following sections:

a. Summary of the analytical method or the Purpose of the method
b. Reagents and Standards—Description of the reagents and standards required
c. Instrument and Apparatus—Description of the analytical instrument and apparatus used
d. Calibration—Description of the calibration standards and number of levels of calibration
e. Data Analysis and Calculation—Description of data analysis and calculation of results where applicable
f. QA/QC—Description of the quality assurance and control required for the method

Format

All ALI SOPs should contain the following information:

a. Anatek Labs, Inc. name and address
b. Subject of the SOP
c. The effective date of the SOP
d. What previous SOP the current SOP supercedes
e. Page numbers in the form of “x of y” where “y” is the total number of pages in the SOP

Numbering

ALI General SOPs will be numbered sequentially according to the following format: A prefix of ALI- followed by the SOP version number. The version number is a zero-padded, two digit number.

ALI Analytical SOPs will be numbered according to the following format: A prefix of ALI-A- followed by the version number. The version number for Analytical SOPs is a three-digit number with the first digit denoting the Section:

1XX—Drinking Water
2XX—Semi Volatile, Non Volatile, Non Drinking Water
3XX—Inorganic and Wet Chemistry
4XX—UST Petroleum
5XX—Coliform and Bacteria

Dating

The effective date of the SOP will be the date indicated in the header.

Paper

Only one copy of the SOP's will be maintained on paper. The paper copy will have all original signatures and be maintained by the SOP manager.

Access

Anatek Labs SOP's will be accessed through the computer workstations. Each workstation will have an icon that will go directly to the SOP's. Electronic SOP's will be maintained and updated by the SOP manager. The electronic version will be considered to be the most current and the only controlled version available to analysts. Copies of frequently used SOP's may be made, but must be checked regularly against the electronic version to insure the most recent version is being used.

Storage

A copy of the current version of the SOPs will be maintained in Anatek Labs, Inc. with the SOP manager. Older versions of the SOPs will be stored in the Archive Room in the SOP Archive section.

4.2 SOP Review, Creation, Approval

SOP Review

a. All personnel may review the SOP and make suggestions and comments to the designated ALI SOP Manager.
b. The SOP will be formally reviewed on an approximately yearly basis.

SOP Creation

a. The SOP Manager will review the need to create a new version of SOP.
b. The SOP Manager will present the proposal to the Lab Manager for comments and approval.

SOP Approval

After final editing, the SOP will be submitted to the Lab Manager for final approval. The proposal and approval should be included as the first page in the SOP.

Anatek Labs, Inc.

Appendix D

Quick Reference for Chemical Safety

ACIDS	**Hazards**	**First Aid (Skin)**	**Fire-Fighting**	**Spillage**
Acetic Acid (CH_3COOH)	Flammable, corrosive	Water spray	CO_2, Powder	Neutralize with weak base
Hydrochloric acid (HCl) (concentrated)	Not combustible, corrosive	Rinse with plenty of water	Any extinguishing agent	Report to supervisor
Hydrochloric acid (HCl) (diluted, 50%<)	Corrosive, not combustible	Rinse with plenty of water	Any extinguishing agent	Neutralize with weak base
Hydrofluoric Acid (HF) (concentrated)	Corrosive, not combustible	Rinse with plenty of water	NO hydrous agent	Report to supervisor
Hydrofluoric Acid (HF) (diluted 30%<)	Corrosive, not combustible	Rinse with plenty of water	NO hydrous agent	Neutralize with weak base
Nitric Acid (HNO_3) (concentrated)	Corrosive, not combustible	Rinse with plenty of water	NO FOAM	Report to supervisor
Nitric Acid (HNO_3) (diluted, 50%<)	Corrosive, not combustible	Rinse with plenty of water	NO FOAM	Neutralize with weak base
Phosphoric Acid (H_3PO_4) (diluted or concentrated)	Corrosive, not combustible	Rinse with plenty of water	Any extinguishing agent	Neutralize with weak base
Sulfuric Acid (H_2SO_4) (diluted or concentrated)	Corrosive, not combustible	Rinse with plenty of water	Powder, CO_2, NO WATER	Neutralize with weak base
BASES				
Ammonium Hydroxide (NH_4OH) (diluted)	Corrosive, not combustible	Rinse with plenty of water	Any extinguishing agent	Neutralize with weak acid
Potassium Hydroxide (KOH) (diluted)	Corrosive, not combustible	Rinse with plenty of water	Any extinguishing agent	Neutralize with weak acid
Sodium Hydroxide (NaOH) (diluted)	Corrosive, not combustible	Rinse with plenty of water	Any extinguishing agent	Neutralize with weak acid
SOLVENTS	**Hazards**	**First Aid (Skin)**	**Fire-Fighting**	**Spillage**
Acetone	Highly flammable	Rinse with water	CO_2, Powder	Ventilate, Collect in

	flammable	water		container
Acetonitrile	Flammable	Rinse with plenty of water	CO_2, Powder	Ventilate, Collect in container
Carbon Disulfide	Highly flammable	Rinse with plenty of water	CO_2, Powder	Evacuate, report to supervisor
Chloroform	Drowsiness, not combustible	Rinse with plenty of water	Any extinguishing agent	Evacuate, Collect in container
Diethyl Ether	Extremely flammable, drowsiness	Rinse with water	CO_2, Powder	Evacuate, Collect in container
Ethanol	Highly flammable	Rinse with water	CO_2, Powder, Water	Collect in container
Ethyl Acetate	Drowsiness, Highly flammable	Rinse with water	CO_2, Powder	Evacuate, Collect in container
Ethylene Glycol	Combustible	Rinse with water	CO_2, Powder	Collect in container
Hexane	Drowsiness, Highly flammable	Rinse with water	CO_2, Powder	Ventilate, Collect in container
Hydrogen Peroxide	Corrosive, not combustible	Rinse with plenty of water	Water	Ventilate, wash with plenty of water
Isooctane	Drowsiness, Highly flammable	Rinse with water	CO_2, Powder	Evacuate, Collect in container
Methanol	Highly flammable	Rinse with water	CO_2, Powder, Water	Evacuate, Collect in container
Methylene Chloride	Drowsiness, combustible	Rinse with water	Any extinguishing agent	Ventilate, Collect in container
MTBE	Highly flammable	Rinse with water	CO_2, Powder	Ventilate, Collect in container
THF	Highly flammable	Rinse with water	CO_2, Powder, Water	Ventilate, Collect in container
Toluene	Highly flammable	Rinse with water	CO_2, Powder	Collect in container

Anatek Labs, Inc.

Appendix E

Laboratory Management and Staff CVs/Qualifications

ANATEK LABS, INC.

MIKE PEARSON
MIKE@ANATEKLABS.COM

EXPERIENCE

08/00– Present **Laboratory Manager**, Alturas Analytics, Inc, Moscow, ID
Manages and initiates experiments in the laboratory including:
Develops and directs employees in the development of HPLC/MS/MS methods,
Maintains analytical equipment, supervise scientific employees, perform HPLC/MS/MS quantitation of drugs and other compounds from various matrices, develops HPLC/MS/MS methods

03/92- Present **Laboratory Director**, Anatek Labs, Inc., Moscow, ID
Directs all aspects of the laboratory including:
Supervise scientific and administrative personnel, develop business plan and marketing strategy, prepare and analyze budgets, bid contracts

09/87-03/92 **Instrumentation Specialist**, Precision Analytics, Pullman, WA

SKILLS AND TECHNIQUES

- Gas Chromatography (GC) with ECD, FID, NPD detection
- Gas Chromatography/Mass spectrometry (GC/MS), and tandem mass spectrometry (GC/MS/MS)
- HPLC with UV and Fluorescence detection and post column reaction techniques
- Liquid Chromatography with tandem mass spectrometry (LC/MS/MS)
- Ion Chromatography and Flow Injection Analysis
- ICP-MS, Atomic Absorption/Atomic Emission spectroscopy AA and AE
- CVAFS – Cold vapor atomic fluorescence spectroscopy
- Method development and analysis of small molecule organic and inorganic compounds using the above techniques
- Extractions and wet chemistry including solid and liquid phase extraction techniques

EDUCATION

BS in Electrical Engineering, University of Idaho, Moscow, ID, 1987

ANATEK LABS, INC.

JOHN W. CODDINGTON
JOHN@ANATEKLABS.COM

EXPERIENCE

1999 – Present **Laboratory Manager**, Anatek Labs, Inc, Moscow, ID
Responsible for all aspects of day-to-day operation of a full service analytical laboratory. Typical duties include training junior level staff, preparing bids and reports, troubleshooting methods and analytical instruments, and developing new methods per customer guidelines, and customer relations.

1997 – 1999 **Research Associate**, Washington State University, Pullman, WA.

1995 – 1997 **Teaching Assistant**, Washington State University, Pullman, WA

1993 – 1995 **Research Assistant**, Washington State University, Pullman, WA

SKILLS AND TECHNIQUES

- Gas Chromatography (GC) with ECD, FID, NPD detection
- Gas Chromatography/Mass spectrometry (GC/MS), and tandem mass spectrometry (GC/MS/MS)
- HPLC with UV and Fluorescence detection and post column reaction techniques
- Ion Chromatography and Flow Injection Analysis
- ICP-MS, Atomic Absorption/Atomic Emission spectroscopy AA and AE
- CVAFS – Cold vapor atomic fluorescence spectroscopy
- Method development and analysis of small molecule organic and inorganic compounds using the above techniques
- Extractions and wet chemistry including solid and liquid phase extraction techniques
- NMR and IR for characterization of organic and inorganic compounds
- Inorganic and Organic synthetic methods

EDUCATION

Ph.D. in Chemistry, Washington State University, Pullman, WA, 1997
BS in Chemistry, Oregon State University, Corvallis, OR, 1993

AWARDS AND PROFESSIONAL AFFILIATIONS

American Chemical Society – Member since 1993
Edward Wagner Memorial Scholarship, Washington State University, 1996

PUBLICATIONS AND REFERENCES

Primary author on 8 publications in refereed ACS journals from 1996-2001 – available upon request

References available upon request

ANATEK LABS, INC.

ERIN LINSKEY
ERIN@ANATEKLABS.COM

EXPERIENCE

7/02 – Present **Inorganic Supervisor, Chemist III**, Anatek Labs, Inc, Moscow, ID
Typical duties include training junior level staff, editing and improving analytical procedures and coordinating Inorganic department, troubleshooting methods and analytical instruments. Responsible for performing preparation and analysis of trace and ultra trace metal levels in samples.

9/98 – 7/02 **Analyst/Lab Technician**, Anatek Labs, Inc, Moscow, ID

9/97 – 5/98 **Lab Technician**, Stukenholtz Laboratory, Twin Falls, ID

SKILLS AND TECHNIQUES

- ICP-MS, Atomic Absorption/Atomic Emission spectroscopy AA and AE
- CVAFS – Cold vapor atomic fluorescence spectroscopy
- Ion Chromatography IC
- Flow Injection Analysis FIA
- Wet Chemistry and Microbiology

EDUCATION

BS in Biology, Minor History, University of Idaho, Moscow, ID, 2000

AWARDS AND PROFESSIONAL AFFILIATIONS

National Dean's List, member, 2000 - present
American Red Cross, Certified First Responder, 1999 – present
Presidential Award for Academic Achievement, 1993

ANATEK LABS, INC.

RONDI A. SCHEI
RONDIS@ANATEKLABS.COM

EXPERIENCE

8/02 – Present **Inorganic Analyst, Chemist I**, Anatek Labs, Inc, Moscow, ID
Responsible for performing preparation and analysis of trace and ultra trace metal levels in client samples. Responsible for Ion Chromatography.

1/99 – 12/00 **Solution Preparation**, Whitworth College, Spokane, WA

1999 **Team Leader**, Analytical Chemistry Lab Research, Whitworth College, Spokane, WA
Tested for Lead in Little Spokane River

SKILLS AND TECHNIQUES

- ICP-MS
- Ion Chromatography IC
- Wet Chemistry

EDUCATION

BA in Chemistry, Minors in Environmental Studies and Business, Whitworth College, Spokane, WA, 2000
Certificate of Completion, Biosphere 2 Center Earth Semester in Environmental Science and Policy, Columbia University of New York, 2000

ANATEK LABS, INC.

ERIC PHILLIPS
ERIC@ANATEKLABS.COM

EXPERIENCE

5/04 – Present	**Chemist III**, Anatek Labs, Inc, Moscow, ID Semivolatile GCMS analyses, and concommitant extraction methods, including methods 525.2 and 8270C.
1/01 – 5/04	**Research Associate**, Washington State University, Pullman, WA
7/97 – 5/99	**Research Chemist**, Oregon State University, Corvallis, OR
6/96 – 4/97	**GCMS Analyst**, REA Technical Management, Salem, OR
2/90 – 2/95	**GCMS Analyst**, Sound Analytical Services, Tacoma, WA

SKILLS AND TECHNIQUES

- Atomic Absorption/Atomic Emission spectroscopy AA and AE
- CVAAS – Cold vapor atomic absorption spectroscopy
- GFAAS – Graphite Furnace Atomic Absorption Spectroscopy
- HPLC
- GC-FID
- GC-PID
- GC-ECD
- GC-ELCD
- GCMS
- Wet Chemistry and Microbiology

EDUCATION

BS in Chemistry, Portland State University, Portland, OR, 2000

ANATEK LABS, INC.

STUART TOLMAN
STUART@ANATEKLABS.COM

EXPERIENCE

1999 – Present **Chemist II**, Anatek Labs, Inc, Moscow, ID
Responsible for GC/FID and GC/ECD analysis and related sample prep.

1998 – 1999 **Product Development**, CAP Creations, Pullman, WA.
1995 – 1996 **Lab Technician**, Washington State University, Pullman, WA
1994 – 1995 **Cheese Maker**, Washington State University Creamery, Pullman, WA
1992 – 1994 **Quality Control**, Oceantrawl Inc., Seattle, WA

SKILLS AND TECHNIQUES

- Gas Chromatography (GC) with ECD, FID detection
- Extractions and wet chemistry including solid and liquid phase extraction techniques
- X-Ray fluorescence
- Bacteriological Analyses

EDUCATION

M.S. in Food Science, Washington State University, Pullman, WA, 1999
B.S. in Food Science, Washington State University, Pullman, WA, 1996

AWARDS AND PROFESSIONAL AFFILIATIONS

Gamma Sigma Delta member
Golden Key Honor Society member
Northwest Food Processors Scholarship
Magna Cum Laude Graduate

ANATEK LABS, INC.

MELISSA SANBORN
MSANBORN@ANATEKLABS.COM

EXPERIENCE

3/01 – Present **Chemist I**, Anatek Labs, Inc, Moscow, ID
Responsible for analysis of VOCs using GC/MS, phosphates, ammonias, nitrates, nitrites by Flow Injection Analysis and all microbiology

SKILLS AND TECHNIQUES

- Gas Chromatography/Mass spectrometry (GC/MS)
- HPLC
- Ion Chromatography and Flow Injection Analysis
- Nuclear Magnetic Resonance Spectroscopy, Infrared Spectroscopy
- Wet Chemistry

EDUCATION

BS in Chemistry, Western Washington University, Bellingham, WA, 2001

AWARDS AND PROFESSIONAL AFFILIATIONS

American Chemical Society – Member since 2001

ANATEK LABS, INC.

M. BRYAN WOOD
BRYANW@ANATEKLABS.COM

EXPERIENCE

4/04 – Present	**Laboratory Technician III**, Anatek Labs, Inc., Moscow, ID Responsible for TSS, TDS, Alkalinity, pH, Turbidity and wet chemistry techniques.
2002	**Lab Technician**, Mass Sampling of Nematoads, Dr. Alan Caplan, University of Idaho, Moscow, ID
2000 – 2001	**Lab Technician**, Age Control as a Function of Caspase activity, Dr. Chuck Passavant, University of Idaho, Moscow, ID
2000	**Lab Technician**, Sample Amplification via PCR, Dr. Jim Morris, Boise State University, Boise, ID
1999 – 2000	**Lab Technician**, Hormonal Control of a Genetic System in Yeast and Maize, Dr. Cliff Weil, University of Idaho, Moscow, ID

SKILLS AND TECHNIQUES

- Wet Chemistry
- Proficient with aseptic technique
- Bacterial culture, isolation, replica plating
- Nutrient agar and broth prep
- Plasmid mass replication, recovery, and manipulation
- Dilutions
- Accelerated Solvent Extractor for organic extraction

EDUCATION

BS in Biology, Emphasis on molecular and cellular interactions, Minor in Botany with emphasis on physiology, University of Idaho, Moscow , ID

ANATEK LABS INC.

BO CHENG
BO@ANATEKLABS.COM

EXPERIENCE

Jun 2002 – Present	**Systems Administrator**, Anatek Labs, Inc. Responsible for maintaining effective functionality of critical information systems defined as all hardware including computer workstations, servers, and IT support equipment plus all laboratory equipment that interfaces with the network or database as well as all software and applications resident on the system
Oct 2001 – Jun 2002	**Assistant System Administrator**, University of Idaho, Dept. of Computer Science
Aug 1996 – Jun 2002	**Research/Teaching Assistant** University of Idaho, Dept. of Physics
Aug 1984 – Jul 1996	**Engineer, Senior Engineer, Deputy Director of R & D Dept**., Yuelong Non-ferrous Metals Ltd., Shanghai, China

EDUCATION

MS in Computer Science, University of Idaho, Moscow, Idaho, August 2001. GPA 3.9/4.0
Ph.D. in Physics, University of Idaho, Moscow, Idaho, May 2002. GPA 3.9/4.0
BS in Physics, Fudan University, Shanghai, P.R. China, 1984

CERTIFICATIONS

MCDBA, Windows 2000 MCSE (Early Achiever), Windows NT 4.0 MCSE.

TECHNICAL SKILLS

Operating Systems
Windows NT, Windows 2000 Active Directory design and implementation, Unix (Linux, HP-UX, Solaris), Windows 9X/ME, XP

Databases
MS SQL Server, Oracle, logical and physical database design, maintenance and tuning, backup and disaster recovery, ODBC, OLE-DB

Network Protocols and Services
TCP/IP, IP routing, PPP/SLIP, VPN, ISDN, Remote Access, DNS/BIND, DHCP, WINS/NBNS, Dfs, NFS, IIS, Apache, MS Exchange Server, Samba

Scripting and Programming Languages
ASP, HTML, SQL, Java, C/C++, Perl, VB script, Pascal

Utilities
MS Remote Installation, IEAK, ADMT, Symantec Ghost, Veritas, Visio

Hardware
SCSI, RAID, NICs, hubs, switches, HP JetDirect printers

ANATEK LABS INC.

GENE M. SOLOMON
GENES@ANATEKLABS.COM

EXPERIENCE

8/04 – Present **QA/QC Officer**, Anatek Labs, Inc., Moscow, ID
Responsible for maintaining company QA Plan, SOPs, and training records. Responsible for ordering and organizing PE samples, performing internal audits and acting as liaison to the Quality departments of the various certifying agencies (IDOH, WADOH, WADOE, etc.)

8/04 – Present **QA/QC Officer**, Alturas Analytics, Inc., Moscow, ID
Responsible for maintaining company SOPs, and training records. Responsible for performing internal audits of all GLP studies. Company Safety Officer.

8/94 – Present **GMP Software Consultant & Trainer**, self-employed, worldwide

1/95 – Present **Technical Writer/Editor**, self-employed, various locations

1/92 – 8/94 **Customer Service Manager**, Blue Mountain Software, State College, PA

EDUCATION

B.A. in Economics with High Honors, University of Montana, Missoula, 1988

LABORATORY QA/QC EXPERIENCE

QA Officer, Anatek Labs, Inc./Alturas Analytics, Inc. Aug 2004 – present

- Maintain master schedule per GLP guidelines
- Maintain audit checklist per GLP guidelines
- Ensure that laboratory and appropriate studies are GLP compliant
- Inspect study binders as needed for GLP studies
- Report study deficiencies to the President and Study Director
- Perform QA audits as per SOP and NELAC guidelines
- Suggests and implements changes to SOP's
- Maintains all Administrative SOP's
- Ensure that SOP's are followed
- Maintains QA Plan per NELAC and State regulations
- Perform annual audits to ensure compliance with NELAC

PROFESSIONAL MEMBERSHIP

Member Pacific Regional Chapter of the Society of Quality Assurance, Aug 2004 – present
Associate Member of the Society of Quality Assurance, Aug 2004 – present

ANATEK LABS INC.

KATHLEEN A. SATTLER
KATHY@ANATEKLABS.COM

EXPERIENCE

10/01 – Present **Laboratory Manager**, Anatek Labs, Inc., Spokane, WA
Responsible for all aspects of day-to-day operation of a full service analytical laboratory. Typical duties include training junior level staff, preparing bids and reports, troubleshooting methods and analytical instruments, and developing new methods per customer guidelines, and customer relations.

07/96 – 10/01 **Microbiology Supervisor**, Anatek Labs, Inc., Spokane, WA

10/96 – 02/97 **Laboratory Assistant**, Sacred Heart Medical Center, Spokane, WA

07/95 – 07/96 **Microbiologist I**, Bremerton-Kitsap County Health District, Bremerton, WA

SKILLS AND TECHNIQUES

- Bacteria cultures, isolation, identification
- Membrane filtration
- Multiple tube fermentation
- Heterotrophic plate count
- Bacteriological examination of water
- Proficient with aseptic technique
- Nutrient agar preparation
- Centrifugation and separation of blood for testing
- Spectrophotometry
- Dilutions, titrations
- Urine analysis
- Quality control and Quality analysis

EDUCATION

B.S. in Microbiology, Minor in Chemistry, University of Idaho, 1994

PROFESSIONAL AFFILIATIONS

American Water Works Association Member
AWWA Inland Empire Subsection Member

ANATEK LABS INC.
KELLEY RASMUSSEN
KELLEY@ANATEKLABS.COM

EXPERIENCE

1998 – Present **Chemistry Supervisor**, **Chemist III**, Anatek Labs, Inc., Spokane, WA
Responsible for WP/WS studies, QC of wet chemistry, IC & PCB analysis. Responsible for TOC's, TOX's. G/BTEX, VOC's and VPH's. Responsible for troubleshooting and repair of instruments and methods. Responsible for report writing.

1997 – 1998 **Laboratory Technician**, Anatek Labs, Inc., Moscow. ID

1997 **Laboratory Technician**, Inland Environmental Laboratories, Spokane, WA

SKILLS AND TECHNIQUES

- Gas Chromatography (GC) with ECD, FID, PID detection
- Gas Chromatography/Mass spectrometry (GC/MS)
- Ion Chromatography
- Extractions and wet chemistry including solid and liquid phase extraction techniques
- NDIR
- TOX 10

EDUCATION

B.S. in Chemistry, Washington State University, 1997

AWARDS AND PROFESSIONAL AFFILIATIONS

Honors College, Washington State University, 1993-97
Distinguished Writing Award 1997
Pi Beta Phi Sorority 1993-97

ANATEK LABS INC.

WENDY OZMINKOWSKI
WENDYO@ANATEKLABS.COM

EXPERIENCE

2004 – Present **Chemist II,** Anatek Labs, Inc., Spokane, WA
Responsible for TOC's, TOX's, G/BTEX, VOC's, VPH's, OxyFuels, BTU's.
Responsible for troubleshooting and repair of instruments and methods.
2002 – 2004 **Organic Chemistry Supervisor**, SVL Analytical, Inc., Kellogg, ID
1998 – 2002 **Organic Chemist I**, SVL Analytical, Inc., Kellogg, ID
1998 **Laboratory Technician,** Quality Coatings, Post Falls, ID
1993 – 1995 **Laboratory Technician**, North Idaho College, Coeur d'Alene, ID

SKILLS AND TECHNIQUES

- Gas Chromatography (GC) with ECD, ELCD, FID, PID detection
- Gas Chromatography/Mass spectrometry (GC/MS)
- Extractions and wet chemistry including solid and liquid phase extraction techniques
- Dohrmann Phoenix 8000 NDIR
- TOX 10

EDUCATION

B.S. in Chemistry, University of Idaho, 1996

AWARDS AND PROFESSIONAL AFFILIATIONS

American Chemical Society, 2000-2004

ANATEK LABS INC.

TREVOR ALLEN
TREVORA@ANATEKLABS.COM

EXPERIENCE

06/03 – Present **Laboratory Technician II**, Anatek Labs, Inc., Spokane, WA

Responsible for TSS, TDS, Alkalinity, pH, Turbidity, Conductivity, BOD's, Cyanides and wet chemistry techniques.

SKILLS AND TECHNIQUES

- IC
- COD's
- Coliform P/A method
- Dilutions, titration
- Spectrophotometry
- Wet Chemistry
- Total Cyanide SM 4500-CN F

EDUCATION

Currently attending Eastern Washington University, B.A. Biochemistry – Forensic Sciences, 2006.

ANATEK LABS INC.

MARK S. FELLEGY
MARKF@ANATEKLABS.COM

EXPERIENCE

08/04 – Present **Maintenance**, Anatek Labs, Inc., Spokane, WA
Responsible for day-to-day maintenance of a full service analytical laboratory. Typical duties include troubleshooting and maintaining analytical instruments, and developing new methods per customer guidelines.

09/01 – 08/04 **Lab Tech III**, SVL Inc., Kellogg, ID

08/79 – 05/01 **Instrumentation Specialist VII**, Cargill Inc., Wayzata, MN

08/75 – 07/79 **Technician**, PCA, Minneapolis, MN

SKILLS AND TECHNIQUES

- Troubleshooting and maintenance of analytical instrumentation
- Method development

EDUCATION

Environmental Technology, Hennepin Technical Center, Eden Prairie, MN 1975

Anatek Labs, Inc.

Appendix F

List of Approved Analytical Methods/ Regulatory Programs Drinking Water (SDWA), Wastewater (CWA) Soils (RCRA)

Current State Certification Certificates and Scopes available upon request

Current State Certifications

Idaho Department of Health
Washington Department of Ecology
Washington Department of Health
Florida Department of Health NELAP # E87893
(Primary Accrediting Authority for NELAP)
Oregon Department of Environmental Quality
ORELAP # ID200001
Nevada State Health Division
Montana Public Health and Human Services
New Mexico Environment Department, Drinking Water Bureau
Colorado Department of Public Health and Environment

Anatek Labs, Inc.

Appendix G

Backup, Fault Tolerance, Disaster Recovery and Data Archive of Mission-critical Information Storage and Services

Bo Cheng
Systems Administrator
9/12/2002

1. Introductions

Mission-critical information storage and services are those that a business cannot afford to lose. Loss of such data or interruption of such services will seriously impact the daily operations of the business and incurs monetary loss.

- **Fault Tolerance**

Fault tolerance in data storage involves redundant storage disks to tolerate certain faults in the hardware. For example, in RAID 5 implementation, in case of failure of one disk, the remaining disks in the array still maintain the data. But the array is in a critical state and its performance is greatly reduced, until the failed disk is replaced and the array is rebuilt.

Fault tolerance only tolerates hardware faults. It does not cover human or application software faults. For example, accidental or intentional deletion by operators or file damage caused by misbehaving applications is not covered by fault tolerance. So Fault tolerance is by no means the replacement of backup.

- **Backup**

Backup is the process of copying important data files to backup devices, usually tapes or disks, to create an extra copy. In case of loss of or damage to these files, they can be restored. Backup is usually a recurring job scheduled at off-peak hours.

Since tapes are data stream devices, files cannot be read off tapes directly by application. Files have to be restored to some disks before they can be accessed. Because tape drives, compared with disks, are slow, file restore can be time consuming. But tapes offer the largest capacity.

In general, backup cannot copy certain system files and open database files e.g. SQL databases and Exchange Information Store. The latter problem can be worked around by using the database's own backup utility to create file backup on the disk first then copying it to tapes.

- **Disaster Recovery**

Disaster is an incident of loss of the server operating system due to hardware or software failure, not just data files.

Generally backup works well only on loss of regular data files. In case of loss of the server system, i.e., the operating system crashes, the server cannot be effectively rebuilt from tape backup, because the server must be up and running before the data can be restored. Since backup fails to copy certain system files, many services must be installed and configured manually in case of server crash, before data files can be restored. Rebuilding a server in such a way is time consuming and the rebuilt system may not be exactly the same as the original. If the rebuild is

done in hurry due to time constraints, some minor functionality may be missing or misconfigured and user complaints will result.

A disaster recovery plan involves capturing the server's entire disk or partition into an image, disregarding its internal file structure, while the server is offline. In case of total failure of a server, the system can be quickly rebuilt from the image, provided failed hardware, if any, has been replaced.

As imaging of a server requires taking it down, it is usually not a recurring job. It is done once after major configuration changes are made to the server and the server is running stably.

· **Data Archive**

Infrequently used older data should be archived onto tapes or optical disks. Data archive serves dual purposes. It frees online disk storage, and, if it is still necessary to put a copy online, the archive provides a backup.

Again, tapes have the largest capacity but are slow to retrieve. Modern optical disks, e.g. writable CD and DVD offer large capacity and fast retrieval at an attractive price, plus, such storage is considered permanent.

2. Identification of mission-critical information storage and services

· **Analytical data and results acquired by the instruments**:

They reside on a Snap server. Snap is a NAS (Network Attached Storage) server that has its own proprietary operating system and file system. It provides network shares for many common operating systems including Windows and Macintosh. Current and recent data files are in \Data share. Older files are archived in \Data_mmyy share, where mmyy is the month and year when the archiving was performed.

· **SQL 7 running on NT server 4.0:**

SQL server databases - LIMS and other databases:
LIMS databases provide data entry, storage and reporting. All data files, logs and indexes reside on E: logical drive of RAID 5 disk of the NT server. Total size 1.6GB (growing steadily as more samples are stored). SQL system binary files reside on C: of the single SCSI disk.

· **Exchange 5.5 running on NT server 4.0:**

Provides e-mail, tasking, scheduling and other collaborating functions to the company.

Exchange Information Store, including employees' mailboxes and public folders:
All directory databases, public/private databases and their logs are on E: logical drive of the RAID 5 disk of NT server. Total size 1GB (breakdown: 830MB private mailboxes and 170MB

public folders. Growing steadily as more messages are stored.). Exchange system binary files reside on C: of the single SCSI disk.

- **NT Server 4.0 SP6a running on HP NetServer LC3:**

Provides domain user logon, user home directories and company shared files. It is the platform on which SQL, Exchange, Web and other services are running. System partition is on C: logical drive, which is part of the single SCSI disk.

- **Apache server 1.3 on Debian Linux 2.4**:

Hosts Alturas Analytics homepage for public access.

- **IIS 4.0 on NT server 4.0:**

Provides a web interface to access SQL databases for internal use.

- **Firewall running on Debian Linux 2.4:**

Provides Internet traffic filtering and Internet connection sharing for internal workstations.

- **QuickBooks company files on NT file server:**

Stores all accounting information of the company, including banking, purchasing, receivable, payable and payroll. They are stored on the RAID disk of NT server.

3. Data security implementations

- **Fault Tolerance**

The Snap server network storage has four physical disks configured as a RAID 5 array. This configuration protects against single disk failure. The disks are not hot swappable.

The LC3 NT server has an external storage housing that has six physical disks. The housing is configured as a RAID 5 array with five disks. The sixth disk is a hot spare. All disks are hot swappable. The housing has redundant power supply.

- **Backup**

The backup software currently in use is ArcServe 2000 and Windows 2000 NTbackup. Backup hardware is the combination of a few hard disks on some workstations and an HP SureStore DLT 40 tape drive. ArcServe 2000 and the tape drive are on a Windows 2000 workstation named Tadpole. Ntbackup is running on Tadpole and another Windows 2000 workstation Boville (IT administrator’s workstation). Both machines are located in the server room. Another Windows

2000 workstation Hill (Office administrator's workstation) has scheduled nightly jobs every weekday to back up the QuickBooks company files.

Because we do not have ArcServe agents for SQL or Exchange, ArcServer cannot backup the these databases on the NT server when they are open and in use. To backup the open database files, SQL built-in backup utility and Exchange plug-in for Ntbackup are used to backup those databases to disk files first, then picked up normal backup.

The general procedures of backup operations are as follows (for day-by-day detailed schedules see attached table):

Analytical data and results acquired by the instruments:
They reside on a Quantum Snap server. The folders that contain current and recent data are backed up by NTbackup onto disks of one or more workstations every weekday. A full backup is scheduled every Friday night. An incremental backup is scheduled every night Monday to Thursday. Two sets of media files are alternated every other week. Whenever the hardware allows, the two sets of media files are placed on two different physical disks for added redundancy. Every Saturday early morning, the most recent full backup is copied onto tape; and the tape is taken off site on the following Monday.

SQL databases:
Because ArcServe cannot backup the SQL open files when SQL is running, the databases files are backed up by SQL native backup utility first onto a disk drive of NT server. A complete database backup of all databases, including Anatek LIMS and system databases are scheduled weekly. Transaction logs of Anatek LIMS are backed up daily before 7:30am and 7:30pm, every 3 hours. They are performed by SQL Server native backup utility and backups are stored on a disk drive of the NT server. As the second step, these files are backed up by Ntbackup onto the disks of one or more workstations every evening Monday to Friday and Sunday. Whenever the hardware allows, two copies of the backup files are maintained on separate physical disks for added redundancy. Finally, the two most recent sets of files on the workstations are backed up every Saturday by ArcServe onto tapes. The tapes are taken off-site.

Exchange directory, mailboxes and public folders:
These files are backed up by Exchange plug-in of Ntbackup onto the disks of one or more workstations every evening Monday to Friday and Sunday. Whenever the hardware allows, two copies of the backup files are maintained on separate physical disks for added redundancy. Finally the two most recent sets of files on Boville are backed up every Saturday by ArcServe onto tapes. The tapes are taken off-site.

User home directories, company's shared files and other general-purpose files on NT server:
They are backed up by ArcServer onto tapes every Monday night. The tapes are taken off site. In addition, Tuesday to Friday every night, all these files are backed up by NTbackup onto a disk of a workstation.

QuickBooks company files:
They are scheduled to be zipped into two different workstations on every weekday night.

Debian Linux server:
Weekly Cron job tars and gzips all mounted volumes to a file on NT server every Friday early morning, which in turn is picked up by ArcServe 2000 onto tape on the following Monday. The tape is then taken off site.

The attached table shows the detailed schedules of all backup operations.

- **Disaster recovery**

We have Symantec Ghost 7.5 as imaging tool. The entire hard disks of the NT server and Debian Linux, as well as several selected workstations have been taken a snapshot. The images of those disks were burned onto DVD disks that are kept off site.

As imaging the servers needs to take them off line, the imaging is not a regularly scheduled task. However, when major changes are made to servers, re-imaging should be done once the servers have been tested to be running satisfactorily.

- **Data archiving**

The older data on Snap server (6 month or older) are moved to different locations on the Snap server at intervals of 6 month or when deemed necessary. These locations are read-only for regular users. Due to their static nature these files are not backed up on a regular basis. Instead, when the files are moved into such locations, a copy of the files are zipped and burned onto DVD/CD disks as permanent archive. The disks are kept off site. The DVD/CD disks, if properly stored, should have a lift time of at least 50 years.

A copy of the old data files is still to be kept on line, as long as the Snap server has enough space for them. When the space approaches depletion, the oldest files will be purged.

The locations for the older data are secured so only system administrators can change them. All regular users have read only permission.

4. Summary

We have hardware redundancy to protect disk failure for the most important data. Backup scheme is three tiered i.e. SQL/Exchange native backup, NTbackup to disks and ArcServer backup to tapes. The disk-base backups are up to one weekday old. The tape backup is up to one week old (off site tapes are up to two weeks old). The servers and a few selected workstations are imaged for quick disaster recovery. Data archiving is done on a regular basis and a permanent copy of archived data is kept off site.

Anatek Labs, Inc.

Appendix H

Control Chart Information

Control Charting

Control charting is a useful way to determine accuracy and precision data for specific repeated recovery calculations (surrogates, LFBs, CCVs, etc.). It is most useful to calculate acceptance criteria from the most recent data, and allows comparison to written method requirements if they exist.

At minimum, control charts must be made for control standards. For methods that require the addition of surrogate compounds, control charts are also required for the surrogate recoveries.

Definitions: Let X_1, X_2, X_3, X_4,.....X_n ($n \geq 20$) represent the first n time ordered determinations for an analyte, and then define the following:

$$X = \text{average} = \frac{1}{n}\,(X_1 + X_2 + X_3 + \ldots\ldots\ldots\ldots + X_n)$$

$$S = \text{Standard Deviation of the Group} = \left[\frac{\Sigma(X_n - X)^2}{n-1}\right]^{\frac{1}{2}}$$

Based on the average and standard deviation information of this n number of trials a control chart can be plotted using the formulas outlined in Table 1. An example of a control chart is shown in Figure 1 with X = 99 % and S = 4 %. Such plot can then be used to determine if one or a set of trial is out of control.

Table 1: Control Chart Formula.

Parameter	**Symbol**	**Formula**
Centerline	CL	X
Upper Control Limit	UCL	X + 3S
Lower Control Limit	LCL	X – 3S
Upper Warning Limit	UWL	X + 2S
Lower Warning Limit	LWL	X – 2S

Criteria for an Out-of-Control Situation

A process is considered out of statistical control whenever one of the following conditions is demonstrated from control charting.

a. Any one point is outside of the control limits.

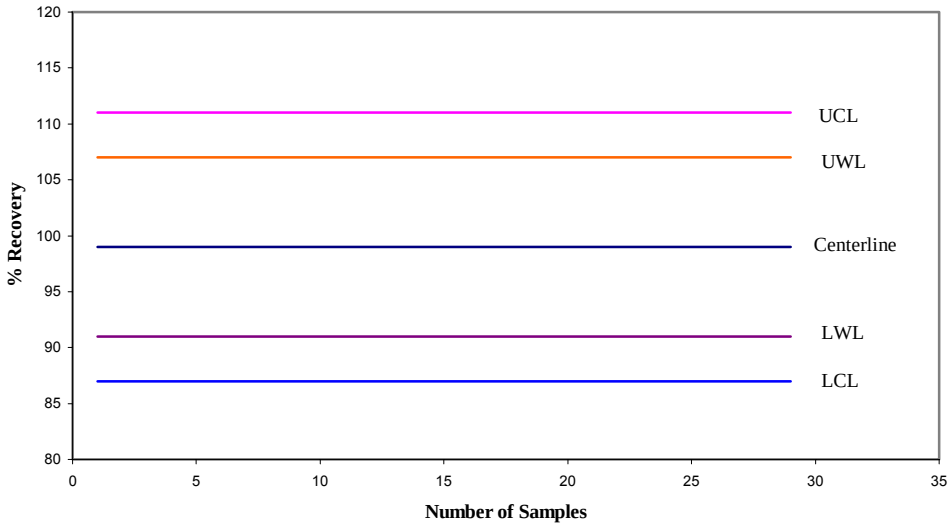
b. Any three consecutive points are outside the warning limits.

c. Any ten consecutive points are on the same side of the centerline.

d. Any six consecutive points are such that each deviation is greater than its predecessor.

e. Any obvious cyclic pattern is seen in the points.

Figure 1: A sample control chart.



Corrective Action

When a process is out of control as determined by control chart monitoring, an immediate solution must be found before processing more samples. An example might be the slow deterioration of the PID lamp, which might cause recoveries to slowly decrease. This problem may easily be remedied by more frequent cleaning or perhaps more frequent calibration.

Anatek Labs, Inc.

Appendix I

Method Detection Limit

USEPA DEFINITION AND METHOD FOR MDL

From: 40 CFR (7–1–95 Edition) Part 136, Appendix B

APPENDIX B TO PART 136 — DEFINITION AND PROCEDURE FOR THE DETERMINATION OF THE METHOD DETECTION LIMIT — REVISION 1.11

Definition

The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is deter-mined from analysis of a sample in a given matrix containing the analyte.

Scope and Application

This procedure is designed for applicability to a wide variety of sample types ranging from reagent (blank) water containing analyte to wastewater containing analyte. The MDL for an analytical procedure may vary as a function of sample type. The procedure requires a complete, specific, and well defined analytical method. It is essential that all sample processing steps of the analytical method be included in the determination of the method detection limit. The MDL obtained by this procedure is used to judge the significance of a single measurement of a future sample. The MDL procedure was designed for applicability to a broad variety of physical and chemical methods. To accomplish this, the procedure was made device- or instrument-independent.

Procedure

1. Make an estimate of the detection limit using one of the following:
(a) The concentration value that corresponds to an instrument signal/noise in the range of 2.5 to 5.

(b) The concentration equivalent of three times the standard deviation of replicate instrumental measurements of the analyte in reagent water.

(c) That region of the standard curve where there is a significant change in sensitivity, i.e., a break in the slope of the standard curve. (d) Instrumental limitations. It is recognized that the experience of the analyst is important to this process. However, the analyst must include the above considerations in the initial estimate of the detection limit.

2. Prepare reagent (blank) water that is as free of analyte as possible. Reagent or interference free water is defined as a water sample in which analyte and interferent concentrations are not detected at the method detection limit of each analyte of interest. Interferences are defined as systematic errors in the measured analytical signal of an established procedure caused by the presence of interfering species (interferent). The interferent concentration is presupposed to be normally distributed in representative samples of a given matrix.

3. (a) If the MDL is to be determined in reagent (blank) water, prepare a laboratory standard (analyte in reagent water) at a concentration which is at least equal to or in the same concentration range as the estimated method detection limit. (Recommend between 1 and 5 times the estimated method detection limit.) Proceed to Step 4.

(b) If the MDL is to be determined in another sample matrix, analyze the sample. If the measured level of the analyte is in the recommended range of one to five times the estimated detection limit, proceed to Step 4. If the measured level of analyte is less than the estimated detection limit, add a known amount of analyte to bring the level of analyte between one and five times the estimated detection limit. If the measured level of analyte is greater than five times the estimated detection limit, there are two options.

> (1) Obtain another sample with a lower level of analyte in the same matrix if possible.
>
> (2) The sample may be used as is for determining the method detection limit if the analyte level does not exceed 10 times the MDL of the analyte in reagent water. The variance of the analytical method changes as the analyte concentration increases from the MDL, hence the MDL determined under these circumstances may not truly reflect method variance at lower analyte concentrations.

4. (a) Take a minimum of seven aliquots of the sample to be used to calculate the method detection limit and process each through the entire analytical method. Make all computations according to the defined method with final results in the method reporting units. If a blank measurement is required to calculate the measured level of analyte, obtain a separate blank measurement for each sample aliquot analyzed. The average blank measurement is subtracted from the respective sample measurements.

(b) It may be economically and technically desirable to evaluate the estimated method detection limit before proceeding with 4a. This will: (1) Prevent repeating this entire procedure when the costs of analyses are high and (2) insure that the procedure is being conducted at the correct concentration. It is quite possible that an inflated MDL will be calculated from data obtained at many times the real MDL even though the level of analyte is less than five times the calculated method detection limit. To insure that the estimate of the method detection limit is a good estimate, it is necessary to determine that a lower concentration of analyte will not result in a significantly lower method detection limit. Take two aliquots of the sample to be used to calculate the method detection limit and process each through the entire method, including blank measurements as described above in 4a. Evaluate these data: (1) If these measurements indicate the sample is in desirable range for determination of the MDL, take five additional aliquots and proceed. Use all seven measurements for calculation of the MDL. (2) If these measurements indicate the sample is not in correct range, reestimate the MDL, obtain new sample as in 3 and repeat either 4a or 4b.

5. Calculate the variance (S2) and standard deviation (S) of the replicate measurements, as

follows:

$$s^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n} x_i^2 - \left(\frac{\left(\sum_{i=1}^{n} x_i\right)^2}{n}\right)\right]$$

$$s = (s^2)^{1/2}$$

where: Xi; i = 1 to n, are the analytical results in the final method reporting units obtained from the n sample aliquots and
S refers to the sum of the X values from i = 1 to n.

6. (a) Compute the MDL as follows:

MDL = t(n-1, 1-alpha = 0.99) (S)

where: MDL = the method detection limit
t(n-1, 1-alpha = .99) = the students' t value appropriate for a 99% confidence level and alpha standard deviation estimate with n-1 degrees of freedom. See Table.
S = standard deviation of the replicate analyses.

(b) The 95% confidence interval estimates for the MDL derived in 6a are computed according to the following equations derived from percentiles of the chi square over degrees of freedom distribution (X^2/df).

LCL = 0.64 MDL
UCL = 2.20 MDL

where: LCL and UCL are the lower and upper 95% confidence limits respectively based on seven aliquots.

7. Optional iterative procedure to verify the reasonableness of the estimate of the MDL and subsequent MDL determinations.

(a) If this is the initial attempt to compute MDL based on the estimate of MDL formulated in Step 1, take the MDL as calculated in Step 6, spike the matrix at this calculated MDL and proceed through the procedure starting with Step 4.

(b) If this is the second or later iteration of the MDL calculation, use S^2 from the current MDL calculation and S^2 from the previous MDL calculation to compute the F-ratio. The F-ratio is calculated by substituting the larger S^2 into the numerator S^2_A and the other into the denominator S^2_B. The computed F-ratio is then compared with the F-ratio found in the table which is 3.05 as follows: if $S^2_A / S^2_B < 3.05$, then compute the pooled standard deviation by the following equation:

$S_{pooled} = [(6S^2_A = 6S^2_B) / 12]^{½}$

if $S^2_A / S^2_B > 3.05$, respike at the most recent calculated MDL and process the samples through the procedure starting with Step 4. If the most recent calculated MDL does not permit qualitative identification when samples are spiked at that level, report the MDL as a concentration between the current and previous MDL which permits qualitative identification.

(c) Use the Spooled as calculated in 7b to compute the final MDL according to the following equation:

$MDL = 2.681 (S_{pooled})$

where 2.681 is equal to t(12, 1-alpha = .99).

(d) The 95% confidence limits for MDL derived in 7c are computed according to the following equations derived from percentiles of the chi squared over degrees of freedom distribution.

LCL = 0.72 MDL
UCL = 1.65 MDL

where LCL and UCL are the lower and upper 95% confidence limits respectively based on 14 aliquots.

TABLES OF STUDENTS' t VALUES AT THE 99 PERCENT CONFIDENCE LEVEL

Number of replicates	Degrees of freedom (n-1)	t(n-1, .99)
7	6	3.143
8	7	2.998
9	8	2.896
10	9	2.821
11	10	2.764
16	15	2.602
21	20	2.528
26	25	2.485
31	30	2.457
61	60	2.390
00	00	2.326

Reporting

The analytical method used must be specifically identified by number or title and the MDL for each analyte expressed in the appropriate method reporting units. If the analytical method permits options which affect the method detection limit, these conditions must be specified with the MDL value. The sample matrix used to determine the MDL must also be identified with

MDL value. Re-port the mean analyte level with the MDL and indicate if the MDL procedure was iterated. If a laboratory standard or a sample that contained a known amount analyte was used for this determination, also report the mean recovery. If the level of analyte in the sample was below the determined MDL or exceeds 10 times the MDL of the analyte in reagent water, do not report a value for the MDL. [49 FR 43430, Oct. 26, 1984; 50 FR 694, 696, Jan. 4, 1985, as amended at 51 FR 23703, June 30, 1986]

Interpretation of Data Index
Pesticide National Synthesis Project Home Page
Contact: Robert J. Gilliom, rgilliom@usgs.gov
Maintained: Tamara Shelton, tshelton@usgs.gov
URL: ***http://ca.water.usgs.gov/pnsp/rep/interpret/.html***
Last Modified: Thu Feb 17 2000

ENERGY LABORATORIES, INC.

BILLINGS, MONTANA

ENERGY LABORATORIES-BILLINGS, MT

QUALITY ASSURANCE PROGRAM
FOR ALL FACILITIES LOCATED IN BILLINGS, MONTANA

Revision 2004.03

Energy Laboratories, Inc.
1120 South 27th Street
PO Box 30916
Billings, Montana 59107

Toll Free: (800) 735-4489
Local: (406) 252-6325
Fax: (406) 252-6069
E-Mail: eli@energylab.com

President:
William T. Brown
Date: 04/16/04

Vice President/Laboratory Director:
John M. Standish
Date: 04/15/04

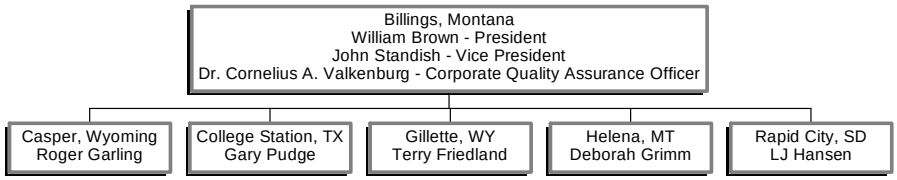
Corporate Quality Assurance Officer:
Cornelius A. Valkenburg Ph.D.
Date: 04/15/04

TABLE OF CONTENTS

INTRODUCTION

Energy Laboratories, Inc. provides chemical, industrial hygiene, and environmental analytical services to private industry, agricultural industry, engineering consultants, government agencies, and private individuals. Analytical services include: analysis of waters and soils for inorganic and organic constituents, aquatic toxicity testing, hazardous waste analysis, radiochemistry, industrial hygiene, microbiology, soils and water physical parameters, and petroleum analysis. Founded in 1952, Energy Laboratories currently incorporates six separate testing laboratories. The main headquarters are located in Billings, MT, with branch laboratories located in Casper, WY, Gillette, WY, College Station, TX, Rapid City, SD, and Helena, MT.

Figure 1
Laboratory Organization



The Quality Control Program establishes acceptable performance criteria for all routine analytical procedures being performed by laboratory personnel. The Quality Control Assessment program provides a formal system for evaluating the quality of data being generated and reported. The ELI Chemical Hygiene Plan insures the safety of all laboratory personnel and monitors the safety of all laboratory operations. These, in addition to the experience and expertise of our analysts, provide a comprehensive Quality Assurance Program. Energy Laboratories, Inc., in Billings, Montana, is certified under the Safe Drinking Water Act by Region VIII EPA for Wyoming, and the States of Montana, Idaho, Colorado, North Dakota, and South Dakota. ELI-Billings also holds accreditation for Clean Water Act, Safe Drinking Water Act and RCRA parameters through the National Environmental Laboratory Accreditation Program (NELAP), which is supported by the EPA. To perform Radon testing, ELI is certified under the National Radon Proficiency Program administered by the National Environmental Health Association. Branch Laboratories of ELI are certified in their own state and in neighboring states. Details on certification parameters for all laboratories are given in our Qualifications Manual.

Quality Assurance Program

Energy Laboratories, Inc. ***Billings, Montana***

The ELI Quality Assurance Program Manual, the ELI Qualifications Manual, and the ELI Analytical Services Catalog together are used to outline the ELI Quality Assurance/Quality Control Program. This Quality Assurance Manual is appropriate to all departments of the Energy Laboratories-Billings. The procedures discussed or referenced in this manual describe our day-to-day laboratory practices and adhere to USEPA Safe Drinking Water Act and NELAP requirements and Good Laboratory Practices (GLPs). Information on ELI-Billings accreditations and certifications can be found in Appendix A of this plan. Where possible, ELI uses EPA, AOAC, ASTM, APHA, NIOSH, OSHA, or published analytical methods and follows the procedures with strict adherence to described protocol and recommended QA/QC parameters. Actual method operating procedures are described in the Standard Operating Procedures Manual, and are available for review at the laboratory. Vital parts of our Quality Assurance Program, quality control and quality assessment, are outlined in Chapters One and Two of this manual.

To generate data that will meet project specific requirements, it is necessary to define the type of decisions that will be made and identify the intended use of the data. Data Quality Objectives (DQOs) are an integrated set of specifications that define data quality requirements and the intended use of the data. Project specific DQOs must be established for both field and lab operations. Through the DQO process, appropriate reporting limits, extraction/digestion methods, clean-up methods, analyses methods, target analytes, method quality control samples, sample security requirements, quality control acceptance ranges, corrective action procedures, and reporting formats and reporting levels can be specified. Professional laboratory project managers are available to assist clients in specifying appropriate laboratory analyses and reporting procedures necessary to meet project requirements. Written Standard Operating Procedures referenced within this manual can be reviewed at our office upon request.

Certain types of analysis requests may not be suitable to standardized analytical methods. These custom requests are handled individually with laboratory management and staff scientists. Project specific methods and reporting packages are available upon request. Attention to documentation of the analytical procedure and use of suitable QC parameters is maintained according to good scientific discipline and Good Laboratory Practice guidelines.

This Quality Manual and related quality documentation meet requirements of the National Environmental Laboratory Accreditation Program (NELAP) and American Association of Laboratory Accreditation (A2LA) standards.

CHAPTER 1 – QUALITY CONTROL PROGRAM

Objective

It is the policy of the management of Energy Laboratories, Inc. to produce laboratory data that is scientifically valid, meets method specifications, satisfies regulatory requirements, and accomplishes the data quality objectives of the client and project. Those method, regulatory, and client requirements are incorporated into our Quality Assurance Program. We will apply appropriate corporate resources to set objectives, provide training opportunities, and monitor the quality performance of our staff. We will also provide facilities and equipment adequate and appropriate to those objectives.

Purpose

The purpose of the Quality Assurance Program is to ensure that the analytical services provided by Energy Laboratories are of the highest quality, and each analytical result produced meets or exceeds a client's requirements and expectations. The quality systems in the program consist of the policies and procedures, and all referenced documents, described in this Quality Assurance Manual. The Quality Control Program also functions to maintain the laboratory's compliance with accreditations through USEPA, State Agencies, and NELAP. All employees are expected to implement and follow the policies contained within the Quality Assurance Program Manual. Internal documents, controlled and associated with the Quality Assurance Program are listed in Appendix B.

The Quality Control program insures that results of analyses are within established accuracy and precision limits required by the referenced method or Standard Operating Procedure (SOP). The Quality Control Program requires that the following points be met for each applicable analytical method:

Demonstration of Laboratory Capability

Performance of any analytical method requires that the proper equipment and instrumentation are available. A list of major equipment is listed in Chapter 12. The procedure for operation of an analytical instrument is described in the equipment manufacturers operating manual, and may also be supplemented with a specific Standard Operating Procedure (SOP) for the instrument and/or the method.

Each SOP covers operation of the instrument including the sequence of operations involved in instrument start-up, calibrating, analyzing, and shutting down. SOPs include recommended preventative maintenance, and/or a list of parameters used to identify other types of maintenance. The SOP also outlines any special safety precautions for operation of the instrument.

SOPs of well detailed EPA, ASTM, NIOSH, APHA, OSHA, or published procedures include, as appropriate, a list of any method specific items or variances, a list of QC parameters and their recommended performance ranges, recommended or example analytical sequences, specific or unique safety information, method references, and a signed signature page. Details and format of method SOPs follow NELAP requirements. Detailed SOPs are prepared for those procedures that do not have published methods.

Detailed information as to what information is required in method SOPs can be found in the ELI SOP 10-001-01.

Demonstration of Analyst's Ability to Generate Data of Acceptable Accuracy and Precision

ELI demonstrates that laboratory staff are qualified and capable of performing the method. Analysts are assigned duties based on their skills and experience. Training records are maintained for all analysts. Curricula vitae of supervisory and senior analysts are described in Appendix E.

It is the responsibility of the analyst to become thoroughly familiar with the methodology and instrument operation before performing the analysis. It is the responsibility of the person providing training to monitor all laboratory results generated for a reasonable time. The amount of time necessary may vary depending on the method and the experience of the analyst. As a minimum, the analyst's performance is to be monitored until the analyst demonstrates the ability to generate results of acceptable accuracy and precision according to the method.

All analysts are required to demonstrate and maintain a record of proof of competency by routinely analyzing quality control samples appropriate to the analytical procedures they perform. Competency in analyzing these control samples is documented in analysts' training files per NELAP requirements (for more information, see SOP 10-005 on Personnel Training). For those analyses where external performance evaluation samples are not routinely analyzed, competency is documented by including the results of routine analyses of internal method quality control samples and/or a verifying statement of procedural review by a supervisor.

Analysis of Quality Control Samples

Each analytical method is subjected to quality control monitoring. The purpose is to demonstrate that results generated meet acceptable accuracy and precision criteria for the method. Quality control requirements are outlined in the methods and ELI at a minimum follows the guidelines specified in the methods used. Additional QC requirements are also added as appropriate. Statistical method performance is periodically evaluated against method requirements using control charts.

Quality control monitoring to measure accuracy for each method generally requires that five to ten percent of all samples analyzed be fortified (spiked) with a known concentration of target analytes tested by the method. Percent recovery is calculated. This provides a means for monitoring method accuracy and evaluating sample matrix effects. Where appropriate, surrogates are included in the method to monitor method performance on each individual sample. Blank spike samples replace matrix spike samples for certain methods, or when there is insufficient sample for a matrix spike analyses. Historical routine batch QC sample performance can be used to estimate the precision and accuracy of the method.

Quality control monitoring to measure precision for each method requires replicate samples be prepared and analyzed when possible. Actual requirements are outlined in the specific SOP. When replicate samples or matrix spike duplicates are analyzed, relative percent difference is calculated and used to monitor precision of the method. In instances where there are no specific method requirements, it is the policy of this laboratory to analyze five to ten percent of all samples in duplicate. Duplicate test results must be within the control limits established for each analysis type. Acceptance limits generally follow specifications listed in the method. Matrix spike duplicates replace sample duplicates for most methods.

When not defined in the method and as appropriate, method blanks and instrument blanks are analyzed one in every 20 samples at a minimum. Method blanks are used to verify that contamination from laboratory reagents

and glassware is not present. The method blank must be less than the reporting limit, or 10 times less than the amount in the sample, for the analytical parameter being tested.

When not defined in the method, and as appropriate, method spikes (blank spikes) are analyzed one in every 20 samples at a minimum.

Calibration standards are analyzed and calibration curves developed for all applicable methods. For additional information on instrument calibration see Chapter 7 of this QA manual.

The initial calibration is continuously monitored by analyzing a continuing calibration standard every 10 to 20 samples, or within a specified time frequency, and at the end of each new set of samples, depending on the method and instrumentation. Results must be within an established range as described by the method SOP. As appropriate, initial calibrations are verified against a standard from a second source.

Performance evaluation samples and further quality control check samples may be required for various methods. Refer to Chapter Two of this QA manual for further details.

Maintenance of Performance Records

All quality control monitoring is recorded and documented. Quality control data is recorded in laboratory notebooks, electronic summary files, and/or analyses sheets. QC data can also be maintained in quality control forms, graphs, or charts. QC data management and control chart generation, maintenance, and usage are described in ELI SOP 20-004. It is the responsibility of the analyst to see that all results are recorded in a timely manner.

All quality control data is filed and available for inspection and assessment by analysts, supervisors, management, and quality control personnel.

Method Quality Control Specifications

Summary of Quality Assurance/Quality Control specifications for a selected subset of procedures offered by ELI are outlined in Appendix C. These tables are recommended for our clients to use in the preparation of Quality Assurance Project Plans (QAPPs). Exact details of method QC can be found in the method SOPs.

CHAPTER 2 – QUALITY ASSESSMENT PROGRAM

Purpose

The function of the Quality Assessment Program is to provide formal evaluation of the quality of data being generated and reported by the laboratory. External and internal quality control measures are used in this assessment. These measures include performance evaluation samples, laboratory quality control check samples, and routine internal and external audits on methodology and documentation procedures.

Performance Evaluation (PE) Samples

PE samples are supplied by an outside entity and contain known amounts of constituents. The laboratory does not have access to known values of the samples. Only the PE provider has knowledge of constituent levels prior to the formal publishing of the test results.

These samples are received on a routine basis, with results sent to the providing entity for evaluation. Acceptable results are those which fall within a defined range as determined by the supplier. These study results are available for review upon request.

Performance Evaluation (PE) Samples for USEPA, NELAP and various State certifications are Water Pollution Study Samples (WP), Water Supply Study samples (WS) and NELAP PE samples provided by either Resource Technology Corporation (RTC) and/or Environmental Resource Associates (ERA), vendors accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). Routine participation in NELAP, WS and WP PE sample studies is used to maintain certifications for Drinking Water, NPDES permit monitoring analyses, and projects requiring NELAP certification. These types of external PE samples are received on a semi-annual basis, with results sent to the reference supplier for evaluation. Acceptable results are those which fall within a defined range as determined by the vendor/EPA/NELAP based on multi-laboratory study results. Results are sent by the provider to USEPA and other certifying agencies as requested by ELI-Billings. Note that our performance is substantially above the national average. Current study results are included in Appendix A. A current copy of the certificate to perform drinking water analyses in the State of Montana and the NELAP certificate is also included in Appendix A. The Montana certification includes a list of parameters for which drinking water certification has been granted. Reciprocal certifications to perform drinking water analysis in Wyoming, North Dakota, South Dakota, and Idaho, are based on the Montana certification. The NELAP certificate and list of parameters includes RECRA methods and methods associated with the Clean Water Act (NPDES permits).

Performance evaluation samples for Radon Proficiency testing certification are from the National Environmental Health Association (NEHA), an EPA approved commercial Radon testing certification association. Our own radon sampling canisters are submitted to NEHA for known levels of radon exposure. Acceptable results are those which fall within a defined ranged based on multi-laboratory study results.

Blind Quality Control Check Samples are samples submitted as regular lab samples and are processed through the system in the same manner as any other sample. The analysts do not know the true value when performing the analyses. Method performance reports are returned to the analysts and maintained in method performance files. Clients occasionally submit these types of samples for their QAPP.

Laboratory Inter-comparison Samples are samples containing known/unknown quantities of analytes that are split and analyzed by more than one laboratory. These samples are routinely analyzed and results are kept on file.

Quality Control Check Samples

Quality Control Check Samples - Are performance evaluation samples used for routine method performance monitoring. As appropriate, analytical procedures include the analysis of a quality control sample with every sample batch analyzed. The materials are obtained from a commercial source when available, or they may be prepared in-house. Acceptable results are within a defined range based on certified ranges, or, against statistically determined control limits. Routinely used methods not subjected to PE sample monitoring are evaluated with Quality Control Check Samples as appropriate.

QC samples are processed through the system in the same manner as any other sample, except the analyst is aware of the source, concentration, and acceptance ranges of target analytes and calculates analyte recoveries to evaluate method performance in real time.

Quality Control Audits

Quality Control Audits are internal and external laboratory analyses inspections designed to monitor adherence to quality control requirements. The audit checks general laboratory operations, overall Quality Systems, adherence to QA program requirements, sample tracking procedures, sample holding times, storage requirements, adherence to procedures during analysis, calculations, completion of required quality control samples within the group surrounding the sample, and proper record-keeping.

Internal quality control audits are conducted periodically by the quality control director of the laboratory (see SOP 30-001 Internal Quality Assurance Audits). ELI conducts internal inspections on a regular basis to monitor adherence to quality control requirements. Results of formal audits are given to management with possible recommendations for corrective action in the event any discrepancies are found. As necessary, a follow-up review is conducted to determine that identified problems have been addressed. Annually, the overall Quality Systems of the laboratory are reviewed and a summary report is prepared. Laboratory management is involved with the annual review of laboratory Quality Systems.

External Quality Control Audits by qualified outside auditors are welcomed by ELI for outside review and comment on the overall QA program. To maintain certifications, accrediting authorities from the State of Montana, USEPA, and NELAP conduct periodic comprehensive external audits. External audits by private clients to meet Quality Assurance Project Plans (QAPPs), as applicable to environmental remediation projects, or for major industries, are also conducted on a continuing periodic basis.

CHAPTER 3 – LABORATORY FACILITIES

Laboratory space includes adequate benchtop and floor space to accommodate periods of peak workloads. Working space includes sufficient benchtop area for processing samples; storage space for reagents, chemicals, glassware, bench and portable equipment items; floor space for stationary equipment; and adequate associated area for cleaning glassware. The laboratory contains at least 15 linear feet of usable bench space per analyst, and at least 150 to 200 square feet per person. Laboratory departments are organized and facilities designed for specific laboratory operations in order to protect the safety of analysts and to minimize potential sources of contamination between and within department areas (for more information see SOP 10-002, Facility Description, Access, and Security).

The laboratory is appropriately ventilated and illuminated, relatively free of dust and drafts, and is not subject to excessive temperature changes. As required, laboratory areas are temperature and humidity controlled. A light intensity of 100-foot candles is present at all working surfaces. Ample cabinets, drawers and shelves are available for storage and protection of glassware. Exhaust and particulate filtering hoods are available as needed for use during preparation, extraction, and analysis of samples. Air quality monitoring is conducted routinely to ensure a safe working environment.

To maintain security, all non-ELI laboratory personnel and visitors must sign an ELI guest book and be escorted by a staff member of ELI when present in laboratory working areas. A secure sample log in area restricts the access of unauthorized personnel to other parts of the laboratory.

The laboratory has provisions for the disposal of chemical wastes and microbiological wastes. These provisions are described in Standard Operating Procedures and outlined in the Chemical Hygiene Plan along with other safety and health guidelines.

CHAPTER 4 – PERSONNEL REQUIREMENTS AND LABORATORY ORGANIZATION

Personnel Requirements

Laboratory Director

The Laboratory Director is required to have education equivalent to a Bachelor of Science degree in Chemistry or a related science. Five years of relevant laboratory experience is required.

Quality Assurance Officer

The Quality Assurance Officer is required to have a bachelors degree in Chemistry or a related science. Five years of relevant laboratory experience is required.

Laboratory Supervisor

A Laboratory Supervisor is required to have education equivalent to a Bachelor of Science degree in Chemistry or related science, Two years of relevant laboratory experience is required.

Analysts

Analysts are required to have education equivalent to a Bachelor of Science degree in Chemistry or related science, or a High School diploma and 3 years experience as an analyst in training. A minimum of 6 months of on-the-job training, under direct supervision of qualified analyst in the measurements being considered for certification is also required. After 6 months, and on a continuing basis thereafter, the analyst must demonstrate acceptable skills through the successful participation in the analysis of applicable performance evaluation and quality control samples.

Laboratory experience can be substituted for academic requirements. For more information, see SOP 10-004, Roles and Responsibilities.

Laboratory Organization

Corporate organization of the six ELI laboratories located in Montana (2), Wyoming (2), Texas, and South Dakota is shown in the Corporate Organizational Chart given in Appendix D. The Billings laboratory is the center for all corporate functions. Each laboratory is managed and operated individually under the supervision of a Laboratory director. Branch laboratory corporate responsibilities are only towards fiscal and general operating policies and goals. Quality Assurance Manuals are prepared individually for each branch and follow the QA/QC program outlined in the ELI-Billings QA manual.

The ELI-Billings Organizational Chart is also included in Appendix D with Curricula vitae of key ELI-Billings laboratory personnel maintained in Appendix E of this manual. Within the **Qualifications Manual**, detailed personnel summaries are given for all managers and supervisors of ELI, Inc. A Personnel Summary for all ELI employees listing title, academic background, and years of relevant experience is also maintained in the Qualifications Manual. Job descriptions can be found in the Roles and Responsibilities ELI SOP #10-004.

CHAPTER 5 – SAMPLING PROCEDURES

Most of the samples processed in this laboratory are collected by private individuals or companies who are responsible for using proper collection procedures. Members of the staff are acquainted with proper sample collection and handling procedures and will advise those who need help in this area. Instructions and forms for initiating Chain-of-Custody are available from ELI. Laboratory procedures for logging in samples for analyses and maintaining Chain-of-Custody are described in ELI SOP 20-001.

When the laboratory has been assigned the responsibility of sample collection, there is strict adherence to correct sampling protocols, initiation of Chain-of-Custody, sampling documentation, complete sample identification, and prompt transfer of sample(s) to the laboratory.

This laboratory will provide proper sample containers and preservatives as specified for the procedure. Certified sample bottles are available upon request. Sample containers, preservatives, coolers for shipping, ice packs for maintaining refrigeration temperature, travel blanks for monitoring contamination during shipping, temperature blanks for accurately monitoring sample receiving temperatures, Chain-of-Custody forms, Chain-of-Custody Seals, and sample bottle labels are provided upon request. Instructions for sampling, sample labeling, sample preservation, and sample packaging/shipping are also provided upon request. Sample container type, sample volume, preservation requirements, and maximum holding times, are detailed for each analyte in the ELI Analytical Services Catalog. For metals analysis, polyethylene plastic with a polypropylene cap liner is preferred. Glass containers with Teflon-lined caps are required for organic analysis. The client is immediately notified (if possible) upon sample receipt if samples are received in unacceptable containers, or if samples have not been properly preserved. Samples not collected properly are rejected for any certifiable analysis and re-sampling is recommended. The laboratory will preserve samples at the time of sample login if samples are unpreserved and preservation is required by the methodology. Aqueous samples for volatile analyses are checked for preservation at the time of analyses. Samples for microbiological analysis are collected in pre-sterilized 120 mL plastic bottles containing sodium thiosulfate.

Sample preservation needs to be performed immediately upon sample collection. For composite samples, each aliquot is preserved at collection. When use of an automated sampler makes it impossible to preserve each aliquot, samples are preserved by maintaining at 4^{o} C until compositing and sample splitting is completed.

The laboratory initiates a sample condition report at the time of sample receipt. The sample condition report evaluates Chain-of-Custody procedures, sample preservation status, carrier used for sample shipment, cooler temperature, and provides general comments concerning sample condition. The sample condition report is provided with the sample analyses results data package. For more information, see ELI SOP 20-001, Sample Receipt, Login, and Labeling.

When any sample is shipped by common carrier or sent through the United States Mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements as described in the ELI Services Catalog, the Office of Hazardous Materials, Material Transportation Bureau, Department of Transportation has determined the Federal Hazardous Materials Regulations do not apply to the following:

A) Hydrochloric Acid - (HCl) in water solutions of 0.04% by weight or less (pH of 1.96 or greater).
B) Nitric Acid - (HNO_3) in water solutions of 0.15% by weight or less (pH of 1.62 or greater).
C) Sulfuric Acid - (H_2SO_4) in water solutions of 0.35% by weight or less (pH of 1.15 or greater).
D) Sodium Hydroxide - (NaOH) in water solutions of 0.080% by weight or less (pH of 12.30 or less).

It is required that all samples be analyzed within the prescribed holding times. Holding times are the maximum times allowed between sampling and analysis for results to still be considered valid. Samples should be delivered to the laboratory as soon as possible following collection to assure that holding times can be met. Samples are analyzed as soon as possible after sample receipt. When maximum holding times cannot be met, resampling is requested. Samples may be held for longer periods only if the permittee, or monitoring laboratory has data on file to show that the specific types of samples under study are stable for the longer time or if a variance is allowed. Some samples may not be stable for the maximum time period as given in the ELI Analytical Services Catalog. A permittee or monitoring laboratory is obligated to hold the sample for a shorter time if knowledge exists to show this is necessary to maintain sample stability.

CHAPTER 6 – SAMPLE HANDLING

Sample Receipt

All samples arriving at the laboratory are recorded in the sample receipt log and each container is given a unique laboratory sample number.

Samples requiring preservation are checked to determine if the client performed preservation. If requested, ELI staff will preserve or filter samples as appropriate. Samples which degrade quickly, or cannot be opened (such as aqueous samples for volatiles), are not preserved at the time of sample login. If samples are improperly preserved, or the maximum holding times are exceeded upon arrival at the laboratory, the collector is notified and resampling is requested.

Chain-of-Custody forms are checked for pertinent information. If necessary information has been omitted, the collector is notified, if possible, and the missing information is requested.

Samples are stored in accordance with method specifications in designated laboratory areas.

During sample login, all sample information such as sample description, client name and address, analyses requested, special requirements, etc. are entered into the computer database of the Laboratory Information Management System (LIMS). Requested analyses parameters and special requirements are communicated to the analysts via their LIMS work lists. Project specific requirements are maintained in the LIMS for any samples received from a special project. This process ensures that individual requirements are maintained.

For more information, see SOP 20-001, Sample Receipt, Login, and Labeling.

Chain-of-Custody

Evidence level internal Chain-of-Custody procedures are available on a project specific basis. For these procedures, internal COC sample custody is maintained down to the individual analyst level. When transferring the possession of the samples, the transferee must sign and record the date and time on the Chain-of-Custody record. Every person who takes custody must fill in the appropriate section of the Chain-of-Custody record. When received by ELI, sample identification information on the sample containers is compared to the custody report form. The sample is inspected and information regarding the condition of the sample and seal (if used) is recorded on a report form, the method of shipping is also documented on the report form. A copy of the report form is kept with the sample data file and a copy is sent to the client with the analysis report. Internal Chain-of-Custody forms are used to document the progress of the sample through the laboratory. For more information, see SOP 30-005, Chain-of-Custody Samples.

ELI's routine COC policy is maintained at the laboratory level through our laboratory access and security policies. See ELI SOP 10-002, Facility Description, Access, and Security.

Sample Tracking

Samples are tracked through the analytical process by the LIMS. When all analyses are completed and approved by supervisory review, the data package is sent to the reporting department for final report generation. The completed report is sent to data validation and finally to invoicing at which point the report is mailed to the client. Generation of the invoice automatically changes the status of the samples in the LIMS to "Done" and removes them from the status report printed by the LIMS. Completed reports are reviewed by the Data Validators and sent to clients. See SOP 20-002, Document Production, Control, and Archiving.

Sample Disposal

It is preferred that excess hazardous sample material be returned to the originator (client) for disposal by the originator. When this is not possible or reasonable, ELI will dispose of excess hazardous sample materials with hazardous waste generated in the laboratory. The disposal of all laboratory wastes will be performed in accordance with all local, state, and federal regulations which apply to such activities. For specific information concerning a given waste, consult the appropriate SOP.

Subcontracting Policy

The ELI Billings laboratory utilizes the expanded branch laboratory capability and expertise to provide comprehensive analytical services. This occurs when the Billings laboratory is requested to perform an analysis they are not capable of doing, during the peak season when we experience sample overload, and when equipment is out of service. Upon completion of the analyses, the branch laboratories report the sample results and their quality assurance package to a Project Officer. The results are reviewed before being reported to our clients.

Other branch laboratories are certified to perform drinking water analyses in their state and in neighboring states. Samples are forwarded to our branch laboratories only if the laboratory is certified in the state from which the sample originated. The branch laboratories QA Program is consistent with the Billings QA Program and is monitored through internal laboratory audits. The following methods are routinely analyzed by branch laboratories to support ELI-Billings analytical services:

Total Organic Halogens (TOX) by SW-846 9020
Low level EDB and DBCP by EPA 504
Organohalide Pesticides and PCBs by EPA 505
Carbamates by EPA 531.1
Glyphosate by EPA 547
Diquat by EPA 549.1
Low level Total Organic Carbon (TOC)
Oil & Grease by SW-846 1664
All Radiochemistry except Radon

In the event that ELI is dependent on the service of an outside laboratory for analyses not available through our facility or our branch laboratories, the client will be notified in advance that their samples are being subcontracted to an outside laboratory. The outside laboratory reports the results to ELI and this becomes part of the final report. All final reports indicate where the analyses were performed.

CHAPTER 7 – INSTRUMENT OPERATION AND CALIBRATION

Laboratory instruments and equipment are operated and calibrated according to the manufacturer's instructions, and according to the requirements of the method being used. Exact calibration procedures are outlined in the appropriate SOP. For most instruments, a calibration curve composed of three to five standards covering the concentration range of the samples is prepared. Unless otherwise specified in the method, at least one of the standards is at or below the practical quantitation limit (PQL) of the method. Routine PQLs for each method are given in the **ELI Analytical Services Catalog**. Calibration standards are routinely compared against second source calibration standards to verify accuracy. The reference standard results must fall within an established range, as described by the SOP, to be accepted. Whenever possible, the laboratory uses calibration standards prepared from certified stock standards. Initial instrument calibration curves are verified and routinely monitored by running a continuing calibration standard every 10 to 20 samples, and at the end of every analytical sequence, depending on the analysis method and instrumentation. High-level samples, which produce an analytical response outside the calibrated range of the instrument, are diluted and reanalyzed such that a response within the calibrated range is obtained.

System cleanliness is verified through the analysis of reagent/instrument blanks prior to analysis, between highly contaminated samples, and at regular intervals during the analysis. Samples are only quantitated within the limits of the response of the standards.

Use of measuring equipment and reagents; glassware, water, chemical reagents, and industrial gases, conform to Good Laboratory Practice guidelines. Good Laboratory Practices (GLPs) are laboratory guidelines which were established by the Food and Drug Administration and published in the Federal Register (21 CFR, part 58) in the mid-1980's. The GLP guidelines were adopted by the Environmental Protection Agency. SOPs are developed in accordance with GLP and NELAC guidelines. Laboratory volumetric glassware conforms to National Institute of Standards and Technology (NIST) Class A standards. All mechanical pipetors are calibrated monthly. Laboratory balances are annually serviced and calibrated by certified technicians. Routine calibration checks of all balances are performed using NIST traceable Class S weights. Laboratory thermometers are annually calibrated against a NIST traceable thermometer, and routinely checked for accuracy. Laboratory drying ovens, incubators, freezers, refrigerators, and water bath temperatures are recorded each working day, or at frequencies as described in the specific SOP. Laboratory pure water is generated by commercial water purification systems and is monitored and documented each working day according to resistivity meter readings. The routine analyses of laboratory blanks is used to verify laboratory water quality and the suitability of sampling containers. Chemical reagents and gases exceed purity requirements for their intended uses. Laboratory stock and working standards are derived from commercially available primary standards whenever possible. Standards preparation notebooks document the source, purity, content, concentration, preparation date, and analyst. All calibrations standards are documented in the analytical sequence such that they are uniquely identifiable and traceable to stock standards and their source.

Standard Operating Procedures (SOPs) detail the sequence of operations involved in instrument start-up, calibration, analyzing, shutting down, and routine maintenance. Suggestions for corrective action are included with the SOPs and parameters are identified which dictate certain types of maintenance. Instrument and method detection limits are performed at the method required frequency or whenever there is a significant change in instrumentation. Detection limits are determined according to EPA guidelines found in 40 CFR, part 136, appendix B. Acceptable instrument response/performance criteria are based upon the manufacturer's or the analytical method specifications. SOPs exist for all major pieces of analytical equipment/methods. Instrument maintenance logbooks are used to document instrument maintenance and repairs.

All instrumental run sequences are documented. Laboratory analysts record and document all instrumental runs in Laboratory Instrument Logbooks or computer files. Instrument Logbooks and/or dated computer files record instrument performance data, analytical sequences, instrument maintenance, calibration standards data, and any other additional information pertinent to operation of the instrument.

CHAPTER 8 - RECORDS AND REPORTING

Laboratory Notebooks

Several different types of Laboratory Notebooks are maintained at the ELI Laboratory. These include, but are not limited to, the following:

Method/Parameter Notebooks
Project Notebooks
Instrument/Equipment Use and Maintenance Notebooks
Standard Preparation Logbooks
Sample Receipt Logbooks
Safety Logbook
Balance Calibration Logbooks
Pipet Calibration Logbooks
General Logbooks

The general purpose of maintaining each of these Laboratory Notebooks is to record the details which may be important in repeating a procedure, interpreting data, or documenting certain operations. Entries in the notebook may include data such as standard and sample weighings, pH measurements, instrument operating parameters, preparation of calibration curves, analytical run sequences, calculations, recording of instrument operating parameters, sample condition, etc. The analyst's notebook is particularly important in documenting analyses which deviate in any way from routine or standard practices. It can also be an important training record. All pertinent data is to be recorded directly in the notebook. Some notebooks or data records are maintained in electronic files. Electronic data records are duplicated using hardcopy and/or alternate electronic backup techniques such as magnetic tape.

It is the responsibility of each analyst to maintain a laboratory notebook according to Good Laboratory Practices (GLP) Guidelines. Procedures for use and maintenance of laboratory notebooks are detailed in ELI SOP 20-010. All laboratory notebooks are assigned a unique logbook control # and are assigned to an analyst or supervisor. Laboratory Notebooks will remain the responsibility of the ELI staff member to whom they are assigned until, or unless, they are formally transferred to another staff member, until they are completely filled and returned to the ELI Quality Assurance Officer or ELI Laboratory Supervisor for archiving, or until the staff member resigns and returns them as a part of the check-out process. ELI staff members other than the individual to whom the Laboratory Notebook is issued may make entries in the Notebook as long as those entries are consistent with the intended use of the Notebook, and such entries are initialed. Laboratory Notebooks are the responsibility of each ELI staff member using the notebook. Supervisors review and approve all Laboratory Notebook formats.

Records

The laboratory for minimum of five years keeps records of chemical analyses, including all quality control records. In the event the laboratory transfers ownership or goes out of business, files will either be maintained, or first be offered to the client prior to their disposal. Details are described in ELI SOP 20-002, Document Production, Control, and Archiving.

Data Reduction

Data reduction refers to the process of converting raw data to reportable units. The reporting units used and analytical methods performed are described in the Analytical Services Catalog.

Wherever possible, the instrument is calibrated to read out directly in the units reported. In this case, the value is recorded directly into a laboratory notebook, logbook, bench sheet, or electronic file and presented for review by supervision.

In cases such as titration, gravimetric measurements, or other techniques which require calculation prior to reporting, raw data is recorded in the appropriate laboratory notebook or electronic file, or on the appropriate laboratory form. The calculations specified in the EPA method are used to determine the reported value. That value is also entered into the laboratory notebook or bench sheet, and on the draft of the client report. Most of the calculations are computerized to reduce the chance of arithmetic or transcription errors.

Wherever possible, electronic data results are transmitted throughout the laboratory via the LIMS computer network. This process is intended to minimize manual data transcriptions within the laboratory. Additional advantages include the opportunity for rapid comprehensive data validation by supervisors, and more rapid data reporting.

Validation

Data validation includes the procedures used to ensure that the reported values are consistent with the raw data, calculated values, sample type, sample history, and other analyses parameters requested.

The data recorded on the draft report is validated with several steps. The analyst who submits the report checks all the values reported for omissions and accuracy. Elements of this review also evaluate all instrument and method QC results. Automated data management programs are designed with an interactive step allowing data review by the analyst. Results to be reported are approved by the analyst.

The reported result and associated QC data is reviewed by the supervisor. Supervisors review the suitability of the data according to project and method performance specifications. Analyses results for each requested parameter are evaluated against other requested parameters, project specifications, other samples within the set, historical files associated with the project/client, and any other information provided with the sample. Supervisors initial all validated sample results.

The reports are generated, proofread, and then reviewed by the reporting staff.

The final report is reviewed by the laboratory manager, or his designate, who also examines the validity of the data.

Internal and external laboratory audits review selected sets of data to ensure that the analysis results are correct and accurate, analytical methods are appropriate, documentation and record keeping procedures complete, and that overall objectives of the Quality Assurance Program are adhered to.

All automated programs used to process and report data are verified using hand-calculated results. Whenever a modification is performed to a program re-verification of overall software function is performed.

Reporting

One copy of the report is mailed to the client on the day the report is completed and reviewed. A standardized report format is used unless otherwise specified. Client specified report formats are available upon request. Electronic results via diskette, modem, or FAX are available upon request. All electronic reporting is followed with a hardcopy of final results.

Various levels of data reporting are available. All analyses results, regardless of the level of reporting used, have record keeping procedures which allow a complete "data validation package" to be produced. Note that a comprehensive "data validation package" is most easily generated at the time of sample analyses. Example data packages are available upon request.

Microbiological samples tested for compliance monitoring may require notification to the appropriate state agencies and this is detailed in individual method SOPs.

If requested by the client, additional copies of the report will be sent to a specified address or person.

The final copy of a completed report is scanned and maintained as a graphics file. The electronic file of the report meets NELAC reporting requirements. An electronic copy of this file is available upon request.

For more information, see SOP 20-002.

CHAPTER 9 - GENERAL LABORATORY PRACTICES

Chemicals and Reagents

When available and appropriate, chemicals used in the laboratory are analytical reagent grade (AR) chemicals purchased from reliable suppliers. Reagents are prepared, standardized, and made fresh as mandated by the method, their stability, and according to Good Laboratory Practices.

Stock or working standards are checked regularly for signs of deterioration, (e.g., discolorations, formation of precipitates) and are compared to independently prepared reference materials.

All standards and reagents are dated when received, opened, or prepared, and each are labeled with expiration dates.

Certified primary standards are obtained from commercial sources when available. Standards used for calibration are verified against second source standards. Secondary and working standards are accurately prepared in volumetric flasks or other calibrated glassware from primary standards and stored in appropriate containers.

Titrants, standards, and other solutions used for analytical purposes frequently must be standardized upon preparation with certified or traceable standards. Method SOPs specify if standardization is necessary. The date and analyst's initials must be recorded on the container whenever re-standardized and records are maintained in a laboratory notebook.

Individual SOPs may also provide additional details for reagent requirements.

Reagent Interference

To determine the extent of reagent interference, method blanks are analyzed prior to sample analysis whenever appropriate.

If any interference cannot be eliminated, the magnitude of the interference is considered when calculating the concentration of the specific constituent in the sample, but only when permitted within the method being used.

If reagents, materials, or solvents contain substances that interfere with a particular determination, they are replaced.

Individual method SOPs may also provide additional requirements for handling reagent interferences.

Glassware Preparation

All glassware used for inorganic analyses is washed in warm detergent solution and thoroughly rinsed in tap water. Glassware is then rinsed well three times with deionized water. This cleaning procedure is sufficient for many analytical needs, but individual SOPs detail additional procedures when necessary. Glassware washing procedures for inorganic analyses are described in ELI SOP 30-001.

All glassware used for organic analyses is washed in warm synthetic detergent solution and thoroughly rinsed in tap water. The glassware is then rinsed well with deionized water, followed by rinses with acetone to remove any

residual organics. Prior to use, the glassware is rinsed three times with the organic solvent to be used with the glassware. Glasware washing procedures for cleaning glassware for organic analyses are described in ELI-SOP-30-002.

All glassware used for microbiological analyses is washed in warm detergent solution. The detergent must be proven to contain no bacteriostatic or inhibiting substances. The glassware is rinsed thoroughly with suitable deionized water. Specific details are described in SOPs.

Disposable glassware/plasticware is preferred for many procedures in the laboratory. The cleanliness, and suitability of disposable glassware/plasticware is continuously evaluated for each test with the routine analyses of method blanks.

All volumetric glassware used in precise measurements of volume is class A, or laboratory calibrated.

Laboratory Pure Water

Distilled or deionized water is used in the laboratory for dilution, preparation of reagent solutions and final rinsing of glassware. For organic analyses, organic-free water is prepared and used. Deionized water is prepared to meet ASTM Type II specification for reagent water. Use and maintenance of laboratory reagent water systems are described in ELI SOP 30-005 and 30-007.

Water quality is monitored for acceptability in the procedure in which it is used. Specific details are listed in the appropriate SOPs.

Employee Training

All new ELI employees and contract personnel are given an initial general orientation and tour of the laboratory facilities. Personnel are shown the locations of safety equipment such as safety showers, eye wash fountains, fire extinguishers, and first aid supplies. Personal protective equipment such as lab coats, disposable gloves, and safety glasses (if applicable) are issued at this time.

Safety considerations are a vital part of the training process. All hazards associated with the performance of a procedure or with the operation of an instrument are to be understood by the trainee before training can be considered complete. General lab safety procedures are a part of the new and current employee training. Specific safety procedures are outlined in SOPs and in instrument Operator's Manuals. Training in use of protective clothing, eye protection, ventilation, and general safety are provided to each employee. Each employee is required to read the laboratory Chemical Hygiene Plan.

All new and existing employees must demonstrate capability prior to performing an analytical procedure independently (See Chapter 1). Method performance on Quality Control Samples is used to document employee training and work quality. Employees are required to read and sign the Quality Assurance Manual and all appropriate SOPs. Each employee also receives training on general laboratory policies including ethics and conflict of interest. ELI encourages attendance at courses, workshops and other forms of continuing education available from on-site seminars, private institutions, local schools, and State and Federal regulatory agencies. Staff and department meetings are held routinely to communicate company policies and procedures. All training on procedures and policies is documented per NELAP guidelines in employee training files. For more information see ELI SOP 10-005, Personnel Training.

Standard Operating Procedures

All routine laboratory operations and procedures are documented in Standard Operating Procedures (SOPs). SOPs are written to provide a reference which specifically defines requirements for routine procedures, so that consistent, safe, and efficient laboratory operations are possible. For analytical methods, SOPs generally provide information on the details of the analysis which are not specified in a published analytical method. For routine procedures other than analytical methods, SOPs define the steps required in accomplishing a given task. All SOPs are reviewed periodically to assure that they reflect any changes in laboratory operations. Method SOPs follow NELAP requirements. For more information on generation and distribution of SOPs, see SOP 10-001, Preparation, Numbering, Use, and Revision of Standard Operating Procedures.

Client Confidentiality

Each employee has the responsibility to maintain confidentiality in all matters pertaining to our clients, samples submitted, and Energy Laboratories, Inc. Information obtained during employment with this laboratory regarding the specific business of this laboratory or its clients shall at no time be revealed to any outside sources without permission from the owner of the data.

CHAPTER 10 - QUALITY CONTROL MONITORING

Routine Monitoring

Temperatures of incubators, water baths, refrigerators, and ovens are checked and recorded according to a prescribed schedule.

All pH meters are calibrated against reference standards. Calibrations are noted in laboratory notebooks.

Conductivity of deionized water is continuously monitored.

Reagents are dated and initialed at the time of receipt; reagents are not used after recommended shelf life is exceeded.

Balances are checked daily against NIST traceable weights and are calibrated and serviced by certified technicians annually.

SOPs are reviewed periodically for correctness.

Laboratory Notebooks are reviewed periodically by supervisors for correctness and accuracy.

Performance Evaluation Samples are analyzed as required. (See Chapter Two of this QA Manual)

Quality Control Check Samples are analyzed with each analytical batch.

Internal and External audits are performed as specified or requested. (See Chapter Two of this QA Manual for additional discussion)

Additional monitoring requirements may also be specified in individual SOPs.

The Laboratory maintains an active fraud protection program that is implemented through the laboratory ethics policy. Additionally, the potential of fraud is monitored through analyst supervision, management supervision, regular internal audits, PT study participation, and an active quality assurance program.

Instruments/Methods

Calibration is performed as required by the analytical method or SOP. (See Chapter 7 of this QA Manual)

Depending on method requirements, the standard curve is verified with a known second source reference sample. The reference sample results must fall within the appropriate target range for the calibration to be accepted.

In most cases, the calibration is checked by running a continuing calibration standard every 10 to 20 samples, depending on the analysis and instrumentation. The verification standard results must fall within an established range as described by the SOP.

All laboratory instruments are subjected to preventive maintenance schedules. Preventive maintenance schedules are specified in instrument maintenance logbooks.

As appropriate, instrument and/or method detection limits are determined annually, or more frequently if changes in instrument performance are noted or per method requirements. Procedures for the determination of instrument detection and method detection limits are described in ELISOP 30-009.

Precision and Accuracy requirements for each method are specified in the SOPs. General guidelines are given below.

Each sample analyses batch will contain QC samples to measure the accuracy of the method. Each QC sample result is monitored to be within QC specifications of the method. Results of blank spiked sample analysis must be within the established control limits. Quality Control Limits are specified in the SOPs and meet recommended QC limits as described in the referenced method.

Each sample analyses batch will contain QC samples to measure the precision of the method. (See chapter One for discussion on duplicate sample analyses.) Criteria for duplicate sample acceptance are found in the SOP, and are generally taken from the referenced method.

Each sample analyses batch will contain QC samples to measure the performance of the method on the sample matrix. These are typically identified as a matrix spike analyses and are often done in duplicate to also measure precision. Typically the sample is fortified with a known amount of target analyte and spike recoveries are calculated. Results outside of method QC guidance are flagged. Quality control limits and appropriate corrective actions steps are specified in the method SOP.

As appropriate, the performance of QC samples results are evaluated with Quality Control Charts. Suitability of existing QC limits is evaluated and possibly adjusted, but not to exceed method specification.

CHAPTER 11 – CORRECTIVE ACTION

When the quality control checks indicate that an analysis is not within the established control limits, corrective action is needed. This section gives general guidelines for corrective action. Corrective actions for each method or instrument are detailed in individual SOPs.

Method QC such as continuing calibrations, instrument blanks, method blanks, duplicate, blank spike, matrix spike, or matrix spike duplicate samples which fail to fall within QC control limits are analyzed again to verify if a problem exists. If this repeat is not within control limits, the particular instrument or procedure is checked according to the specific protocols outlined in the method or according to the instrument manufacturer's guidelines. Once results are within control limits, analysis of all samples that were analyzed while the procedure was out of control are repeated, i.e., all analyses are repeated back to the previous acceptable control sample. If the analyst is unable to achieve acceptable results after following the corrective action guidelines detailed in the SOP, supervision is consulted. If necessary, the appropriate service personnel are contacted if the problem is determined to be due to instrument error, and cannot be resolved. In certain cases, where control limits are exceeded, it is possible that problems cannot be corrected to satisfy QC criteria. This could be due to problems such as matrix interference, instrument problems, lack of sufficient sample, missed holding times, high blank contamination, etc. If all possible solutions available to correct the problem are examined and the sample results are still considered valid, qualifying comments are attached to the sample report describing the non-compliance to QC and probable cause.

In the event that a QC audit or other informational review shows an analysis report to be incorrect, incomplete, or adversely compromised, a written corrected report and explanation is submitted to the client. As appropriate, an explanation submitted to the client should give a detailed review of the problem and document any unapproved deviations from the regulations, standard operating procedures, or project specific scope of work that may have caused it. The explanation to the client shall include but not be limited to the following components:

What actions have been taken regarding the data set(s) affected.
Identification of the cause.
Corrective action taken to prevent future occurrence.

Procedure for Dealing with Complaints

Definition:

Complaint For the purposes of this procedure, a complaint comes from a client or other user of our data. The complaint might cover issues about the quality of our data, turnaround, method used, pricing, or other expectations.

Client The client is the person or company that ordered and paid for the services. This is the person that a sample is logged in or filed under.

Procedure:

The staff person receiving the complaint exercises judgment in deciding the severity and disposition of every complaint. The judgment must be used to decide whom, if anyone is alerted to the complaint and what actions are appropriate. The individual handling the complaint is instructed to follow ELI's guidelines on how to handle the complaint. This involves listening to the client and getting adequate information so the complaint can be investigated and resolved. The appropriate laboratory staff is notified and a solution to the problem and a timeline for action is given.

After the complaint is investigated or resolved, as necessary, the client is made aware of the results and determination is made as to what further actions are needed. Complaints and investigations may result in the need to submit a revised report or invoice. Complaints that are straightforward and can be resolved using the resources available to the person handling the complaint should be resolved there. These include such things as minor revisions of reports or invoices. If other decisions need to be made, the appropriate person should be contacted.

It may be appropriate to initiate or prepare a non-compliance report. This report should be completed with the intention of informing the affected staff about the problem so that we can all learn from it, change our procedures and improve our service. A procedure to document non-compliance reports is documented in ELI SOP 20-011.

Penalty for Improper, Unethical or Illegal Actions

Employees of Energy Laboratories, Inc. are expected to work in an ethical, proper, and legal manner. They are expected to perform laboratory analyses according to the cited method(s) and in conjunction with the SOP and the Quality Assurance Plan. Employees are expected and required to report any violations of this policy.

The penalty for improper, unethical, or illegal actions performed by an employee will be determined on a case-by-case basis. It will be set, in part, by the severity of the offense. A first time, minor offense may simply require instruction about the expectations of the company. A subsequent, willful, or more serious incident may require anything from supervisor reprimand to termination of employment. The supervisory staff and the laboratory director will determine the penalty. Consideration of such elements as employee experience, training, and attitude, and the seriousness of the problem will be used to set the penalty.

CHAPTER 12 - MAJOR EQUIPMENT AND METHODS

ENERGY LABORATORIES, INC – BILLINGS, MONTANA

Equipment	Quantity	Methods
Gas Chromatograph-FID with auto sampler	3	DRO, EPH (Mass. Method), TPH as Diesel
Gas Chromatograph-PID/FID with purge and trap and auto sampler	4	GRO, VPH (Mass. Method), TPH as Gasoline, 602, 8020
Gas Chromatograph-Dual ECD with auto sampler	2	504, 505, 508, 515, 608, 8081, 615, 8151
Gas Chromatograph-Mass Spectrometer with auto sampler	5	525, 507 mod., 625, 8270
Gas Chromatograph-Mass Spectrometer with purge and trap and auto sampler	4	524, 624, 8260
GPC cleanup apparatus	1	3640
Atomic Absorption Spectrophotometer with cold vapor apparatus	1	7470, 7471, 245.2
Inductively Coupled Argon Plasma Emission Spectrophotometer	2	200.7, 6010
Inductively Coupled Argon Plasma Spectrophotometer-Mass Spectrometer	2	200.8, 6020
Ion Chromatograph	2	300.0
Microscope, PCM, PLM	1	EPA 600/M4-82-020, RTI 600/R-93/116, NIOSH 7400, NIOSH 7402
Auto Titrator	2	310.0, SM 2320B
Flow Injection Analyzer	3	350.1, 353.2, 365.1, 420.2, 335.1, 335.3, 335.4, 415.2, ASTM D2036
Fix Wavelength IR Spectrophotometer	1	413.1, 418.1
UV-VIS Spectrophotometer	1	410.4, SM 3500-Cr, 376.2, SM4500, 420.1

CHAPTER 13 - PREVENTIVE MAINTENANCE

Preventive maintenance is performed on laboratory equipment according to the manufacturer's guidelines and our experience in its operation. An outline of the maintenance on our major equipment follows:

Instrument	Maintenance	Frequency
Balances	Check with Class S weights	Daily
	Independent Service	Annually
Pipettes	Check volume	Monthly/Daily
ICP-Atomic Emission	Check Pump Tubing	Daily
	Check Coolant Levels	Daily
	Lubricate Autosampler	Quarterly
	Air Filter	Quarterly
	Optics Servicing	Annually
ICP-Mass Spectrometry	Check Pump Tubing	Daily
	Check Coolant Levels	Daily
	Check Electron Multiplier	Monthly
	Lubricate Autosampler	Quarterly
	Air Filter	Quarterly
	Same as other Mass spectrometers	
Gas Chromatograph	Change Septum	As needed
	Check injection liner	Daily
	Clean detector	As needed
	Change gas cylinders	At 200 psi
	Change column	As needed
Auto Analyzers	Check bath temperature	Daily
	Check for leaks	Daily
	Change tubing	When wear is visible
	Align flow cell	Quarterly
	Lubricate pumps	Annually
	Lubricate sampler	Annually
Mass Spectrometers	Monitor vacuum pressures	Daily
	Monitor background levels	Daily
	Monitor electron multiplier	Daily
	Change pump oil	Annually
Aquatic Toxicology	Room temperature	Daily
	Aquarium temperatures	Daily
	Aquarium pH	Daily
	Aquarium water levels	Daily
	Aquarium water parameters	Daily
	Aquarium filters	Annually, or as specified
	Dechlorination filter	Quarterly
	Pump maintenance	Annually
Microbiology	Monitor room temperature	Twice daily
	Monitor Incubator Temperature	Twice daily
	Autoclave maintenance	Annually
	Monitor water bath temperature	Twice daily
Reagent Water Systems	Change/check cartridges	Quarterly, or as needed
Compressed Gases	Change gas cylinders	At 50 psi, monitor daily
Liquid Chromatograph	Flush system	Daily
	Change filters	As needed
	Change lamps	As needed
	Replace seals	As needed

CHAPTER 14 - REFERENCES

Handbook for Analytical Quality Control in Water and Wastewater Laboratories Environmental Protection Agency.

Standard Methods for the Examination of Water and Wastewater, 20th Edition, APHA, 1998.

Methods for Chemical Analysis of Water and Wastes Environmental Protection Agency, 600/4-79-020.

Methods for the Determination of Metals in Environmental Samples – Supplement I, EPA/600/R-94-111, May 1994

Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93-100, August 1993.

Methods for the Determination of Organic Compounds in Drinking Water, EPA/600/4-88/039, December 1998.

Methods for the Determination of Organic Compounds in Drinking Water – Supplement I, EPA/600/4-90/020, July 1990.

Methods for the Determination of Organic Compounds in Drinking Water – Supplement II, EPA/600/R-92/129, August 1992.

Technical Notes on Drinking Water Methods, EPA/600/R-94/173, October 1994.

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW846), Environmental Protection Agency, Final Update III, 1997

ASTM Annual Book of Standards, Part 31 (water). American Society for Testing and Materials.

Manual for the Certification of Laboratories Analyzing Drinking Water, 4th Ed., EPA 815-B-97-001, 1997.

NELAC Chapter 5: Quality System Standard, 2001

Laboratory Services Catalog, Current Revision, Energy Laboratories, Inc.

Qualifications Manual, Current Revision, Energy Laboratories, Inc.

CHAPTER 15 - GLOSSARY OF TERMS

Accuracy - The degree of agreement between an observed value and an accepted reference value.

Analytical Sample - Any solution or media introduced into an instrument on which an analysis is performed, excluding instrument calibration, initial calibration verification, initial calibration blank, continuing calibration verification, and continuing calibration blank.

Audit - A systematic evaluation to determine the conformance to quantitative specifications of some operational function or activity.

Batch - Environmental samples which are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to twenty environmental samples of the same matrix, meeting the criteria above. An analytical batch is composed of prepared environmental samples, extracts, digestates, or concentrates, which are analyzed together as a group and in a similar time frame.

Blind QC Check Samples - Samples whose analyte concentrations are not known to the analyst. That the sample is a QC check sample may or may not be known to the analyst.

Blank - An artificial sample designed to monitor the introduction of artifacts into the process. The blank is taken through the appropriate steps of the process.

Blank Spike - See Standard Matrix Spike.

Calibration - The set of operations which establish, under specified conditions, the relationship between values indicated by the measuring instrument and the corresponding known value of the property being measured.

Calibration Blank - A volume of reagent water fortified with the same matrix as the calibration standards, but without the analytes, internal standards, or surrogate analytes.

Calibration Check Standard - See Check Standard.

Calibration Curve - The mathematical relationship between the known values and the instrument responses for a series of calibration standards.

Calibration Standard - A solution of known concentration used in the calibration of an analytical instrument.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) - The enabling legislation (42 USC 9601 - 9675 *et seq*., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 USC 9601 *et seq*.), to eliminate the health and environmental threats posed by hazardous waste sites.

Check Standard - A material of known composition that is analyzed concurrently with test samples to evaluate a measurement process.

Clean Water Act - Public Law PL 92-500. Found at 40 CFR 100-140 and 400-470. The act regulates the discharge of pollutants into surface waters.

Continuing Calibration Standard - See Check Standard.

Continuing Calibration Verification - See Check Standard.

Control Limits - A range within which specified measurement results must fall to be compliant.

Control Standard - See Check Standard.

Corrective Action - An action taken to eliminate the causes of an existing nonconformity, defect, or other undesirable situation in order to prevent recurrence.

Data Quality Objectives - An integrated set of specifications that define data quality requirements and the intended use of the data.

Duplicate - A second aliquot of a sample that is treated the same as the original sample to determine the precision of the method.

Duplicate Sample - See Duplicate.

Fortified Sample - See Sample Matrix Spike.

Initial Calibration Verification - A sample of known concentration, from a source other than that of the calibration standards, analyzed following calibration to demonstrate validity of the calibration.

Instrument Blank - See Calibration Blank.

Laboratory Intercomparison Sample - A performance evaluation sample analyzed by numerous laboratories. Acceptance criteria are often based statistically on the analysis results.

LIMS - Laboratory Information Management System.

Matrix Spike - See Sample Matrix Spike.

Matrix Spike Duplicate - See Sample Matrix Spike Duplicate.

Method Blank - A clean sample processed simultaneously with, and under the same conditions as, samples containing an analyte of interest through all steps of the analytical procedure.

Method Detection Limit - A measure of the limit of detection for an analytical method determined according to the procedure given in 40 CFR Part 136 Appendix B.

MCL-Maximum Contaminant Level. Regulatory action levels for a contaminant of concern.

NELAC - National Environmental Laboratory Accreditation Conference.

NELAP - National Environmental Laboratory Accreditation Program.

National Pollutant Discharge Elimination System (NPDES) - A discharge permit system authorized under the Clean Water Act.

Performance Evaluation (PE) Sample - A sample with a composition unknown to the analyst which is provided to test whether the analyst/laboratory can produce analytical results with specified limits.

Precision - The degree to which a set of observations or measurements of the same property conform to themselves.

Preservation - Refrigeration and/or reagents added at the time of sample collection to maintain the chemical and/or biological integrity of the sample.

Quality Assurance Project Plan (QAPP) - A formal document describing the detailed quality control procedures pertaining to a specific project. For environmental clean-up projects this is typically produced by an engineering firm with references to include a laboratories Quality Assurance Program Manual.

Replicate - An additional aliquot of a sample that is treated the same as the original sample to determine the precision of the method.

Reporting Limit (RL) – Also known as the Practical Quantitation Limit (PQL). The lowest level of reportable concentration for the method and the analyte.

Resource Conservation and Recovery Act (RCRA) - The enabling legislation under 42 USC 321 *et seq.* (1976) that gives EPA the authority to control hazardous waste.

Safe Drinking Water Act (SDWA) - The enabling legislation, 42 USC 300f *et seq*. (1974), which requires the USEPA to protect the quality of drinking water in the U.S. by setting maximum allowable contaminant levels, monitoring, and enforcing violations.

Sample - A portion of material to be analyzed.

Sample Matrix Spike - An aliquot of a sample to which known quantities of specific compounds are added, and which is carried through the entire analytical process to determine the effect of the matrix on the methods recovery efficiency.

Sample Matrix Spike Duplicate - A second aliquot of a sample to which known quantities of specific compounds are added, and which is carried through the entire analytical process to determine the effect of the matrix on the methods recovery efficiency and the precision of the method.

Spiked Sample - See Sample Matrix Spike.

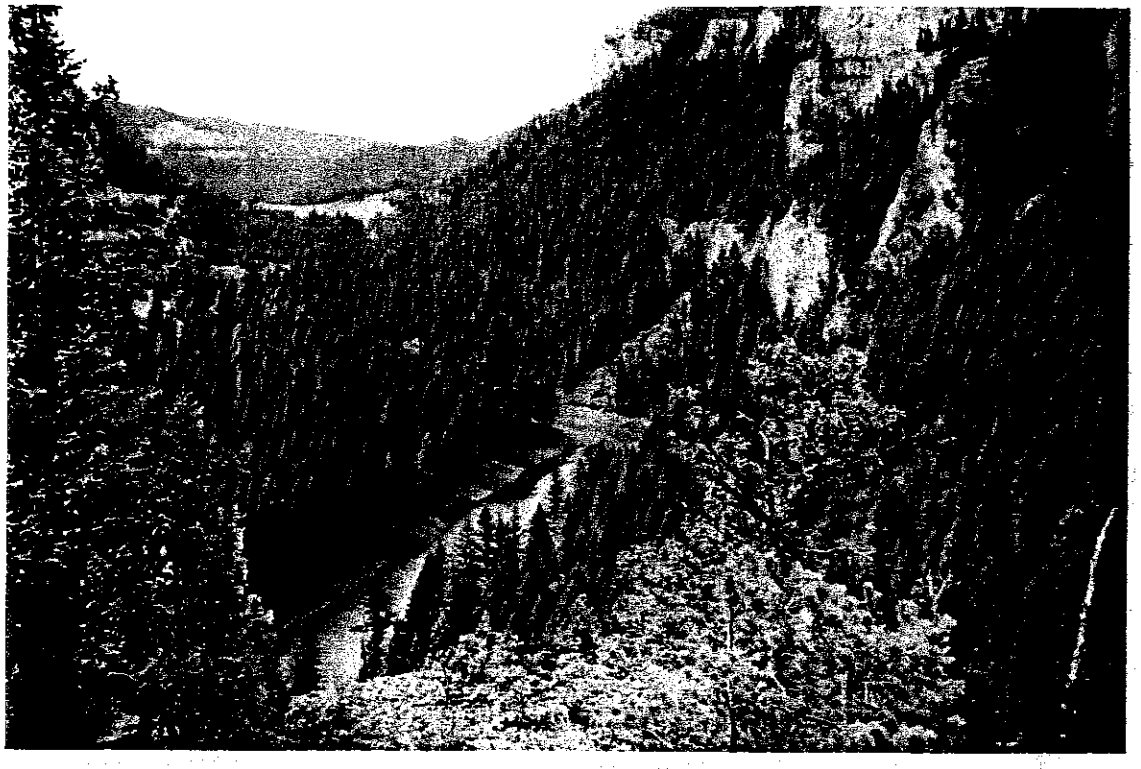
Standardization - See Calibration.

Standard Matrix Spike - An aliquot of blank matrix to which known quantities of specific compounds are added, and which is carried through the entire analytical process to determine the method’s recovery efficiency.

Standard Operating Procedure - A written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks.

APPENDIX A

For current certificates please go to certification section of ELI Web Page.



APPENDIX B
Quality Systems Controlled Documents

Quality Assurance Program Manual

Qualifications Manual

Energy Laboratories Analytical Services Catalog

Policies and Procedures Package
- Benefits
- 401-K
- Employee Leave Time, Work Week
- Computer Software Policy
- Work Ethic Policy
- Drug and Alcohol
- Non-Discrimination and Harassment in the Workplace Policy
- Confidentiality Agreement

SOPs
- Organization and Personnel (10-Series)
  - SOP of SOPs'
  - Access and Security
  - Roles and Responsibilities
  - Personnel Training
  - Policies and Procedures
- General Facility Operations (20-Series)
  - Login/Chain of Custody
  - Document Production/Archives
  - Lab Waste Management
  - Internal QA Audits
  - External QA Audits
  - Shipping
  - Property Procurement
  - Lab Notebooks
  - Non-Conformance
  - Sample Storage
  - Purchasing of Laboratory Reagents and Supplies
- General Laboratory Procedures (30-Series)
- Equipment Use and Maintenance (40-Series)
- Analytical Methods (50-Series)

Laboratory Notebooks

APPENDIX C

Quality Assurance / Quality Control Specifications

Appendix A - Table 1 - QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) SPECIFICATIONS - ENERGY LABORATORIES, Inc.

PARAMETER	METHOD REF.	HOLDING TIME**	INITIAL CALIBRATION	CONTINUING CALIBRATION	EXTERNAL CHECK SAMPLE	METHOD BLANK	SURROGATE Recovery	MATRIX SPK Frequency Recovery	DUPLICATE or Matrix Spk Dup	CALIBRATION STANDARDS VERIFICATION	OTHER
BTEX	8021/602 MDHES	14 Days	5 Point 20% RSD 20% RSD of MnRF	Every 12 Hours 85-115% of Initial	Every 48 Hrs 70-130	Every 12 Hrs <PQL	Trifluorotoluene 80-120% Rec.	10% of Smpls 70-130% Rec.	MSD <20% RPD	48 Hrs Check Smpl	PER METHOD SOP Instrument Blk as needed
GRO	MDHES	14 Days	5 Point 25% RSD OF RF 25% RSD of MnRF	Every 12 Hours 75-125% of Initial	Every 12 Hrs 50-150%	Every 12 Hrs <PQL	Trifluorotoluene 50-150% Rec.	10% of Smpls 60-120% Rec.	MSD <20% RPD	48 Hrs Check Smpl	PER METHOD SOP Instrument Blk as needed
DRO	MDHES	Water Extr 7 Days Soil Extr 14 Days Analyze 40 Days	5 Point 25% RSD of MnRF 25% RSD of MnRF	Every 12 Hours 75-125% of Initial	Daily/Batch 60-120%	Every 12 Hrs <PQL	O-terphenyl 50-150% Rec.	10% of Smpls 60-120% Rec.	MSD & BLKSPK <20% RPD	Each Lot of Stds	PER METHOD SOP Instrument Blk as needed
TPH as Diesel	8015 mod	Water Extr 7 Days Soil Extr 14 Days Analyze 40 Days	5 Point 25% RSD of MnRF 25% RSD of MnRF	Every 12 Hours 85-115% of Initial	Daily/Batch 60-140%	Every 12 Hrs <PQL	O-terphenyl 50-150% Rec.	10% of Smpls 60-120% Rec.	MSD & BLKSPK <20% RPD	Each Lot of Stds	PER METHOD SOP Instrument Blk as needed
TPH by Infrared Spectroscopy	418.1	28 Days	4 Point Linear Regression r>.995	Daily 90-110%	Daily/batch 90-110%	10% of Smpls <PQL	NA NA	10% of Smpls 90-110%	MSD <20% RPD	Each Lot of Stds	Calibrate IR wavelength
Purgeable Organics	8260 624*	14 Days	5 Point* <30%RSD Min. RRF 0.25	Every 12 Hrs +/- 25% for CCC +/- 30%*	5% of Smpls QC Limits	10% of Smpls <PQL	3 Surrogates Statistical	10% of Smpls	MSD Statistical Limits	Each Lot of Stds	Tuning every 12 Hrs I.S. areas 50-150% of I.C. Analyte ID RRT +/- .06 Major Ions +/- 20% CLP Guidelines
Regulated and Unregulated Volatile Organic Compounds	524.2	14 Days	5 Point* <30%RSD or Linear Regression Min. RRF 0.25	Every 8 Hrs +/- 30%*	5% of Smpls QC Limits	10% of Smpls <PQL	3 Surrogates 80-120%	N/A	N/A	Each Lot of Stds	Tuning every 8 Hrs I.S. areas 50-150% of I.C. Analyte ID RT +/- 30 sec Major Ions +/- 20% CLP Guidelines
Ignitability	1010	NS	Six Months	NA	5% of Smpls	NA	NA	NA	5% of Smpls	Check Smpl	AS PER METHOD SOP
Corrosivity, pH	9040/9045	Immediately	2 Point bracket sample pH	Every 10thSample +/- 0.1 pH units	per Sequence +/- 0.1 pH units	NA	NA	NA	5% of Smpls	Each lot of Stds	AS PER METHOD SOP
Cyanide Reactivity	9012/9013	14 Days	3 Point Linear Regression r>.995	Every 10 Smpls 85-115% of Initial	NA	5% of Smpls <PQL	NA	NA NA	10% of Smpls 3xLLD or 10%RPD	Check Smpl Instrument	AS PER METHOD SOP
Sulfide Reactivity	9030/9031	7 Days	3 Point Linear Regression r>.995	Every 10 Smpls 85-115% of Initial	NA	5% of Smpls <PQL	NA	NA	10% of Smpls 3xLLD or 10%RPD	Check Smpl Instrument	AS PER METHOD SOP
Specific Gravity	NS	NS	NA	NA	NA	NA	NA	NA	10% of Smpls	NA	
Paint Filter Test	9095	NS	NA	NA	NA	NA	NA	NA	10% of Smpls	NA	
Total Halogens	D808	NS	NA	NA	NA	Batch <0.03 %	NA	NA	10% of Smpls per method	NA	ASTM method

Appendix A - Table 1 - QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) SPECIFICATIONS - ENERGY LABORATORIES, Inc.

PARAMETER	METHOD REF.	HOLDING TIME**	INITIAL CALIBRATION	CONTINUING CALIBRATION	EXTERNAL CHECK SAMPLE	METHOD BLANK	SURROGATE Recovery	MATRIX SPK Frequency Recovery	DUPLICATE or Matrix Spk Dup	CALIBRATION STANDARDS VERIFICATION	OTHER
Acid Digestion	3050		NA	NA	Daily/Batch	Daily/Batch	NA	10% of Smpls	5% of Smpls	NA	AS PER METHOD SOP
Metals, except mercury	ICP/ICPMS	6 Months	2 Point Blank and Std	Every 10 Samples 90-110% of Value	5% of Smpls 90-110% 95-105% for 1st CCV	Daily/Batch <2.2*MDL or 1/10 sample	NA	10% of Smpls 70-130% (200.7) 75-125% (6010)	5% of Smpls 3xLLD or 10%RPD	Check Smpl	AS PER METHOD SOP Instrument Blk as needed Intensity of I.C. Std area Interference Check Std
Mercury	AA	28 days	same as other metals								
TCLP	1311		NA	NA	NA	10% of Smpls	NA	EVERY MATRIX	NA	NA	NA
mercury		28 days to extract									
other metals		180 days to extract									
organics		14 days to extract									
Biochemical Oxygen Demand	405.1	48 hours	Daily, saturated air	NA	Daily 85-115%	Daily <0.2 mg/l	NA	NA	3 replicates/sample		
Chemical Oxygen Demand	410.1	28 days	3 point Linear Regression r>0.995	Every 10 Smpls 85-115% of Initial	10% of Smpls QC Range	Daily/Batch <PQL	NA	10% of Smpls 85-115% Rec.	5% of Smpls 3xLLD or 10%RPD	Check Smpl	AS PER METHOD SOP Instrument Blk as needed
Total Suspended Solids	160.2	7 days	Daily balance calibration	NA	NA	5% of Smpls	NA	NA	5% of Smpls 3xLLD or 10%RPD	NA	
Total Kjeldahl Nitrogen	351.3	28 days	5 pt Linear Regression r>0.995	NA	Daily 90-110%	Daily	NA	10% of Smpls 85-115% Rec.	5% of Smpls 3xLLD or 10%RPD	NA	
Nitrate+Nitrite as N	353.2	28 days	5 point Linear Regression r>0.995	Every 10 Smpls 90-110% of Initial	10% of Smpls 90-110%	10% of Smpls <MDL	NA	10% of Smpls 90-110% Rec.	5% of Smpls 3xLLD or 10%RPD	Check Smpl	AS PER METHOD SOP Instrument Blk as needed
Total Phosphorus as P	365.1	28 days	5 point Linear Regression r>0.995	Every 10 Smpls 90-110% of Initial	10% of Smpls 90-110%	10% of Smpls <MDL	NA	10% of Smpls 90-110% Rec.	5% of Smpls 3xLLD or 10%RPD	Check Smpl	AS PER METHOD SOP Instrument Blk as needed

*QA/QC criteria similar to method shown.

**Holding Times do not reflect actual sample turnaround times.

NS=Not Specified, NA=Not Applicable, Smpl=Sample, IC=Initial Calibration, CC=Continuing Calibration, I.S.=Internal Std, Std=Standard, Blk=Blank, MSD=Matrix Spike Duplicate, MDL=Method Detection Limit,Extr=Extract, RF=Response Factor,MnRF=Mean Response Factor,RRF=Relative Response Factor,RSD=Relative Standard Deviation,RRT=Relative Retention Time,LLD=Lower Limit of Detection. CLP=Contract Laboratory Program SOW 1988

Method Detection Limits are determined annually for chromatographic systems, QA/QC charts as needed. Chain-of-Custody records maintained, sample condition reports for every sample.

ENERGY LABORATORIES, INC. * 1120 S 27th St * PO Box 30916 * Billings, MT 59107-0916
Toll Free 800.735.4489 * 406.252.6325 * FAX 406.252.6069 * eli@energylab.com

METHOD QA/QC PARAMETERS
ELEMENTAL ANALYSES BY ICP by EPA Method 200.7/6010B
For Water, Waste, and Soil Analyses

QA SAMPLE/ INDICATOR	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	COMMENTS/REPORTING
Sample Preparation	Soils: 3050 Digestion Waters: Turbidity <1 Analyze direct , >1 digest using 200.2 Total metals are all digested	Meet method QC criteria for the matrix.	1) Reanalyze sample	Reporting: Audit review, "Digestion batch ID for each sample and Date extracted available in Dates Report".
Instrument Initial Calibration (IC)	Daily, or when needed. 1 point calibration and blank	None	None	Calibration of instrument. Calibration validity Tested by ICV and ICB. Reporting: In data QC report
Initial Calibration Verification (ICV)/Instrument Performance Check (IPC)	Immediately follows calibration. Use second source standard.	6010B: R% =90-110 200.7: %R=95-105 immediately after IC,	1) Recalibrate and rerun 2) Prepare fresh standards or/ ICV.	Evaluates accuracy/bias in calibration standards. Reporting: In data QC report
Initial Calibration Blank (ICB)	Immediately follows ICV	<2.2xMDL, or <10% of reporting limit, whichever is greatest.	1) Repour Blanks, recalibrate and rerun. 2) Prepare fresh blank	Evaluates reagent contamination and instrument carryover and background.. Reporting: In data QC report. Blanks values reported down to criteria used.
Low Level Calibration Verification (CRI)	Reporting limit standard analyzed at beginning and end of run.	R%= 50-150	1) None	Verifies instrument ability to quantitate analytes at the reporting limit. Reporting: In data QC report
Interference Check Sample "A" (ICSA)	Run daily	R%=80-120 for interferents +/- 2* reporting limit for analytes	1) Evaluate sample data. Results near reporting limit suspect if failing ICSA. 2) Rerun sample as indicated.	Reporting: In data QC report
Interference Check Sample "AB" (ICSAB)	Run daily	R%=80-120 for interferents	1) Evaluate sample data. Results near reporting limit suspect if failing ICSB. 2) Rerun sample as indicated.	Reporting: In data QC report
Continuing Calibration Verification (CCV)	Run every 10 samples and at end of run.	R% =90-110 as continuing calibration check 200.7: %R=95-105 immediately after IC, 90-110 following CCV's	1) Recalibrate and rerun all samples since last valid CCV 2) Check for sample matrix problems.	Evaluates instrument calibration drift. Reporting: Prior CCV In data QC report, ending CCV = audit review.
Continuing Calibration Blank (CCB)	Run with every CCV and after high level samples as needed.	<2.2xMDL, or <10% of reporting limit, whichever is greatest.	1) Check for high concentration sample 2) Reanalyze CCB. 3) Reanalyze affected samples	Measures analyte carryover in instrument and also evaluates possible contamination in reagents and glassware. Reporting: In data QC report, Blanks values reported down to criteria used.
Instrument Matrix Spike Sample (MS)	6010: Minimum 1/20 samples . 200.7: Minimum 1/10 samples and for each batch. Not performed on digested samples See MS	6010B: %R =75-125 200.7 %R-70-130	1) Rerun spike 2) Evaluate LCS performance.	Evaluates affect of matrix on method performance. Results not evaluated when sample analyte concentration greater than 4X spike level. Reporting: In data QC report.
Instrument Duplicate Sample or Matrix Spike duplicate.	Minimum 1/20 Samples in instrument sequence. Not performed on digested samples	Either 3* PQL or <10%RPD, whichever is greatest. %R= See MS	1) Rerun duplicate/spike 2) Evaluate LCS	Measures method precision. MSD may be used instead of duplicate. Reporting: In data QC report.
Method Blank Also see ICB and	Digested Samples, Minimum 1/20 samples or for each batch	< 10% of sample concentration,	1) Re-digest samples from batch which fail acceptance criteria.	Evaluates possible contamination in reagents and glassware. Reporting:

METHOD QA/QC PARAMETERS
ELEMENTAL ANALYSES BY ICP by EPA Method 200.7/6010B
For Water, Waste, and Soil Analyses

QA SAMPLE/ INDICATOR	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	COMMENTS/REPORTING
CCB for direct analyses	whichever is more frequent Direct analyses: Daily and each sequence	<2.2xMDL, or <10% of reporting limit, whichever is greatest.		Reporting: In data QC report, Blank values reported down to criteria used.
Laboratory Control Sample = LFB for direct instrument analyses (undigested).	Digested Samples, Minimum 1/20 samples or for each batch whichever is more frequent Direct analyses: Daily and each sequence.	6010B: %R= 75-125 200.7 %R=85-115 Soils: Within established acceptance ranges for certified material.	1) Repeat LCS analyses 2) Prepare new standards 3) Recalibrate 4) Re-extract and re-analyze samples associated with LFB. 5) Flag data or re-digest batch	Evaluates method precision and accuracy. Reporting: In data QC report
Matrix Spike (MS) (Laboratory Fortified Sample Matrix (LFM)) Pre-digestion for digested samples.	6010: 1/20 samples or 1/Digestion Batch whichever is more frequent. 200.7: 1/10 samples or per batch whichever is more frequent.	6010B: %R= 75-125 200.7: %R=70-130	1) See LCS 2) Flag data or re-digest batch 3) Repeat analyses Note MS recovery performance in soils varies considerably with matrix.	Evaluates digestion extraction efficiency and sample matrix effects on analyses. Reporting: In data QC report.
Matrix Spike Duplicate (MSD) or digestion duplicate Pre-digestion for digested samples	1/20 samples or 1/Digestion Batch whichever is more frequent	Either +/- 3*LLD or 10% RPD %R=See MS	1) See LCS 2) Flag data or re-digest batch 3) Repeat analyses.	Measures method precision. MSD may be used instead of duplicate. Reporting: In data QC report.
Serial Dilution Sample	when new matrix is encountered	%R=90-110 for analytes >50*PQL	1) Rerun samples 2) Run samples on dilution	Used for screening analyses and for evaluating new matrices.
Inter-element correction Factor Studies	Annually, or whenever instrument changes might affect inter-element corrections.	Comparison to historical data	1) Repeat 2) Correct problem	Correction factors to account for spectral overlap between differing elements.
Upper Linear Range Studies	Annually, or whenever instrument changes might affect sensitivity.	Comparison to historical data	1) Repeat 2) Correct problem 3) Adjust upper calibration limit	Used to determine the upper linear calibration range for the instrument.
MDL/IDL Studies	Annually or whenever instrument changes, which might affect sensitivity.	<2.2 X reporting limit and comparisons to prior studies.	1) Repeat 2) Correct problem 3) Adjust reporting limit to >MDL	Evaluates overall method detection limits in clean sample matrix. Actual samples may have higher MDL. Reporting: Audit review
External PE Samples	Semi-annually, WS and WP study samples and internal double blind samples.	Within EPA specified interlaboratory control limits	1) Repeat 2) Correct problem	External review of analytical method accuracy. Historically, excellent performance. Reporting: Current study results available on www. energylab.com website.
Control Charting and Proof of Competency	Annual, statistical review of method QC data for each analyst. or as needed	Data statistically within control limits.	1) Correct method problem 2) Adjust control limits	For statistical process control. Reporting: Audit review

ENERGY LABORATORIES, INC. * 1120 S 27th St * PO Box 30916 * Billings, MT 59107-0916
Toll Free 800.735.4489 * 406.252.6325 * FAX 406.252.6069 * eli@energylab.com

METHOD QA/QC PARAMETERS
ELEMENTAL ANALYSES BY ICP-MS by EPA Method 200.8/6020
for Water, Waste, and Soil Analyses

QA SAMPLE/ INDICATOR	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	COMMENTS/REPORTING
Sample Preparation	Soils: 3050 Digestion Waters: Turbidity <1 Analyze direct , >1 digest using 200.2 Total metals are all digested	Meet method QC criteria for the matrix.	1) Reanalyze sample	Reporting: Audit review, "Digestion batch ID for each sample and Date extracted available in Dates Report".
Instrument Tuning	Daily – before calibration, analyze tuning solution; conduct mass calibration, and mass resolution check. Per method requirements	Per individual method requirements:	1) Rerun tuning solutions 2) Adjust instrument parameters and retune 3) Correct Problems	Set instrument parameters for accurate qualitative elemental identification. Tuning solution varies according to matrix and targeted analytes. Reporting: Audit review
Instrument Initial Calibration (IC)	Daily, or when needed. 2 point calibration and blank	None	None	Calibration of instrument. Calibration validity Tested by ICV and ICB. Reporting: In data QC report
(ICV) Initial Calibration Verification	Immediately follows calibration. Use second source standard.	R% =90-110	1) Recalibrate and rerun 2) Prepare fresh standards or/ ICV.	Evaluates accuracy/bias in calibration standards. Reporting: In data QC report
Initial Calibration Blank (ICB)	Immediately follows ICV	<2.2xMDL, or <10% of reporting limit, whichever is greatest.	1) Repour Blanks, recalibrate and rerun. 2) Prepare fresh blank	Evaluates reagent contamination and instrument carryover and background.. Reporting: In data QC report. Blanks values reported down to criteria used.
Low Level Calibration Verification (CRI)	Reporting limit standard analyzed at beginning and end of run.	R%= 50-150	1) None	Verifies instrument ability to quantitate analytes at the reporting limit. Reporting: In data QC report
Interference Check Sample "A" (ICSA)	Run daily per 6020B requirements	R%=80-120 for interferents +/- 2* reporting limit for analytes	1) Evaluate sample data. Results near reporting limit suspect if failing ICSA. 2) Rerun sample as indicated.	Reporting: In data QC report
Interference Check Sample "AB" (ICSAB)	Run daily for 6020B per 6020B requirements	R%=80-120 for interferents	1) Evaluate sample data. Results near reporting limit suspect if failing ICSB. 2) Rerun sample as indicated.	Reporting: In data QC report
Continuing Calibration Verification (CCV)	Run every 10 samples and at end of run.	R%= 90-110	1) Recalibrate and rerun all samples since last valid CCV 2) Check for sample matrix problems.	Evaluates instrument calibration drift. Reporting: Prior CCV In data QC report, ending CCV = audit review.
Continuing Calibration Blank (CCB)	Run with every CCV and after high level samples as needed.	<2.2xMDL, or <10% of reporting limit, whichever is greatest.	1) Check for high concentration sample 2) Reanalyze CCB. 3) Reanalyze affected samples	Measures analyte carryover in instrument and also evaluates possible contamination in reagents and glassware. Reporting: In data QC report, Blanks values reported down to criteria used.
Instrument Matrix Spike Sample (MS)	6020: Minimum 1/20 samples . 200.8: Minimum 1/10 samples and for each batch. Not performed on digested samples	6020B: %R =75-125 200.8 %R-70-130	1) Rerun spike 2) Evaluate LCS performance.	Evaluates affect of matrix on method performance. Results not evaluated when sample analyte concentration greater than 4X spike level. Reporting: In data QC report.
Instrument Duplicate Sample or Matrix Spike duplicate.	Minimum 1/20 Samples in instrument sequence. Not performed on digested samples	Either 3* PQL or <10%RPD, whichever is greatest. %R= See MS	1) Rerun duplicate/spike 2) Evaluate LCS	Measures method precision. MSD may be used instead of duplicate. Reporting: In data QC report.
Method Blank or	Digested Samples: Minimum 1/20	< 10% of sample	1) Re-digest samples from batch	Evaluates possible contamination in

METHOD QA/QC PARAMETERS
ELEMENTAL ANALYSES BY ICP-MS by EPA Method 200.8/6020
for Water, Waste, and Soil Analyses

QA SAMPLE/ INDICATOR	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	COMMENTS/REPORTING
LRB) (Digested samples only) Also See ICB and CCB for direct analyses	samples or for each batch whichever is more frequent. Direct analyses: Daily and each sequence.	concentration, <2.2xMDL, or <10% of reporting limit, whichever is greatest.	which fail acceptance criteria.	reagents and glassware. Reporting: Reporting: In data QC report, Blank values reported down to criteria used.
Laboratory Control Sample = LFB for direct instrument analyses (undigested).	Digested Samples: Minimum 1/20 samples or for each batch whichever is more frequent. Direct analyses: Daily and each sequence.	6020B: %R= 75-125 200.8 %R=85-115 Soils: Within established acceptance ranges for certified material.	1) Repeat LCS analyses 2) Prepare new standards 3) Recalibrate 4) Re-extract and re-analyze samples associated with LFB. 5) Flag data or re-digest batch	Evaluates method precision and accuracy. Reporting: In data QC report
Matrix Spike (MS) (Laboratory Fortified Sample Matrix (LFM)) Pre-digestion for digested samples.	6010: 1/20 samples or 1/Digestion Batch whichever is more frequent. 200.8: 1/10 samples or per batch whichever is more frequent.	6020B: %R= 75-125 200.8: %R=70-130	1) See LCS 2) Flag data or re-digest batch 3) Repeat analyses Note MS recovery performance in soils varies considerably with matrix.	Evaluates digestion extraction efficiency and sample matrix effects on analyses. Reporting: In data QC report.
Matrix Spike or Digestion duplicate sample	1/20 samples or 1/Digestion Batch whichever is more frequent	Either +/- 3*LLD or 10% RPD %R=See MS	1) See LCS 2) Flag data or re-digest batch 3) Repeat analyses.	Measures method precision. MSD may be used instead of duplicate. Reporting: In data QC report.
Internal Standards	Monitor in all standards, samples, and QC samples.	6010B: 30-140% of IC for all standards, blanks, and samples. 200.7: 60-125% of IC for all analyses.	1) Reanalyze sample 2) Dilute sample and reanalyze. 3) Evaluate associated QC samples in sequence. 4) Reanalyze sequence	Internal standards compensate for instrument drift and sample matrix affects. Internal standards used depend on parameters and sample matrix. Reporting: Audit review
MDL/IDL Studies	IDL's Quarterly, MDL's semiannually, or both whenever instrument changes which might affect sensitivity.	<2.2 X reporting limit and comparisons to prior studies.	1) Repeat 2) Correct problem 3) Adjust reporting limit to >MDL	Evaluates overall method detection limits in clean sample matrix. Actual samples may have higher MDL. Reporting: Audit review
Upper Linear Range Studies	Annually, or whenever there are instrument changes, which might affect sensitivity.	Comparison to historical data	1) Repeat 2) Correct problem 3) Adjust upper calibration/quantitation limit	Used to determine the upper linear calibration range for the instrument. Reporting: Audit review
External PE Samples	Semi-annually, WS and WP study samples and internal double blind samples.	Within EPA specified interlaboratory control limits	1) Repeat 2) Correct problem	External review of analytical method accuracy. Historically, excellent performance. Reporting: Current study results available on www. energylab.com website.
Control Charting and Proof of Competency	Annual, statistical review of method QC data for each analyst. or as needed	Data statistically within control limits.	1) Correct method problem 2) Adjust control limits	For statistical process control. Reporting: Audit review

ENERGY LABORATORIES, INC. * 1120 S 27th St * PO Box 30916 * Billings, MT 59107-0916
Toll Free 800.735.4489 * 406.252.6325 * FAX 406.252.6069 * eli@energylab.com

METHOD QA/QC PARAMETERS
VOLATILE ORGANICS BY PURGE AND TRAP GC/MS
EPA Method SW-846 8260B for SOIL & WATER

QA SAMPLE/ INDICATOR	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	COMMENTS/REPORTING
Sample Preparation	Methods: Soils: Extracted by 5030B then analyzed by Purge & Trap Waters: 5030B Purge & Trap Surrogates added to all samples	Meet method QC criteria for the matrix.	1) Reanalyze sample	Waters are introduced into the GC/MS using Purge & Trap. Soils are extracted into methanol and the methanol extract is added to water and analyzed by Purge and Trap/GC/MS
Initial Calibration	5 point initial calibration Range: 2,5,10, 15, 20 ug/L	If %RSD<15 use avg RF, alternatively use calibration curve (See Note #1).	1. Correct problem 2. Prepare new standards 3. Recalibrate	Calibration of instrument and check of response linearity. Reporting: Audit review
Tuning	BFB Initially and every 12 hours thereafter.	Meet method tuning criteria. (Table 2 SOP ELI 50-006)	1. Adjust instrument 2. Recheck tune 3. Until successful	Evaluate mass sensitivity, mass resolution, isotope ratio, and baseline threshold. Reporting: Audit review
(ICV) Initial Calibration Verification	See LFB using second source standard.			Evaluates accuracy/bias in calibration standards.
Continuing Calibration (CC)	Mid-level standard analyzed every 12 hours to update internal standard response factors (RF)	RF +/- 20% of IC for CCCs, 30% for all others. Internal Std areas R% = 50-150 of IC, See Note #2	1. Correct problem -Reanalyze CC. 2. Re run instrument tune 3. Re-calibrate and re-analyze all samples since last valid calibration check.	Verifies instrument calibration and stability throughout analyses. Reporting: In data validating report package
Method Blank	Each batch of 20 samples/matrix or when there is a change of reagents, whichever is more frequent.	<½ PQL	1. Repeat analyses once 2. Correct problem 3. Re-extract and re-analyze all samples associated with method blank.	Measures and evaluates possible contamination in reagents and glassware used in method. Reporting: Routine data reporting package.
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	Each batch of 20 samples/matrix or when there is a change of reagents, whichever is more frequent.	CLP SOW 3/90 %R = 60-140 %RPD = See example QA Matrix Spike reports	1. Repeat analyses 2. Re-extract and reanalyze MS, (if sufficient sample). 3. Evaluate LFB performance.	Evaluates affect of matrix on method performance. Reporting: Routine data reporting package.
Lab Fortified Blank (LFB) or Lab Control Sample (LCS)	Minimum 1/20 samples/matrix and each batch of samples, whichever is more frequent. Use second source standards to check calibration.	%R = 60-140 Includes the 65 compounds on ELI Short List.	1. Repeat analyses 2. Prepare new standards 3. Recalibrate 4. Re-extract and re-analyze all samples associated LFB.	Evaluates method precision and accuracy. Method specifies 70-130 Reporting: Routine data reporting package.
Internal Standards (Samples and QC)	Monitor total areas in each analyses Bromochloromethane-d2 Fluorobenzene Chlorobenzene-d5 1,2-Dichlorobenzene-d5	Samples: Area% 50-150% of IC RT = +/- 30 sec of IC.	1. Repeat analyses 2. Correct Problem 3. Re-prepare samples 4. Analyze different sample 5. Re-analyze set of samples.	Measures instrument stability and sensitivity. Reporting: Audit review
Surrogates	Present in all extracted samples (including QC) 1,2-Dichloroethane-d4 Toluene-d8 p-Bromofluorobenzene	%R = 80-120	1. Repeat analyses 2. Recalibrate with fresh fortification standard. 3. Re-extract samples	Evaluates method performance on each individual sample analyzed. Reporting: Routine data reporting package.
Mass Spectra	Review all target analytes in standards, and also target compounds found in samples.	Spectra must be consistent with library database	1)Verify calibration spectra and retention times 2) Repeat analyses	Used to qualitatively identify target compound hits in samples. Reporting: Audit review

ENERGY LABORATORIES, INC. * 1120 S 27th St * PO Box 30916 * Billings, MT 59107-0916
Toll Free 800.735.4489 * 406.252.6325 * FAX 406.252.6069 * eli@energylab.com

METHOD QA/QC PARAMETERS
VOLATILE ORGANICS BY PURGE AND TRAP GC/MS
EPA Method SW-846 8260B for SOIL & WATER

QA SAMPLE/ INDICATOR	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	COMMENTS/REPORTING
MDL Studies	MDL - Annually for water and soils and initially for each new instrument setup or analyst.	MDL< PQL	1. Repeat once 2. Correct problem	Evaluates overall method detection limits in clean sample matrix. Actual samples may have higher MDL. Reporting: Audit review
External PE Samples	Semi-annually, WP study samples.	Within specified interlaboratory control limits	1. Repeat 2. Correct problem	External review of analytical method accuracy. Reporting: Audit review
Control Charting and Proof of Competency	Annual, statistical review of method QC data for each analyst. or as needed	Data statistically within control limits.	1. Correct method problem 2. Adjust control limits 3. Replace analyst	For statistical process control. Reporting: Audit review

Note 1: CCC = Continuing Calibration Check Compounds. Calibration curve (first or higher order), all analytes %RSD<30 then R2 >0.99, RF for System Performance Check Compounds (SPCCs) >0.3000 for Chlorobenzene and 1,1,2,2-Tetrachloroethane;>0.1 for Chloromethane and 1,1-dichloroethane, and Bromoform.
Note 2: RF acceptance criteria for SPCCs same as for initial calibration.

ENERGY LABORATORIES, INC. * 1120 S 27th St * PO Box 30916 * Billings, MT 59107-

Toll Free 800.735.4489 * 406.252.6325 * FAX 406.252.6069 * eli@energylab.com

TABLE 2.
BFB MASS - INTENSITY SPECIFICATIONS (4-BROMOFLUOROBENZENE)[a]

Mass	Intensity Required (relative abundance)
50	15 to 40% of mass 95
75	30 to 60% of mass 95
95	base peak, 100% relative abundance
96	5 to 9% of mass 95
173	less than 2% of mass 174
174	greater than 50% of mass 95
175	5 to 9% of mass 174
176	greater than 95% but less than 101% of mass 174
177	5 to 9% of mass 176

[a] Alternate tuning criteria may be used (e.g. CLP, Method 524.2, or manufacturers' instructions), provided that method performance is not adversely affected.

ENERGY LABORATORIES, INC. * 1120 S 27th St * PO Box 30916 * Billings, MT 59107-0916
Toll Free 800.735.4489 * 406.252.6325 * FAX 406.252.6069 * eli@energylab.com

METHOD QA/QC PARAMETERS
SEMIVOLATILE ANALYSES BY GC/MS
EPA Method 8270C

QA SAMPLE/ INDICATOR	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	COMMENTS/REPORTING
Sample Preparation Extraction	SW-846 Methods: Soils: 3550B or 3545 Waters: 3510C or 3520C Wastes: 3550B, 3545, 3580 Surrogates added to all samples	Meet method QC criteria for the matrix.	1) Re-analyze sample or re-extract sample. If re-extraction outside of holding time report both sets of data.	Minimum sample volume required per sample. (Additional recommend) Soils: 30 grams Water: 1 Liter
Instrument Initial Calibration (IC)	5 point initial calibration Range:20,50,75,100,150	See Note #1	1) Correct problem 2) Prepare new standards 3) Recalibrate	Calibration of instrument and check of response linearity. Reporting: Audit review
Tuning	DFTPP Initially and every 12 hours thereafter.	Meet method tuning criteria. (Table 3 SOP ELI 50-009)	1) Adjust instrument 2) Recheck tune 3) Until successful	Evaluate mass sensitivity, mass resolution, isotope ratio, and baseline threshold. Reporting: Audit review
(ICV) Initial Calibration Verification	Quarterly or with each new lot# of standards used for calibration.	R% = 85-115 of IC	1) Correct problem 2) Prepare new ICV or IC standards	Evaluates accuracy/bias in calibration standards. Reporting: In data validating report package
Continuing Calibration (CC)	Mid-level standard analyzed every 12 hours to update internal standard response factors (RF)	See Note #2	1) Correct problem -Reanalyze CC. 2) Re-run instrument tune 3) Re-calibrate and re-analyze all samples since last valid calibration check.	Verifies instrument calibration and stability throughout analyses. Reporting: In data validating report package
GC Performance Analyte Degradation	Each Tuning: Evaluate TIC areas of DDT breakdown products and chromatographic profile	<20% breakdown	1) Instrument maintenance 2) Re-check tune	Evaluates chromatographic system for reactivity. Reporting: Audit review
Method Blank	Each batch of 20 samples/matrix or when there is a change of reagents , whichever is more frequent.	<½ PQL excepting phthalates	1) Repeat analyses once 2) Correct problem 3) Re-extract and re-analyze all samples associated with method blank.	Measures and evaluates possible contamination in reagents and glassware used in method. Reporting: Routine data reporting package.
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	Each batch of 20 samples/matrix or when there is a change of reagents, whichever is more frequent.	CLP SOW 3/90 (Table 9 - SOP ELI 50-009) or statistical control limits. %RPD = See example QA Matrix Spike reports	1) Repeat analyses 2) Re-extract and reanalyze MS, (if sufficient sample). 3) Evaluate LFB performance. (See Note #3)	Evaluates affect of matrix on method performance. Reporting: Routine data reporting package.
Lab Fortified Blank (LFB) QC Check Sample	Minimum 1/20 samples/matrix and each batch of samples, whichever is more frequent.	(Table 6 - SOP ELI 50-009) or statistical control limits.	1) Repeat analyses 2) Prepare new standards 3) Recalibrate 4) Re-extract and re-analyze all samples associated with LFB.	Evaluates method precision and accuracy. Reporting: Routine data reporting package.
Internal Standards (Samples)	Monitor total areas in each analyses Acenapthene-d10 Phenanthrene-d10 Chrysene-d12 1,4 Dichlorobenzene-d4, Napthalene-d8, and Perylene-d12	Samples: Area% 50-150% of IC RT = +/- 30 sec of IC.	1) Repeat analyses 2) Correct Problem 3) Re-prepare samples 4) Analyze different sample 5) Re-analyze set of samples.	Measures instrument stability and sensitivity. Reporting: Audit review
Mass Spectra	Review all target analytes in standards and reported analytes in samples	Spectra must be consistent with library	1)Verify calibration spectra and retention times	Used to qualitatively identify target compound hits in samples.

ENERGY LABORATORIES, INC. * 1120 S 27th St * PO Box 30916 * Billings, MT 59107-0916
Toll Free 800.735.4489 * 406.252.6325 * FAX 406.252.6069 * eli@energylab.com

METHOD QA/QC PARAMETERS
SEMIVOLATILE ANALYSES BY GC/MS
EPA Method 8270C

QA SAMPLE/ INDICATOR	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	COMMENTS/REPORTING
	in samples.	database	2) Repeat analyses	Reporting: Audit review
Surrogates	Present in all extracted samples (including QC)	CLP-SOW 3/90 (Table 8 - SOP ELI 50-009) or statistical control limits	1) Repeat analyses 2) Recalibrate with fresh fortification standard. 3) Re-extract samples	Evaluates method performance on each individual sample analyzed. Reporting: Routine data reporting package.
MDL Studies	MDL - Annually each for water and for soils, initially for each new instrument setup or analyst. Calculated from method validation study of QC check sample. %R=60-140, %RSD <30	MDL <0.2X of PQL PQL = 10ug/L or 0.33ug/g with exceptions (See Note #4)	1) Repeat once 2) Correct problem	Evaluates overall method detection limits in clean sample matrix. Actual samples may have higher reporting limit. Reporting: Audit review
Control Charting and Proof of Competency	Annual, statistical review of method QC data for each analyst. Or as needed	Data statistically within control limits.	1) Correct method problem 2) Adjust control limits 3) Replace analyst	For statistical process control. Reporting: Audit review

Note #1 %RSD for CCC (Table 4 SOP ELI 50-009) <30. RF for SPCC's (N-nitroso-di-n-propyl amine, hexachlorocyclopentadiene, 2,4-Dinitrophenol, and 4-Nitrophenol) > 0.050. If % RSD for a compound is < 15, linearity is assumed and average RF is used. If % RSD > 15 (and less than 30 for CCC), use a calibration curve with correlation coefficient >= 0.990. Lower calibration levels are not used for certain compounds. PQL's are adjusted as appropriate.

Note #2 RF for SPCC>0.050, RF of CCC's must be <20% difference from IC. RF of all other compounds must be <30% difference from IC.

Note #3 If any analyte in the MS/MSD fails, QC limits for failed compounds must be within acceptable recovery limits for the blank spike laboratory control sample.

Note #4 PQL for Benzidine, 3,3' Dichlorobenzidine, and pyridine = 20ug/L. 4-Nitrophenol, Pentachlorophenol, 2,4-Dinitrophenol, 4,6-Dinitro-2-methylphenol = 50 ug/L.

ENERGY LABORATORIES, INC. * 1120 S 27th St * PO Box 30916 * Billings, MT 59107-0916
Toll Free 800.735.4489 * 406.252.6325 * FAX 406.252.6069 * eli@energylab.com

METHOD QA/QC Parameters Volatile Petroleum Hydrocarbons (VPH) per Massachusetts Method January 1998 Revision				
QA SAMPLE/ INDICATOR	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	COMMENTS
Sample Preparation	Soils: Methanol Preserved vials required. 10 grams Soil/10mL of methanol VPH Surrogates added to all samples before extraction. Waters: VOA Vials, preserve to a PH<2.	Meet all method QC criteria for the matrix.	1) Reanalyze sample	VPH surrogates added to all sample before extraction.
Instrument Calibration (IC)	5 Point calibration to precede analyses. Use average response factors. Certain compounds are selected for FID calibration and other compounds are used for PID calibration.	25% RSD of Mean Response Factors. Includes individual compound response factors and range response factors.	1. Repeat calibration 2. Correct problem 3. Recalibrate	Used to calibrate instrument response. Consists of a 13 component standard containing both aliphatic and aromatic hydrocarbons
Initial Calibration Verification (ICV)	Follows valid initial calibration (See Blank Spike)		1. Repeat once 2. Recalibrate 3. Prepare fresh standards	Second source standard to evaluate calibration standard biases.
Continuing Calibration Check (CCC)	Every 12 Hours and at the end of every analytical sequence	75-125% of Initial Calibration for the CCC preceding sample analyses.	1. Repeat once 2. Correct problem 3. Recalibrate 4. Reanalyze all samples since last valid calibration check.	Analyses of Mid-level calibration standard to measure drift in instrument sensitivity/method performance.
Method Blank	Minimum 1/20 Samples	½ of PQL for target analytes	1. Repeat once 2. Correct problem 3. Re-analyze all samples since last valid method blank.	Method blank evaluates glassware reagents, and methodology to be free of contamination. Soil method blanks use clean sand.
Matrix Spike and Matrix Spike duplicate (MS/MSD)	Minimum 1/20 samples	(Recommended) 70-130% Recovery. 20% RPD between duplicates.	1. Evaluate matrix, possibly repeat using higher spiking level. 2. Correct problem 3. Verify sample homogeneity for soils.	Evaluates affect of matrix on method performance. Soils are spiked at time of extraction.
Laboratory Fortified Blank (Blank Spike)	Minimum 1/20 samples Soils are prepared using a blank sand matrix.	R% = 70 - 130	1. Repeat once 2. Correct problem 3. Re-analyze all samples since last valid laboratory fortified blank.	Evaluates overall performance of method on a characterized matrix.
Surrogates	TFT spiked into all samples analyzed	Recovery 70-130%	1. Evaluate sample matrix and surrogate spike level. 2. Repeat once 3. Evaluate LFB performance	Evaluates method performance on each individual sample matrix.
Analyte Confirmation in Samples	Confirm target VPH analytes by GC/MS analyses.	Upon client request.	None	Analyte identifications in samples are not routinely confirmed. GC/MS confirmation done only per client request.

METHOD QA/QC Parameters Volatile Petroleum Hydrocarbons (VPH) per Massachusetts Method January 1998 Revision				
MDL Studies	MDL - Annually for soils and water and initially for each new instrument setup or analyst.	MDL<0.3X of PQL	1. Repeat once 2. Correct problem 3. Until successful	Method Detection Limit (MDL) studies are used to verify the ability to measure analyte measurements at the minimum reporting level.
Proof of Competency	Statistical review of method QC data for each analyst.	Data statistically within control limits.	1. Correct method problem 2. Replace analyst	Review of each analyst QC data show them to be skilled competent analysts.
External PE Samples	None	Within interlaboratory control limits	1. Repeat 2. Correct problem	External PE samples are not utilized. Laboratory analyzes internal QC samples as per method.
Control Charting	Annually or as needed	Data statistically within control limits.	1. Correct method problem 2. Adjust control limits 3. Replace analyst	Surrogate, MS, LCBS %recovery, and RPD are done biannually. MS/MSD data not plotted.

ENERGY LABORATORIES, INC. * 1120 S 27th St * PO Box 30916 * Billings, MT 59107-0916
Toll Free 800.735.4489 * 406.252.6325 * FAX 406.252.6069 * eli@energylab.com

METHOD QA/QC PARAMETERS
Extractable Petroleum Hydrocarbons (EPH) per Massachusetts Method
January 1998 Revision

QA SAMPLE/ INDICATOR	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	COMMENTS
Sample Preparation	Methods: Soils: 3550 (30 grams to 1mL) Waters: 3510 or 3520 (1 Liter to 1 mL) 1mL of EPH extraction surrogates added to all samples prior to extraction. 1 ml of EPH separation surrogates added to extract just prior to separation.	Meet all method QC criteria for the matrix.	1) Re-analyze sample	Samples are extracted using Methylene chloride solvent and then the extract is concentrated. Following separation of extract into an aliphatic and aromatic fraction each fraction is independently analyzed by GC/FID. Sample amount and final extract volume may be adjusted based on analyte levels and/or sample matrix.
Fractionation Check	Per each Lot # of Separation Cartridges Used	Effective separation of target analytes into appropriate fraction. R%=40-140 except the more volatile target analytes with >20% recovery.	1. Repeat once 2. Correct problem (adjust elution volumes) 3. Prepare new standards 4. Recalibrate	Uses aliphatic and aromatic hydrocarbon standards in hexane. The more volatile aromatic and aliphatic compounds may have lower recoveries than method specified limits.
Initial Calibration (IC)	5 point initial calibration each for aliphatics and aromatics, external standardization option of method chosen. Aliphatic Standard Solution Aromatic Standard Solution Range: 5,50,200,500,and 1000 ug/mL. To precede sample analyses.	25% RSD MnRF 25%RSD each component.	1. Repeat once 2. Correct problem 3. Prepare new standards 4. Recalibrate	Used to Calibrate instrument, evaluates chromatographic separation effectiveness, and instrument response linearity. .
Chromatography	1) Each IC or CCC- Resolution is verified 2) Retention Time Windows –Use RRT and analyst discretion for instrument stability.	Chromatographic resolution: Monitored against historical performance levels. 50% separation of phenanthrene and anthracene.	1. Repeat once 2. Adjust column conditions 3. Perform instrument maintenance 4. Replace GC column	Verifies that gas chromatographic system is operating properly. Resolution criteria for two selected PAH pairs are not met as per method specifications.
Initial Calibration Verification (ICV)	Follows the IC, using second source calibration standards. DRO standard used to verify aliphatic IC standard and a separate PAH standard is used for aromatics.	+/- 25% of MnRF +/- 25% RF each component	1. Repeat once 2. Prepare fresh standards and reanalyze. 3. Recalibrate and re-analyze all affected samples.	Evaluates accuracy of calibration standards.
Continuing Calibration Check (CCC)	Mid-level standard analyzed every 12 hours and at the end of every analytical sequence	+/- 25% of MnRF +/- 25% RF each component	1. Repeat once 2. Correct problem 3. Re-calibrate and re-analyze all samples since last valid calibration check.	Verifies instrument calibration and stability throughout analyses. No QC criteria for the CC following sample analyses.
Method Blank	Each batch of 20 samples/matrix or when there is a change of reagents, whichever is more frequent.	<½ PQL	1. Repeat analyses once 2. Correct problem 3. Re-extract and re-analyze all samples associated with method blank.	Measures and evaluates possible contamination in reagents and glassware used in method.

ENERGY LABORATORIES, INC. * 1120 S 27th St * PO Box 30916 * Billings, MT 59107-0916
Toll Free 800.735.4489 * 406.252.6325 * FAX 406.252.6069 * eli@energylab.com

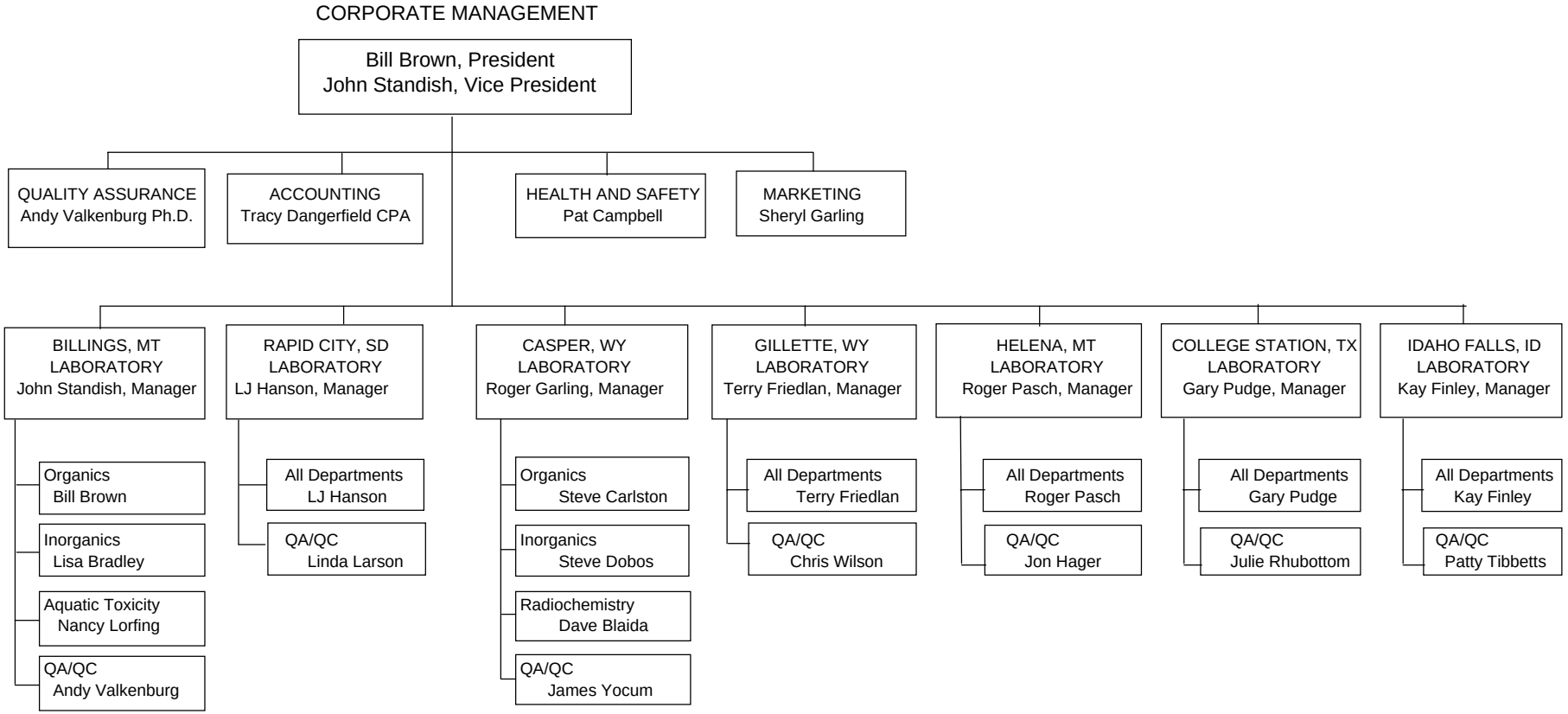
QA SAMPLE/ INDICATOR	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	COMMENTS
Instrument Blank	Each 12 hour sequence or as indicated, such as after a heavily contaminated extract. A method blank analyses can be substituted for an instrument blank.	<½ PQL	1. Repeat analyses once 2. Perform Instrument maintenance 3. Re-analyze all associated samples in sequence where contamination level may affect result.	Measures and evaluates possible contamination in gas chromatographic analysis system.
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	Each batch of 20 samples/matrix or when there is a change of reagents, whichever is more frequent. Fortified with 5 or more representative aliphatic and 5 or more aromatic compounds. Uses a second source standard.	%R = 40-140 except for the more volatile aromatic and aliphatic compounds which may have lower recovery. %RPD = 50% (advisory)	1. Repeat GC analyses 2. Re-extract and reanalyze MS/MSD, (if sufficient sample) or select another sample to MS. 3. Evaluate LFB performance.	Evaluates affect of individual matrix on method performance and method precision. Poor MS/MSD QC performance does not necessarily reject extraction batch group. Control limits are advisory due to sample matrix effects.
Blank Spike (BLKSPK)	Minimum 1/20 samples/matrix and each batch of samples, whichever is more frequent. Same spiking solution as for MS/MSD	%R = 40-140 .	1. Repeat analyses 2. Prepare new standards 3. Recalibrate 4. Re-extract and re-analyze all samples associated with LFB.	Evaluates method accuracy. Used for ongoing proof of competency.
Extraction Surrogates	Added to all samples prior to extraction (including QC). Ortho-Terphenyl (PAH fraction) and 1-Chloro-octadecane (Aliphatic fraction).	%R = 40-140 Control limits are advisory due to possible sample matrix effects.	1. Repeat analyses 2. Evaluate for matrix effects 3. Re-extract samples if method batch performance is suspected.	Evaluates extraction and separation method performance on each individual sample analyzed. Water samples containing sediment may have reduced analyte and surrogate extraction efficiency. Extraction performance alone can be evaluated from an EPH screening result.
Separation Surrogates	Surrogates added to sample extract prior to fractionation. 2-Bromonapthalene and 2-Fluorobiphenyl.	%R = 40-140 in Aromatic fraction. Control limits are advisory due to possible sample matrix effects.	1. Repeat analyses 2. Evaluate for matrix effects 3. Re-extract samples if method batch performance is suspected.	Evaluates the effectiveness of the aliphatic/aromatic separation step. Proportional Level of presence of either surrogate in the aliphatic fraction suggests incomplete separation of the more volatile PAH's from the aliphatic fraction.
EPH Screening	Analyses of extract prior to the separation step of the EPH method.	%R = 40-140 for extraction surrogates. Full EPH recommended if TEH result >0.1mg/L for waters or 50ug/g for soils.	1. Repeat analyses 2. Evaluate for matrix effects 3. Re-extract samples if method batch performance is suspected.	Evaluates method extraction performance on each individual sample analyzed. Target analyte levels in result are used to determine if full EPH analyses is necessary.
PAH Target Analyte Confirmations	Analyses performed by 8270 on Aromatic fraction if PAH target analytes are present above MTDEQ limits.	Meets 8270 analyses criteria	1. Repeat analyses to meet all 8270 method QC criteria	Confirms and accurately quantitates PAH levels in aromatic extract. 8270 method isconsidered less sensitive to false positives than the EPH method..
MDL Studies	MDL – Annually for water and soils and initially for each new instrument setup or analyst.	MDL< PQL	1. Repeat once 2. Correct problem	Evaluates overall method detection limits in clean sample matrix. Actual samples may have higher MDL.
External PE Samples	None	Within specified interlaboratory control limits	1. Repeat 2. Correct problem	External review of analytical method accuracy. See BLKSPK.
Control Charting and Proof of Competency	Annual, statistical review of method QC data for each analyst. or as needed	Data statistically within control limits.	1. Correct method problem 2. Adjust control limits 3. Replace analyst or extractionist	For statistical process control and demonstration of capability for analysts.

APPENDIX D
Organizational Charts

Corporate Organizational Chart
ELI-Billings Organization Chart

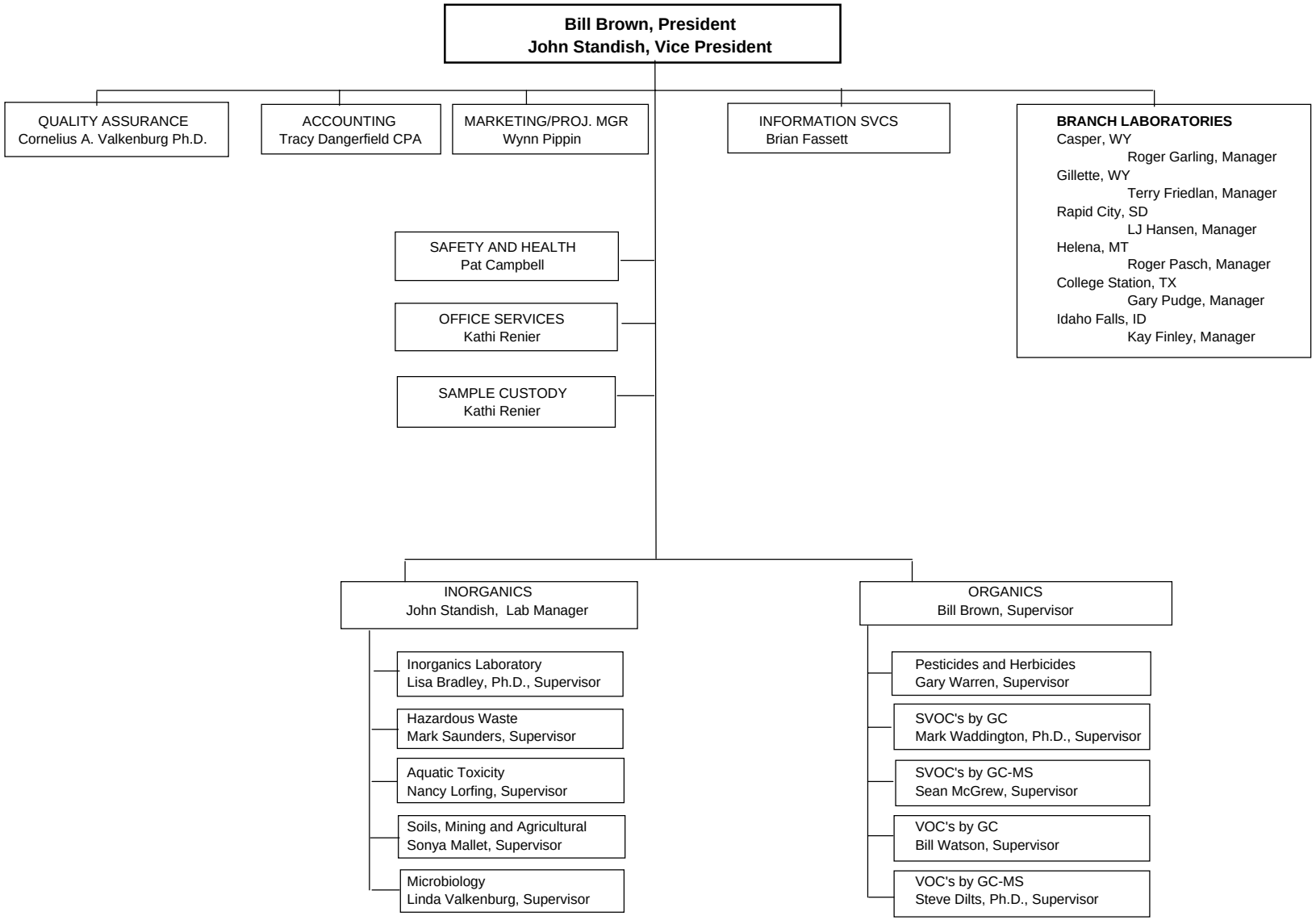
Handout 08B

ENERGY LABORATORIES, INC.
CORPORATE ORGANIZATIONAL CHART



Handout 08B

ENERGY LABORATORIES, INC.
BILLINGS ORGANIZATIONAL CHART



APPENDIX E

Curricula Vitae of Key Laboratory Personnel

WILLIAM T. BROWN

President
Director of Organic Analysis Department

Experienced in laboratory methods development, on-site sampling and analysis, and analytical chemistry.

Education & Academic Training

Bachelor of Science in Fish and Wildlife, Montana State University, Bozeman, MT, Management, 1977

Organic Chemistry and Analytical Instruments, Eastern Montana College, Billings, Montana. 1980

Operation and maintenance of Dionex Ion Chromatograph, Dionex Corporation, 1977.

Modern Techniques in Gas Chromatography, American Chemical Society Short Course, 1988.

Gas Chromatography Mass Spectrometry, American Chemical Society Short Course, 1989.

Finnigan Mat Company Gas Chromatograph Mass Spectrometry Training Course, 1989.

Analysis of Water & Waste Samples by U.S. EPA Methods, American Chemical Society Short Course, 1990.

Professional Experience

1986 to present, President, Chemist - Energy Laboratories, Inc., Billings, Montana. In charge of the development of the trace organics analytical department. Develops test methods, selects equipment, and trains technical staff in the analysis of trace organic compounds in samples of environmental and commercial interest.

1981 - 1987, Manager - Energy Laboratories, Inc., Branch Laboratory, Gillette, Wyoming. Responsible for routine analysis and quality control of water, natural gas, and petroleum products. Involved in field on site sampling and testing, meter calibrations, and supervision of branch laboratory staff.

1979 - 1981, Laboratory Technician - Energy Laboratories, Inc., Billings, Montana. Responsible for the natural gas and petroleum products department of the lab including field natural gas testing. Also involved with various work in water and soil analysis including formal training in ion chromatography.

1977 - 1979, Fisheries Biologist - Water and Forests Department of the Government of Niger, Africa. While in the Peace Corps, responsible for developing fisheries management programs in a specific region including monitoring water quality by on-site testing.

JOHN M. STANDISH

Lab Director/Chief Chemist

Experienced in the examination of many types of environmentally related samples including water, soil, coal, and air pollutants

Education and Academic Training

Bachelor of Science in Biology, College of Great Falls, Great Falls, MT, 1973

Managing the Chemical Analysis Laboratory, 32 hr seminar, 1979

Financial Management of the Closely Held Business, 8 hr seminar, 1985

Hiring and Firing, 8 hr seminar, 1986

MS-DOS Operating Systems, 16 hr class, 1986

Dale Carnegie Training, 14 week training 1986

Taking Control of Your Workday, 8 hr seminar, 1989

Pittsburgh Conference of Analytical Chemistry, 5 day conference, 1989 & 1992

Unix Operating Systems, 24 hr class, 1991

New Sample Preparation Methods for Chemical Analysis, American Chemical Society Short Course, 1992.

Professional Experience

1981 - Present, Chief Chemist - Energy Laboratories, Inc., Billings, Montana. Coordinates laboratory analysis with client contracts. Responsible for direction, training, and supervision of the analytical laboratory staff. Involved in new procedural and equipment development, quality assurance program, client relations, and report preparation.

1974 - 1981, Director of Chemical and Environmental Laboratory - Northern Testing Laboratories, Inc., Billings, Montana. Responsible for personnel training and supervision, laboratory schedules, client relations and analytical methodology development. Chief areas of analysis were soils, water, coal, air pollution, and meteorological monitoring.

Professional Organizations

American Society of Testing and Materials
Montana Mining Association
Montana Geological Society
Northwestern Mining Association

CORNELIUS A. VALKENBURG Ph.D.

Senior Analytical Chemist/Quality Assurance Officer

Education

Ph.D., Analytical Chemistry, Montana State University, Bozeman, Montana, 1987
Bachelor of Arts, Biology with minor in Chemistry, Carroll College, Helena, Montana, 1979
Technical Writing, University of Nevada, Las Vegas, Nevada, 1988
Emergency Medical Training, Hillsboro Medical Hospital, 1981
Mass Spectrometry, Oregon Graduate Center, 1981
Dale Carnegie Management Training, Billings, Montana, 1996
Dale Carnegie Graduate Assistant Training, Billings, Montana 1997

Professional Experience

1992- Present, Analytical Chemist/Quality Assurance Officer - Energy Laboratories, Inc., Billings, Montana. Corporate Quality Assurance Officer responsible for the Quality Assurance monitoring of laboratory operations. Performs method development, prepares and updates standard operating procedures, performs technical training, and involved with special projects. Manages laboratory solvent recycling program.

1989 - 1992, Senior Organic Analytical Chemist - ICF Kaiser Engineers, Las Vegas, Nevada. Provide supervisory and technical support in the design, preparation, analysis, and multi-laboratory certification of analytical method performance evaluation materials used to evaluate current and proposed EPA organic analytical procedures. Also review proposed EPA methods contracts for technical accuracy. Secondary duties as Laboratory Safety Officer.

1987 - 1989, Senior Scientist - Lockheed Engineering and Sciences Company, Environmental Programs (Organic Chemistry Section), Las Vegas, Nevada. Responsible for research and development projects as applied to improved methods for the analysis of EPA priority pollutants. Areas of study include: liquid-liquid extractions, solid-phase extraction, soil leachability modeling (TCLP), chemical derivatives for gas and liquid chromatography, production of performance evaluation materials, gas chromatographic methods, supercritical fluid chromatography and extraction, and laboratory automation.

1981 - 1987, Ph.D. Candidate, Graduate Research, Assistant - Montana State University, Department of Chemistry, Bozeman, Montana. Research in gas chromatographic detector design, modification, and characterization by computer modeling. Teaching of undergraduate laboratories in the areas of inorganic, organic, and analytical chemistry.

1981 - 1981, Research and Development Chemist - Falls Chemicals, Great Falls, Montana. Methods development for the analysis of raw materials and formulated products used or produced by Falls Chemicals. Performed optimization studies for plant chemical processes.

1980 - 1981, Research Technician - Oregon Graduate Center, Beaverton, Oregon. Synthesis and purification of polyamine dueterated analogues for their use as internal standards in mass spectrometry.

1978 - 1979, Field Technician and Student Researcher - State of Montana Water Quality Bureau and Carroll College, Helena, Montana. Evaluate the effects of subsurface drainage on saline seep areas.

Summer 1978, Lab Technician - American Chemet Corporation, East Helena, Montana. Quality control for the manufacture of CuO and CuO_2, and the trace analysis of Pb. Methods used were wet chemistry, electrochemistry, and atomic absorption.

Professional Organizations

American Chemical Society

WYNN PIPPIN

Project Manager

Education

B.S. Microbiology, Agronomy, South Dakota State University, Brookings, South Dakota 1977

B.A. Biology/Chemistry, South Dakota State University, Brookings, South Dakota 1977

Masters credits in Hydrology, University of Wyoming, Laramie, Wyoming 1981-1982

Professional Experience

1997-Present, Project Manager, Energy Laboratories, Inc., Billings, Montana. Duties include Project Management of Safe Drinking Water Act (SDWA), refinery RFI clients and others. Performs data review of technical reports issued to clients. Represents Energy Laboratories, Inc. at various marketing activities.

1989-1997, Project Manager, Inter-Mountain Laboratories, Inc., Bozeman, Montana. Analyzed water and soil samples for VOCs, SVOCs, Pesticides and Herbicides. Supervised laboratory personnel, served as project manager for Safe Drinking Water Act (SDWA), Resource Conservation and Recovery Act (RCRA), mining and refinery clients. Served as Quality Assurance Officer for the laboratory.

1981-1989, Chemist, Wyoming Department of Agriculture, Laramie, Wyoming. Analyzed water, soil, tissue samples for general chemistry, metals, VOCs, pesticides, herbicides, method development for metals in tissue.

1978-1981, Program Director, South Dakota Department of Agriculture, Pierre, South Dakota. Supervised soil/water irrigation compatibility program.

1977-1978, Chemist, Desert Research Institute, Reno, Nevada. Analyzed water samples for anions, perform cation/anion balances, experiment with extraction of U w/resin.

STEPHEN B. DILTS, Ph.D.

Senior Analytical Chemist

Education

Ph.D., Analytical Chemistry, Washington State University, Pullman, WA, 1993
M.S., Analytical Chemistry, Washington State University, Pullman, WA, 1985
B.S., Chemistry, Montana State University, Bozeman, MT, 1981

Professional Experience

1994-Present, Senior Analytical Chemist- Energy Laboratories, Inc., Billings, MT.
Volatile organics GC/MS supervisor and analyst.

1993-1994, Senior Analytical Chemist- Energy Laboratories, Inc., Billings, MT.
Supervisor of the organics extraction laboratory.

1989-1993, Research Assistant- Department of Civil and Environmental Engineering, WSU, Pullman, WA. Performed field research in the analysis of atmospheric organic compounds.

1986-1989, Chemist- Montana Department of Agriculture-Laboratory Bureau, Bozeman, MT. Performed pesticide, hazardous waste and toxicological analysis for regulatory purposes.

1982-1985, Research Assistant- Department of Civil and Environmental Engineering, WSU, Pullman , WA. Performed field research in the analysis of atmospheric sulfur compounds.

1982, Laboratory Technician- Halliburton Services, Inc., Evansville, WY. Performed oil field water, cement, and soils analysis.

Professional Organizations

American Chemical Society

NANCY LORFING

Aquatic Toxicologist/Supervisor

Academic Training

Bachelor of Science, Biology (Chemistry Minor), Eastern Montana College, Billings, MT, 1970

Professional Experience

1992 - Present, Aquatic Toxicologist - Energy Laboratories, Inc., Billings, Montana. Responsible for supervision and management of aquatic toxicology department. Duties include performance of aquatic acute and chronic aquatic toxicity testing using Ceriodaphnia and Pimephales promelas (fathead minnows), field sampling, and client interaction.

1977 - 1992, Orthopedic Technician - Orthopedic Surgeons, P.S.C, Billings, Montana. Physicians assistant responsible for patient medical history screening, minor medical procedures, clerical duties and patient file recordkeeping.

1970 - 1975, Biologist - Montana Fish and Game Department, Billings, Montana. Duties included field work on a 5 year pheasant study and general clerical duties.

TIMOTHY D. BAILEY Ph.D.

Senior Analytical Chemist

Laboratory instrumentation experience working for a commercial laboratory and for a major international chemical producer. Tim is knowledgeable with inductively coupled plasma optical emission (ICP-OES) and mass spectrometer (ICP-MS), and atomic absorption (AA) techniques. He has extensive experience with implementation of EPA Good Laboratory Practices programs, statistical quality management for laboratory analysis, and EPA SW-846, 500, and 600 series analytical methodologies.

Education

Ph.D., Analytical Chemistry, University of Wisconsin-Madison, Madison, Wisconsin, 1989
Bachelor of Arts, Chemistry, Montana State University, Bozeman, Montana, 1980

Professional Experience

1994- Present, Senior Analytical Chemist - Energy Laboratories, Inc., Billings, Montana.

1989-1994, Project Leader/Senior Research Chemist - The Dow Chemical Company, Midland, Michigan.
1988-1989, Graduate Technical Assistant/Chemistry Department Instrument Center - University of Wisconsin-Madison, Madison, Wisconsin.

1984-1988, Graduate Teaching Assistant/Analytical and General Chemistry - University of Wisconsin-Madison, Madison, Wisconsin.

1980-1984, Analytical Chemist - Energy Laboratories, Inc., Billings, Montana.

LISA A. BRADLEY Ph.D.

Senior Analytical Chemist/Supervisor

Experienced in atomic absorption spectroscopy (AA), inductively coupled plasma optical emission (ICP-OES), and mass spectrometry (ICP-MS).

Education

Ph.D., Analytical Chemistry, Indiana University - Bloomington, Indiana, 1995
Bachelor of Science, Chemistry, Montana State University, Bozeman, Montana, 1990

Professional Experience

1996- Present, Supervisor, Analytical Chemist - Energy Laboratories, Inc., Billings, Montana. Supervisors inorganics laboratory. Performs chemical analysis using laboratory instrumentation.

October, 1990-1995, Research Assistant/Department of Chemistry - Indiana University, Bloomington, Indiana.

August, 1990-December, 1992, Associate Instructor of Chemistry - Indiana University, Bloomington, Indiana.

1986-1990, Undergraduate Research Assistant - Montana State University, Bozeman, Montana.

1989, Laboratory Assistant - InterMountain Laboratory, Bozeman, Montana.

NORTHERN ANALYTICAL, INC.

BILLINGS, MONTANA

NORTHERN ANALYTICAL LABORATORIES, INC.

QUALITY ASSURANCE MANUAL
for the
CHEMICAL and INDUSTRIAL HYGIENE LABORATORY

NORTHERN
Analytical Laboratories, Inc.

602 South 25th Street
P O Box 30315
Billings, MT 59107
Telephone: (406) 254-7226
Fax: (406) 254-1389
email: nlabs@wtp.net

QUALITY ASSURANCE MANUAL
NORTHERN ANALYTICAL LABORATORIES, INC.

Analytical Services
Chemistry and Industrial Hygiene Laboratory
Billings, Montana

Prepared by:

1/28/02 Laboratory Manager

1-28-02 Quality Assurance Coordinator

Date: January, 2002

typing/docs/QA Manual Jan2002 rev.doc

TABLE OF CONTENTS

1.0 PURPOSE

The purpose of this manual is to provide written policies and procedures for testing services provided by Northern Analytical Laboratories, Inc., an analytical services laboratory located in Billings, Montana. These written policies and procedures communicate the standards of performance expected within our organization to all our employees and interested clients. Our quality assurance system addresses personnel, equipment, facilities, testing and supervision. A quality control coordinator has been designated to monitor the program and report discrepancies to the Laboratory Manager. This quality assurance plan serves as a basis for conformance audits by our clients, federal agencies, and certification organizations.

2.0 OBJECTIVES

It is our objective to document the quality of the data generated by our testing services, and thus to maintain a reputation of quality service, including timely, and within budget expectations. We intend to meet these objectives by charging a reasonable fee to our clients and by making a profit for the owners of Northern Analytical Laboratories, Inc.

Specific objectives of our standards of performance are as follows:

- To develop, implement, review, and update laboratory practices and routine methodologies. This will encompass, among other things, analytical procedures, sample preparation, and personnel training.

- To monitor and take corrective action as required, to maintain a performance level consistent with our guidelines, client needs, and/or regulatory agency requirements.

- To utilize personnel who are trained for the tasks assigned and to provide the supervision and expertise to assure that the analysis complies with standard procedures and recognized chemical laboratory techniques.

- To inventory, maintain, and calibrate testing equipment used in our business. To purchase supplies and services that provide us with the ability to maintain our testing objectives.

- To review all laboratory data to assure it meets our quality requirements before results are given to the client.

- To participate in performance evaluation studies, inter-laboratory and other round robin evaluation programs in order to monitor the consistency and level of quality within the chemical laboratory.

3.0 ORGANIZATION

3.1 Laboratory History

Northern Engineering and Testing, Inc. was founded in 1958. In 1987 Northern Engineering and the Denver based firm, Chen and Associates, were acquired by Huntingdon International Holdings (HIH). The two firms were merged in 1988 to form Chen-Northern, Inc. In 1993 HIH consolidated all of their United States holdings into one corporate structure, Huntingdon Engineering and Environmental, Inc. In May, 1995 Huntingdon Engineering and Environmental was purchased by Maxim Technologies headquartered in Dallas, Texas. On August 4, 1999 Northern Analytical Laboratories, Inc. purchased the Billings, Montana chemistry laboratory from Maxim Technologies.

3.2 Operations

The services provided by the chemical laboratory include drinking water, water and wastewater, soil, and solid waste analysis. Air quality, industrial hygiene, asbestos identification, and mining related soils analysis is also performed.

As our clients require testing and/or the analysis of materials outside our areas of expertise, we will employ qualified laboratories or consultants who have demonstrated expertise and qualifications consistent with the quality of service precepts of Northern Analytical Laboratories, Inc.

3.3 Organizational Structure

The responsibilities and authority of the individual positions in the laboratory are described in the following sections. The organizational structure of Northern Analytical Laboratories, Inc. is in diagram form in Figure 3-1.

3.3.1 Laboratory Manager

The laboratory manager is responsible for the overall supervision of laboratory personnel, policies, and procedures. The laboratory manager's responsibilities include:

- Personnel supervision for timeliness, productivity, and performance of appropriate activity. This includes compliance to quality assurance and safety policies.
- Scheduling of testing and services to meet EPA holding times and client expectations in a timely and efficient manner and to meet Northern profit goals.
- Implementation of corrective actions when nonconforming work is identified. This includes assignment of necessary actions to analytical group leaders, quality assurance staff, or project management staff.
- Cost control for supplies, labor, and equipment.

- Review of laboratory capabilities for proper use of equipment and methods, use of equipment to its full potential, and limitations in capabilities of methods and equipment. Approval of use of new methods, techniques and equipment after development of such by the lab staff.
- Review of laboratory quality system to maintain quality policies to the standards required by our accrediting bodies including ISO 17025 criteria, EPA's Drinking Policies for Certification of Drinking Water Laboratories, NIST Handbook 150 and AIHA Laboratory Quality Assurance Program Policies.
- Management support to maintain employee moral, client support, and client and employee confidence in management.
- Client communications, including timely response to client requests, timely reporting of laboratory results, professional communication in both written and verbal form.
- Price/fee determinations, including quotations of fees to clients, fair and equal fee administration, and fee determination based on fair profit expectations.

3.3.2 Quality Assurance Coordinator (QAC)

The QAC is responsible to the laboratory manager for the oversight and implementation of the quality assurance program as outlined in this manual. The QAC's duties include:

- Daily review of work performed by the laboratory analysts
- Identifying and responding to QA needs, resolving problems, initiating corrective actions, and answering requests for guidance or assistance
- Overseeing proficiency testing for laboratory accreditations and coordinating on-site inspections
- Perform internal audits as deemed necessary by the QAC or the laboratory manager and submit a written report to the laboratory manager
- Establish quality control acceptance criteria through statistical manipulation of quality control data or as required by the analytical method
- Provide oversight and maintenance of the Standard Operating Procedures

3.3.3 Group Leaders

Group leaders are assigned as technical and scheduling experts for each group of similar methods, instruments or analyte types. Typically, a group leader is assigned to each of the following groups.

Metals analysis

Inorganics analysis

Organics analysis

The authorities and responsibilities of the group leader include but are not limited to:

- Scheduling of tests to achieve valid analyses within appropriate holding times
- Review analyses performed by members of the group for appropriateness, calculation verification, compliance to quality assurance program
- Scheduling of analysts to achieve productive use of all staff members
- Develop and implement new techniques, methods or instruments for approval by the lab manager for use by the lab staff

3.3.4 Chemists

Chemists are assigned sample preparation and analysis duties based on their education, experience and training. Typically, staff members assigned as chemists have bachelors degrees in chemistry, biology or other related scientific field. While not responsible for supervising others, they are assigned to train coworkers.

3.3.5 Laboratory Technicians

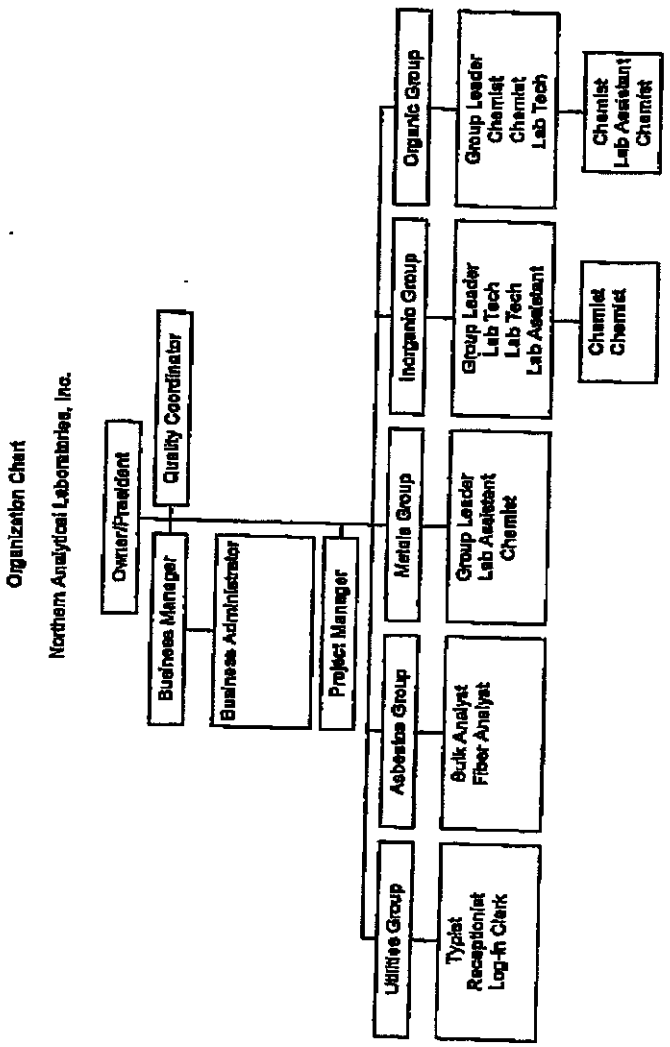
Staff assigned as laboratory technicians are assigned sample preparation and analysis duties based on their education, experience and training. Minimum education requirements vary but personnel must have education or experience that provides them with adequate knowledge to perform quantitative analysis under the supervision of a chemist.

3.3.6 Utility Staff

This title includes staff members assigned as laboratory assistants, log-in clerks and typists. A high school education is required for this position. Personnel are assigned work at the direction of a group leader or manager.

Figure 3-1

Organizational Structure



4.0 FACILITIES

The laboratory has a total of 5000 square feet of floor space assigned to laboratory service. An additional area of 1500 square feet is used for support staff and functions such as lunchroom and mail processing. Figure 4-1 shows the layout of the laboratory, including labeled areas for specific laboratory analysis. A floor plan is not provided for the support space.

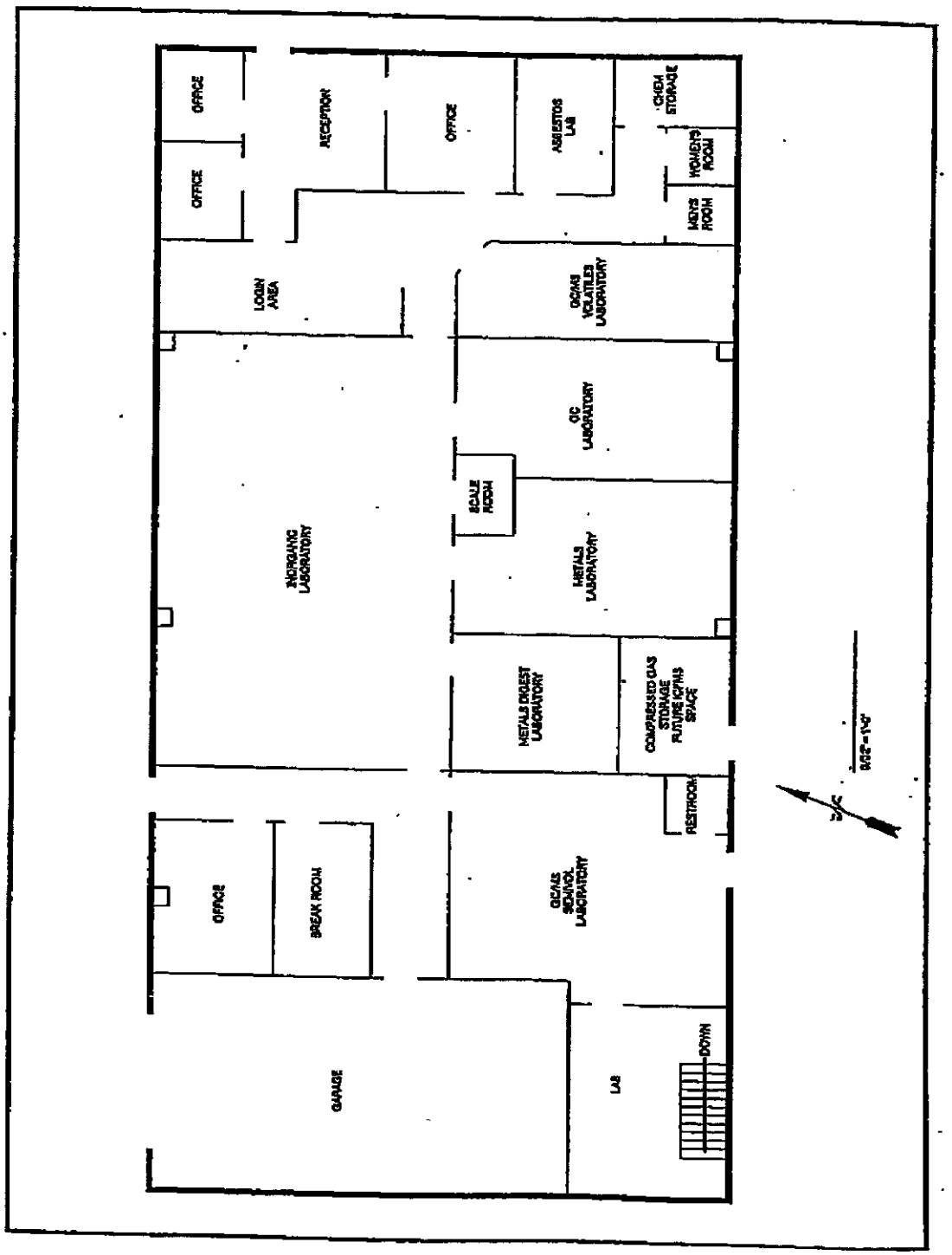
The air quality of the laboratory is controlled by the use of ventilation. The laboratory is equipped with three forced air heating systems. Air conditioning is also provided by three central units. In addition a make up air unit with heating and cooling capabilities can be turned on when additional air flow is needed. Seven fume hoods having face velocities of 80-100 feet per minute provide exhaust ventilation of noxious fumes to maintain air quality. There are also canopy fume hoods for general elimination of hazardous and noxious vapors from the Atomic Absorption and Inductively Coupled Plasma Units.

Sample refrigeration is provided by four large commercial refrigeration units and one small refrigerator. In addition four refrigerator/freezers provide storage of standards and organic extracts. The temperature of all coolers is monitored daily and kept within a range of 2 to 6 degrees centigrade.

Deionized water is provided by a Millipore reverse osmosis system. Type II reagent grade water is produced by passing tap water through the reverse osmosis system and Barnstead polishing cartridges. Type I water is produced by passing the Type II water through a Millipore Super Q four bed system. Water used for organic analysis is prepared by passing Type II water through a charcoal bed or is obtained from a private well which has been demonstrated to be free of the analytes for which we test.

Figure 4-1

Laboratory Floor Plan



5.0 RECORDKEEPING, CHAIN OF CUSTODY, DOCUMENT CONTROL

Records are maintained in the chemical laboratory which establish the chain of custody, identify the sample, request the prescribed analysis, document the analysis, and document the report. Records are also maintained on personnel qualifications, equipment status, and quality control reports.

5.1 Chain of Custody

Upon receipt of samples in the laboratory, they are forwarded to the laboratory manager's representative in the sample log-in area. The condition of the samples upon receipt at the laboratory is recorded on the Sample Receipt Checklist (Figure 5-1). A copy of this checklist is included with the final report. For environmental samples, the temperature of the shipping container is recorded. The shipping container (ie: cooler, box, mailer, etc) is unpacked and the identifications on the samples compared against the chain of custody. The chain of custody is signed by the manager's representative. The date and time of receipt are recorded. If delivered by common carrier, the carriers name is recorded. Any identity deviations are noted on the chain of custody. Also noted are samples listed but not received or samples received that are not listed.

The pH of the preserved environmental samples is checked with wide range pH paper and additional preservative added if necessary. The pH of VOA vials, DRO, EPH, 418.1, and Oil and Grease samples are checked at the time of analysis.

For air samples collected on filters or sorbent tubes, the condition of each sample is examined. Factors that affect validity include cassette or tube condition, presence of the sealing plugs, unreadable identifications, and contaminated outside containers. Inspections for punctures, tears, wetness, particulate loading or other factors that may affect sample validity are made by the analyst. Notes of these factors shall be made on the sample analysis sheet or Sample Receipt Checklist and the written report to the client.

For asbestos identification in bulk samples each sample shall be examined at the time of log-in for factors that affects its validity. Notes of these factors shall be made on the Sample Receipt Checklist, and include integrity of the sample container and contamination on the outside of the samples. Sample acceptance/rejection shall be determined by the analyst based on these factors and sample size or wetness which might have effected discreet layer sizes. The analyst shall complete the

Sample Receipt Checklist item #9 or the "Comments" section to note if the sample is inappropriate for analysis.

Clients are contacted by phone or facsimile message when it is determined that the condition of their samples upon receipt jeopardizes the validity of the samples.

A three part chain of custody is used (Figure 5-2). The original is kept in the laboratory with the sample work order. The pink carbon is kept by the client, the yellow carbon is sent back to the client as an acknowledgement of sample receipt. A copy of the chain of custody is included with the final report to the client.

5.2 Sample Log-in

The project information accompanying the samples is recorded on a sample log sheet and is assigned an order number. The order laboratory number is recorded on the chain of custody and written on every sample container along with a fraction code. The fraction code is a letter or letter(s) and number to designate the type of sample, the container and preservative used for that aliquot of sample. A list of fraction codes is posted in log in section of the laboratory.

Before distribution of the samples to the laboratory, the laboratory numbers written on the sample bottles are checked against the chain of custody and sample log sheet by a second person. The sample identification information is then entered into the laboratory information management system (LIMS): client identification; project number; sample identity; date received; date and time collected; and samplers name. The requested tests are then assigned to that sample.

A work order is then printed which lists the entered information listed above, and the tests assigned to each sample. The work order copy is posted in the laboratory with any packing slips, purchase orders, chain of custodies or letters of transmittal that accompanied the sample upon delivery. The requested tests and holding time expiration (if applicable) are then recorded on the appropriate tracking charts. Charts are located in the inorganic, metals, organic, and GC/MS laboratories. Samples are stored in the laboratory under conditions specified by the method or the SOP until the test has been performed in a satisfactory manner. The samples are then stored for a minimum of thirty days after the report has been sent to the client in a sample archive area which is maintained at room temperature and indoor environmental conditions. The sample is then either disposed in

accordance with environmental regulations for solid wastes or returned to the client. Samples will be retained for longer than thirty days if requested by the client in writing.

5.3 Document Control

In order to maintain consistency in our work, our laboratory management provides for the control of all documents that are recognized as having a significant effect on our work. The following document types are controlled for use by our laboratory quality policy. Details of the policies are described herein.

Quality System documentation (5.3.1)
Test methods (5.3.2)
Standard operating procedures (5.3.3)
Regulations which affect analysis (5.3.4)
Equipment manuals (5.3.5)
Software (5.3.6)
Laboratory analysis (5.3.7)
Reports of analysis (5.3.8)
Test requests from clients (5.3.9)
Contracts with clients (5.3.10)
Supporting QA documents (5.3.11)

5.3.1 Document Control for Quality System Documents

Quality system documents are defined as documents that define procedures and policies used to ensure the generation of analytical results of acceptable quality. Examples of quality system documents are this manual, SOPs, precision and accuracy critera, and memos that institute new, or clarify existing quality system guidelines. This QA manual and SOPs are controlled documents for which distribution lists are kept. When other quality system documents are distributed the document is dated, initialed, and given an effective date. The analyst intials are obtained on the QACs copy of the document indicating the document was received and, where applicable, that old copies of the document are to be discarded.

5.3.2 Document Control for Test Methods

Test methods used by this laboratory are taken from published sources which are directly related to the client's need for testing. Sources such as the American Society for Testing and Materials (ASTM), the United States Code of Federal Regulations (CFR), the

Environmental Protection Agency (EPA), the National Institute of Occupational Safety and Health (NIOSH) and others are used for test methods. Written copies of methods from these sources are maintained by the quality assurance coordinator. When tests are performed by the laboratory, our standard operating procedures (SOP) are used. If an SOP is not available, the analyst obtains a copy of the reference method from the quality assurance coordinator. When writing SOPs or performing tests for which an SOP is not a available, the analyst is referred to Table 11-1 of this manual. This table directs the analyst to the appropriate method to use based on the type of sample to be analyzed. Sample types include drinking water, wastewater and solid waste.

5.3.3 Document Control of Standard Operating Procedures (SOPs)

Standard operating procedures are written for commonly used methods performed by our laboratory. These are written and revised in accordance with our SOP for writing and revising SOPs. SOPs are distributed by the QAC. A central file copy of original current revisions of SOPs is maintained by the QAC and kept in the QAC office. Outdated SOP revisions are maintained by the QAC in a separate file. Three controlled laboratory copies of the SOP manuals are maintained by the QAC and are available to laboratory personnel. A SOP distribution list is maintained by the QAC. Controlled SOP copies are distributed to the three lab copies and uncontrolled copies are distributed to the appropriate lab analysts. The SOP table of contents, maintained by the QAC, lists all current revisions of the SOPs. Each SOP is assigned a revision number that denotes the number of revisions of the SOP and the month and year of the revision. For example, the second revision of a SOP completed in August of 2001 would be assigned the revision number 02-0801.

5.3.4 Document Control for Regulations

Regulations which effect the production of our test results are tracked by the laboratory manager. On an annual basis, review of the following regulations are made to determine if our laboratory methods are in compliance with current state or federal regulations.

40 CFR Part 136 for wastewater analysis

29 CFR Part 1910.1000 Table Z for breathing zone contaminants

40 CFR Part 141 for drinking water

40 CFR Part 261 for solid waste analysis

5.3.5 Document Control for Equipment Manuals

Operators manuals are obtained (when published by the manufacturer) with all equipment purchased for use in the laboratory. These manuals are stored in two ways. For key instrumentation like gas chromatographs, inductively coupled plasma spectrometers, microscopes, block digestors and other devices; the operators manuals are located in the laboratory with the instrument. These are typically dated when received with the instrument and are available for use by the operator at all times. For other instruments and machines such as processing equipment, an alphabetical file of operations manuals is kept by the file clerk. This is located in the reception area and each analyst is advised of its location. Analysts are advised to obtain the manual from the file when they need to refer to it then return it to the file clerk for filing when they are finished with the manual.

5.3.6 Document Control of Software

Software used in our laboratory typically serves one or more of the following four operational functions. Examples of each type are listed with the functions. A complete list of software with version numbers is provided in our equipment list.

Word processing-Microsoft WORD or Microsoft WORKS

Calculation-Microsoft EXCEL, Microsoft WORKS or Lotus 1-2-3

Instrument operation-Hewlett Packard Chemstation, Perkin Elmer Elan, Astoria Pacific FASTPAC, Thermo Jarrell Ash ThermoSpec.

Data management-Visual LabPro by Prism, Inc.

The following steps are taken to provide for the integrity of data produced by or stored by software in this laboratory.

- Electronic spreadsheets are prepared for use then checked using several scenarios of entries to check mathematical correctness and to verify the calculated results represent the true test results. The applicable cells are then locked by the electronic spreadsheet and password protected by the quality assurance coordinator. Changes in the spreadsheets are made only by the quality assurance coordinator and then are rechecked using this process. The approved spreadsheets are dated and initialed by the quality assurance coordinator.
- Vendor software such as Hewlett Packard's Chemstation software or Perkin Elmer's Elan software is used without modification by the laboratory.

- Calculations made in LabPro or Visual LabPro are prepared by an analyst and checked by the group leader. A record of their verification is stored in the raw data log books. Changes to these calculations require a second review and approval.

5.3.7 Document Control of Laboratory Analysis

Laboratory analysis is documented in one of six ways.

1. The data is written in a bound paginated laboratory notebook.

   Laboratory notebooks in use in the laboratory are bound and paginated either by the manufacturer or are bound and paginated by our utility staff and sealed for use by the quality assurance coordinator. Record sheets in method specific formats for data record keeping are designed and approved for use by the QAC or lab management. These record sheets are paginated and bound into sets of one hundred pages. The QAC applies a custody seal prior to distribution for use in the laboratory.
2. Instrument printouts are used for GC, GC/MS, ICP, ICP/MS and auto analyzer data. Bound and paginated run logs are maintained for these instruments where applicable. Current auto analyzer instrument printouts are stored in a labeled three ring binder. When the binder has been filled the printouts are removed, page number stamped, bound, and a custody seal applied to the bound notebook. GC, GCMS, ICP and ICPMS instrument printouts attached to the work order or stored in labeled file boxes.
3. Raw data is recorded directly in the LIMS as it is generated. The LIMS then calculates and posts the results. An analytical report of the raw data and final calculated result is then printed. Current data is stored in a labeled three ring binder. When the binder as been filled the printouts are removed, page number stamped, bound and a custody seal applied to the bound notebook.
4. Raw data from laboratory notebooks and/or instrument printouts is entered into laboratory approved spreadsheets for calculation of final results and posting of the spreadsheet results to the LIMS. The spreadsheets are printed and attached to the work order or attached to the associated raw data.
5. Fiber count data is entered into a electronic spreadsheet and printed. The individual spreadsheets are then bound and page numbered in sets of 100 pages. A custody seal is applied to the bound data.
6. Bulk asbestos data is recorded on previously numbered recordsheets. The completed recordsheets are then bound in sets of 100 pages and a custody seal applied to the bound data.

Notebook pages, record sheets and instrument printouts are initialed and dated by the analyst. Manual calculations are checked by a second analyst. Data entries into electronic spreadsheets are checked by a second analyst.

Upon completion of the analysis, the test results are recorded on the work order or the instrument printouts or spreadsheets are attached to the work order. The data is then entered in the LIMS. GC, GC/MS, and auto analyzer data is directly downloaded into LIMS from the instrument. Raw data that is recorded into and calculated by LIMS is posted. All other results are entered into LIMS by data entry personnel from instrument printouts or the laboratory notebook.

Laboratory analysis data are stored in our file archive by data or instrument type in sequential order by date for five years, ten years for environmental lead data, after the data is produced unless other arrangements are made by the client. The file archive is reviewed on a semiannual basis and records are disposed at the direction of the laboratory manager. Raw data records are disposed directly to the solid waste dumpster for disposal at the local sanitary landfill.

While electronic records are kept for gas chromatography analyses, these records are not used by the laboratory as the source of the data which was reported to the client. Use of these electronic records is only allowed at the direction of the lab management. Then, review of the storage conditions of the records is made by the manager, quality assurance coordinator and the analyst to verify that subsequent analytical determinations made from the data are appropriate for client use.

5.3.8 Document Control of Reports of Analysis

Upon completion of all requested analysis, the data produced by the laboratory is summarized in report form by the LIMS or by a word processor. The data on the printed report is compared to the instrument data, the manual entries made on the work order or the record sheets. Discrepancies are resolved by the reviewer by obtaining the instrument log and raw data and identifying the valid test result. Any required edits are noted and the edits made in the LIMS or in the word processed document by word processing personnel. The edited report is then reviewed and signed by the laboratory manager or representative. As a result of this process, each report is reviewed by two different authorized reviewers or, if the

report consists of routine analytes and samples it may be reviewed twice by the same reviewer. For bulk asbestos analysis and fiber counts by NIOSH Method 7400, the analyst is one of the reviewers. For bulk asbestos reports, only signatories approved by NVLAP are allowed to routinely review and sign reports.

The laboratory report produced by this laboratory consists of a case narrative, pages containing sample results and quality control sample results and applicable attachments such as sample receipt checklists and chain of custodies. The case narrative contains the following information.

identity of the client that is responsible for the samples
client job number
date the report is prepared
source of the samples by project name or number
signature by an approved signatory with typed name and title
total number of pages in the report
attachments
identity of others who receive copies of the report

The narrative will identify the source of the methods used for our testing, define qualifies which would limit the use of the data and describe the contents of the report. For samples applicable to our AIHA accreditation, the presence of field blanks will be noted with a description as to how the blank results were applied to the sample results. Should the report be revised, the revision date will be clearly noted in the top right corner of the case narrative and will contain a description of the changes made to the report.

The results of our analysis will follow on subsequent, numbered report pages. Reports for samples relating to our NVLAP and AIHA accreditations will be numbered using the page number and total number of pages on each page. The project data provided for each sample will consist of sample description, laboratory number, matrix, date collected and sample collector's identity. Analytical results will be documented by analyte name, measured value, statistical variation of the measured value if applicable, units, method code and date analyzed. For industrial hygiene samples, the limit of quantitation will be provided with the results or on the case narrative. Data qualifiers will be provided through the use of footnotes

or lettered designations whose definitions are spelled out in the case narrative. Results of quality control tests may be provided, their inclusion will be based on client needs.

When multiple report copies are requested or when a copy of a previously published report is requested by a client, only paper copies of final reports are reproduced for client use. If a paper report cannot be located, the report preparation and review process is repeated as described previously to verify all data on the final report. The report is reviewed and signed as if it were produced for the first time. Electronically stored final reports are not reproduced for client use without undergoing the complete review process described above.

The original signed report is mailed to the client with copies of attachments which usually consist of the chain of custody and the sample receipt checklist. A copy of the report, the work order, and all accompanying attachments are placed in the project file. Project files are numbered using a two digit number signifying the year the client first requested work to be performed by the lab. A three digit number follows which is assigned consecutively throughout the year by the utility staff. An additional two digit suffix may be applied when a particular client has two addresses for receipt of reports or multiple projects which may be more readily filed separately. Current files are stored in file cabinets in the file room near the reception area. Due to limited space, aged files are stored in file boxes by client number in the file archive area which is located inside the confines of our laboratory building. Each report is retained for ten years, unless otherwise required by regulation or mutual agreement with our client. The file archive is reviewed semiannually and aged records are disposed directly to the sanitary landfill to protect the client information contained therein. All disposal of final reports is performed at the direction of the laboratory manager.

5.3.9 Documentation of Test Requests and Client Communications

Requests for testing should be received in writing from the authorized representative of the entity paying for the laboratory services. Typically, test requests are made on chain of custody documents, letters of transmittal, purchase orders or in written contracts. These are stored with the laboratory data in the client file for the period of storage specified for the raw data. Verbal test requests or changes in test requests made verbally by authorized client representatives are recorded on the chain of custody or the work order by the person receiving the request from the client. The request is documented in writing with the name of the client representative, the initials of our employee receiving the request and the date the

request was made. Efforts by our staff will be made to substantiate the validity of the request if the request is made by someone other than the sample collection agent or the person to whom the report is to be directed.

Other communication from clients which relate to the performance of the tests will be recorded with date and initials on the work order. Complaints regarding data or other aspects of the testing will be recorded and placed in the file with the work order and report. The laboratory manager will be notified of the complaint and the resolution of the problem. A file of customer complaints will be kept in the manager's possession in order that trends and frequency of complaints can be evaluated.

5.3.10 Document Control of Contracts

Contracts made with our clients are kept in a central file in the business office. The applicable scope of work, accompanying quality assurance plan or test request is provided to the laboratory at the time of sample log-in. References to the contract are made in the laboratory report if appropriate and on the final invoice. Contracts are disposed after five years from the date the contract has been satisfied. When a contract has not been formally entered into with a particular client, a statement of understanding is delivered to the client upon receipt of samples. This statement is mailed with the sample receipt checklist and the chain of custody if the sample is delivered by courier. When samples are hand delivered, a copy of the statement is given to the person delivering the samples.

5.3.11 Supporting Quality Assurance Documentation

Additional documentation is maintained to insure that this laboratory meets overall quality standards.

1. Personnel qualifications - Employee resumes are maintained on file as well as training files for each employee.
2. Equipment operation and maintenance – A list of approved operators is maintained for each instrument used to produce analytical results. Maintenance logs are kept for each major analytical instrument.
3. Corrective action reports and analytical non-conformance reports - A corrective action report system is maintained by the QAC.

The documentation maintained by this laboratory is extensive and not limited to that mentioned above.

Figure 5-1

Sample Receipt Checklist

NORTHERN Analytical Laboratories, Inc.

SAMPLE RECEIPT CHECKLIST

Dear Valued Client: This checklist documents the condition of your sample(s) as it (they) arrived at our lab. Please review it and familiarize yourself with its contents. Should you have any questions or comments, please contact us. Thank you for your use of our services.

Client Name _____ Date/Time Received _____ Date / Time

Project _____ Received by _____

Laboratory Number(s) _____ Carrier Name _____

Checklist Completed by _____ Initials / Date Sample Type _____

	YES	NO		YES	NO
1. Shipping container in good condition?	___	___	14. pH check performed by: _____		
2. Custody seals present on shipping container? Condition: Intact ___ Broken ___	___	___	15. Metals bottle(s) pH <2?	___	___
3. Chain of custody present?	___	___	16. Nutrient bottle(s) pH <2?	___	___
4. Chain of custody signed when relinquished and received?	___	___	17. Cyanide bottle(s) pH >12?	___	___
5. Chain of custody agrees with sample labels?	___	___	18. Sulfide bottle(s) pH >9?	___	___
6. Custody seals on sample bottles? Condition: Intact ___ Broken ___	___	___	19. TOC bottle(s) pH <2?	___	___
7. Samples in proper container/bottle?*	___	___	20. Phenolics bottle(s) pH <2?	___	___
8. Sample containers intact?*	___	___	21. Oil & grease bottle(s) pH <2? (checked by analyst)	___	___
9. Sufficient sample volume for indicated test?*	___	___	22. DRO/418.1 bottle(s) pH <2? (checked by analyst)	___	___
10. Ice/Frozen Blue Ice present in shipping container? (circle one) container temperature 1.___ 2.___ 3.___ * (if <0 or>10)	___	___	23. Volatiles (VOA) pH <2? (VOA pH checked by analyst)	___	___
			24. Herbicides (515) pH <2? (checked by analyst)	___	___
			25. Semivolatiles (525) pH <2? (checked by analyst)	___	___
11. All samples rec'd within holding time?*	___	___	26. Client contacted?	___	___
12. VOA vials have zero headspace? * (if contains >5mm headspace)	___	___	27. Person contacted	_____	
13. Trip Blank received?	___	___	28. Date contacted	_____	

NOTES: Samples may be affected when not transported at the temperature recommended by the EPA for the test you've selected. Please contact the lab if you have concerns about the temperature of your samples.

* Critical item - If marked "NO" contact lab manager.

COMMENTS: _____

Figure 5-2

Chain of Custody

CHAIN OF CUSTODY RECORD

NORTHERN
Analytical Laboratories, Inc.

602 South 25th Street
Billings, Montana 59101
Ph: 406-254-7226 • Fax: 406-254-1389

Project or Site Name

Project Number

Sampler Name (Printed)

Contact Name

Report to (Firm or Agency)

Address

City State Zip

Phone Fax

DATE COLLECTED	TIME COLLECTED	SAMPLE LOCATION OR DESCRIPTION	COMP OR GRAB	SAMPLE MATRIX	NO. OF CONTAINERS	ANALYSIS REQUIRED	NOTES	LAB NUMBER
Relinquished by:		Date	Time	Received by:				
Relinquished by:		Date	Time	Received by:				
Relinquished by:		Date	Time	Received by:				

6.0 QUALITY CONTROL POLICIES

Policies which are implemented by the chemical laboratory to achieve and support the quality objectives are listed in this section. A flow diagram (Figure 6-1), indicates the quality control routine used by this laboratory. This flow diagram governs the actions of the chemists and technicians as they analyze samples for any parameter.

To verify, control, and demonstrate capability as an analytical laboratory, Northern Analytical Laboratories, Inc. subscribes to and participates in the following quality audit programs (See section 15.0):

- Water Supply Performance Evaluation (WS) - Semiannually
- AIHA - PAT program - Quarterly
- AIHA - ELPAT program - Quarterly
- NIST - Asbestos Identification audit - Semiannually

6.1 Documentation / Data Handling / Data Validation

Many of our documentation and data handling policies have already been discussed in Section 5.

Complete and current analytical methods and instrument operating instructions are made available to laboratory personnel. This includes standard operating procedures written specifically for our equipment and methods of analysis.

Administrative and technical review of laboratory reports and records to assure validity and uniformity is provided by the QAC, the analyst generating the data, and the laboratory manager.

Raw data such as tare weights, titration volumes, absorbencies, peak heights, etc. are recorded in the laboratory notebook or entered directly into the LIMS at the time it is generated. Under no circumstances shall data be recorded on a separate sheet of paper for later entry into the LIMS or lab notebooks. Dates, the technician's initials, and method code are recorded in the laboratory notebooks, instrument printouts, and LIMS reports. Notes of unusual circumstances or special sample treatments are to be recorded.

Raw data shall be converted to concentration units by using the calculations given in the appropriate method. Deviations from this are recorded. Data necessary to calculate and verify the data shall be recorded. This includes normalities, dilutions, spiked concentrations, expected spike and control sample results, and percent recoveries. Any data generated is to be calculated. Calculations must be checked by a second analyst or by computer calculation and this check noted along with the analysts initials and date.

6.2 Calibration

Analytical instruments are calibrated at regular intervals as recommended by the manufacturer and as required by the method. Calibration of all equipment used, and documentation of the calibration, will be performed by the analysts or by an independent calibration firm. Refer to the appropriate standard operating procedure or method for specific step by step instructions. The calibration documentation is kept on file in the chemical laboratory.

Analytical standard preparations are recorded in a standard preparation log book and each standard assigned a unique identifying number. Standard solutions are labeled with the standard prep number, date prepared, date expires, concentration and analyst. The standard number is referenced in the laboratory notebooks so that all standards may be traced back to their original source. Analytical standards are traceable to a primary standard as defined by the American Chemical Society and/or to the National Institute of Standards and Technology (NIST). Certificates of analysis received with purchased standards are placed in a central file maintained by the laboratory file clerk.

Calibrations consist of a minimum of three standards and a blank. The analyst should be aware that some analytical methods require calibration with more than three standards or do not require a blank standard in the calibration. Method requirements supersede this document. The calibration is verified by the analysis of a calibration check standard. Where allowable, it is advisable to prepare the check standard from a source separate from the calibration standards. The analyst is advised to refer to the method or standard operating procedure for calibration verification standard source requirements. The calibration is verified by the analysis of the check standard at a minimum of every twenty samples. The analyst is advised to refer to the method or standard operating procedure, as some analytical methods require the check standard to be analyzed more often. Method requirements supersede this QA manual. When sample concentrations exceed the calibrated range or linear range of the instrument, the sample shall be diluted and reanalyzed.

Instruments and anciliary equipment, such as microscopes, analytical balances, pH meters and conductivity meters, are calibrated, or the calibration checked, according to the manufacturers instructions or the appropriate standard operating procedures.

6.3 Analytical Quality Control Requirements

This section will present the general quality control policies used by the laboratory to evaluate the data produced by the laboratory. Each method and/or standard operating procedure specifies the type and frequency of quality controls to be performed. The method and standard operating procedure supersedes this document as to the quality control requirements. The quality control acceptance criteria for accuracy, precision, and surrogate recovery is given in the tables at the end of this section.

- Blanks - System contamination introduced by reagents, glassware, etc. is monitored by the analysis of a reagent blank. At least one reagent blank is run with every batch of up to twenty samples to be analyzed. The reagent blank is taken through the entire analytical process. A calibration blank shall be analyzed at the beginning of each analytical run and at a minimum of every twenty samples thereafter. Detection of an analyte in a blank is to be evaluated and corrective action taken as necessary. Refer to the appropriate method, or standard operating procedure, for blank acceptance criteria.

- Matrix spike - Matrix spikes are used to access accuracy and evaluate sample matrix interferences. A matrix spike is performed on ten percent of samples analyzed. The matrix spike is taken through the entire analytical process. When applicable, bench spikes (post digestion) may be performed. The matrix spike acceptance criteria is generated using data produced in our laboratory or specified by the method. The matrix spike recovery acceptance limits are given in the Accuracy and Precision Report at the end of this section. Recoveries outside of these limits are evaluated and corrective action taken, or the data qualified, as necessary. The matrix spike recovery is calculated as follows:

  $$[(SSR-SR)/SA] \times 100$$

  Where: SSR = Spiked sample result
  SR = Sample result
  SA = Spike added

- Duplicates / Matrix spike duplicates - Duplicates or matrix spike duplicates (MSD) are used to assess precision. A duplicate or MSD is performed on ten percent of the samples

analyzed. These are taken through the entire analytical process. The acceptance criteria for precision is up to twenty percent relative percent difference (RPD) for samples with concentrations equal to or greater than five times the practical quantitation limit (PQL).

The RPD is calculated as follows:

[(S-D)/((S+D)/2)] X 100

Where: S = Sample concentration

D = Duplicate concentration

The allowable range of duplication for samples with concentrations less than, or equal to, five times the PQL is one times the PQL. For example, the PQL of nitrate is 0.05 mg/l, therefore the acceptable range of duplication for samples with a concentration of < or = 0.25 mg/l is 0.05 mg/l. The duplication acceptance limits are given in the Accuracy and Precision Report at the end of this section. Recoveries outside of these acceptance limits are evaluated and corrective action taken as necessary.

- Laboratory Control Samples - A laboratory control sample (LCS), also known as a laboratory fortified blank (LFB) or blank spike, is prepared in the laboratory. Reagent water is spiked with a known amount of analyte and then taken through the entire analytical process. A LCS or LFB is used to assess the accuracy of the method without matrix interferences. A LCS should be analyzed at a minimum of once per analytical batch and at an overall rate of five percent. LCS acceptance limits are given in the Accuracy and Precision Report at the end of this section. Other limits may be specified in the method or may be calculated using data produced in our laboratory. Recoveries outside the acceptance limits are evaluated and corrective action taken as necessary.

- Quality Control Check Sample - A QC check sample is a certified control purchased from an outside source and is used as an independent check of our analytical procedures and standards. The frequency of use varies per method from once per batch to once per quarter. The QC check sample acceptance limits are provided by the QC manufacturer. Recoveries outside those acceptance limits shall be evaluated and corrective action taken as necessary.

- Surrogate Spikes - System performance and matrix interferences are evaluated by the addition of a surrogate to samples evaluated by GC and GC/MS. The surrogate is added prior to extraction or purging. Surrogate recovery acceptance limits are calculated using

data generated by this laboratory or are specified by the method and are given in the Accuracy and Precision Report. Recoveries outside these limits are evaluated and corrective action taken as necessary.

6.4 Corrective Action

When a quality control indicator or other aspect of our work does not meet the requirements of this qap, corrective action is taken. Two types of corrective action reports are routinely used by this laboratory; the Analytical Non-Conformance Report (Figure 6-2) and a Corrective Action Report (Figure 6-3). Either may be initiated by the QAC, lab manager, or the analysts. The QAC maintains a central log of these reports.

The nonconformance report is used when a batch of samples analyzed using a particular method contains quality control sample results that do not comply with our published limits or holding times have been exceeded. The nonconformance report includes the corrective action to be made by the analyst or report writer. These are typically completed by the analyst, reviewed by the qac and provided to the lab manager. The corrective actions may include re-calibration and reanalysis, re-preparation and analysis or application of qualifiers to the written report to the client. If data has been reported to the client for non-compliant batches and the noncompliance has an effect on the data quality, the lab manager will contact the client in writing regarding the validity of the data.

The corrective action report is used when a system routinely fails to support a quality product. That is, some aspect of our service fails to meet the client needs or the requirements of this qap. The corrective action report is initiated by manager, qac or analyst. It will contain a description of the shortcoming, suggested corrective measures and a due date. The report will be provided to the manager and affected staff. The staff members assigned to correct the system make necessary changes to the process or system, describe the steps taken in the corrective action report and return the report to the manager who approves or takes other corrective measures. The completed report is returned to the qac to be logged as a completed action. . If data has been reported to the client for samples analyzed in a system that needs corrective measures and the noncompliance has an effect on the data quality, the lab manager will contact the client in writing regarding the validity of the data.

A review of the log of non conformances and corrective actions is made in the quarterly review (see 6.5 below) in conjunction with the customer complaints file to identify repeating problems in the

quality system. Then, the lab manager, quality coordinator and other appropriate staff review the problem to identify the root cause of the recurring error. The review should consist of

the nature of the problem (analytical, clerical, verbal communication, etc.)
the method Northern uses for the action or service and any applicable SOPs
the recipient or users interpretation or actions relating to the service or action provided
the staff members involved in the service or action that is identified as problematic
quality assurance plan policies relating to the problem

This process is then documented in a corrective action report and the corrective action is implemented by the appropriate staff members with the lab manager's oversight. An entry into the lab manager's time file is made to remind the manager to ask for an internal audit by the qac at some appropriate time interval if follow up is necessary.

6.5 Quality Reviews

An internal audit of the laboratory's quality assurance system will be conducted on an annual basis. This review will be conducted by the QAC. A written report will be made to the laboratory manager of the deficiencies found. Audits will be conducted using on-site audit checklists obtained from the accrediting body applicable to the service aspect being audited. For example, the following audit checklist sources will be used:

Drinking Water—Montana Department of Public Health and Human Services
Industrial Hygiene and Lead—American Industrial Hygiene Association
Asbestos Bulk—National Voluntary Lab Accreditation Program

Internal audits of specific areas of concern or specific methods will be conducted by the QAC as directed by the laboratory manager or as deemed necessary by the QAC. A written report of the findings will be made to the laboratory manager. Written quality assurance reviews of specific projects are provided to our clients when requested.

A quarterly report of QC activities is made by the QAC to the lab manager.

Figure 6-1

QUALITY CONTROL ROUTINE

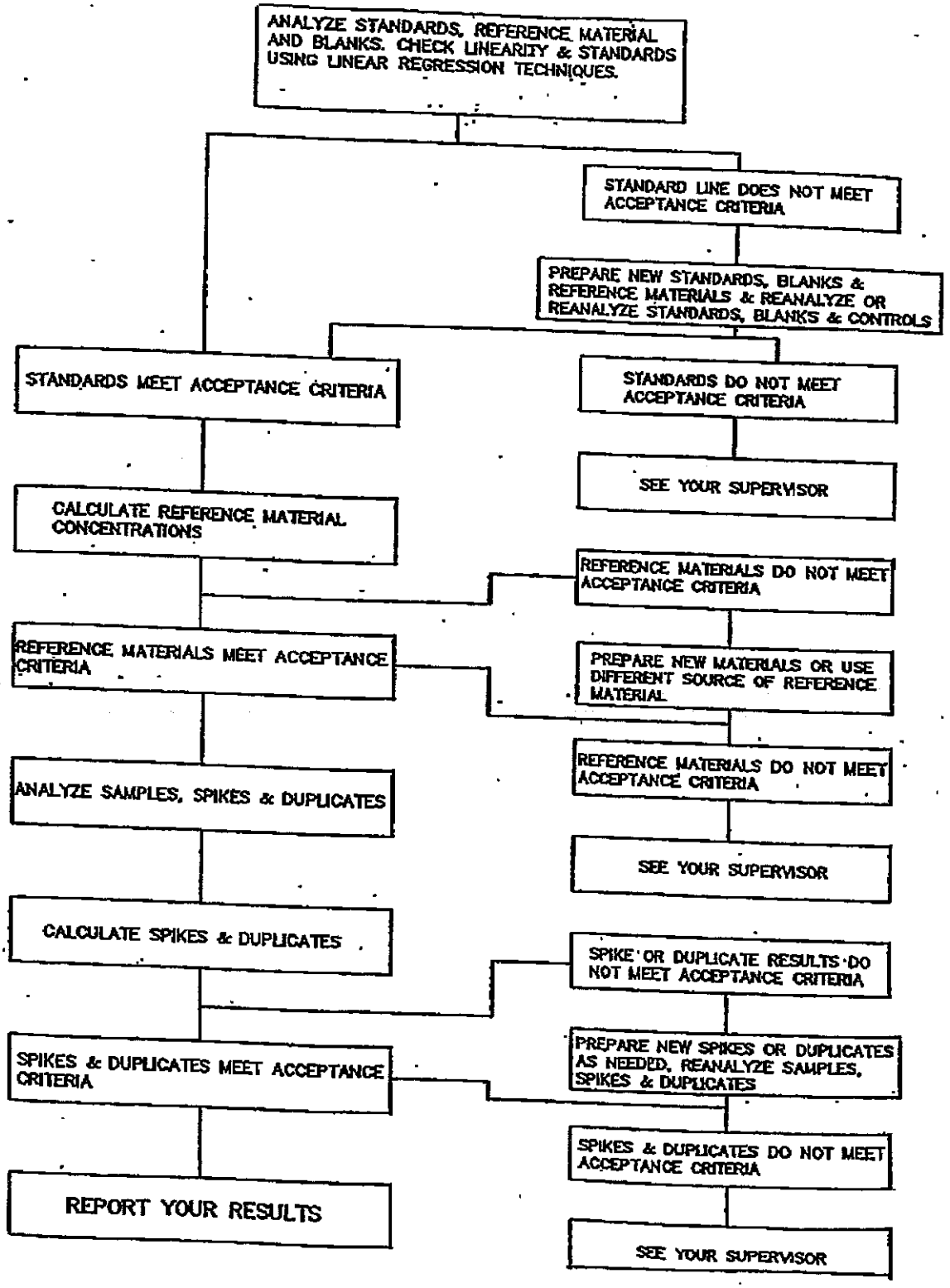


Figure 6-2

ANALYTICAL NON-CONFORMANCE NC. Number_____

Test: _____ Date Analyzed: _____ Analyst: _____

Samples Affected: _____

Clients Affected: _____

Non-Conformance: (Check all that apply)

(Describe non-conformance at right)

_____ Initial calibration not acceptable

_____ CCV or CCC/SPCC's out of control

_____ LFB or LCS out of control

_____ Blank out of control

_____ Duplicate out of control

_____ Spike out of control

_____ Surrogates out of control

_____ Compounds outside calibration range

_____ Other (describe at right)

Non-Conformance Response:
(Analyst, indicate your response to the non-conformance)

_____ Reanalyze sample/batch

_____ Reprep and reanalyze sample/batch

_____ To QA officer for response guidance

_____ Other (describe at right)

_____ Accept data with report flags

_____ Accept data without report flags

Comments: _____

_____

Analyst/Date: _____
QA Officer/Date:_____

Figure 6-3

CORRECTIVE ACTION REPORT

TO:
FROM:
DATE:
CA LOG NO.:

TEST:

SAMPLES / CLIENTS AFFECTED:

DEFICIENCY:

REQUIREMENTS / SUGGESTIONS:

CORRECTIVE ACTION TAKEN:

INITIALS: **Analyst** _____ **Date:** _____

Analyst _____ **Date:** _____
Lab Manager _____ **Date:** _____
QA _____ **Date:** _____

RETURN TO LAB MANAGER BY:

QUALITY CONTROL ACCEPTANCE CRITERIA

ACCURACY AND PRECISION REPORT

Metals by ICP Water (8/01)	Matrix Spike Recovery 6010B	Laboratory Fortified Blank 6010B	Matrix Spike Recovery 200.7	Laboratory Fortified Blank 200.7	Duplicate Range % RPD [2]	Reporting Limit mg/l [5]
Aluminum	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.1
Antimony	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.05
Arsenic	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.1
Barium	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.1
Beryllium	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.005
Boron	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.1
Cadmium	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.01
Calcium	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	1
Chromium	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.02
Cobalt	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.02
Copper	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.02
Iron	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.05
Lead	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.05
Manganese	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.02
Magnesium	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	1
Molybdenum	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.05
Nickel	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.05
Potassium	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	5
Selenium	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.1
Silver	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.05
Sodium	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	1
Vanadium	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.1
Zinc	75 – 125 [4]	85 - 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.02

[1] Mean +/- two or three standard deviations

[2] 20 % RPD applicable to samples greater than five times the reporting limit. A control limit of +/- the reporting limit shall be used for sample values less than five times the reporting limit.

[3] Statistical control limit not calculated

[4] Method defined control limit.

[5] The reporting limit is a general guideline but is subject to change due to sample matrix effects or MDL studies

QUALITY CONTROL ACCEPTANCE CRITERIA

ACCURACY AND PRECISION REPORT

Metals by AA	Matrix Spike Recovery RCRA / CWA	Laboratory Fortified Blank RCRA / CWA	Matrix Spike Recovery 245.1 SDWA	Laboratory Fortified Blank 245.1 SDWA	Duplicate Range % RPD [2]	Reporting Limit [5] mg/l
Arsenic (8/01)	71 - 128 [1]	75 – 108 [1]	NA	NA	20	0.005
Mercury (8/01)	72 – 126 [1]	89 - 118 [1]	70 – 130 [4]	89 – 115 [1]	20	0.0005
Selenium (8/01)	80 - 112 [1]	80 – 112 [1]	NA	NA	20	0.005
Lead Matrices (8/01)	**Matrix Spike Recovery ELLAP**	**Laboratory Control Sample ELLAP**	**Matrix Spike Recovery**	**Laboratory Fortified Blank**	**Duplicate Range % RPD [2]**	**Reporting Limit [5]**
Lead in Air	75 - 125	80 - 120	NA	NA	25	6 ug/filter
Lead in Soil	75 - 125	80 - 120	NA	NA	25	20 mg/kg
Lead in Paint	75 - 125	80 - 120	NA	NA	25	50 mg/kg
Lead in Wipes	75 - 125	80 - 120	NA	NA	25	10 ug/wipe

Metals by ICP Soil (8/01)	Matrix Spike Recovery 6010B	Laboratory Fortified Blank 6010B	Matrix Spike Recovery CLP	Laboratory Fortified Blank CLP	Duplicate Range % RPD [2]	Reporting Limit [5] mg/kg
Aluminum	75 – 125 [4]	80 – 120 [3]	75 – 125 [4]	80 – 120 [4]	20	30
Antimony	75 – 125 [4]	80 – 120 [3]	75 – 125 [4]	80 – 120 [4]	20	20
Arsenic	75 – 125 [4]	80 – 120 [3]	75 – 125 [4]	80 – 120 [4]	20	20
Barium	75 – 125 [4]	80 – 120 [3]	75 – 125 [4]	80 – 120 [4]	20	10
Beryllium	75 – 125 [4]	80 – 120 [3]	75 – 125 [4]	80 – 120 [4]	20	2
Cadmium	75 – 125 [4]	80 – 120 [3]	75 – 125 [4]	80 – 120 [4]	20	5
Chromium	75 – 125 [4]	80 – 120 [3]	75 – 125 [4]	80 – 120 [4]	20	4
Cobalt	75 – 125 [4]	80 – 120 [3]	75 – 125 [4]	80 – 120 [4]	20	5
Copper	75 – 125 [4]	80 – 120 [3]	75 – 125 [4]	80 – 120 [4]	20	4
Iron	75 – 125 [4]	80 – 120 [3]	75 – 125 [4]	80 – 120 [4]	20	50
Lead	75 – 125 [4]	80 – 120 [3]	75 – 125 [4]	80 – 120 [4]	20	20
Manganese	75 – 125 [4]	80 – 120 [3]	75 – 125 [4]	80 – 120 [4]	20	2
Nickel	75 – 125 [4]	80 – 120 [3]	75 – 125 [4]	80 – 120 [4]	20	10
Silver	75 – 125 [4]	80 – 120 [3]	75 – 125 [4]	80 – 120 [4]	20	5
Vanadium	75 – 125 [4]	80 – 120 [3]	75 – 125 [4]	80 – 120 [4]	20	10
Zinc	75 – 125 [4]	80 – 120 [3]	75 – 125 [4]	80 – 120 [4]	20	10

QUALITY CONTROL ACCEPTANCE CRITERIA

ACCURACY AND PRECISION REPORT

Metals by ICP/MS Water (8/01)	Matrix Spike Recovery 6020	Laboratory Fortified Blank 6020	Matrix Spike Recovery 200.8	Laboratory Fortified Blank 200.8	Duplicate Range % RPD [2]	Reporting Limit mg/l
Aluminum	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.05
Antimony	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.003
Arsenic	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.003
Barium	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.005
Beryllium	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.001
Boron	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.05
Cadmium	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.0001
Chromium	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.001
Cobalt	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.001
Copper	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.001
Iron	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.05
Lead	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.003
Manganese	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.005
Mercury	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.0002
Molybdenum	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.05
Nickel	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.02
Selenium	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.001
Silver	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.003
Thallium	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.002
Vanadium	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.05
Zinc	75 – 125 [4]	85 – 115 [3]	70 – 130 [4]	85 – 115 [4]	20	0.02

[1] Mean +/- two or three standard deviations

[2] 20 % RPD applicable to samples greater than five times the reporting limit. A control limit of +/- the reporting limit shall be used for sample values less than five times the reporting limit.

[3] Statistical control limit not calculated

[4] Method defined control limit.

[5] The reporting limit is a general guideline but is subject to change due to sample matrix effects or MDL studies

QUALITY CONTROL ACCEPTANCE CRITERIA

ACCURACY AND PRECISION REPORT

Anions	Matrix Spike Recovery RCRA / CWA	Laboratory Fortified Blank RCRA / CWA	Matrix Spike Recovery SDWA	Laboratory Fortified Blank SDWA	Duplicate Range % RPD [2]	Reporting Limit [5] mg/l
Alkalinity (8/01)	78 – 114 [1]	88 – 108 [1]	78 - 114 [1]	88 – 108 [1]	20	1
Chloride-325.3 (8/01)	85 – 114 [1]	85 – 114 [1]	85 – 114 [1]	85 – 114 [1]	20	1
Fluoride (8/01) Fluoride distilled	78 - 135 [3] 75 – 135 [3]	90 – 109 [1] 75 – 125 [3]	90 – 110 [4] NA	90 – 110 [4] NA	20 20	0.1 0.1
Sulfate-375.3	80 – 120 [3]	80 – 120 [3]	NA	NA	20	5
Sulfate-375.2 (8/01)	81 – 119 [1]	93 – 114 [1]	90 – 110 [4]	90 – 110 [4]	20	5
Sulfate- soil (8/01)	75 - 125 [3]	88 - 125 [1]	NA	NA	20	0.01%

Nutrients	Matrix Spike Recovery RCRA / CWA	Laboratory Fortified Blank RCRA / CWA	Matrix Spike Recovery SDWA	Laboratory Fortified Blank SDWA	Duplicate Range % RPD [2]	Reporting Limit [5] mg/l
Ammonia (8/01)	78 – 122 [1]	93 – 110 [1]	90 – 110 [4]	93 – 110 [1]	20	0.05
Nitrate+Nitrite (8/01)	88 – 111 [1]	93 – 109 [1]	90 – 110 [4]	93 – 109 [1]	20	0.05
Nitrite (8/01)	87 – 107 [1]	87 – 107 [1]	90 – 107 [1]	90 – 107 [1]	20	0.05
Orthophosphate	80 – 120 [3]	80 – 120 [3]	90 – 110 [4]	90 – 110 [4]	20	0.02 (0.005)
TK N	80 – 120 [3]	80 – 120 [3]	90 – 110 [4]	90 – 110 [4]	20	0.2
Total Phosphorous	80 – 120 [3]	80 – 120 [3]	90 – 110 [4]	90 – 110 [4]	20	0.02 (0.005)

[1] Mean +/- two or three standard deviations

[2] 20 % RPD applicable to samples greater than five times the reporting limit. A control limit of +/- the reporting limit shall be used for sample values less than five times the reporting limit.

[3] Statistical control limit not calculated

[4] Method defined control limit.

[5] The reporting limit is a general guideline but is subject to change due to sample matrix effects or MDL studies

QUALITY CONTROL ACCEPTANCE CRITERIA

ACCURACY AND PRECISION REPORT

General Chemistry	Matrix Spike Recovery Control Limit RCRA / CWA	Laboratory Control Sample Control Limit RCRA / CWA	Matrix Spike Recovery Control Limit SDWA	Laboratory Control Sample Control Limit SDWA	Duplicate Range % RPD [2]	Routine Reporting Limit mg/l [5]
COD (8/01)	86 – 111 [1]	86 – 111 [1]	NA	NA	20	5
Cyanide-Total (8/01)	58 – 116 [1]	73 – 107 [1]	90 – 110 [3]	90 – 110 [3]	20	0.005
EC	NA	90 – 110 [3]	NA	90 – 110 [3]	20	10 umhos/cm
O & G-water (8/01)	64 - 104 [1]	64 - 104 [1]	NA	NA	20	5
O & G-soil (8/01)	76 – 127 [1]	76 – 127 [1]	NA	NA	20	0.01 %
Mercap. Sulfur (8/01)	NA	81 – 114 [1]	NA	NA	20	0.0001 %
Sulfide	80 - 120 [3]	80 - 120 [3]	NA	NA	20	4
TDS (8/01)	NA	94 – 108 [1]	NA	94 – 108 [1]	20	20
TSS (8/01)	NA	72 – 115 [1]	NA	72 – 115 [1]	20	5
Turbidity	NA	90 – 110 [3]	NA	90 – 110 [3]	20	0.12 NTU

[1] Mean +/- two or three standard deviations

[2] 20 % RPD applicable to samples greater than five times the reporting limit. A control limit of +/- the reporting limit shall be used for sample values less than five times the reporting limit.

[3] Statistical control limit not calculated

[4] Method defined control limit.

[5] The reporting limit is a general guideline but is subject to change due to sample matrix effects or MDL studies

QUALITY CONTROL ACCEPTANCE CRITERIA

ACCURACY AND PRECISION REPORT

GC Organics	Matrix Spike Recovery Control Limit	Laboratory Control Sample Control Limit	–	–	Duplicate Range % RPD [2]	Routine Reporting Limit [5]
BETXMN 8021B	70 – 130 [3]	70 – 130 [3]	–	–	20	1 ug/l 5 ug/kg
GRO	50 – 150 [3]	50 – 150 [3]	–	–	20	0.5 mg/l 1 mg/kg
DRO	60 – 120 [3]	60 – 120 [3]	–	–	20	0.5 mg/l 10 mg/kg
VPH	70 - 130 [4]	70 – 130 [4]	–	–	20	Various
EPH	40 – 140 [4]	40 – 140 [4]	–	–	20	Various

GC Organic Surrogates	Water	Soil
BETXMN 8021B	70 – 130 [3]	70 – 130 [3]
Gasoline Range Organics	50 – 150 [3]	50 – 150 [3]
Diesel Range Organics	50 – 150 [3]	50 – 150 [3]
VPH	70 - 130 [4]	70 - 130 [4]
EPH	40 – 140 [4]	40 – 140 [4]

[1] Mean +/- two or three standard deviations

[2] 20 % RPD applicable to samples greater than five times the reporting limit. A control limit of +/- the reporting limit shall be used for sample values less than five times the reporting limit.

[3] Statistical control limit not calculated

[4] Method defined control limit.

[5] The reporting limit is a general guideline but is subject to change due to sample matrix effects or MDL studies

QUALITY CONTROL ACCEPTANCE CRITERIA

ACCURACY AND PRECISION REPORT

GCMS Volatiles	Matrix Spike Recovery 8260B	Lab Control Recovery 8260B	Matrix Spike Recovery 624	Lab Control Recovery 624	Matrix Spike Recovery 524.2	Lab Control Recovery 524.2	Duplicate Range % RPD [2]
Benzene (9/01)	76 – 112 [1]	76 – 112 [1]	37 – 151 [4]	37 – 151 [4]	70 – 130 [4]	70 – 130 [4]	20
Chlorobenzene (9/01)	82 – 112 [1]	82 – 112 [1]	37 – 160 [4]	47 – 150 [4]	70 – 130 [4]	70 – 130 [4]	20
1,1-Dich-ethene(9/01)	50 – 134 [1]	50 – 134 [1]	10 – 234 [4]	10 – 234 [4]	70 – 130 [4]	70 – 130 [4]	20
Toluene (9/01)	81 – 111 [1]	81 – 111 [1]	47 – 150 [4]	47 – 150 [4]	70 – 130 [4]	70 – 130 [4]	20
Trichl-ethene (9/01)	81 – 111 [1]	81 – 111 [1]	71 – 157 [4]	71 – 157 [4]	70 – 130 [4]	70 – 130 [4]	20
Other Volatiles	NA	NA	71 – 138* [4]	71 – 138* [4]	70 – 130 [4]	70 – 130 [4]	20

* See 624 method Table 5 "Range for P" for limits not listed here. The 71-138% limits listed here are the most stringent listed in Table 5 and may be used as default limits for all 624 volatiles.

GCMS BTEXMN	Matrix Spike Recovery 8260B	Lab Control Recovery 8260B	Matrix Spike Recovery 624	Lab Control Recovery 624	Matrix Spike Recovery 524.2	Lab Control Recovery 524.2	Duplicate Range % RPD [2]
Benzene (9/01)	72 – 114 [1]	72 – 114 [1]	37 – 151 [4]	37 – 151 [4]	70 – 130 [4]	70 – 130 [4]	20
Toluene (9/01)	76 – 118 [1]	76 – 118 [1]	47 – 150 [4]	47 – 150 [4]	70 – 130 [4]	70 – 130 [4]	20
Ethylbenzene (9/01)	79 – 115 [1]	79 – 115 [1]	37 – 162 [4]	37 – 162 [4]	70 – 130 [4]	70 – 130 [4]	20
Total Xylenes (9/01)	65 – 119 [1]	65 – 119 [1]	50 – 150 [3]	50 – 150 [3]	70 – 130 [4]	70 – 130 [4]	20
MTBE (9/01)	60 – 132 [1]	60 – 132 [1]	50 – 150 [3]	50 – 150 [3]	70 – 130 [4]	70 – 130 [4]	20
Naphthalene (9/01)	73 – 127 [1]	73 – 127 [1]	50 – 150 [3]	50 – 150 [3]	70 – 130 [4]	70 – 130 [4]	20

GCMS Volatiles Surrogate Control Limits	Water (9/01)	Soil (10/00)
1,2-Dichloroethane-d4	73 – 121 [1]	55 – 135 [1]
Toluene-d8	91 – 109 [1]	85 – 117 [1]
4-Bromofluorobenzene	85 – 115 [1]	82 – 122 [1]

QUALITY CONTROL ACCEPTANCE CRITERIA

ACCURACY AND PRECISION REPORT

GC/MS Semivolatiles (9/01)	Matrix Spike Recovery Control Limit 8270C	Laboratory Control Sample Control Limit 8270C	Matrix Spike Recovery Control Limit 625	Laboratory Control Sample Control Limit 625	Duplicate Range % RPD [2]	Routine Reporting Limit [5] ug/l
Acenaphthene	25 – 117 [1]	25 – 117 [1]	47- 145 [4]	47- 145 [4]	20	10
4-Chl-3-meth-phenol	19 – 143 [1]	19 – 143 [1]	22 – 147 [4]	22 – 147 [4]	20	10
2-Chlorophenol	26 – 126 [1]	26 – 126 [1]	23 – 134 [4]	23 – 134 [4]	20	10
1,4-Dichlorobenzene	12 – 120 [1]	12 – 120 [1]	20 – 124 [4]	20 – 124 [4]	20	10
2,4-Dinitrotoluene	22 – 138 [1]	22 – 138 [1]	39 – 139 [4]	39 – 139 [4]	20	10
4-Nitrophenol	10 – 98 [1]	10 – 98 [1]	10 – 132 [4]	10 – 132 [4]	20	10
N-Nit-di-n-pro-amine	16 – 148 [1]	16 – 148 [1]	10 – 230 [4]	10 – 230 [4]	20	10
Pentachlorophenol	15 – 155 [1]	15 – 155 [1]	14 – 176 [4]	14 – 176 [4]	20	10
Phenol	10 – 105 [1]	10 – 105 [1]	10 – 112 [4]	10 – 112 [4]	20	10
Pyrene	31 – 151 [1]	31 – 151 [1]	52 – 115 [4]	52 – 115 [4]	20	10
1,2,4-Trichl-benzene	23 – 123 [1]	23 – 123 [1]	44 – 142 [4]	44 – 142 [4]	20	10
Other Semivolatiles	60 – 112*	60 – 112*	60 – 112*	60 – 112*	20	various
PAHs by 8270C	59 – 115**	59 – 115**	59 – 115**	59 – 115**	20	various
PAHs by 525.2	70 – 130 [4]	70 – 130 [4]	–	–	20	0.1
SDWA by 525.2	70 – 130 [4]	70 – 130 [4]	–	–	20	various

* See Table 6, Range for P, in the 8270C and 625 methods for semivolatile limits not listed here. The 60-112% limits listed here are the most stringent limits listed in Table 6 and may be used as default limits for all semivolatile compounds. The limits given in Table 6 in both the 8270 and 625 methods are identical.

** See Table 6, Range for P, in the 8270C and 625 methods for individual PAH limits. The 59-115% limits listed here are the most stringent PAH limits listed in Table 6 and may be used as default limits for all PAHs. The limits given in Table 6 in both the 8270 and 625 methods are identical.

[1] Mean +/- two or three standard deviations

[2] 20 % RPD applicable to samples greater than five times the reporting limit. A control limit of +/- the reporting limit shall be used for sample values less than five times the reporting limit.

[3] Statistical control limit not calculated

[4] Method defined control limit.

[5] The reporting limit is a general guideline but is subject to change due to sample matrix effects or MDL studies

QUALITY CONTROL ACCEPTANCE CRITERIA

SURROGATE RECOVERY

GCMS Semivolatile Surrogate Control Limits	Water	Soil
2-Fluorophenol (9/01)	10 – 110 [1]	24 – 96 [1]
Phenol-d6 (9/01)	10 – 119 [1]	26 – 98 [1]
Nitrobenzene-d5 (9/01)	27 – 121 [1]	37 – 97 [1]
2-Fluorobiphenyl (9/01)	47 – 127 [1]	46 – 110 [1]
2,4,6-Tribromophenol (9/01)	36 – 124 [1]	34 – 118 [1]
Terphenyl-d14 (9/01)	61 – 133 [1]	44 – 124 [1]
525.2-Perylene-d12	70 – 130 [4]	NA

QUALITY CONTROL ACCEPTANCE CRITERIA

ACCURACY AND PRECISION REPORT

Herbicides 515.1 / 8151A	Matrix Spike Recovery Control Limit Water	Laboratory Control Sample Control Limit Water	Matrix Spike Recovery Control Limit Soil	Laboratory Control Sample Control Limit Soil	Duplicate Range % RPD [2]	Routine Reporting Limit [5] SDWA Trigger/ water/soil ug/l & ug/kg
2,4-D (9/01)	62 – 148 [1]	62 – 148 [1]	48 – 214 [3]	48 – 214 [3]	20	0.1,5,50
Dalapon (9/01)	32 – 96 [1]	32 – 96 [1]	40 – 160 [3]	40 – 160 [3]	20	1,50,100
2,4-DB	48 – 126 [3]	48 – 126 [3]	48 – 126 [3]	48 – 126 [3]		–,5,100
Dicamba	38 – 232 [3]	38 – 232 [3]	38 – 232 [3]	38 – 232 [3]	20	–,2,20
Dichlorprop	46 – 168 [3]	46 – 168 [3]	46 – 168 [3]	46 – 168 [3]	20	–,5,150
Dinoseb (9/01)	49 – 123 [1]	49 – 123 [1]	10 – 84 [3]	10 – 84 [3]	20	0.2,3,160
MCPA	40 – 160 [3]	40 – 160 [3]	40 – 160 [3]	40 – 160 [3]	20	–,500,20000
MCPP	40 – 160 [3]	40 – 160 [3]	40 – 160 [3]	40 – 160 [3]	20	–,500,10000
Pentachlorophenol (9/01)	49 – 117 [1]	49 – 117 [1]	36 – 224 [3]	36 – 224 [3]	20	0.04,0.5,10
Picloram	44 – 138 [3]	44 – 138 [3]	44 – 138 [3]	44 – 138 [3]	20	0.1,50,20
2,4,5-T	42 – 226 [3]	42 – 226 [3]	42 – 226 [3]	42 – 226 [3]	20	–,5,10
2,4,5-TP (9/01)	71 – 121 [1]	71 – 121 [1]	48 – 214 [3]	48 – 214 [3]	20	0.2,2,20
DCAA Surrogate (9/01)	39 – 106 [1]	39 – 106 [1]	45 – 117 [1]	45 – 117 [1]	NA	–

[1] Mean +/- two or three standard deviations

[2] 20 % RPD applicable to samples greater than five times the reporting limit. A control limit of +/- the reporting limit shall be used for sample values less than five times the reporting limit.

[3] Statistical control limit not calculated

[4] Method defined control limit.

[5] The reporting limit is a general guideline but is subject to change due to sample matrix effects or MDL studies

QUALITY CONTROL ACCEPTANCE CRITERIA

ACCURACY AND PRECISION REPORT

Pesticides/PCBs 508 / 608 / 8081A / 8082	Matrix Spike Recovery 508	Laboratory Control Sample 508	Matrix Spike & Lab Control Sample 608	Matrix Spike & Lab Control Sample 8081A/8082	Duplicate Range % RPD [2]	Reporting Limit [5] 508/608/8081 ug/l & ug/kg
Aldrin	51 – 121 [3]	56 – 116 [3]	42 – 122 [3]	70 - 130 [3]	20	0.2/0.1/3
a-BHC	57 – 127 [3]	62 – 122 [3]	37 - 134 [3]	70 - 130 [3]	20	–/0.1/3
b-BHC	60 – 130 [3]	65 – 125 [3]	17 - 147 [3]	70 - 130 [3]	20	–/0.1/3
d-BHC	67 – 138 [3]	72 – 132 [3]	19 - 140 [3]	70 - 130 [3]	20	–/0.1/3
g-BHC (Lindane)	54 - 124 [3]	59 – 119 [3]	32 - 127 [3]	70 - 130 [3]	20	0.02/0.1/3
Chlordane	64 – 134 [3]	69 – 129 [3]	45 – 119 [3]	70 - 130 [3]	20	0.2/0.1/3
DDD	72 – 142 [3]	77 – 137 [3]	31 - 141 [3]	70 - 130 [3]	20	–/0.2/7
DDE	64 – 134 [3]	69 – 129 [3]	30 - 145 [3]	70 - 130 [3]	20	–/0.2/7
DDT	77 – 147 [3]	82 – 142 [3]	25 – 160 [3]	70 - 130 [3]	20	–/0.2/7
Dieldrin	52 – 122 [3]	57 – 117 [3]	36 – 136 [3]	70 - 130 [3]	20	0.02/0.2/7
Endrin	53 – 123 [3]	58 – 118 [3]	30 – 147 [3]	70 - 130 [3]	20	0.01/0.2/7
Endrin aldehyde	53 – 123 [3]	58 – 118 [3]	–	70 - 130 [3]	20	–/0.6/30
Endosulfan I	52 – 122 [3]	57 – 117 [3]	45 – 153 [3]	70 - 130 [3]	20	–/0.1/3
Endosulfan II	57 – 127 [3]	62 – 122 [3]	10 – 202 [3]	70 - 130 [3]	20	–/0.2/20
Endosulfan sulfate	67 – 137 [3]	72 – 132 [3]	26 – 144 [3]	70 - 130 [3]	20	–/0.6/20
Heptachlor	63 – 133 [3]	68 – 128 [3]	34 – 111 [3]	70 - 130 [3]	20	0.04/0.1/3
Heptachlor epoxide	52 – 122 [3]	57 – 117 [3]	37 – 142 [3]	70 - 130 [3]	20	0.02/0.1/3
Hexachlorobenzene	64 – 134 [3]	69 – 129 [3]	–	70 - 130 [3]	20	0.1/–/–
Hexachlorocyclopent	65 – 135 [3]	70 – 130 [3]	–	70 - 130 [3]	20	0.1/–/–
Methoxychlor	70 – 140 [3]	75 – 135 [3]	–	70 - 130 [3]	20	0.1/1/33
Toxaphene	65 – 135 [3]	70 – 130 [3]	41 – 126 [3]	70 - 130 [3]	20	1/2/66
PCBs	65 – 135 [3]	70 – 130 [3]	50 – 114* [3]	70 - 130 [3]	20	0.1/1/33
PCBs in Oil - ASTM	70 – 140 [1]	70 – 140 [1]	–	–	20	2 ppm

QUALITY CONTROL ACCEPTANCE CRITERIA

SURROGATE RECOVERY

GC Pesticide/PCB Surrogate Control Limits	Water	Soil
TCMX (9/01)	(8081/608) 34 – 122 [1] (508) 70 – 130 [4]	16 – 124 [1]
DCB (9/01)	(8081/608) 10 – 139 [1] (508) 70 – 130 [4]	65 – 153 [1]

[1] Mean +/- two or three standard deviations

[2] 20 % RPD applicable to samples greater than five times the reporting limit. A control limit of +/- the reporting limit shall be used for sample values less than five times the reporting limit.

[3] Statistical control limit not calculated

[4] Method defined control limit.

[5] The reporting limit is a general guideline but is subject to change due to sample matrix effects or MDL studies

7.0 MAINTENANCE OF INSTRUMENTS AND EQUIPMENT

Maintenance log books are maintained for all major laboratory instrumentation. The log book may consist of a numbered and paginated book or consecutively dated loose leaf binder. The book shall identify the manufacturer and model number of the instrument and if several of the same type are present in the lab, the unit serial number. Entries into the log will be in ink with date and initial of the person making the entry. A description of the reason for the maintenance (preventative or corrective action) will be provided as well as the actions taken to make the repairs. Purchase orders, packing list or parts descriptions shall be included in the log by attachment or reference. If maintenance is performed by the manufacturer's representative or contracted service, the date and identity of the service provider will be included.

Following is a listing of some of the preventive maintenance procedures performed on our major instrumentation.

GC/MS

- Clean source – every six months or as needed
- Replace column – every six months or as needed
- Replace trap (volatiles) – every six months or as needed
- Replace injection port liner, clean port, replace septa, cut column (semivolatiles) - daily, when in use
- Bake trap (volatiles) - after each sample

Inductively Coupled Plasma Emission Spectrophotometer (ICP)

- Check air flow – daily
- Profile – daily
- Replace sample tubing – daily
- Clean nebulizer – daily
- Clean air filters – monthly
- Fill water circulator – as needed
- Replace torch - as needed

Inductively Coupled Plasma Emission Mass Spectrometry (ICPMS)

- Auto optimize - daily
- Clean nebulizer – as needed
- Replace torch – as needed
- Replace sample tubing – every 8 hours
- Replace waste and A/S tubing – as needed
- Fill coolant – as needed
- Replace pump oil – as needed
- Clean filters – monthly
- Clean/replace cones – as needed
- Clean/replace lens – as needed

Atomic Absorption Spectrophotometer

- Clean air inlet filters - monthly

Auto Analyzer (Alpkem Flow Solution)

- Replace tubing - as needed
- Clean cartridges - monthly
- Wipe surfaces - weekly

Gas Chromatograph (direct injection)

- Replace septum and liner - weekly or as needed
- Cut column - as needed
- Clean FID - every six months or as needed
- Send ECD in for cleaning – annually or as needed
- Change oxygen and moisture traps (on gas lines) - every 2 years or as needed

Gas Chromatograph (volatiles)

- Change trap - every 6 months or as needed
- Clean FID - every 6 months or as needed
- Clean PID - monthly or as needed

8.0 CHEMICAL AND REAGENT QUALITY

The control of incoming materials, chemicals, and reagents is handled by the individual who placed the order. Upon receipt of the supplies, the ordering information is compared with the receiving information. If a discrepancy is found that may affect the quality of the product, the materials are returned. If accepted, a label is affixed to the bottle so that the date received, date opened, and date expires may be recorded. Purchase orders and packing lists are maintained in a central file as a check on materials received. Certificates of analysis are kept in a central file for each analytical group. Material safety data sheets are placed in the MSDS binders and are easily accessible.

The laboratory manager determines the shelf life or, for certain chemicals, a shelf life is provided by the manufacturer. A first-in first-out usage is maintained by the users. The laboratory manager surveys the store room monthly for appropriate storage of items kept there.

The laboratory evaluates the vendors from which we purchase supplies and services. A list of approved vendors is maintained, posted in the laboratory, and available to personnel purchasing supplies and services.

The quality of the reagent or chemical used depends upon the analysis for which it is used. At a minimum "Reagent" grade is used when higher purity grades are not required. High purity acids and solvents are used for metals digestions and trace level organic extractions. If other grades are used, it first must be ascertained that the chemical is of sufficiently high purity to permit its use without lessening the accuracy of the analysis. Refer to the "Purchase of Supplies" standard operating procedure for a list of chemical and reagent grade/quality to be ordered.

Reagents and solvents are stored in borosilicate glass bottles, metal, or polyethylene containers, whichever is appropriate according to method specifications. Reagents and solvents sensitive to light or temperature are stored in dark bottles or in a cool dark place.

Reagent preparations are recorded in a reagent preparation log book and each reagent assigned a log number. All reagents are labeled at a minimum with the name, reagent log number, date prepared and date expires where applicable. The concentration and composition of many reagents are susceptible to change over a period of time.
Blanks, control, or reference samples are analyzed with each set of samples for all analytical procedures to insure that the reagents used have not degraded or become contaminated.

Gases used in the laboratory can be classified to serve one of three functions: fuel, oxidant or carrier. The following is a list of the types of gases used:

Type	Parameter	Use (function)
Air, zero grade	Organic Analysis	Oxidant
Argon	Metals Analysis	Carrier
Helium, UHP	Organic Analysis	Carrier
Helium, HP	Ion Chromatography	Carrier
Hydrogen, UHP	Organic Analysis	Fuel
Nitrogen, UHP	Organic Analysis	Carrier
Nitrogen	Metals Analysis	Carrier
Oxygen	Heat of Combustion	Oxidant
Oxygen	Sulfur Analysis	Oxidant

Air supplied by a compressor is passed through a filter to remove any oil, water, and trace metals from the line. This air supply is used only for enriching dilution water for BODs.

Several grades of water are used in the laboratory: Tap Water, Type II ASTM Reagent Water, and Type I ASTM Reagent Water and water collected specifically for some of our organic analyses. A description of the various waters used follows:

1. Tap Water - The tap water used in the laboratory is from the Billings City water supply. Its primary use is for the washing of glassware and containers.
2. Type II ASTM Reagent Water - This water is produced by passing tap water through a Millipore reverse osmosis system and Barnstead polishing cartridges.
3. Organic Free Water -- This water is produced by passing ASTM Type V water through a charcoal bed..
4. Type I ASTM Reagent Water – This higher quality water is produced by treating the Type II water with a Millipore Super Q four bed recirculating system. This water is available on demand at up to 3 gpm.

The electrical conductivity of the deionized water is monitored weekly at various laboratory outlets to verify the quality. The electrical conductivity for the ASTM type I "Q3" water is to be 3 umhos/cm or less. The conductivity of the ASTM type II water is to be 5 uhmos/cm or less.

The type of glassware and its cleanliness are important factors in obtaining accurate analytical results in the laboratory. The cleaning method for the glassware is dependent upon the substances that are to be removed and the use of the glassware. Special cleaning techniques are published in our Standard Operating Procedures Manual.

9.0 TRAINING

Laboratory employees are trained to perform the tasks assigned to them. This consists of on-the-job training. Short courses and specialty conferences are included when appropriate. All technical personnel are required to attend an indoctrination program administered by representatives of the laboratory manager. The indoctrination program covers employment requirements, policies, safety and laboratory procedures, and objectives of Northern Analytical Laboratories, Inc. A copy of the quality assurance program is provided and time is assigned for its review.

All new employees are considered probationary for a period of six months from the time of employment. The training program for new personnel is administered by the laboratory manager. The trainee is required to read the appropriate standards, methods or standard operating procedures and to become familiar with the equipment and measurements used in testing. The trainee observes an experienced operator perform the tests and then performs the test under the direct supervision of the operator.

Before any test is performed by a trainee without direct supervision, an experienced analyst observes the trainee performing the test and then initials the trainee's "Personnel Proficiency Check Sheet" (Figure 9-1). Maintenance of the proficiency check sheet system is the responsibility of the laboratory manager. The personnel proficiency check sheets are filed in the employee's training file. A summary of the tests for which any employee has been trained is placed in the employees training file and is reviewed annually by the laboratory manager.

It is Northern Analytical Laboratories' policy to provide for the continuing training and development of its technical personnel. The program is administered by the laboratory manager and provides for the following:

- Selected external programs for attendance by key personnel.
- Selected special training for specialized positions or for newly created positions may include assistance for attendance at accredited educational institutions. The laboratory manager has the responsibility for selecting and recommending participation in these programs.
- The laboratory manager will review and evaluate the development programs once a year regarding the effectiveness of the programs and changes to be made.

FIGURE 9-1

PERSONNEL PROFICIENCY CHECK SHEET

Employee Name: _____ Date of Employment: _____

Test: _____ Method: _____

Trainer: _____ Training Period: _____

The following steps must be completed, initialed and dated by the employee and verified by the trainer. Mark NA for those items that do not apply.

1. **Read Standard Operating Procedure** Date read _____Analyst _____Trainer _____
   Record the name and revision number of SOP: _____
2. **Read Methods** Date read _____Analyst _____Trainer _____
   Record method names/numbers: _____
3. **Procedure** (Preparation / calibration / analysis)
   - Procedure explained by trainer: Date _____Analyst _____Trainer _____
   - Procedure demonstrated by trainer: Date _____Analyst _____Trainer _____
   - Procedure performed by analyst under trainer supervision:
     Date _____Analyst _____Trainer _____
   - Procedure successfully and independently performed by analyst:
     Date _____Analyst _____Trainer _____
4. **Quality Control**
   - Quality control requirements explained by trainer:
     Date _____Analyst _____Trainer _____
   - Quality control sample preparation and/or analysis demonstrated by trainer:
     Date _____Analyst _____Trainer _____
   - Quality control sample prep. and/or analysis performed by analyst under trainer supervison:
     Date _____Analyst _____Trainer _____
   - Quality control sample prep. and/or analysis successfully and independently performed by analyst:
     Date _____Analyst _____Trainer _____

PERSONNEL PROFICIENCY CHECK SHEET

(Continued)

5. **Calculations**

- Calculations used to obtain sample and QC results explained and demonstrated by trainer:

  Date _____ Analyst _____ Trainer _____

- Analyst demonstrates understanding of, and successfully performs, all calculations:

  Date _____ Analyst _____ Trainer _____

6. **Record keeping**

- Sample prep. and/or analytical results record keeping requirements explained and demonstrated by trainer: Date _____ Analyst _____ Trainer _____
- Transfer of results to work order and LIMS explained and demonstrated by trainer:

  Date _____ Analyst _____ Trainer _____

- Analyst demonstrates understanding of record keeping requirements:

  Date _____ Analyst _____ Trainer _____

7. **Documentation of Proficiency**

- Attach copy of a successful independent preparation and/or analysis.
- Attach copy of four lab control samples or lab fortified blanks prepared and/or analyzed by employee.
- Summarize LCS or LFB percent recovery below: (attach additional sheets as needed)

Analyte 1 _____	LCS 1 _____%	Analyte 2 _____	LCS 1 _____%
	LCS 2 _____%		LCS 2 _____%
	LCS 3 _____%		LCS 3 _____%
	LCS 4 _____%		LCS 4 _____%
	LCS 5 _____%		LCS 5 _____%
	Avg. Recovery _____%		Avg. Recovery _____%
	RSD _____%		RSD _____%

8. **Comments**

9. **Authorization**

The employee has demonstrated that he/she can successfully perform the above named test.

Trainer _____ Date _____

Quality Assurance _____ Date _____

Laboratory Manager _____ Date _____

10.0 SAFETY

Appropriate safety techniques and procedures are required with the continual expansion and sophistication of techniques, chemicals and equipment used in an environmental laboratory. It is never assumed that personnel at any level of work have adequate information about laboratory safety. For this reason, the need for a training program is recognized to insure a safe laboratory environment.

This program involves the availability of proper safety equipment and adequate personnel training. The following is a list of the safety equipment located in the laboratory:

- Emergency shower
- Eye wash fountain
- Eye wash solution
- Fire extinguishers
- First aid kit
- Thermal gloves
- Safety glasses
- Laboratory coats
- Fume exhaust hoods
- Face shields
- Explosion shield

Fume hoods are provided in the laboratory for safe use of gaseous or toxic reagents. The reagents are stored in proper containers at ambient temperature in specifically designated areas of the laboratory. These areas are segregated to avoid contact of incompatible hazardous materials. Proper grounding of electrical equipment in the laboratory is inspected and monitored as a part of the routine preventative maintenance program.

A hazard communication program is in place in the laboratory. Full details of the laboratory safety program is given in the Chemical Hygiene Plan.

11.0 ANALYTICAL METHODS

The analytical methods used by the laboratory for the analysis of samples have been selected based on the needs of the client. Methods validated by U.S. EPA, NIOSH, the OSHA Technical Center, ASTM or other recognized method publication group will be used. Our laboratory does not design or validate methods for sample analysis. When methods are modified for use, modifications are made based on sound chemical principals and approved by the direction of the laboratory manager.

Before a new method is used for the analysis of client samples, an initial demonstration of capability (IDC) is performed to demonstrate that the laboratory can produce accurate and precise results. The IDC consists of the analysis of four quality control samples and a method detection limit study. The quality control sample may be purchased from an outside source or prepared by laboratory personnel. The individual and average recoveries are calculated along with the relative standard deviation. These results are compared with criteria specified in the method.

Methods for analysis of water and wastes have been documented by the U.S. Environmental Protection Agency as approved methodologies, under the National Pollutant Discharge Elimination System (NPDES) Permit Program, Clean Water Act (CWA), Safe Drinking Water Act (SDWA), or the Resource Conservation Recovery Act (RCRA). Methods for the analysis of materials for asbestos are from NIOSH Manual of Analytical Methods and EPA's Interim Method for the Determination of Asbestos in Bulk Insulation Samples, EPA 600/R93/116. Industrial hygiene samples are analyzed in accordance with methods published by NIOSH, the collection device manufacturer or OSHA.

The analytical methods used by the laboratory are given in Table 11-1 and are from the following sources:

1. EPA/600/4-79-020 "Methods for Chemical Analysis of Water and Wastes"
2. EPA/600/R-94-111 "Methods for the Determination of Metals in Environmental Samples" Supplement I
3. EPA/600/R-93-100 "Methods for the Determination of Inorganic Substances in Environmental Samples"
4. "Standard Methods for the Examination of Water and Wastewater" 18th edition
5. SW-846 "Test Methods for Evaluating Solid Waste", 3rd Edition with updates I, II, IIA, IIB, III

6. Code of Federal Regulations , Title 40, Part 136
7. EPA/600/R-95-131 "Methods for the Determination of Organic Compounds in Drinking Water" Supplement III
8. 3M Company method entitled "Determination of Selected Organic Vapors in Air"
9. EPA 1993 Draft Methods entitled, "Gasoline Range Organics" and Diesel Range Organics"
10. US Department of Agriculture Handbook No. 60 "Diagnosis and Improvement of Saline and Alkali Soils"
11. American Society of Agronomy, "Methods of Soil Analysis" American Society for Testing Materials, "Annual Book of ASTM Standards"
12. American Society for Testing Materials, "Annual Book of ASTM Standards"
13. NIOSH "Manual of Analytical Methods", 4th Edition
14. Western States Laboratory Proficiency Testing Program "Soil and Plant Analytical Methods", Version 4.0.
15. USEPA Contract Laboratory Program "Statement of Work for Inorganics Analysis" ILM04.0.
16. Massachusetts Department of Environmental Protection "Method for the Determination of Volatile Petroleum Hydrocarbons (VPH)" and "Method for the Determination of Extractable Petroleum Hydrocarbons (EPH)" Jan. 1998.
17. "Field and Laboratory Methods Applicable to Overburden and Mine Soils" by A. Sobek et al

Standard Operating Procedures are written for the tests that we perform. A list of the laboratories SOPs is given in Figure 11-2. At a minimum these SOPs specify:

- appropriate instrumentation and equipment
- sample handling and preservation
- instrument calibration
- standard preparation
- reagent preparation and standardization
- analytical procedure
- method of calculation of results
- quality control criteria
-

The SOPs are updated as required to remain current with methods of analysis. Outdated SOPs are maintained in a separate file.

ANALYTICAL METHODS TABLE 11-1
INORGANIC PARAMETERS

PARAMETER	DRINKING WATER	CLEAN WATER ACT / NPDES	RCRA	OTHER
Acidity	2310-B [4]	305.1 [1] 2310-B [4]	-	-
Alkalinity	2320-B [4]	310.1 [1] 2320-B [4]	-	-
Ammonia	-	350.1 [1]	-	Soil-KCl S-3.50
Biochemical Oxygen Demand	-	5210-B [4] 405.1 [1]	-	-
Bromide	-	320.1 [1]	-	-
Chemical Oxygen Demand	-	410.1 [1] 410.2 [1]	-	-
Chloride	300.0 [6,7]	325.2 [1] 325.3 [1]		Water Soluble 3c [10]
Color	2120-B [4]	2120-B [4]	-	-
Cyanide Amenable	4500-CN-G [4]	4500-CN-G [4] 335.1 [1]	9010B/9014 [5]	-
Cyanide Total	4500-CN-E [4]	4500-CN-E [4] 335.2 [1]	9010B/9014 [5]	-
Cyanide WAD	-	-	-	4500-CN-I [4]
Electrical Conductivity	2510-B [4]	2510-B [4] 120.1 [1]	9050A [5]	Sat. Paste S-1.20 [14]
Fluoride	4500-F-C [4]	4500-F-C [4] 340.2 [1]	-	Water Soluble 3c [10]
Halogens, Total	-	-	5050 [5]	-
Hardness	-	2340-B [4]	-	-
Heat of Combustion	-	-	-	D 2015 [12] E 711 [12]
Ignitability	-	-	1010 [5] 1030 [5]	-
Iodide	-	-	-	345.1 [1]
Kjeldahl Nitrogen, Total	351.2 [3]	351.1 [1]	-	-
Asbestos Fibers	-	-	-	7400 [13]
Asbestos Identification	-	-	-	EPA600/R93/116

ANALYTICAL METHODS TABLE 11-1
INORGANIC PARAMETERS

PARAMETER	DRINKING WATER	CLEAN WATER ACT / NPDES	RCRA	OTHER
Nitrate	353.2 [3]	353.2 [1]	-	Soil KCl S-3.10 [14]
Nitrite	353.2 [3]	353.2 [1]	-	Soil KCl S-3.10 [14]
Nitrate + Nitrite	353.2 [3]	353.2 [1]	-	Soil KCl S-3.10 [14]
Odor	2150-B [4]	-	-	-
Oil and Grease	-	413.1 [1]	9070 [5] 9071A [5]	-
Organic Nitrogen	-	351.1-350.1 [1] TKN-Ammonia	-	-
Ortho Phosphate	365.1 [3] 4500-P-E [4]	365.1/365.2 [1] 4500-P-E [4]	-	-
Oxygen Dissolved	-	360.2 [1] 4500-O-C [4]	-	-
pH	150.1 [1]	150.1 [1]	9040B/9045C [5]	Sat. Paste S-1.10 [14]
Paint Filter	-	-	9095A [5]	-
Phenols	-	420.1 [1]	9065 [5]	-
Phosphorus Total	-	365.1 [1] 365.2 [1]	-	Soil-extractable S-4.10 [14]
Reactivity	-	-	8.3 [5]	-
Solids, Settleable	-	160.5 [1]	-	-
Solids, Total Dissolved, TDS	2540-C [4]	2540-C [4] 160.1 [1]	-	-
Solids, Total Suspended, TSS	-	160.2 [1]	-	-
Solids, Total	-	160.3 [1]	-	-

ANALYTICAL METHODS TABLE 11-1
INORGANIC PARAMETERS

PARAMETER	DRINKING WATER	CLEAN WATER ACT / NPDES	RCRA	OTHER
Solids, Total Volatile	-	160.4 [1]	-	-
Specific Gravity	-	-	-	2710-F [4]
Sulfate	375.2 [3]	375.3 [1]	9036 [5]	Water Soluble 3c [10]
Sulfide	-	376.1 [1]	9030A*** [5] 9034 [5]	-
Sulfite	-	377.1 [1]	-	-
Surfactants, Foaming Agents	5540-C [4]	5540-C [4] 425.1 [1]	-	-
TCLP Extraction	-	-	1311 [5]	-
Turbidity	180.1 [3]	180.1 [1]	-	-

ANALYTICAL METHODS TABLE 11-1
METALS

PARAMETER	DRINKING WATER	CLEAN WATER ACT / NPDES	RCRA	OTHER
Aluminum	200.7 [2] / 200.8 [2]	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5]	200.7 CLP-M [15] 7300 [13]
Antimony	200.8 [2]	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5]	200.7 CLP-M [15]
Arsenic	200.8 [2]	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5] 7062 [5]	200.7 CLP-M [15] 7300 [13]
Barium	200.7 [2] / 200.8 [2]	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5]	200.7 CLP-M [15]
Beryllium	200.8 [2]	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5]	200.7 CLP-M [15] 7300 [13]
Boron	-	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5]	200.7 CLP-M [15]
Cadmium	200.7 [2] / 200.8 [2]	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5]	200.7 CLP-M [15] 7300 [13]
Calcium	200.7 [2] / 200.8 [2]	200.7 [6] / 200.8 [2]	6010B [5] / 6020 [5]	7300 [13] Sat. Paste S-1.60 [14]
Chromium	200.7 [2] / 200.8 [2]	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5]	200.7 CLP-M [15] 7300 [13]
Chromium, Hexavalent	-	218.4** [1]	7196A [5]	3500-CR-D [4]

ANALYTICAL METHODS TABLE 11-1
METALS

PARAMETER	DRINKING WATER	CLEAN WATER ACT / NPDES	RCRA	OTHER
Cobalt	-	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5]	200.7 CLP-M [15] 7300 [13]
Copper	200.7 [2] / 200.8 [2]	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5]	200.7 CLP-M [15] 7300 [13]
Iron	200.7 [2] / 200.8 [2]	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5]	200.7 CLP-M [15] 7300 [13]
Lead	200.8 [2]	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5]	200.7 CLP-M [15] 7300 [13]
Magnesium		200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5]	7300 [13] Sat. Paste S-1.60 [14]
Manganese	200.7 [2] / 200.8 [2]	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5]	200.7 CLP-M [15] 7300 [13]
Mercury-water -soil	245.1 [2]	245.1 [1]	7470A [5] 7471A [5]	245.1 CLP-M [15] 245.5 CLP-M [15]
Molybdenum	-	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5]	200.7 CLP-M [15] 7300 [13]
Nickel	200.7 [2] / 200.8 [2]	200.7 [6] / 200.8 [2]	6020 [5] / 6010 B [5]	200.7 CLP-M [15] 7300 [13]
Potassium		200.7 [6] / 200.8 [2]	6020 5 / 6010B [5]	Sat. Paste S-1.60 [14]
Selenium	200.8 [2]	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5] 7742 [5]	200.7 CLP-M [15] 7300 [13]
Silica	200.7 [2]	200.7 [6]	-	-
Silver	200.8 [2]	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5]	200.7 CLP-M [15] 7300 [13]

ANALYTICAL METHODS TABLE 11-1
METALS

PARAMETER	DRINKING WATER	CLEAN WATER ACT / NPDES	RCRA	OTHER
Sodium	200.7 [2]	200.7 [6] / 200.8 [2]	6010B [5] / 6020 [5]	7300 [13]
Strontium	-	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5]	-
Thallium	200.8 [2]	200.8 [2]	6020 [5]	7300 [13]
Tin	-	200.8 [2]	6020 [5] / 6010B [5]	-
Titanium	-	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5]	200.7 CLP-M [15]
Vanadium	-	200.7 [6] / 200.8 [2]	6020 [5] / 6010B [5]	200.7 CLP-M [15] 7300 [13]
Zinc	200.7 [6] / 200.8 [2]	200.7 [2] / 200.8 [2]	6020 [5] / 6010B [5]	200.7 CLP-M [15] 7300 [13]
Acid Digestion-Total ICP/AA	-	200.7 [6]	3010A [5]	CLPA-2
Acid Digestion-ICP-AA Total Recoverable	200.7 [2]	200.7 [6]	3005A [5]	-
Acid Digestion-Total ICPMS	200.2 [2]	3020A [5]	3020A [5]	-
Acid Digestion-Total Recoverable ICPMS	200.8 [2]	200.8 [2]	3005A [5]	-
Acid Digestion-Soil	-	-	3050B [5]	CLPB-1

* Preliminary distillation or analysis by the method of standard additions required on NPDES samples

** This method not currently performed by our laboratory

*** Modified

ANALYTICAL METHODS TABLE 11-1
ORGANIC PARAMETERS

PARAMETER	DRINKING WATER	CLEAN WATER ACT / NPDES	RCRA	OTHER
BETX	-	602 [6]	5030B [5] 8021B [5]	VPH [16] 1500/1501 [13] 3M [8]
DRO/TEH	-	-	8015B [5]	DRO [9]
EDB and DBCP	504.1 [7]	-	-	-
EPH	-	-	-	EPH [16]
GRO/TPH	-	-	8015B [5]	GRO [9] 1500 [13] 3M [8]
Herbicides	515.1 [7]	-	8151A [5]	-
Oil and Grease	-	413.1 [1]	9070 [5] 9071A [5]	-
Pesticides/PCBs	508 [7] 525.2 [7]	608 [6]	8081A [5] 8082 [5]	D4059 [12]
Semivolatiles	525.2 [7]	625 [6]	8270C [5]	-
TRPH	-	418.1 [1]	-	-
Volatiles	524.2 [7]	624 [6]	8260B [5]	1500, 1501, 1003 [13] 3M [8]
VPH	-	-	-	VPH [16]
Sample Extraction-water	Applicable Method	Applicable Method	3510C [5]	EPH [16]
Sample Extraction-soil	-	-	3550B [5]	EPH [16]

[1] EPA/600/4-79-020 "Methods for Chemical Analysis of Water and Wastes"
[2] EPA/600/R-94-111 "Methods for the Determination of Metals in Environmental Samples" Supplement I
[3] EPA/600/R-93-100 "Methods for the Determination of Inorganic Substances in Environmental Samples"
[4] "Standard Methods for the Examination of Water and Wastewater" 18th Edition
[5] SW-846 "Test Methods for Evaluating Solid Waste" 3rd Edition with updates I, II, IIA, IIB
[6] Code of Federal Regulations, Title 40, Part 136
[7] EPA/600/R-92-129 "Methods for the Determination of Organic Compounds in Drinking Water" Supplement III
[8] 3M Company method entitled "Determination of Selected Organic Vapors in Air"
[9] EPA 1993 Draft Methods entitled "Gasoline Range Organics" and Diesel Range Organics"
[10] US Department of Agriculture Handbook No. 60 "Diagnosis and Improvement of Saline and Alkali Soils"
[11] American Society of Agronomy, "Methods of Soil Analysis"
[12] American Society for Testing Materials, "Annual Book of ASTM Standards"
[13] NIOSH "Manual of Analytical Methods", 4th Edition.
[14] Western States Laboratory Proficiency Testing Program "Soil and Plant Analytical Methods", Version 4.0.
[15] USEPA Contract Laboratory Program – "Statement of Work for Inorganics Analysis", ILM04.0
[16] Massachusetts Department of Environmental Protection "Method for the Determination of Volatile Petroleum Hydrocarbons (VPH)" Jan. 1998 and "Method for the Determination of Extractable Petroleum Hydrocarbons (EPH)" Jan. 1998
[17] "Field and Laboratory Methods Applicable to Overburden and Mine Soils" by A. Sobek et al

FIGURE 11-2
NORTHERN ANALYTICAL LABORATORIES, INC.
STANDARD OPERATING PROCEDURES
Table of Contents

VOLUME I INORGANICS

FIGURE 11-2
CONTINUED

Sulfide-Titrimetric	01-0593	6
Sulfite-Titrimetric	01-0494	6
Surfactants-MBAS	01-0297	6
Total Kjeldahl Nitrogen- Automated Phenate	01-040192	6
Total Kjeldahl Nitrogen-Block Digester	01-0298 Draft[1]	6
Toxicity Characteristic Leaching Procedure	02-0593	6
Turbidity	03-0401	6

(1) SOP typed and currently under review
(2) SOP not yet written

FIGURE 11-2 CONTINUED

NORTHERN ANALYTICAL LABORTORIES, INC.
STANDARD OPERATING PROCEDURES
Table of Contents

VOLUME II METALS / SOILS

(1) SOP typed and currently under review
(2) SOP not yet written

ndata:\typing\sop's\tableofcontentsrev0701doc

FIGURE 11-2 CONTINUED

NORTHERN ANALYTICAL LABORATORIES, INC.
STANDARD OPERATING PROCEDURES
Table of Contents

VOLUME III ORGANICS

(1) SOP typed and currently under review
(2) SOP not yet written

adata:\typing\sop's\tablcofcontentsrev0701doc

FIGURE 11-2 CONTINUED

NORTHERN ANALYTICAL LABORATORIES, INC.
STANDARD OPERATING PROCEDURE
Table of Contents

VOLUME IV INDUSTRIAL HYGIENE, ASBESTOS, MISC.

(1) SOP typed and currently under review
(2) SOP not yet written

ndata:\typing\sop's\tableofcontentsrev0701doc

12.0 SIGNIFICANT FIGURES

The primary objective is to report all results in such a way that they can be interpreted properly with reference to the accuracy of the test. Numerical data can be calculated with more digits than are justified by the test's accuracy or precision. Data should be rounded to the number of figures consistent with the confidence that can be placed in it. After rounding the last digit of the reported result is doubtful. For example: if the analytical result is reported as 75.6 mg/l the 75 should be quite certain while the 0.6 is uncertain.

When calculating results, the number of significant figures in the reported result cannot be more than the factor that contained the fewest significant figures.

For example: $\frac{0.22 \times 100}{1.0665} = 20.62822...$

but should be rounded to 21 as 0.22 contains the least amount of significant figures (two).

Rounding Off Numbers: The following rules should be used for rounding off numbers to the correct significant places:

	Examples
If number ends in 1-4, round off to smaller number:	364 to 360
If number ends in 6-9, round off to larger number:	487 to 490
If number ends in 5, round off to even number:	365 to 360 375 to 380

Then two or more figures are to the right of the last figure to be retained, they are to be considered as a group in rounding decisions. For example: 2.4(501) would be rounded to 2.5 as the group (501) is greater than 5. 2.4(499) would be rounded to 2.4 as the group(499) is less than 5.

13.0 SAMPLE COLLECTION, CONTAINERS AND PRESERVATION

In order to maintain the integrity of the sample from the time it is collected until it is received in the laboratory for analysis, we recommend the use of proper sample containers and preservatives to our clients for the collection of samples. Upon request, we will supply our clients with appropriate sample containers and preservatives. Instructions for sample preservation are given as are material safety data sheets for each preservative supplied.

The EPA provides guidelines for sample preservation and holding times. A sample preservation table is provided in this section for the analyses that this laboratory performs. This table lists preservation, holding times, sample container, and sample volume required.

The analyses of those parameters with short holding periods – 48 hours or less – are given priority and completed as quickly as possible.

NORTHERN ANALYTICAL LABORATORIES, INC.
P O Box 30315 - Billings MT 59107 - Phone: (406) 254-7226 Fax: (406) 254-1389

SAMPLE PRESERVATION

PARAMETER	PRESERVATION	HOLDING TIME	CONTAINER TYPE SAMPLE VOLUME
Acidity	Cool, 4°C	14 days	P/G 200 mls
Alkalinity	Cool, 4°C	14 days	P/G 200 mls
Ammonia Nitrogen	Cool, 4°C H_2SO_4 to pH <2	28 days	P/G 50 mls
BETXMN in water	Cool, 4°C HCL to pH<2	14 days	3-40 ml VOA vials no head space
BETXMN in soil	Cool, 4°C	14 days	Glass, 100 gms minimal headspace
Biochemical Oxygen Demand	Cool, 4°C	48 hours	P/G 1000 mls
Bromide	Cool, 4°C	28 days	P/G 100 mls
Cations Ca, Mg, Na, K	HNO_3 to pH <2	6 months	P/G 100 mls
Chemical Oxygen Demand	Cool, 4°C H_2SO_4 to pH <2	28 days	P/G 200 mls
Chloride	Cool, 4°C	28 days	P/G 100 mls
Color	Cool, 4°C	48 hours	P/G 100 mls
Cyanide	Cool, 4°C NaOH to pH >12	14 days	P/G 500 mls
Diesel Range Organics, water	Cool, 4°C HCl to pH <2	7 days to extraction 40 days to analysis	Glass, 1000 mls
Diesel Range Organics, soil	Cool, 4°C	14 days to extraction 40 days to analysis	Glass, 100 gms
EDB and DBCP by 504	Cool, 4°C [1]	28 days	4 - 40 ml VOA vials no headspace
Electrical Conductivity	Cool, 4°C	28 days	P/G 100 mls
EPH in water	Cool, 4°C HCL to pH<2	14 days to extraction 40 days to analysis	Glass, 1000 mls
EPH in soil	Cool, 4°C	7 days to extraction 40 days to analysis	Glass, 100 gms minimal headspace
Fluoride	Cool, 4°C	28 days	P/G 100 mls
Gasoline Range Organics, water	Cool, 4°C HCl to pH <2	14 days	2 - 40 ml VOA vials no headspace
Gasoline Range Organics, soil	Cool, 4°C	14 days	Glass, 100 gms minimal headspace

[1] If the water sample is chlorinated, add sodium thiosulfate

NORTHERN ANALYTICAL LABORATORIES, INC.

P O Box 30315 - Billings MT 59107 - Phone: (406) 254-7226 Fax: (406) 254-1389

SAMPLE PRESERVATION

PARAMETER	PRESERVATION	HOLDING TIME	CONTAINER TYPE SAMPLE VOLUME
Halogens, Total	None	None given	Glass, 10 gms minimal headspace
Herbicides by 8151A water	Cool, 4°C	7 days to extraction 40 days to analysis	Glass, 1000 mls
Herbicides by 8151A soil	Cool, 4°C	14 days to extraction 40 days to analysis	Glass, 100 gms
Herbicides by 515.1	Cool, 4° C [1]	14 days to extraction 28 days to analysis	Glass, 1000 mls
Hexavalent Chromium	Cool, 4°C	24 hours	P/G 200 mls
Iodide	Cool, 4°C	24 hours	P/G 200 mls
Kjeldahl Nitrogen Total	Cool, 4°C H_2SO_4 to pH <2	28 days	P/G 100 mls
Metals, Dissolved (except Mercury)	Filter, then HNO_3 to pH <2	6 months	P/G 500 mls
Metals, Total (except Mercury)	HNO_3 to pH <2	6 months	P/G 500 mls
Methane	Cool, 4°C	14 days	Glass 1/3 headspace
Mercury	Cool, 4°C HNO_3 to pH <2	28 days	P/G 200 mls
Nitrate + Nitrite	Cool, 4°C H_2SO_4 to pH <2	28 days	P/G 100 mls
Nitrite	Cool, 4°C	48 hours	P/G 100 mls
Odor	Cool, 4°C	24 hours	Glass, 200 mls
Oil and Grease	Cool, 4°C H_2SO_4 to pH <2	28 days	Glass, 1000 mls
Organic Carbon, Total	Cool, 4°C HCl to pH <2	28 days	Glass, 100 mls
Organic Nitrogen	Cool, 4°C H_2SO_4 to pH <2	28 days	P/G 100 mls
Ortho Phosphate	Cool, 4°C	48 hours	P/G 100 mls
Oxygen, Dissolved	Call laboratory Fix O_2 on site	analyze immediately	Glass, 300 mls no headspace

[1] If the water sample is chlorinated, add sodium thiosulfate

NORTHERN ANALYTICAL LABORATORIES, INC.

P O Box 30315 - Billings MT 59107 - Phone: (406) 254-7226 Fax: (406) 254-1389

SAMPLE PRESERVATION

PARAMETER	PRESERVATION	HOLDING TIME	CONTAINER TYPE SAMPLE VOLUME
PAH by 525.2	Cool, 4°C HCl to pH<2[2]	14 days to extraction 30 days to analysis	Glass, 1000 mls
Pesticides/PCBs by 8081 & 8082, water	Cool, 4°C	7 days to extraction 40 days to analysis	Glass, 1000 mls
Pesticides/PCBs by 8081, soil	Cool, 4°C	14 days to extraction 40 days to analysis	Glass, 100 gms
Pesticides by 508	Cool, 4°C[1]	14 days to extraction and analysis	3 - 40 ml VOA vials no headspace
pH	Cool, 4°C	24 hours	P/G 100 mls
Phenolics	Cool, 4°C Copper sulfate & H_3PO_4	28 days	Glass, 1000 mls
Phosphorus, Total	Cool, 4°C H_2SO_4 to pH <2	28 days	P/G 100 mls
Recoverable Pet. Hydrocarbons, TRPH	Cool, 4 C HCl to pH <2	28 days	Glass, 1000 mls
Semivolatiles by 8270 water	Cool, 4°C	7 days to extraction 40 days to analysis	Glass, 1000 mls
Semivolatiles by 8270 soil	Cool, 4°C	14 days to extraction 40 days to analysis	Glass, 100 gms
Semivolatiles by 525.2	Cool, 4°C[2] HCl to pH <2	14 days to extraction 30 days to analysis	Glass, 1000 mls
Solids, Settable	Cool, 4°C	48 hours	P/G 1000 mls
Solids, Total TDS, TVS, TS, TSS	Cool, 4°C	7 days	P/G 1000 mls
Sulfate	Cool, 4°C	28 days	P/G 200 mls
Sulfide	Cool, 4°C NaOH & ZnAcetate to pH >9	7 days	P/G 500 mls
Sulfite	Cool, 4°C 1 ml EDTA solution per 100mls, call lab	analyze immediately	P/G 200 mls minimal headspace avoid aeration
Surfactants	Cool, 4°C	48 hours	P/G 500 mls
Turbidity	Cool, 4°C	48 hours	P/G 100 mls

[1] If water is chlorinated add sodium thiosulfate.
[2] If water is chlorinated, add sodium sulfite.
[3] If water is chlorinated, add ascorbic acid.

NORTHERN ANALYTICAL LABORATORIES, INC.

P O Box 30315 - Billings MT 59107 - Phone: (406) 254-7226 Fax: (406) 254-1389

SAMPLE PRESERVATION

PARAMETER	PRESERVATION	HOLDING TIME	CONTAINER TYPE SAMPLE VOLUME
Volatile Organics in Water	Cool, 4°C HCl to pH <2 [3]	14 days	3 - 40 ml VOA vials no headspace
Volatile Organics in Soil	Cool, 4°C	14 days	Glass, 100 gms minimal headspace
VPH in Water	Cool, 4°C HCl to pH<2	14 days	3-40 ml VOA vials no headspace
VPH in Soil	Cool, 4°C	7 / 28 days [4]	Glass 100 gms no headspace
Lead in Soil	None	180 days	P/G 50 grams
Lead in Paint Chips	None	180 days	P/G 5 grams
Lead in Wipe Samples	None	180 days	Use ASTM approved wipe include blank wipe
Lead in Air	None	180 days	0.8 um cellulose ester membrane include blank filter

[3] If the water sample is chlorinated, add ascorbic acid

[4] Preserve in methanol within 7 days of collection, analyze within 28 days of methanol preservation.

14.0 EQUIPMENT LIST

Following is a list of equipment currently used by the laboratory. Notes are included as to make, model, and generalized calibration requirements. Authorization for individual staff members to use the key instruments in the laboratory is obtained from the laboratory manager. A record of the authorization is kept with our equipment records. This record system includes the identity of devices in use by the laboratory, operators manual location (if one is provided) and notes or comments about the instrument's use.

Type	Model	Manufacturer	Calibration Frequency
Oven	Wooden Cabinet	Classic WoodSam Walter	None
Oven	255D	Fisher	Eash Use
Oven	200A	Blue M	Each Use
Oven	Muffle Furnace	Sybron	Each Use
Oven	---	Despatch	Each Use
Oven	630F	Fisher	Each Use
Oven	1370F	VWR	Each Use
Oven	Muffle Furnace	Thermolyne	Each Use
Incubator	146A	Fisher Scientific	Each Use
Balance	GA110	OHAUS	Daily
Balance	Top loader	American Scientific Products	Daily
Balance	A-30	Mettler	Daily
Balance	7224DA	Fisher Scientific	Daily
Balance	AE100	Mettler	Daily
Balance	A-200 DS	Fisher Scientific	Daily
Balance	Navigator	OHAUS	Daily
Spectro-photometer	Spectronic 301	Milton Roy	Each Use
Turbidimeter	Micro 1000	HF Instruments	Each Use
Infrared Spectro-photometer	FT 57	Biorad	Each Use
Centrifuge	6K	Marathon	None
Shaker	---	Eberbach	None
Air Compressor	---	Sanborn	None
Water Cooler	---	Thermo Jarrell Ash	None
Bomb Colorimeter	1241	Parr	None
Emission Spectro-photometer	ICAP 61	Thermo Jarrell Ash	Each Use
ICP/Mass Spectrometer	ELAN 6100	Perkin Elmer	Each Use
Sulfur Analyzer	S144-DR	Leco	Each Use
Atomic Absorption Spectrophotometer	Video 12E	Thermo Jarrell Ash	Each Use

14.0 EQUIPMENT LIST (cont.):

Type	Model	Manufacturer	Calibration Frequency
3 - Microscope	BHT/2	Olympus	Each Use
3 - Microscope	SPT	Fisher	Each Use
Conductivity Bridge	AR 50	Accumet	Each Use
pH Meter/Ionanalyzer	501	Orion	Each Use
pH Meter/Ionanalyzer	420A	Orion	Each Use
pH Meter	301	Orion	Each Use
pH Meter	AR 50	Accumet	Each Use
1 - Gas Chromatograph	9000	Tremetrics	Each Use
5 - Gas Chromatograph	5890	Hewlett Packard	Each Use
2 - Gas Chromatograph/ Mass Spectrometer	5890/5971	Hewlett Packard	Each Use
1- Purge and Trap	3100	Tekmar	None
3 - Purge and Traps	4460A	O.I. Analytical	Each Use
3 - Purge and Traps	LSC 2000	Tekmar	Each Use
3 - Autosamplers	MPM-16	O.I. Analytical	None
2 – Autosamplers	ALS 2016	Tekmar	None
1- Autosampler	AquaTek 70	Tekmar	None
5 - Autoinjectors	7673	Hewlett Packard	None
3 - Heater Jackets	MHC-16	O.I. Analytical	None
Auto Analyzer	Flow Solution Alk/Cl/SO4/NO3/NH3/TKN/PO4	Alpkem	Each Use
Flash Point Tester	Pensky-Martens	Koehler	Each Use
Hot Water Bath	---	Intedge	Each Use
Sonic Bath	3200	Branson	None
Sonifier	450	Branson	None
Sonifier	---	Heat Systems	None
TCLP Extractor/Rotator	---	Millipore	Each Use
TCLP Extractor/Rotator	---	Our Manufacture	Each Use
3 - Zero Headspace Extractors	---	Millipore	None
2 - Micro Kjeldahl Distillation Apparatus	---	Labconco	None
Block Digester	BD-46	Lachat	None
Block Digestor	Mod Block	CPI	None
20 - Personal Computer	---	Various Models	None
7 - Printers	---	Various Models	None

14 EQUIPMENT LIST (cont.):

1 - Strip Chart Recorder	---	Linear	None
3 - Refrigerators	Isotemp	Fisher Scientific	Daily
1 - Refrigerator	Explosion Proof	Lab Line	Daily
4 - Refrigerators	Under Counter	Kenmore	Daily
2 - Fume Hood	Safety Flow 93-890EQ	Fisher Scientific	Annually
4 - Fume Hoods	---	Various Models	Annually
Biological Hood	---	Labconco	Annually
Deionized Water System	Reverse Osmosis	Millipore	Weekly
Deionized Water System	Milli-Q	Millipore	Weekly
Evaporator	TurboVap 500	Zymark	None
Microsoft NT		Microsoft	
Visual Lab Pro		Prism, Inc.	
Microsoft Word		Microsoft	
Microsoft Excel		Microsoft	
Lotus 1-2-3		Lotus	
Hewlett Packard Chem Station for GC		Hewlett Packard	
Hewlett Packard Chem Stations for GC/MS		Hewlett Packard	
Fast Pac by Alpkem		Alpken/Astoria	
Obsolete or not in use:			
High Pressure Liquid Chromatograph	Waters 600	Millipore	Each Use
UV Detector	757	Applied Biosystems	Each Use
Ion Chromatograph	20001	Dionex	Each Use
1 - Gas Chromatograph/ Mass Spectrometer	5890/5970A	Hewlett Packard	Each Use
2-Ovens	---	Manufacturer unknown	Each Use
Conductivity Bridge	Model 35	YSI	Each Use

15.0 AUDIT PROGRAMS/LABORATORY ACCREDITATIONS

Northern Analytical Laboratories, Inc. participates in many performance evaluation programs. These audits can take the form of simple round robin analyses or formal audits by regulatory agencies. The following is a list of audit programs in which we are currently enrolled:

- Water Supply (WS) Audit - Semiannually
- NIOSH ELPAT Programs for Lead in Paint Chips, Soil, & Dust Wipes Quarterly
- NIOSH PAT Program for Fiber Analysis by Phase Contrast Microscopy, Solvents, and Metals - Quarterly
- NIST Asbestos Identification for Bulk Material - Semiannually

The NIOSH PAT and NIST audit programs support the laboratories industrial hygiene and asbestos services. The WS and NIOSH ELPAT audit programs support the chemical services provided by this laboratory.

Performance evaluation (PE) samples are given a laboratory number and submitted to the lab for analysis in the same manner as a regular client sample. Sample preparation instructions received with the samples are given to the lab staff. In order to ensure that the PE samples are prepared correctly, preparation instructions are to be read and concurred with by two analysts and a second analyst is to observe the preparation. PE samples are to be analyzed in the same manner as a client sample. Multiple analyses of PE samples are not to be conducted and a single, unaveraged, result is to be reported. All required calculations are to be checked by a second analyst. The results recorded on the PE report form are to be checked by a second person for correctness before submittal.

This laboratory is currently accredited by three federal or state regulatory agencies. A list of these accreditations is give in Table 15-1. Copies of accreditation certificates can be provided upon request.

TABLE 15-1

NORTHERN ANALYTICAL LABORATORIES, INC.
LABORATORY ACCREDITATIONS

American Industrial Hygiene Association
2700 Prosperity Ave. Suite 250
Fairfax, VA 22031
Fibers, Metals, Solvents – PAT
Lead - ELPAT

State of Montana
Department of Environmental Quality
Cogswell Building, 1400 Broadway
Helena, MT 59620
Drinking water

National Voluntary Laboratory Accreditation Program
National Institute of Standards and Technology
Building 411, Room A162
Gaithersburg, MD 20899
Bulk Asbestos

16.0 RECIPIENTS OF QUALITY ASSURANCE PLAN

A distribution list of all recipients of the quality assurance plan is maintained by the quality assurance officer. The list is not printed herein to maintain client confidentiality.

17.0 DEFINITION OF TERMS

1. Accuracy - The closeness of agreement between an observed value and its know or reference value.

2 Calibration - To establish a plot of concentrations of known analyte standards verses instrument response to the analyte.

3 Calibration blank - An analyte free water, matrixed and prepared in the same manner as a calibration standard.

4. Calibration standards - A series of known concentration analyte solutions used for the calibration of an instrument.

5. Corrective Action - To respond to and correct a condition that does not meet established quality standards.

6. Duplicate - A second aliquot of a sample that is treated in the same manner as the original sample in order to determine the precision of the method.

7. Laboratory Control Sample (Laboratory fortified blank) - A control sample of know concentration prepared by laboratory personnel that is analyzed using the same preparation and analytical methods as the samples. Used to assess accuracy.

8. Matrix Spike - A second aliquot of a sample to which a known amount of analyte(s) is added. The matrix spike is prepared and analyzed in the same manner as the sample and is used to determine accuracy and matrix effects.

9. Method Blank - An aliquot of analyte free matrix that is prepared and analyzed in the same manner as the samples.

10. Method Detection Limit (MDL) – A statistical calculation of the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The MDL is determined by analysis of seven samples prepared at known concentration and taken through the entire analytical process.

11. Quality Control Sample - A control of certified concentration purchased from an outside vendor.

12. Practical Quantitation Limit (Reporting Limit) - The minimum concentration of analyte reported to the client. The PQL/RL is project specific and is determined by the laboratory method detection limit, applicable regulatory limits, client requirements and sample matrix.

13. Precision - The agreement among a set of replicate measurements without assumption of knowledge of the true value.

14. Surrogate - An organic compound added by the laboratory to the sample prior to extraction and analysis which behaves in a similar manner to the target analytes but which is not normally found in environmental samples. Used to access accuracy and matrix effects.

18.0 REVISIONS

The Quality Assurance Manual is reviewed annually and revised as needed to stay current with the requirements of the regulatory agencies, methods, and laboratory practices. Revisions to the manual are made by the laboratory manager or the QAC then reviewed by the other. Both are signatories for the publication of the manual. This section provides an overview of the revisions made in this version of the QA manual as dated on the cover page.

1. Section 1 – Revised wording in "Purpose" section..
2. Section 3 – Description of responsibilities of Chemists, Laboratory Technicians and Utility Staff added.
3. Section 5 – Revised and added wording to Section 5.1 "Chain of Custody"
4. Section 5 – Revised and added wording to Section 5.2 "Sample Log-in"
5. Section 5 – Revised heading of Section 5.3 from "Doumentation of Analysis" to "Document Control"
6. Section 5 – Added sections 5.3.1 through 5.3.10
7. Section 5 - Revised section desigination of "Supporting Quality Assurance Documentation" from section 5.5 to section 5.3.11.
8. Section 5 – Deleted section 5.4 and incorporated contents of 5.4 into section 5.3.8
9. Section 5 – Added figures 5-6 to 5-12, examples of final report formats
10. Section 6 – Added matrix spike calculation
11. Section 6 – Updated and revised the table "Quality Control Acceptance Criteria"
12. Section 6 – Added figure 6-4 "Standard Preparation Label"
13. Section 6 – Revised section 6.4, described corrective action and non-conformance reports
14. Section 7 – Added description of maintenance log books
15. Section 8 – Added figure 8-3, chemical and reagent labels
16. Section 8 – Deleted Table 8-1 "Reagent Shelf Life"
17. Section 11 – Added method validation criteria
18. Section 11 – Revised "Analytical Methods Table 11-1"
19. Section 11 – Updated and revised figure 11-2 "Standard Methods for the Examination of Water and Wastewater", 18th Edition.
20. Section 11 – Updated and revised figure 11-2 "Standard Operating Procedure Table of Contents"

21. Section 13 – Add lead matrices to "Sample Preservation" Table
22. Section 14 – Updated equipment list
23. Section 15 – Updated Table 15.1 "Laboratory Accreditations" list

APPENDIX E

STANDARD OPERATING PROCEDURES

SOP#	
3	Surface Water Sampling
5	Field Measurement of Electric of Specific Conductance (EC/SC)
6	Field Measurement of pH
7	Field Measurement of Water Temperature
8	Field Measurement of Dissolved Oxygen
9	Sample Packaging and Shipping
10	Field Forms
11	Equipment Decontamination
12	Sample Documentation
16	Monitoring Well Construction
17	Monitoring Well Development
18	Groundwater Sampling
20	Field Measuremnt of Ground Water Level
22	Soil Sample Collection
23	X-Ray Fluoresence (XRF) Spectrometer Use and Calibration
24	Soil Sample Preparation and Preservation
27	Field Measurement of Volatile Organic Compounds Headspace
44	Ionization Device (PID or FID) Operation
46	Collection of Asbestos Samples
47	Collection of Lead-Based Paint Samples
---	EPA Low-Flow Sampling Procedure

STANDARD OPERATING PROCEDURE NO. 3
SURFACE WATER SAMPLING

Equipment List:
DH-48 or D-74 sediment sampler
Sample containers

EQUAL DISCHARGE INTEGRATED SAMPLING

1. Visually check DH-48 or D-74 sediment sampler for damage. Replace or repair parts as necessary.

2. Decontaminate all parts of the sampler including nozzle, body, gasket, sample collection bottle, and handle using the procedure outlined in SOP-11.

3. Following streamflow measurement, and utilizing the same tag line or surveyor's tape stretched across the stream, divide the stream into an appropriate number of sections of equal discharge based on stream gaging results. At the mid point of each equi-discharge section, lower the sampler into the stream with one continuous motion making sure the sample handle is vertical. Lower the sediment sampler to the streambed at a rate based on the rating curve for the nozzle size used and the velocity of the stream. The sample bottle should be just under half full upon encountering the streambed. Raise the sampler at a rate similar to the descent rate. Low velocity streams are slow to fill the sample bottle; repeat the procedure until sampler is nearly full. The sample bottle should not be completely full upon removal from the stream. Pour contents of sample bottle into a churn splitter or into an appropriately sized compositing container.

4. Repeat procedure for the other equal discharge sections identified, composite collected samples.

5. Mix composite sample, fill out bottle labeling information, and fill the appropriate sample bottle.

6. Fill out appropriate field form documenting sample location, time, and other pertinent information prior to leaving sampling site.

GRAB SAMPLING

1. Decontaminate sampling container in accordance with SOP-11.

2. Locate sampling point if feasible at the interval in the stream which exhibits the largest volume of flow and/or highest velocity. More than one interval may be sampled.

3. Submerge sample container at sampling point such that mouth of container is under water surface 2 to 3 inches, if possible. If sampling inorganics, allow container to fill partially; rinse container by shaking and discharge this water away from sample site. Repeat this procedure three times. Do not rinse sample bottles for organics analysis.

4. Collect sample and transfer into compositing container. Transfer water from compositing container into pre-labeled sampling bottles.

5. Fill out appropriate field form(s) documenting sample location, time, and other pertinent information prior to leaving sampling site.

SURFACE SAMPLING

1. This sampling procedure is to be used when sampling for organic constituents that float on top of water (e.g. oil and grease).

2. Decontaminate sampling container in accordance with SOP-11. The sampling container should be a wide mouth jar.

3. Submerge the sampling container in such a manner that leaves the mouth of the container half-way out of the water. Wait for container to fill.

4. Transfer directly into sampling bottles.

5. Fill out appropriate field form(s) documenting sampling location, time and other pertinent information prior to leaving the sampling site.

STANDARD OPERATING PROCEDURE NO. 5
FIELD MEASUREMENT OF ELECTRIC OR SPECIFIC CONDUCTANCE (EC/SC)

Equipment List:
EC/SC meter
D-cell batteries
De-ionized water
Potassium chloride (KCl) solution standards
200 ml glass beaker
Screw driver
De-inonized water
Polyvinychloride bottle with de-ionized water

INSTRUMENT CALIBRATION (for non-temperature compensating meters)

At the beginning each day of making measurements, determine the cell constant for the meter in the field or lab.

1. Turn on machine and check red line and zero point on meter. Adjust as necessary. If unable to reach red line, or zero point, replace D cell batteries.

2. Plug probe into jack, and rinse probe with deionized water.

3. Measure conductivity and temperature of two KCl solution standards which best bracket the expected EC/SC of the sample.

4. Calculate EC/SC using the following chart to adjust conductivity measurement for temperature correction.

TEMPERATURE CORRECTION TABLE

TEMP EC	FACTOR	TEMP EC	FACTOR	TEMP EC	FACTOR
-1	1.89	8	1.46	17	1.18
0	1.84	9	1.42	18	1.15
1	1.79	10	1.38	19	1.13
2	1.74	11	1.35	20	1.10
3	1.68	12	1.32	21	1.08
4	1.63	13	1.29	22	1.06
5	1.58	14	1.26	232	1.04
6	1.54	15	1.23	24	1.02
7	1.50	16	1.20	25	1.00

5. Use the following procedure to calculate cell factor:

SC of Standard_____(a) Temperature of Standard _____

Instrument Reading_____ Temperature Correction Factor (from above table)

Temp.Corrected SC_____(b) Cell Correction Factor _____
[divide (a)/(b)]

6. The cell factor is calculated for each standard and then averaging the values from the two standards. The cell correction factor is the ratio of the actual conductivity of the standard KCl solution(a) to the computed conductivity(b). Use the averaged value of the two standards to adjust the measured field conductivity for each sample taken during the day.

FIELD PROCEDURE

1. Turn on machine and check red line and zero point on meter. Adjust as necessary. If unable to reach red line, or zero point, replace D cell batteries.

2. Rinse decontaminated glass beaker with approximately 50 milliliters of sample water three times.

3. Place approximately 150 ml. of sample in decontaminated glass beaker.

4. Rinse probe with deionized water and place conductivity probe in sample water.

5. Immerse conductivity probe in sample so that vent hole is submerged. Move probe around in sample to displace any air bubbles. The probe should not be touching the sides of the beaker. Turn instrument to appropriate scale for sample being analyzed. Multiply reading by the correct multiplier from the dial and record to the nearest ten micromhos/centimeter. Measure sample temperature to nearest 0.5^{o}C from conductivity meter.

6. Record temperature and conductivity reading on the sample field form. Compute the adjusted specific conductivity using the following procedure:

   Water Temp. _____ Observed SC (a) _____

   Temperature Correction (from table) (b) _____
   Cell Correction Factor (from above) (c) _____
   Adjusted Sample SC [multiply (a)(b)(c)] _____

7. Remove probe from sample and rinse probe with DI water. Store probe in deionized water to protect coating.

MAINTENANCE

1. Store meter in its case during transport. Store probe immersed in deionized water (a poly bottle with rubber stopper works well).

2. Check batteries before taking meter into the field. Carry spare batteries and screwdriver.

3. Inspect conductivity electrodes regularly for cracks or other damage.

4. If platinum black has flaked off, a sharp end point cannot be achieved or readings are erratic. Return probe to factory so it can be re-platinized.

STANDARD OPERATING PROCEDURE NO. 6
FIELD MEASUREMENT OF pH

Equipment List
pH meter & electrodes
Distilled or deionized water
Calibration solutions (7.0, 4.1, 10.0)
Potassium Chloride (KCl) solution
Batteries
Screwdriver

INSTRUMENT CALIBRATION

1. Calibrate pH meter before leaving for the field and each day in the field when pH will be measured. Calibrate using following procedure:

   - Rinse pH electrode and temperature probe with distilled water.

   - Immerse electrode and temperature probe in bottle of commercial calibration solution of pH buffer 7.0. Calibrate meter to within 0.1 standard unit (s.u.).

   - Remove electrode and temperature probe from solution, rinse with distilled water.

   - Immerse electrode and temperature probe in second pH calibration buffer having a pH of 3 units higher or lower than the first, bracketing the expected range of field sample pH.

   - The pH meter should be recalibrated during the field day, especially when air temperatures are changing by 5 or more degrees. To recalibrate pH meter, measure pH of the 7.0 buffer solutions. If the measured value differs from expected value by more than 0.1 units, recalibrate meter using according to meter instructions.

FIELD PROCEDURES

1. Rinse decontaminated glass beaker with approximately 50 milliliters of sample water three times.

2. Rinse pH electrode with deionized water.

3. Check meter using 7.0 pH buffer. Re-calibrate meter, if not within 0.1 pH units.

4. Fill beaker with sample water.

5. Immerse electrode and temperature probe in sample, agitate probes to provide thorough mixing. Continue to agitate until reading has stabilized. Read pH to nearest 0.1 s.u.

6. Record the sample pH. Note any problems such as erratic readings.

7. Rinse probe with DI water and store according to manufacturer's directions.

MAINTENANCE

1. Store meter in its case with electrode immersed in a KCl or pH 7.0 buffer solution.

2. If meter is not used often, inspect bi-weekly to make sure electrode is immersed in one of the solutions

described above.

3. Check batteries each time meter is used. Carry a spare battery pack and a screwdriver into the field in the pH meter case.

4. It is wise to keep an additional pH electrode available in case of probe malfunction or breakage. Usually probes are replaced as their sensitivity becomes weakened. If stabilized readings take an unusually long time to reach, or the meter cannot be calibrated.

STANDARD OPERATING PROCEDURE NO. 7
FIELD MEASUREMENT OF WATER TEMPERATURE

Equipment List
NBS-calibrated thermometers
250-ml glass beaker
Field log book or field data sheets
De-ionized water

1. Carry two NBS-calibrated thermometers inside cases, into the field.

2. Check thermometer for cracks or gaps in the solution. Do not use thermometers if either cracks or gaps are visible. (Some gaps can be closed by submersing tip in a beaker of boiling water, or placing thermometer in a freezer).

3. When possible, measure temperature of surface water at midstream submersing the thermometer for approximately one minute or until temperature stabilizes. Temperatures should be collected from moving water, avoiding still pools which may be warmer than actual conditions.

4. When in situ temperature measurements are not possible, draw sample of at least 200 mL into a decontaminated beaker or sample bottle as soon after sampling as possible.

5. Place thermometer in sample. Do not allow thermometer bulb to touch sides of beaker. Allow to equilibrate (about 1 minute).

6. Record temperature to nearest $0.5^{o}C$ in field log book or on field data sheet.

7. Rinse thermometer with deionized water.

8. On a quarterly basis, check field thermometers against a NBS-certified laboratory thermometer. Agreement should be within $0.5^{o}C$.

STANDARD OPERATING PROCEDURE NO. 8
FIELD MEASUREMENT OF DISSOLVED OXYGEN

Equipment List
Dissolved oxygen meter & repair kit with membrane and electrolyte solution
Batteries
Screw driver
Deionized water
250-ml glass beaker

1. Inspect dissolved oxygen (DO) meter for damage. The probe end should be examined to be sure the membrane is intact. Repair as necessary according to manufacturer's instructions.

2. Rinse probe and cable with Deionized water.

3. Prepare probe and DO meter in accordance with instrument manufacturer's operating procedures (in meter box). Make certain probe contains sufficient electrolyte and the oxygen sensor membrane is in good repair.

4. Calibrate probe and meter using the fresh water - air calibration method. Correct calibration value for temperature and altitude; adjust meter accordingly.

5. When possible place probe directly into the stream, or water to be measured. If not possible, place probe into beaker filled with sample. Manually raise and lower probe through sample about 1 foot/second. Allow sufficient time for probe to stabilize to sample temperature and dissolved oxygen concentration.

6. Read dissolved oxygen value. Record appropriate data on field forms.

STANDARD OPERATING PROCEDURE NO. 9
SAMPLE PACKAGING AND SHIPPING

All environmental samples collected should be packaged and shipped using the following procedures:

Equipment List
Coolers
Ice or frozen blue ice packets
Absorbent cushioning material
Chain-of-custody
Shipping forms
Fiberglass strapping tape
Resealable bags
Paint cans filled with vermiculite (for hazardous materials/waste)

PACKAGING

1. Label all sample containers with indelible ink (on the side, not on the cap or lid). Place labeled sample bottles in a high quality cooler containing an adequate amount of ice and/or frozen blue ice (appropriate for the season), making sure the cooler drain plug is taped shut.

2. Place the samples in an upright position and wrap the samples with absorbent, cushioning material for stability during transport. Samples should not be loose; the cooler should be able to withstand rough handling during shipment without sample breakage.

3. Fill out the appropriate shipping forms, and place the paperwork in a ziploc bag and tape it to the inside lid of the shipping container. Shipping forms usually include: 1) a chain-of-custody form, documenting the samples included in the shipment; 2) an analysis request form, specifying the laboratory analyses for each sample. If more than one cooler is used per chain of custody, put a photocopy in the other coolers and mark them as a copy.

4. Close and seal the cooler using fiberglass strapping tape.

5. Secure the shipping label with address, phone number, and return address clearly visible.

SHIPPING HAZARDOUS MATERIALS/WASTE

Hazardous materials need to be shipped using procedures specified under Federal Law. Samples need to be shipped in Ziploc bags or paint cans filled with vermiculite, depending on the level of hazard. Special package labeling may be needed. Consult the project manager for specific shipping procedures.

STANDARD OPERATING PROCEDURE NO. 10
FIELD FORMS

All pertinent field investigations and sampling information shall be recorded on a field form during each day of the field effort and at each sample site. The field crew leader shall be responsible for ensuring that sufficient detail is recorded on the field forms. No general rules can specify the extent of information that must be entered on the field form. However, field forms shall contain sufficient information so that someone can reconstruct all field activity without relying on the memory of the field crew. All entries shall be made in indelible ink weather conditions permitting. Each day's or site's entries will be initialed and dated at the end by the author.

Equipment List:
Indelible ink pens (pencils or write-in-the-rain pens)
Field Notebooks
Field logs

At a minimum, entries on the field sheet or in field notebook shall include:

1. Date and time of starting work and weather conditions.

2. Names of field crew leader and team members

3. Project name and type

4. Description of site conditions and any unusual circumstances.

5. Location of sample site, including map reference, if relevant

6. Equipment ID numbers

7. Details of actual work effort, particularly any deviations from the field work plan or standard operating procedures

8. Field observations

9. Field measurements made (e.g., pH)

For sampling efforts, specific details for each sample should be recorded using Maxim Technologies, Inc. standardized field forms. Surface water and groundwater field forms contain fill-in-the-blank type information in order that all pertinent information shall be recorded. In addition to the items listed above, the following information is recorded on field forms during sampling efforts:

1. Time and date samples were collected

2. Number and type (field, duplicate, QA/QC) of samples collected

3. Analysis requested

4. Sampling method, particularly deviations from standard operating procedures

Strict custody procedures shall be maintained with the field forms. Field forms shall remain with the field team at all times, while being used in the field. Upon completion of the field effort, photocopies of the original field forms will be made and used as working documents; original field forms shall be filed in an appropriately secure manner.

STANDARD OPERATING PROCEDURE NO. 11
EQUIPMENT DECONTAMINATION

The purpose of this section is to describe general decontamination procedures for field equipment in contact with mine/mill tailings, soil, or water. During field sampling activities, sampling equipment will become contaminated after it is used. Sampling equipment must be decontaminated between sample collection points if it is not disposable. Field personnel must wear disposable latex or vinyl gloves while decontaminating equipment at the project site. Change gloves between every sample. Every precaution must be taken by personnel to prevent contaminating themselves with the wash water and rinse water used in the decontamination process.

Table A-1 lists equipment and liquids necessary to decontaminate field equipment.

The following should be done in order to complete thorough decontamination:

1. Set up the decontamination zone upwind from the sampling area to reduce the chances of windborne contamination.

2. Visually inspect sampling equipment for contamination; use stiff brush to remove visible material.

3. The general decontamination sequence for field equipment includes: wash with Liquinox or an equivalent degreasing detergent; rinse with deionized water three times; 10% dilute nitric acid rinse; deionized water rinse; rinse with sample water three times. (Note: When collecting rinsate blanks, the rinsate blank will be collected prior to rinsing the equipment with sample water.)

4. Rinse equipment with methanol in place of the nitric rinse if sampling for organic contamination. Follow with a deionized water rinse.

5. Decontaminated equipment that is to be used for sampling organics should be wrapped in aluminum foil if not used immediately.

6. Clean the outside of sample container after filling sample container.

Alternatively, field equipment can be decontaminated by steam cleaning, rinsing with 10% dilute nitric acid, and rinsing with deionized water.

All disposable items (e.g., paper towels, latex gloves) should be deposited into a garbage bag and disposed of in a proper manner. Contaminated wash water does not have to be collected, under most circumstances.

If vehicles used during sampling become contaminated, wash both inside and outside as necessary.

TABLE A-1. EQUIPMENT LIST FOR DECONTAMINATION

5-gallon plastic tubs	Liquinox (soap)
5-gallon plastic water-container	Hard bristle brushes
5-gallon carboy DI water	Garbage bags
1-gallon cube of 10% HNO_3	Latex gloves
1-gallon container or spray bottle of 10% Methanol or pesticide grade acetone for organics	Squeeze bottles
	Paper Towels

STANDARD OPERATING PROCEDURE NO. 12
SAMPLE DOCUMENTATION

Sample documentation is an important step to ensure the laboratory, project manager, and field personnel are informed on the status of field samples. Depending on the specifics required for each project, a number of forms will need to be filled out. Most sample documentation forms are preprinted carbonless triplicates, enabling copies to be filed or mailed from labs or offices. The forms will be completed by field personnel, who have custody of the samples. The office copy will be kept in the project file and subsequent copies sent to the laboratory, or other designated parties. The responsibility for the completion of these forms will be with each field crew leader. It is important the field crew leader is certain field personnel are familiar with the completion process for filling out forms, and the expected information is included.

Potential documents to be completed clearly in ink for each sample generated include:

1. Field Form
2. Chain-of-Custody
3. Custody Seal

If working on Superfund activities, the following additional forms will also be prepared:

1. EPA Sample Tags
2. Sample Identification Matrix Forms

STANDARD OPERATING PROCEDURE NO. 12
SAMPLE DOCUMENTATION

Sample documentation is an important step to ensure the laboratory, project manager, and field personnel are informed on the status of field samples. Depending on the specifics required for each project, a number of forms will need to be filled out. Most sample documentation forms are preprinted carbonless triplicates, enabling copies to be filed or mailed from labs or offices. The forms will be completed by field personnel, who have custody of the samples. The office copy will be kept in the project file and subsequent copies sent to the laboratory, or other designated parties. The responsibility for the completion of these forms will be with each field crew leader. It is important the field crew leader is certain field personnel are familiar with the completion process for filling out forms, and the expected information is included.

Potential documents to be completed clearly in ink for each sample generated include:

1. Field Form
2. Chain-of-Custody
3. Custody Seal

If working on Superfund activities, the following additional forms will also be prepared:

1. EPA Sample Tags
2. Sample Identification Matrix Forms

STANDARD OPERATING PROCEDURE NO. 16
MONITORING WELL CONSTRUCTION

Equipment List

Equipment supplied by drilling company:
- Drill rig and applicable casing and equipment suitable for type of drill rig and project
- 1.4-inch inside diameter split spoon sampler
- 140 pound hammer
- Well casing and screens
- Inert silica sand
- Bentonite chips
- Cement
- Surface casing
- Well caps

Maxim personnel
- Field notebook or field forms
- Personal protective equipment
- First aid kit
- Health and safety plan

1. Arrive on-site with properly sized drilling equipment and materials for site conditions. All drilling equipment and materials should be properly decontaminated prior to its arrival on-site. Decontamination usually includes steam - or hot water-cleaning methods.

2. Drilling muds or drilling solutions of any kind are not to be used during drilling activities in conjunction with monitoring well construction. Acceptable drilling techniques include air-rotary, cable tool, or hollow-stem auger. If unconsolidated material is encountered, it may be necessary to drive steel casing during drilling to maintain borehole integrity. It is suggested threaded steel casing be used in lieu of welding joints together to minimize this source of potential well contamination. Hydraulic jacks or the drill rig can be used to pull back the steel casing following emplacement of plastic casing.

3. A detailed lithologic log shall be completed during drilling activities. Water bearing characteristics of the formations should also be denoted on the log. In addition, details of monitoring well construction should also be described on the well log including total depth, perforated interval, sizes and types of construction materials, etc.

4. Seven- or ten-inch outside diameter hollow-stem augers can used in drilling shallow exploration drill holes in many situations. Care is taken to avoid contamination due to oil and grease from the drill rig and split spoon sampler. Appropriate decontamination of the drill rig between drill holes is performed. Soil and sediment samples are collected using a standard 1.4 inch inside diameter split spoon sampler and a 140 pound drive hammer. The number of blows necessary to obtain an 18 inch length of sample is recorded on the exploration log. Appropriate decontamination of the split spoon sampler is accomplished between samples.

   Either a single- or multi-completion monitoring well can be constructed in a single borehole where hollow-stem auger drilling is not used. Backfill with chemically-inert silica sand to above the perforated interval and emplace a bentonite plug above the sand. Install factory-screened and blank PVC (or stainless steel or PTFE for organics) well casing into the borehole. Where appropriate, begin pulling temporary steel casing out of borehole. Emplace silica frac sand above and below any perforated sections in the borehole; install bentonite plugs above and below sand pack around perforated sections.

Backfill remaining well annulus with a bentonite slurry or with grout to the surface. Monitoring well development is presented in SOP-17.

5. Place locking well protector over PVC casing(s) after outer steel casing has been removed from the borehole if necessary. Place bentonite plug below bottom of well protector; grout well protector in place and lock with high quality lock.

6. Many states now require certification and licensing for monitoring well drillers. Be sure you know the State's regulations before arriving on-site, especially if drilling outside your own State.

7. Safety equipment required on-site of the drill rig is mandatory. Personal protective equipment includes (at a minimum): hard hat, safety glasses, steel toed boots, gloves, first aid kit, and site safety plan - with routes to hospitals known by all personnel on-site.

STANDARD OPERATING PROCEDURE NO. 17
MONITORING WELL DEVELOPMENT

Equipment List
Stigners, air hoses, surge block, bailer
Liquinox solution
Nitric Acid
Deionized water
10% methanol
Field meters (pH, specific conductivity, temperature)
Field notebook or Field forms

1. Visually inspect all well development equipment for damage - repair as necessary.

2. Decontaminate all stingers, air hoses, surge blocks by scrubbing with brush and Liquinox solution, rinsing with dilute nitric acid solution, and rinsing with deionized water. If sampling for organics, replace the nitric acid rinse with 10% methanol as per SOP 11.

3. If using compressed air method for well development, make certain compressor utilized does not produce air laden with hydraulic fluid for lubricating purposes. This may affect the integrity of the monitoring well for producing viable water quality data.

4. Develop well by using surging techniques (surge block or bailer) followed by well evacuation. Repeat this procedure until evacuated water is visibly clean and essentially sand-free. In most cases, evacuated water can be disposed of on-site.

5. If specified in the project workplan, during evacuation process, collect water samples for field determinations of temperature, specific conductivity, and pH. Continue developing well until field parameters stabilize to within $\pm$5% on three consecutive measurements.

6. Report field observations and volume of water removed on standard form.

STANDARD OPERATING PROCEDURE NO. 18
GROUNDWATER SAMPLING

EQUIPMENT:

5-gallon bucket graduated in gallons	pH meter/thermometer (optional)
coolers and ice	specific conductance meter (optional)
sample bottles	bailer(s)
preservatives	bailer rope or teflon reel
filter apparatus	field sampling forms
decontamination equipment & fluids	indelible marker
water level probe	stop watch
purge pump(s)	generator
discharge hose	fuel

All sampling equipment shall be inspected for damage, and repaired if necessary, prior to arriving on-site.

GENERAL PROCEDURE - PURGING

Purging must be performed on all wells prior to sample collection. If required by the project workplan, the stability of pH, specific conductivity, and temperature will be evaluated. A minimum of three volumes of groundwater in the well casing shall be withdrawn prior to sample collection. The volume of water present in each well shall be computed using the length of water column, monitoring well inside diameter, and casing diameter. The total volume of water in the well (gallons) can be approximated using the following formula (depth and water level measurements in feet; borehole diameter in inches):

$$\textbf{(1/25)(Total Depth - Measured Water Level)(Casing Diameter)}^2 \textbf{ = gallons}$$

Several general methods are used for well purging. Well purging may be achieved using bailers, bladder pumps and submersible pumps. The specific pumping method shall be chosen based on depth to groundwater, diameter of well, existing well configuration and contaminant(s) of concern. Specific conductance, pH, temperature, and purge volume values will be entered on the Field Sampling Forms. If sampling for hydrocarbon compounds, wells shall be checked for the presence of free product prior to purging and sampling.

If specified by the project workplan, field parameters will be measured periodically during well purging. The well is ready for sampling when either or both of the following conditions are met: 1) measured field parameters stabilize at plus or minus five percent of the reading, over three successive readings or, 2) three to five casing volumes have been evacuated from the well.

If the recovery of a low-yield well exceeds two hours after purging, the sample shall be extracted as soon as sufficient volume is available in the well for a sample to be extracted. At no time will a monitoring well be pumped dry if the recharge rate causes formation water to cascade down the well casing causing an accelerated loss of volatiles and change in pH.

COLLECTING WATER QUALITY SAMPLES

1. Generally, wells shall be sampled from the least contaminated to the most contaminated, if known. Open well and measure water level (SOP-20).

2. Decontaminate sampling equipment using the following procedure: scrub with brush and Liquinox solution; rinse with 10% dilute nitric acid; rinse with methanol, if sampling for organic compounds; rinse

three times with deionized water. Use disposal latex or vinyl gloves throughout decontamination and sampling procedure and new gloves for each sampling point.

3. Sampling Monitoring Wells

   a. To collect a water quality sample, use a decontaminated disposable polypropylene, stainless steel, or teflon bailer and a spool of polypropylene rope or equivalent bailer cord (teflon-coated stainless steel cable). Tie a bowline knot through the bailer loop to secure.

   b. Slowly lower bailer or other sample collection device to the bottom of the well and remove an additional 5 feet of rope from the spool. Secure end of rope to steel well casing or wrist.

   c. Purge well by bailing or pumping, collecting evacuated water in a graduated 5 gallon bucket to measure the total volume discharged.

   d. Collect a sufficient quantity of water using the bailer or pump into a decontaminated one gallon sample container to fill all sample bottles.

4. Sampling Domestic Wells

   a. Turn-on household fixture (preferably an outside faucet without a hose connected) that is on the well-side of any household water conditioning device.

   b. Using the above equation, calculate the volume of water to be evacuated. Measure the discharge rate from the faucet in a graduated 5 gallon bucket, or other suitable container, to compute the rate of discharge. Calculate the time needed to evacuate the predicted volume from the well. Record all measurements and calculations on field forms.

   c. Samples should be collected directly from hydrant or faucet and prior to entry of the water through any water conditioning devices. Do not collect samples through rubber hoses.

5. If specified by the project work plan, measure pH and specific conductance (SOP-05 and SOP-06). Continue monitoring field parameters (pH and specific conductance) periodically during purging process. The well is ready for sampling when either or both of the following conditions are met: 1) the purged volume is equal to three to five casing volumes and/or, 2) measured field parameters are within plus or minus five percent ($\pm$ 5%) over three successive readings.

6. If sampling for dissolved metals, field filter sample according to SOP-04.

7. Label each sample container with project number, sample location, well owner, date, military time, sampler's initials, preservative, and analysis required. For inorganics samples, rinse sample containers, without preservatives, three times with sample water before final collection. Do not rinse containers for organics analysis.

8. Pour the sample into the appropriate sample containers and and any needed preservatives in accordance with SOP-42. Also see ("Handbook for Sampling and Sample Preservation of Water and Wastewater", EPA-600/4-82-029; "Guidelines Establishing Test Procedures for the Analyses of Pollutants Under the Clean Water Act", 40 CFR 136; and "Test Methods for Evaluating Solid Wastes," EPA SW-846). A few common sample preservatives are listed below:

Dissolved Metals	Add 3-4 ml. Nitric Acid to 500 ml. sample
Nutrients	Refrigerate to 4EC; Add 3-4 ml. Sulfuric Acid to 500 ml.sample

Common Ions	Refrigerate to 4EC
Hydrocarbon VOA	Refrigerate to 4EC; Add 3-4 drops HCl*
Diesel Range Organics	Refrigerate to 4EC; Add 80 drops (4ml) HCl
Fluorescent Tracer Dye	Refrigerate to 4EC; Prevent exposure to light

For additional bottling and sample preservation information, consult the Maxim Technologies, Inc. laboratory.

9. For volatile analyses add preservative to sample vial and fill vials at the rate of 100 milliliters per minute (24 seconds for 40 milliliter vial); form positive meniscus over vial brim and cap. After capping, invert vial, gently tap and look for air bubbles. If bubbles are present, un-cap vial, add more water and repeat procedure.

10. If required by the project workplan, perform field parameter tests including pH, SC, Eh, and temperature on water sampled from the well. Record field measurements on field forms.

11. Complete the necessary shipping and handling paperwork, and record all pertinent information on Field Sampling Form in accordance with SOP-10.

STANDARD OPERATING PROCEDURE NO. 20
FIELD MEASUREMENT OF GROUND WATER LEVEL

1. Calibrate well probe to a steel tape prior to and following each data gathering episode. Note any corrections to well probe measurements on field forms.

2. Check well probe prior to leaving for field for defects by placing probe in water and testing buzzer and light. Repair as necessary. Make certain the well probe, a tape measure calibrated to tenths of feet and extra batteries are in the carrying case.

3. Measure all wells (monitoring and domestic) from the top of the well casing in the north quadrant or from a designated measuring point, as appropriate. Measure and record distance from measuring point to ground level. Make sure measuring point is labeled on well, so future measurements can be made from the same location.

4. Obtain a depth to water from measuring point to the nearest hundredth of a foot. Record data on appropriate field forms.

5. Decontaminate well probe between each measurement by rinsing with deionized water. Additional decontamination, such as liquinox scrubbing, may be required for certain wells; consult the project work plan.

STANDARD OPERATING PROCEDURE NO. 22
SOIL SAMPLE COLLECTION

This SOP describes the field equipment and sampling methods for surface and subsurface sampling of soil material. Methods explained in this SOP may be different from those identified in the project specific Sampling and Analysis Plan (SAP) and the project specific SAP should be referenced for additions or deletions to the methods noted below. All sampling equipment should be cleaned before arriving on site.

FIELD EQUIPMENT

Sharp shooter and clean-out shovel
Stainless steel mixing bowl and sampling trowel
Dilute (10%) hydrochloric acid
Hand lens (10) power
Steel tape (10 foot)
pH and electrical conductivity meters (if required)
Munsel color book (if required)
No. 10 sampling screen
Field forms and field book
Bucket augers

SURFACE SAMPLING

Surface soil/tailings samples are collected from the surface to a depth of one inch unless otherwise specified in the project specific SAP. Sufficient sample will be collected for the analysis that will be performed but generally this will be on the order of one gallon. Soil samples will be collected in either wide mouth glass jars or resealable polyethylene bags (ziploc or equivalent).

Samples should be described according to the procedures outlined in the Unified Soil Classification System (USCS; method ASTM D2487) or the Soil Conservation Service (SCS) classification system. Soil texture should be classified by either the USCS or U.S. Department of Agriculture (USDA) classification. Descriptions shall be recorded in field books or on standard morphological description logs as provided in the SAP.

Samples should be collected from an area of approximately six square feet by digging up the top inch with the sampling trowel and placed in the mixing bowl. The sample should be screened with the 10 mesh sieve if coarse fragments are to be excluded from the sample. If a sod or duff layer is present, this layer should be pealed back to the top of the mineral soil.

The sample placed in the mixing bowl shall be well mixed and then a portion of the sample placed in the sample container. To select a sample from the mixing bowl, quarter the sample in the bowl and place an equal volume of soil from each quarter in the sample container. When sampling soil for organics, the samples should not be mixed.

All equipment used in the sampling of surface soils will be decontaminated using the procedures in SOP-11. All necessary paperwork will be filled out in accordance with SOP-12.

SUBSURFACE SAMPLING

Subsurface sampling will be completed using a bucket auger, split spoon sampler, or hand dug or backhoe excavated pits. Sampling procedures for each type of equipment is described below. Sample collection,

homogenation, and transfer to sampling containers should follow the same procedures as outlined for collection of surface samples.

Bucket Auger

1. Arrive on-site equipped with stainless steel auger rod and several sizes of stainless steel bucket augers (e.g. 2-inch, 4-inch, 6-inch, etc.).

2. Bucket auger holes can be drilled as one size or in a telescoping manner if contamination between sample intervals is a concern. If a single sized, advance the bucket auger to the desired sampling interval depth and empty the contents of the auger in a stainless steel mixing bowl. For the telescoping method, advance the largest auger to an approximate depth of three feet, collecting specified depth increment samples as the auger is advanced. Install temporary decontaminated PVC casing with a diameter slightly smaller than the borehole to keep the hole open and reduce possible cross-contamination between depth intervals. Using the next size smaller bucket auger, repeat the process.
3. Select sample intervals for packaging for laboratory analysis in accordance with procedures described in the SAP.

4. Fill out appropriate paper work and bottle labels as necessary prior to leaving site.

5. Decontaminate all equipment between sample locations.

Split Spoon Sampler

1. Arrive on-site equipped with at least two standard 1.4 inch inside diameter split spoon samplers. If geotechnical information is desired, a 140 pound drive hammer is required.

2. Install sampler into borehole and advance to the desired depth with the 140 pound drop hammer or equivalent means. Record number of blow counts to complete sampling over each 18-inch interval, as necessary. Retrieve sampler and place on work table. Using the other sampler, repeat this sequence.

3. Record lithology and percent recovery from cores retrieved from split spoon sampler.

4. Based upon the project work plan or sampling and analysis plan, composite like core intervals by mixing in stainless steel bowl in a similar manner as described for surface sampling. When sampling for organics, the sample should not be mixed.

5. Decontaminate sampling equipment between each interval sampled if required by the SAP. Decontaminate sampling equipment between sampling sites.

Backhoe or Hand Dug Excavations

1. Locate the site to be sampled and insure that equipment can safely access the site. Minimize off road travel to prevent off site damage to surrounding vegetation.

2. Orient excavation to maximize use of the angle of the sun to illuminate the pit for photographs. Place excavated material a sufficient distance from the excavation.

3. Excavate to the prescribed depth. If the pit exceeds five feet in depth, OSHA construction standards for shoring or sloping must be observed to prevent accidental burials. Sampling personnel should enter the pit with care during and after excavation.

4. Soil profile descriptions shall be made from a hand cleaned surface along the pit wall. Complete profile descriptions and take photographs before pit is sampled.

5. Soil samples shall be collected from depth intervals specified in the SAP. When a depth interval is sampled, an equal volume of soil should be collected from the entire interval exposed on the pit wall. Soil samples will be collected with the stainless steel trowel and mixing bowl according to methods described for surface soil sampling. When sampling for organics, the sample should not be mixed.

6. After sampling is completed, the pit should be backfilled with excavated material in the reverse order that it was excavated so that topsoil material is returned to the top of the pit. When backfilling is complete the area should be cleaned-up to its original condition.

7. Decontaminate sampling equipment between sampling sites. Excavation equipment should be cleaned between sites with water (where possible) or with a shovel to remove accumulated dirt and mud.

"Daylighting" using a Vacuum Truck

1. Select excavation site.

2. Collect surface soil sample, if needed, prior to excavation with vacuum truck.

3. Vacuum truck should employ dry excavation method (no water). Excavate with vacuum truck to desired depth interval. Remove vacuum truck tube from excavation.

4. Hand excavate the subsurface soil sample interval, no greater than 6-inches, with a hand auger.

5. Place soil sample in appropriate containers for laboratory analysis and/or PID screening.

6. Record lithology and not odor and visual observations.

7. Advance to next depth interval and repeat hand sampling steps.

8. Decontaminate sampling equipment between sampling sites.

STANDARD OPERATING PROCEDURE NO. 23
X-RAY FLUORESCENCE SPECTROMETER (XRF) USE AND CALIBRATION

Equipment List
XRF spectrometer & Analysis kit
2 milimeter (No. 10) non-metalic sieve
Soil split samples that have been analyzed by an analytical laboratory for the metals required for site-specific analysis
Field Notebook or field forms
Oven

The chemical characterization of soil samples in the field will be determined by the field portable X-ray fluorescence (XRF) Spectrometer ATX-100 instrument manufactured by Aurora Tech, Inc, Salt Lake City, Utah. The instrument uses low level self-contained and shielded radioactive sources that produce spectral peaks whose position (energy level) is specific to an individual element and whose peak height or area which is indicative of the concentration of that element within the area exposed to the source. Two sources will be used, cadmium-109 (15 millicuries) and Iron-55 (100 millicuries) emplaced by the manufacturer. These sources allow semiquantitative determination of the copper, zinc, arsenic, iron, manganese and lead concentrations. Additional elements that will be monitored include chromium, barium, cobalt, nickel, selenium, and molybdenum.

The detection limit for each parameter is a function of source strength, geometry/particle size, counting time, and the concentration of other elements. Since the source strength and instrument geometry are constants, the detection limit is dependent on geometry/particle size, counting time, and concentration. It has been demonstrated that 80-mesh particle size dominantly composed of a siliceous or calcareous skeletal matrix will give analytical results within 20 percent. The larger the particle size, the larger the error. A rock made up of fine-grained minerals, however, will essentially have the same precision and accuracy as a finely ground sample.

Soil samples will be screened and all particles greater than 2 mm (No. 10 sieve) will be removed.

The counting time also affects the detection limit. In general, the longer the counting time, the lower the detection limit, and certainly the higher the precision and accuracy. The instrument has controllable time units of 10, 30, 100, 300, and manual control seconds. The 30 second counting time will likely be the standard for this test. The time may change for either or both sources depending on the actual sample matrix encountered in the field.

The primary operator will receive one day's training on the proper use of the instrument particularly for health and safety purposes. The manufacturer's statement on radiation safety is also attached. Each operator will have a gamma film badge service (monthly) and will have the dates and times used logged in the record book specifically kept for this purpose.

Calibration of the unit will be provided by the following method.

The XRF will be calibrated before being taken in the field by developing response curves of index values verses actual concentrations of metals in soils. Response curves will be developed using site-specific soil samples, where available. Otherwise, archived soil samples will be used. Numerous samples have been analyzed through the CLP program for metals content and splits of these samples are archived in Helena. These splits will be used to develop the response curves so that the index values that are generated in the field can be converted into concentrations. These concentrations will then be used to help direct the soil sampling program for laboratory samples. The XRF will also be calibrated using the internal standards as recommended by the manufacturer. This internal calibration will be performed, each day of use, in the

morning, at noon and at the end of the day. Time, temperature and calibration data will be noted during each calibration in the field logbook. Data for Cu, Zn, Fe, Mn, Pb, As, and Ni will be recorded in the field logbook or on standard forms. To obtain the best quantitative XRF results, a uniform volume of soil material of generally the same particle size will be used. The sample should be prepared in the following manner:

1. Disaggregate and homogenize field moist sample, foreign objects such as rocks, twigs, roots, etc.

2. Dry sample (preferably overnight) in an oven set at approximately 105^{o}C.

3. Cool sample to room temperature.

4. Sieve sample through a 2 mm nonmetallic sieve.

5. Homogenize sieved sample.

6. Place sample in a 2-inch petri dish.

The soil material will be well packed in the petri dish and the top surface should be uniformly smoothed to the level of the petri dish edges. The head of the XRF should then be placed over the petri dish.

If soil is sticking to the XRF, place a piece of Saran Wrap over the petri dish. If any dust sticks to the head of the XRF, clean it with a fine-bristle paint brush.

STANDARD OPERATING PROCEDURE NO. 24
SOIL SAMPLE PREPARATION AND PRESERVATION

This SOP applies to EPA Superfund and Brownfield projects.

The Document Control Officer (DCO) will direct all packaging and shipping procedures in the field. Each of the three field scientists will be responsible for a specific task to ensure consistency.

Equipment List
Custody seals
Sample tags/labels
Indelible ink pen/marker
Packed with vermiculite or other soft packaging material
Chain-of-Custody
Air bill for shipping
Re-sealable bags
Fiberglass tape

PROCEDURE

1. All soil sampling, decontamination, QA/QC samples, sample splits, and pH and SC measurement should be completed for each sample.

2. Upon filling a soil sample container, a field scientist will place a completed EPA custody seal over the top of the container. The custody seal serves two purposes. It secures custody of the sample and it secures the lid of the container.

3. An EPA sample tag is completed by a field scientist, and is taped securely to the sample container.

4. The soil samples will then be placed into a cooler labeled "SOIL SAMPLES", with the site identification and date also written on the cooler top. Since soil samples will be in glass ICHEM jars, they will be packed with vermiculite or other soft packaging material to prevent breakage. The cooler will be packed full, so there is no empty space for the contents to move about.

5. When the cooler is full, or when the sample collection is complete, the correct Chain-of-Custody can be completed at a later date. A pre-numbered airbill will be assigned to that cooler.

6. The DCO will double check the forms to assure those samples mentioned on the COC are all present and accounted for in the cooler. He/she will document this on the Sample ID Matrix.

7. The cooler will be clearly marked "FRAGILE/THIS SIDE UP" on all four sides and the top as appropriate.

8. The DCO will then place the proper COC, Sample ID Matrix, and Packing Lists in a ziplock bag, taped to the inside roof of the cooler.

9. The DCO or field scientist will then close the cooler and affix the airbill to the top of the cooler.

10. The DCO or field scientist will then seal the cooler and place the appropriate custody seals (one in front and one in back), signed and dated, on the cooler.

11. The field scientist will then place fiberglass tape over the custody seals and around the cooler, making sure everything is secure.

12. The cooler will be labeled as to type of samples and date of sampling, with a large felt-type pen. A label should also be placed on top of the cooler so the laboratory will return the cooler to you.

13. The cooler(s) will then be transported to a secure storage facility, where they can be kept under custody until they are shipped.

STANDARD OPERATING PROCEDURE NO. 27
FIELD MEASUREMENT OF VOLATILE ORGANIC COMPOUNDS HEADSPACE

Equipment List
Photoionization detector (PID)
Clean canning jars
Aluminum foil
New Ziplock (resealable bags)
Batteries
Grease pencil

INSTRUMENT CALIBRATION

Calibrate meter before leaving for the field and each day in the field when headspace will be measured. Calibrate using one of the following procedures:

1. HNU (PID)
    A. Connect probe to the body of the instrument and turn selector switch to desired sensitivity range (typically 0-200)
    B. Zero instrument and connect span gas.
    C. Adjust span setting to read appropriate concentration for gas type and photoionization bulb.

2. Photovac Microtip (PID)
    A. Assemble instrument and turn on.
    B. Press calibrate button and follow instructions as they appear on the screen.

3. Foxboro OVA (FID)
    A. Assemble instrument, open H2 supply valves, put operation and pump toggle switches to "on" position.
    B. Allow to run for 3-5 minutes and push in the ignition button for 1/2 second. Check unit with span gas or known volatile to assure instrument is operating.

FIELD PROCEDURES

1. Place sample to be tested in clean canning type jar. Cover the sample tightly using aluminum foil and the outer ring of the jar lid. Alternately, a new ziploc bag maybe used. Be sure to mark container with sample location (boring/test pit # and depth)!

2. Allow sample to come to room temperature (approximately 70 - 80 ˚F) by placing in warm location not in direct sunlight. This can be accomplished by placing the container under the heater vent of the vehicle in winter or in a closed vehicle in summer.

3. Insert probe through foil or ziploc opening and record maximum reading.

    NOTE: Consistency in results is enhanced by using approximately equal portions of material, similar jar or bag sizes and similar test temperatures. Moisture content may also affect readings using some instruments.

MAINTENANCE

1. Disassemble and store meters in their case.

2. Charge batteries after each use as described in user's manual.

3. Occasional routine maintenance may be necessary ie. cleaning or replacing filters. Any maintenance you feel unqualified to perform should be handled by an authorized service representative.

STANDARD OPERATING PROCEDURE

IONIZATION DEVICE (PID or FID) OPERATION

Equipment List:
Photoionization detector or Flame Ionization Detector
Supply bottle with calibration gas

1. Before taking the instrument to the field check the following:

   - Test the condition of the battery and recharge if necessary.
   - Make sure you have calibration gas.
   - If you are using the FID, check the hydrogen pressure and refill from the supply bottle if below 1000 psi.
   - Check the integrity of the instrument and its accessories. Repair or replace broken parts and clean the sampling tip. On the PID clean the inlet filter.
   - Make sure you have all the accessories you will need for sampling.

2. Arrive on-site with decontaminated equipment in working order. During transport, keep the instrument temperature stable and moderate.

3. Follow the manufacturer's instructions for starting up the instrument. Turn the instrument on and let it run for a few minutes, allowing the electronics to stabilize.

4. For the FID, let the electronics warm up for about 5 minutes and the pump to run for at least 3 minutes before attempting to light the flame. After lighting the flame, test the instrument with a known hydrocarbon to make sure the flame remains lit.

5. Calibrate the instrument by setting the zero and span against the calibration gases. To zero the instrument you may use clean air, if available, or a cylinder of compressed zero gas.

6. Complete your organic vapor readings and record the results according to the SOP covering the test procedure you are using.

7. Shut down the instrument according to the manufacturer's instructions. Decontaminate and carefully pack the instrument before leaving the site.

8. See Table 1 for comparisons of different instruments.

TABLE 1
COMPARISON OF ORGANIC VAPOR ANALYTICAL FIELD INSTRUMENTS

Instrument	Advantages	Disadvantages	Limitations
Foxboro/Century OVA-128GC (FID	1. Measures total hydrocarbon content 2. Has fast response. 3. Instant readout of organic vapor level 4. Unaffected by condensing vapor in sample gas. 5. Has simple calibration procedure.	1.Maximum concentration of hydrocarbons must be less than 1000 ppm. 2.Instrument is heavy and awkward to use. 3.Individual hydrocarbons cannot be identified unless used in GC mode. 4.GC mode is difficult and very slow to use. 5.Requires hydrogen gas as fuel. 6.Analog readout.	1.Hydrocarbon concentration must be less than 1000 ppm in the sample stream. 2.A single battery/hydrogen charge will last between 6 and 8 hours. 3.Strong breezes will blow out the flame through the flame arrestor on the chamber inlet. 4.High hydrocarbon concentrations will make the flame go out. The only indication of this will be a constant below zero reading. 5.No filter on the sample probe will allow dirt and dust to be sucked into the instrument. 6.Recommended temperature operating range 10 to 40E C. 7.Accuracy 10 to 20% of full scale reading.
Photovac Microtip MP-100 (PID)	1. Has fast response. 2. Instant readout of organic vapor level. 3. Has simple calibration procedure. 4. Lightweight and very portable. 5. Retains the last maximum reading in memory. 6. Contains a built-in filter on the sample tip to prevent dirt and dust from entering the instrument. 7. Lighted digital display.	1.Susceptible to inaccurate readings due to moisture condensing on the UV lamp. Condensing moisture causes the reading to slowly rise until it reaches a high plateau level or goes off-scale. 2.Measures only hydrocarbons with activation energies below the rating of the lamp (10.6 eV for the standard lamp), 3.Liquid water or condensing vapor in the instrument will cause readings to become increasingly erratic. Eventually the instrument will refuse to operate, giving a "FAULT" message. 4.Not recommended for freezing temperatures.	1.Hydrocarbon concentrations limited to less than 2000 ppm in the sample stream. 2.Accuracy approximately ∀ 2 to 4 ppm for 0 # C # 100 ppm, ∀ 20% for 100 # C # 1000 ppm, and ∀ 25% for 1000 # C # 2000 ppm. 3.Water vapor condensing in the instrument will disable it for hours or days. Immediate disemploy and cleaning will make it useable again. 4.Recommended operating temperature range 0 to 40E C. 5.A single battery charge will last 6 to 8 hours.
HNU PI-101 (PID)	1. Has fast response. 2. Instant readout of organic vapor level. 3. Has simple calibration procedure. 4. Lightweight and very portable.	1.Susceptible to inaccurate readings due to moisture condensing on the UV lamp. Condensing moisture causes the reading to slowly rise until it reaches a high plateau level or goes off-scale. 2.Measures only hydrocarbons with activation	1.Hydrocarbon concentrations limited to less than 2000 ppm in the sample stream. 2.Accuracy estimated to be approximately ∀ 20% for full scale reading. 3.Water vapor condensing in the instrument will disable it for hours or until cleaned out.

TABLE 1
COMPARISON OF ORGANIC VAPOR ANALYTICAL FIELD INSTRUMENTS

Instrument	Advantages	Disadvantages	Limitations
		energies below the rating of the lamp (10.2 eV for the standard lamp; An 11.6 eV lamp is available). 3.Liquid water or condensing vapor in the instrument will cause readings to become increasingly erratic. Eventually the instrument will refuse to operate. 4.Not recommended for freezing temperatures. 5.Analog readout.	4.Recommended operating temperature range - 10 to 40E C. 5.A single battery charge will last up to 10 hours.

STANDARD OPERATING PROCEDURE NO. 45

SPECIALIZED SOIL SAMPLE COLLECTION AND HORIZON DESCRIPTION FOLLOWING XRF ANALYSIS

Equipment List
1-foot square board
Plastic trowel
Plastic tub
Stainless steel knife
Laboratory provided sample jars
Mechnical soil splitter
Field notebook or field forms
Stiff brush
Deionized water
Paper towels

Soil samples will be collected from the upper inch of the soil profile at locations where there is no or minimal vegetation. At each location, a one foot square board will be placed on the ground and an equal volume of soil from each corner of the board collected. Soil will be scraped from the ground with a plastic trowel and deposited directly into a plastic tub where it will be mixed and any clods broken up. At locations where grass or other vegetation is present, the sod root zone will be peeled back with a stainless steel knife and the upper inch of soil will be sampled as described above.

At each location selected for soil sampling (i.e.: one residential lot, one playground), three individual sites at that location will be sampled if average XRF readings for metals from that location are within 50 percent of the highest readings obtained. Samples from each of the three sites will be combined in a plastic tub and mixed. If a particular location selected for soil sampling has one or two sites with XRF readings greater than 50 percent of the average of all the XRF readings at that location, only the one or two sites with the highest readings will be sampled.

Sample splits will be taken for use as replicates, pH, Eh, and SC determinations and XRF measurements. Samples will be split by mixing and dividing on a plastic sheet or by use of a mechanical soil splitter. Soil samples will be placed in 8-ounce I-CHEM jars with a plastic trowel. After each soil sample, all appropriate paperwork will be completed before moving to the next sample location.

Between sample collection, all equipment will be cleaned thoroughly with a stiff brush and rinsed with distilled water and paper towels. Equipment rinsate samples will be collected after decontamination as a cross-contamination blank at a frequency specified in the Field Sampling Plan (FSP). Bottle blanks, consisting of distilled water used for decontamination placed into a sampling jar, will also be inserted into the sample train at a frequency specified in the FSP.

Soil horizons will be described using standard morphological descriptions in use by USDA-SCS. In addition, the grain size of the soil will be described using the Unified Soil Classification System.

STANDARD OPERATING PROCEDURE NO. 46
COLLECTION OF ASBESTOS SAMPLES

EQUIPMENT

Ladder to access areas.

Flashlight to aid in visibility.

Air tight sampling containers (film canisters, centrifuge tubes, zip lock baggies).

Spray mister bottle with water to spray the area to be sampled.

Plastic drop cloth to spread beneath the area to be sampled.

Knife, linoleum cutter, cork borer, or other tool appropriate for extracting samples.

Caulking gun and compound for filling holes once a sample has been extracted.

Spray acrylic or adhesive to encapsulate sample extractions.

Duct tape for repairing thermal system insulation jackets.

Cloth (pre-moistened) for cleaning up debris and tools.

Vacuum cleaner equipped with high efficiency particulate air (HEPA) filters.

Indelible ink pen for labeling sample containers.

Camera for photographic documentation.

Disposable protective clothing, gloves and bootees.

Personal respirator, either a negative pressure full or half mask with HEPA cartridges.

Safety glasses for eye protection

PLANNING PHASE

Prior to commencing building inspection activities the following tasks should be performed.

1. Contact management of the facility to inform them as to what will take place during the inspection.
2. Hours of operation of the facility.
3. Develop a project schedule agreeable to the building owner including arrival time at the site and time of initial meeting with building personnel.
4. Review existing as-built drawings, if available to become familiar with the facility as to the mechanical system layout, and materials used in construction. Develop scaled drawings from as-built drawings, if provided by the building owner, for use in the inspection.
5. Review any previous asbestos inspections that may have been conducted in the past.

INSPECTION PHASE

Inspections should be performed using the currently recognized standard protocol developed for schools under AHERA. General guidelines for conducting the inspection are as follows:

1. Conduct on-site informational meetings with facility personnel to inform them of what will transpire during the inspection. Discuss bulk sampling protocol with maintenance personnel and determine sampling locations that will be acceptable to the owner.
2. Perform an initial walk through of the building accompanies by a maintenance person if possible.
3. Observe the building layout and whether the building was built in phases or all at once.

4. Observe where the divisions are between construction phases.
5. Locate all mechanical areas.
6. Document location of and access to all pipe chases, pipe tunnels, crawl spaces, attics, and roof(s).
7. Walk completely around the outside of the building.
8. Fill out asbestos inspection checklist sheet (Appendix D).
9. Fill out building information sheet (Appendix F).
10. Fill out homogeneous area summary sheet (Appendix E).
11. Fill out room by room sheets (Appendix G).
12. Prepare a building diagram.

NUMBER OF SAMPLES

Nine samples per homogeneous sampling area are recommended. With nine samples, the likelihood of detecting asbestos when it is present is very high. Cost or other constraints, may limit the number of samples that can be collected. If nine samples cannot be collected, use the following table to determine the minimum number as required by AHERA Rules.

Friable Surfacing Material

The number of samples collected from friable surfacing material will be determined based on the following protocol developed under AHERA.

- 1,000 square feet or less – 3 bulk samples
- 1,000 to 5,000 square feet – 5 bulk samples
- Over 5,000 square feet – 7 bulk samples

Thermal System Insulation

Thermal system insulation will be sampled in a randomly distributed manner, with at least three bulk samples collected from each homogeneous material. At least one bulk sample will be collected from each homogeneous material of patched thermal system insulation that is not assumed to be ACBM.

Bulk samples will also be collected from each insulated mechanical system where cement or plaster was used on fittings, such as tees, elbows, or valves. The number of samples will be sufficient enough to determine whether the material is asbestos containing. Generally, three samples will be collected from each homogenous area.

Bulk samples will not be collected from any homogeneous material where the inspector determined that the thermal system insulation is fiberglass, foam glass, rubber, or other non-asbestos containing building material.

Miscellaneous Material

Bulk samples will be collected from each miscellaneous material. The number of samples will be sufficient enough to determine whether the material is asbestos containing. Generally, three samples will be collected from each homogenous area.

Non-friable Suspected ACBM

The number of samples collected from non-friable suspect ACBM will sufficient enough to determine whether the material is asbestos containing. Generally, three samples will be collected from each homogenous area.

SELECTION OF SAMPLES

Sample locations are selected so that they are representative of the sample area. When nine samples are collected, they will be distributed evenly throughout the sampling area. If fewer than nine samples are collected, a random sampling scheme will be used to determine their location. Choosing sample locations according to personal judgment produces samples, which may not be representative and can lead to a wrong decision about the presence or absence of asbestos. The sampling scheme described here avoids this problem and controls the frequency of mistakes.

Divide the sampling area into nine equally sized sub areas. This is done by dividing the length and breadth of the sampling area into three equal lengths and drawing a grid over the diagram (see Appendix C). This can be done carefully by eye. Exact measurements are not needed. If the sampling area does not easily fit into a rectangular shape, parts of the grid might not be in the sampling area. This is not a problem in most cases. If, however, a large part of the grid falls outside the sampling area, it is advisable to divide the sampling area into two or more separate sampling areas, each of which is approximately rectangular, and select sample locations by applying the sampling scheme to each sampling area. If three samples are going to be collected, take them from the sub areas marked 1,2,3,4, and 5, and so on.

For each sampling area, use a new diagram. If you have more than 18 sampling areas, start again at the top of the random number diagram (sample area #1) to determine sampling locations for sampling area 19.

IDENTIFICATION OF SAMPLES

Assign a unique sample ID number to each sample location. This ID number will be on the sampling container when it goes to the certified laboratory for analysis. Record the ID number and the sample location on the sample area diagrams and also on room by room summary sheets.

This must be done carefully so that there is no uncertainty about the location and identity of each sample collected. Make sure that no two samples have the same ID number. Non-sequential numbers are used to prevent the laboratories from knowing which samples come from the same sample areas or the same buildings. On the other hand, non-sequential ID numbers make organizing the analytical results by homogeneous area much more difficult. Suspect material sheet is provided in Appendix E.

SAMPLE COLLECTION

1. Personal protective equipment should be utilized. Since inhalation of asbestos fibers during hundreds of asbestos inspections and sampling projects may pose a serious health hazard, the use of personal protective equipment by building inspectors is crucial during the sampling process. As a minimum level of protection, inspectors should wear a respirator, either a negative pressure full or half mask with HEPA cartridges. Disposable clothing should be worn during sampling if the sampling operation is likely to dislodge pieces of suspect material or if the environment is extremely dusty. Inspectors should have plastic bags, twisters, and labels with them to handle the disposal of cartridges, protective clothing, wet cloths, and debris. These waste materials should be stored pending survey results. If laboratory reports establish the presence of asbestoscontaining materials, these waste materials should be disposed of as asbestos containing waste.
2. If possible, collect samples after hours or when the building is not in use.
3. Spread the plastic drop cloth and set up other equipment.
4. Put on protective equipment.
5. Label containers with its ID, sample location, and type of material sampled on a sample data form. Always place the label on the container itself. If using ridged containers always place the ID on the container, not on the lid, as lids can be inadvertently switched by a laboratory when handling numerous sample containers.

6. Mark the location of the sample on the sampling diagram and record the sample identification number on the plan diagram as well.
7. Moisten area where sample is to be extracted (spray the immediate area with water).
8. Extract sample using a clean knife to cut out or scrape off a small piece of the material. Be sure to penetrate all layers of material. Be careful not to disturb adjacent material.
9. Place sample in a container and tightly seal it.
10. Wipe the exterior of the container with a wet wipe to remove any material which may have adhered to it during sampling.
11. Clean your tools with wet wipes and wet mop or vacuum area with a HEPA vacuum to clean all debris.
12. Fill hole with calking compound on highly friable material and/or spray with an encapsulant (to minimize subsequent fiber release) or for appearance.
13. Repeat the above steps at each sample location. Place sample containers in plastic bags.
14. Discard protective clothing, wet wipes and rags, filter cartridges, and drop cloth in a labeled plastic bag.

SAMPLE HANDLING

1. After placing a sample in a container according to the procedures outlined earlier, enter the ID number on the Chain-of-Custody Sheet. A sample Chain-of-Custody Sheet is located in Appendix J.
2. Upon receipt of samples from the inspector, the laboratory should check and sign the Chain-of-Custody Sheet(s), copy same and return original(s) to the inspector. It is important that this, or a similar arrangement for sample accountability be agreed upon by the laboratory prior to sending samples for analysis.
3. Each individual or laboratory engaged in asbestos identification shall participate in the Proficiency Analytical Testing Program, the Asbestos Analyst Registry or equivalent.
4. Polarized light microscopy (PLM) according to EPA Method 600/R4-93-116 is the approved method for analyzing bulk materials for asbestos. This method of analysis is relatively inexpensive. PLM utilizes a light microscope equipped with polarizing filters. The identification of asbestos fiber bundles is determined by the visual properties displayed when the sample is treated with various dispersion staining liquids. Identification is substantiated by the actual structure of the fiber and the effect of polarized light on the filter, all of which is viewed by the trained technician. The limit of detection of asbestos by PLM is about 1% by area. Samples containing lower levels of asbestos are not reliable detected by this technique.

QUALITY ASSURANCE

After inspection is completed perform a field quality assurance program as indicated by the following tasks.

1. Review all inspection forms for completeness. (Remember a physical street address is required by AHERA).
2. Walk through building one last time to verify that you have identified all the suspect homogeneous areas.
3. Review Chain-of-Custody document for completeness and verify the number of samples and sample numbers for the suspect materials collected during the inspection.

STANDARD OPERATING PROCEDURE NO. 47
COLLECTION OF LEAD BASED PAINT SAMPLES

EQUIPMENT

X-Ray Florescence Spectrum Analyzer (XRF)

Ladder to access areas.

Flashlight to aid in visibility.

Air tight sampling containers (film canisters or centrifuge tubes).

Plastic drop cloth to spread beneath the area to be sampled.

Heat gun, scraper or other tool appropriate for extracting samples.

Required forms

Cloth (premoistened) for cleaning up debris and tools.

Vacuum cleaner equipped with high efficiency particulate air (HEPA) filters.

Pen and indelible ink pen for field forms and labeling sample containers.

Camera for photographic documentation.

Disposable protective clothing, gloves and bootees.

Personal respirator, either a negative pressure full or half mask with HEPA cartridges.

Safety Equipment required for the particular site (safety glasses, hearing protection, hard hat, steel-toed boots, etc.)

Radiation Dosimeter Badge

Laptop for downloading XRF readings

PLANNING AND PREPARATION

Prior to commencing building inspection activities the following tasks should be performed:

1. Schedule the inspection with the site contact so adequate notice can be given to building occupants and/or tenants and review historical information regarding any previous lead-based paint activities at the site. This step will often involve the following tasks:
    a. Determine the hours of operation for the facility.
    b. Develop a project schedule agreeable with the building owner, including arrival time at the site and time of initial meeting with site personnel.
    c. Review any previous lead-based paint inspection reports, lead risk assessments, or lead-hazard screens.
2. Collect all materials necessary for the inspection.
3. Ensure that all the XRF components are in its case. Equipment in the case should include; XRF with battery, spare battery, battery charger, charger cords, bar-code reader wand, XRFComputer interface cable, building component barcode pages, lead calibration pages, leak test documentation, and XRF source documentation.
4. Ensure that both batteries are fully charged and ready to go. Note that batteries will slowly lose a charge from sitting in the case and should be recharged before going into the field.
5. Obtain the XRF Performance Characteristic Sheet for the instrument to be used for the inspection. Review the XRF Performance Characteristic Sheet to determine the inconclusive range for the XRF.

6. Follow all Maxim radiation safety procedures when handling or using the XRF, as it is a potential source of radiation. Radiation dosimeter badges are assigned to personnel who routinely use the XRF instruments.
7. For multi-family buildings, determine how many units can be considered homogeneous, based on the HUD Guidelines and determine the number of units required to be sampled.

INSPECTION

Inspections should be performed using the currently recognized standard protocol developed by HUD. General guidelines for conducting the inspection for lead-based paint are as follows:

1. Calibration. Take at least three calibration check readings prior to the commencement of the lead-based paint inspection. These calibration check readings should be repeated every four hours, every time the XRF is turned on, or at the conclusion of the sampling job, which ever is more frequent.
2. The XRF calibration check readings are taken on the red 1.02 mg/cm2 Standard Reference Material (SRM) paint film, developed by the National Institute of Standards and Technology (NIST).
3. These films can be obtained by calling (301) 975-6776 and referencing SRM #2579.
4. Calibration check readings should be taken through the red 1.02 mg/cm2 SRM paint film when the film itself is at least 12 inches away from any source of lead. For example, the red NIST SRM film should not be placed on a tool box or suitcase or on a surface coated with lead-based paint to take calibration check readings.
5. The red NIST SRM film should be attached to a wooden board measuring about 6 inches long by 4 inches wide by 1 inch thick or attached directly to the XRF probe. Readings can then be taken while standing further than a foot from the wall. Alternatively, the red NIST SRM film can be placed on top of a 12 inch piece of styrofoam or some other lead-free material as recommended by the manufacturer before taking readings.
6. Each time calibration check readings are made, three nominal-time readings should be taken on the red NIST (1.02 mg/cm2) SRM film and the results recorded. The average of the three calibration check readings should be computed and also recorded.
7. Large differences of calibration check reading averages from 1.02 mg/cm2 may alert the lead-based paint inspector to problems in the instrument's performance. The calibration check reading averages should not differ from 1.02 mg/cm2 by more than the calibration check tolerance specified in the XRF Performance Characteristics Sheet for the specific instrument used.
8. If the observed calibration check average minus 1.02 is greater than the calibration check tolerance, the instructions provided by the manufacturer should be followed in order to bring the instrument back into control before any more XRF testing is done. All readings taken by the suspended instrument since the last successful calibration check test should be repeated. If a backup XRF instrument is used as a replacement, the backup instrument must successfully pass the initial calibration check test before retesting the affected test locations.
9. Single-Family Housing
10. Obtain a drawing of the building and exterior areas.
11. Perform a walk-through of the building with building personnel to familiarize yourself with the layout of the building.
12. Determine the testing combinations in each room equivalent or on each exterior building component. An inventory of the painted surfaces in interior rooms, on exterior walls, and on surfaces in other exterior areas, such as fences, playground equipment, and garages, should be conducted. An

inventory of a house should be completed prior to any XRF testing. It may be also done on a room-by-room basis during testing.

13. A testing combination is characterized by the room equivalent, component, substrate, and visible color of the paint. A completed inventory of the painted components in a room equivalent is a list of the testing combinations in that room equivalent.
14. A room equivalent is an identifiable part of a residence, such as a room, a house exterior side, or an exterior area. Hallways, stairways, and exterior areas, such as porches, back yards, and each side of the house, are all examples of room equivalents. Closets or other adjoining areas to room equivalents should be designated room equivalents if large (for example, a walk-in closet) or if obviously dissimilar (for example, a different color) from the adjoining room equivalent. In most closets are not considered room equivalents.
15. Each room equivalent is made up of components. Components can be located inside or outside the dwelling. For example, components in a bedroom could be the ceiling, floor, walls, a door and its casing, the window sash, and window casings. All components that are coated with paint, varnish, shellac, stain, or other coating should also be tested. Some components may be grouped if painting histories are identical as described below.
16. Take at least one XRF Reading on each testing combination.
17. Using the XRF Performance Characteristic Sheet, determine whether or not a substrate correction is necessary for that testing combination. If necessary, determine the substrate correction value using the method specified in the HUD Guidelines.5
18. The substrate is the material underneath the paint. Substrates are generally classified into one of six substrate types: brick, concrete, drywall, metal, plaster, and wood. These substrate types are intended to include a broad range of materials. For example, the concrete substrate type includes poured concrete, precast concrete, and concrete block. If the true substrate is not one of the six types, the substrate type that most closely matches the true substrate should be selected. For substrates on top of substrates, such as plaster over concrete, the substrate directly beneath the painted surface should be used.
19. XRF results are corrected for substrate bias by subtracting a correction value determined separately in each house for each type of substrate. The correction value is an average of XRF readings taken from test locations that have been scraped clean of their paint covering. A criterion for selecting these test locations is that their initial XRF results are less than 2.5 mg/cm2. If test locations with XRF results equal to or greater than 2.5 mg/cm2 were selected, the outcome might "overcorrect" XRF results. Therefore, only test locations with initial XRF results less than 2.5 mg/cm2 should be chosen. If all initial readings on a substrate type are above 2.5 mg/cm2, the locations with the lowest initial reading should be chosen. This will help ensure that XRF readings taken from nonrepresentative portions of substrates and other underlying materials, such as hidden nails and pipes, are not used to compute the substrate correction. It is important to note that some XRF results may not need to be corrected for substrate bias depending on the specific instruments used and the specifications in the XRF Performance Characteristics Sheet.
20. Using the same XRF instrument, take a reading on the first bare substrate area. Record the substrate and XRF readings. Repeat this procedure for each bare substrate area and record the readings on the same form. A variant to this step is to first cover the bare area with an NIST SRM film prior to taking the readings. The need for this variation will be specified in the XRF Performance Characteristics Sheet for affected XRF instruments and instructions will be provided explaining how to compute the correction value when this variation is used.
21. Compute the correction value for each necessary substrate type in the house by computing the average of all readings.

22. Classify the XRF results as negative, positive, or inconclusive.
23. For inconclusive readings, collect a bulk sample of the inconclusive paint for laboratory analysis. If sampling is not desired, inconclusive readings must be assumed positive.
24. Record the locations, component, substrate, and color of materials found to be positive for lead or assumed to be positive for lead.
25. Location of the material should include room and side of the room.
26. Component should be the component being tested. Examples of components are listed earlier in this section.
27. Substrate should be one of the six substrate types explained earlier in this section.
28. For practical purposes, paint is almost always differentiated by color. Since more than one color may be observed when paint is peeling or the substrate is damaged, both "white" and "blue over green" would be acceptable color entries.
29. Multi-Family Housing
30. Obtain a list of all units, common areas, and exterior site areas.
31. Obtain a drawing of the building and exterior areas.
32. Perform a walk-through of the building with building personnel to familiarize yourself with the layout of the building.
33. Determine, using the HUD Guidelines, the areas that can be grouped together and the minimum number of units to be inspected. The minimum number of units to be sampled can be determined by using Table 7.3 located in Chapter 7 of the HUD Guidelines.
34. Select units to be inspected using the random technique explained in the HUD Guidelines.
35. For each unit, common area, or exterior site to be tested, determine the testing combinations in each room equivalent.
36. Take at least one XRF Reading on each testing combination.
37. Using the XRF Performance Characteristic Sheet, determine whether or not a substrate correction is necessary for that testing combination. If necessary, determine the substrate correction value using the method specified in the HUD Guidelines.
38. Classify the XRF results as negative, positive, or inconclusive.
39. Record the locations of materials found to be positive for lead or assumed to be positive for lead.

FORMS

Since the information required for a lead-based paint inspection report is gathered in the field, accurate and complete forms are required so the report can be completed in a timely manner.

This section describes the forms to be used and completed during Maxim’s lead-based paint inspections. Forms described in this section are located in the appendices of this SOP.

Chain-of-Custody Form. This form documents the individuals who have had possession of bulk samples from the time of collection to receipt of the laboratory. This form should be completed by the individual who collected the sample. Information included on this form includes; sampler name, date, size of sample (cm2), analysis required, contact information, location of sample, homogeneous area number, and signatures of persons who have had possession of the sample. The Chain-of-Custody form described in this section is located in Appendix D.

LABORATORY TESTING OF PAINT CHIP SAMPLES

For XRF results that fall into the inconclusive range and for areas that cannot be tested using XRF instruments, a paint-chip sample should be removed and sent to a laboratory for lead determination according to TCLP procedure (EPA Method 1311). Results should be reported in mg/cm2, the primary unit of measure. Results should only be reported as percent by weight if the dimensions of the surface area cannot be accurately measured or if all paint within the sampled area cannot be appropriately removed. In these cases, results should not be reported in mg/cm2, but in µg/g or weight percent.

1. Collection of Paint Chip Samples. If it is necessary to remove a paint-chip sample for laboratory analysis, only one paint-chip sample is needed for each testing combination. The paint-chip sample location should be representative of the paint on the entire testing combination. If the testing combination is replicated, one representative paint-chip sample should be taken from one randomly selected replicate.
2. Collect at least a 4-square-inchs of material to ensure that the laboratory has a sufficient sample to conduct the analysis and that it is representative of the testing combination being sampled Samples collected are placed in sealable rigid containers such as screw top, plastic centrifuge tubes rather than plastic bags which generate static electricity. Paint-chip collection should include, as a priority, collection of all the paint layers from the substrate, while minimizing any collection of actual substrate. If substantial substrate material is included, results should definitely be reported in mg/cm2 to avoid a downward bias in results.
3. Identification of samples: Assign a unique sample ID number to each bulk paint sample collected. This ID number will be on the sampling container when it goes to the certified laboratory for analysis. Record the ID number and the sample location on the sample area diagrams, the room by room summary sheets, and the chain-of-custody form. This must be done carefully so that there is no uncertainty about the location and identity of each sample collected. Make sure that no two samples have the same ID number.

QUALITY ASSURANCE

After inspection is completed perform a field quality assurance check by performing the following tasks.

1. Review all inspection forms for completeness.
2. Walk through building one last time to verify that you have identified all the homogeneous areas of paint suspected to be lead-based.
3. Review Chain-of-Custody documents for completeness and verify that the number of samples, the sample numbers for the bulk samples collected.

STANDARD OPERATING PROCEDURE NO. 48
INVESTIGATION-DERIVED WASTES

Equipment List:

55-gallon drums with lid and seal ring
Wrenches
Drum labels

SOIL

Investigation-derived waste originating from test pits will be returned to the test pit. Material removed from the test pit will be replaced back into the test pit in the approximate same depth and location as from where it was removed.

For soil borings, soil will be screened on-site via visual and olfactory sense and using a PID or FID, where appropriate to determine whether the soil should be containerized for possible disposal at an appropriate landfill. If on-site screening with a PID or FID detect organic vapor at a concentration of 250 ppm or above, the drill cuttings will be containerized. As an alternative, field personnel may choose to containerize all drill cuttings, depending on known site history and/or known contaminants of potential concern.

Soil with no physical signs of contamination will be thin spread on the ground surface near the borehole. Contaminated soil will be containerized in 55-gallon drums or other appropriate sealable containers until sample analytical results are received from the analytical laboratory. The drums will be labeled appropriately and securely sealed. The drums will be removed and disposed of in accordance with state and federal regulations after receipt of soil analytical results. This may include disposal of RCRA-listed hazardous waste substances

GROUNDWATER

Groundwater purged from wells during development and sampling will be released to the ground surface away from the well. If water purged from the well has a sheen, indicating free product in the well, the water will be containerized in 55-gallon drums or other appropriate sealable containers until sample analytical results are received from the analytical laboratory. Once the results are reviewed, Maxim will determine the appropriate disposal method for the water. The drums will be removed and disposed of in accordance with state and federal regulations after receipt of soil analytical results. This may include classifying the water as a RCRA-listed hazardous waste substances and disposal at a hazardous waste disposal facility.

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUND WATER SAMPLES FROM MONITORING WELLS

July 30, 1996
Revision 2

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUND WATER SAMPLES FROM MONITORING WELLS

I. SCOPE & APPLICATION

This standard operating procedure (SOP) provides a general framework for collecting ground water samples that are indicative of mobile organic and inorganic loads at ambient flow conditions (both the dissolved fraction and the fraction associated with mobile particulates). The SOP emphasizes the need to minimize stress by low water-level drawdowns, and low pumping rates (usually less than 1 liter/min) in order to collect samples with minimal alterations to water chemistry. This SOP is aimed primarily at sampling monitoring wells that can accept a submersible pump and have a screen, or open interval length of 10 feet or less (this is the most common situation). However, this procedure is flexible and can be used in a variety of well construction and ground-water yield situations. Samples thus obtained are suitable for analyses of ground water contaminants (volatile and semi-volatile organic analytes, pesticides, PCBs, metals and other inorganics), or other naturally occurring analytes.

This procedure does not address the collection of samples from wells containing light or dense non-aqueous phase liquids (LNAPLs and DNAPLs). For this the reader may wish to check: Cohen, R.M. and J.W. Mercer, 1993, DNAPL Site Evaluation; C.K. Smoley (CRC Press), Boca Raton, Florida and U.S. Environmental Protection Agency, 1992, RCRA Ground-Water Monitoring: Draft Technical Guidance; Washington, DC (EPA/530-R-93-001).

The screen, or open interval of the monitoring well should be optimally located (both laterally and vertically) to intercept existing contaminant plume(s) or along flowpaths of potential contaminant releases. It is presumed that the analytes of interest move (or potentially move) primarily through the more permeable zones within the screen, or open interval.

> Use of trademark names does not imply endorsement by U.S.EPA but is intended only to assist in identification of a specific type of device.

Proper well construction and development cannot be overemphasized, since the use of installation techniques that are appropriate to the hydrogeologic setting often prevents "problem well" situations from occurring. It is also recommended that as part of development or redevelopment the well should be tested to determine the appropriate pumping rate to obtain stabilization of field indicator parameters with minimal drawdown in shortest amount of time. With this information field crews can then conduct purging and sampling in a more expeditious manner.

The mid-point of the saturated screen length (which should not exceed 10 feet) is used by convention as the location of the pump intake. However, significant chemical or permeability contrast(s) within the screen may require additional field work to determine the optimum vertical location(s) for the intake, and appropriate pumping rate(s) for purging and sampling more localized target zone(s). Primary flow zones (high(er) permealability and/or high(er) chemical concentrations) should be identified in wells with screen lengths longer than 10 feet, or in wells with open boreholes in bedrock. Targeting these zones for water sampling will help insure that the low stress procedure will not underestimate contaminant concentrations. The Sampling and Analysis Plan must provide clear instructions on how the pump intake depth(s) will be selected, and reason(s) for the depth(s) selected.

Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. Achievement of turbidity levels of less than 5 NTU and stable drawdowns of less than 0.3 feet, while desirable, are not mandatory. Sample collection may still take place provided the remaining criteria in this procedure are met. If after 4 hours of purging indicator field parameters have not stabilized, one of 3 optional courses of action may be taken: a) continue purging until stabilization is achieved, b) discontinue purging, do not collect any samples, and record in log book that stabilization could not be achieved (documentation must describe attempts to achieve stabilization) c) discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization (note: there is a risk that the analytical data obtained, especially metals and strongly hydrophobic organic analytes, may not meet the sampling objectives).

Changes to this SOP should be proposed and discussed when the site Sampling and Analysis Plan is submitted for approval. Subsequent requests for modifications of an approved plan must include adequate technical justification for proposed changes. All changes and modifications must be approved before implementation in field.

II. EQUIPMENT

A. Extraction device

Adjustable rate, submersible pumps are preferred (for example, centrifugal or bladder pump constructed of stainless steel or

Teflon).

Adjustable rate, peristaltic pumps (suction) may be used with caution. Note that EPA guidance states: "Suction pumps are not recommended because they may cause degassing, pH modification, and loss of volatile compounds" (EPA/540/P-87/001, 1987, page 8.5-11).

The use of inertial pumps is discouraged. These devices frequently cause greater disturbance during purging and sampling and are less easily controlled than the pumps listed above. This can lead to sampling results that are adversely affected by purging and sampling operations, and a higher degree of data variability.

B. Tubing

Teflon or Teflon lined polyethylene tubing are preferred when sampling is to include VOCs, SVOCs, pesticides, PCBs and inorganics.

PVC, polypropylene or polyethylene tubing may be used when collecting samples for inorganics analyses. However, these materials should be used with caution when sampling for organics. If these materials are used, the equipment blank (which includes the tubing) data must show that these materials do not add contaminants to the sample.

Stainless steel tubing may be used when sampling for VOCs, SVOCs, pesticides, and PCBs. However, it should be used with caution when sampling for metals.

The use of 1/4 inch or 3/8 inch (inner diameter) tubing is preferred. This will help ensure the tubing remains liquid filled when operating at very low pumping rates.

Pharmaceutical grade (Pharmed) tubing should be used for the section around the rotor head of a peristaltic pump, to minimize gaseous diffusion.

C. Water level measuring device(s), capable of measuring to 0.01 foot accuracy (electronic "tape", pressure transducer). Recording pressure transducers, mounted above the pump, are especially helpful in tracking water levels during pumping operations, but their use must include check measurements with a water level "tape" at the start and end of each record.

D. Flow measurement supplies (e.g., graduated cylinder and stop watch).

E. Interface probe, if needed.

F. Power source (generator, nitrogen tank, etc.). If a gasoline generator is used, it must be located downwind and at least 30 feet from the well so that the exhaust fumes do not contaminate the samples.

G. Indicator field parameter monitoring instruments - pH, Eh, dissolved oxygen (DO), turbidity, specific conductance, and temperature. Use of a flow-through-cell is required when measuring all listed parameters, except turbidity. Standards to perform field calibration of instruments. Analytical methods are listed in 40 CFR 136, 40 CFR 141, and SW-846. For Eh measurements, follow manufacturer's instructions.

H. Decontamination supplies (for example, non-phosphate detergent, distilled/deionized water, isopropyl alcohol, etc.).

I. Logbook(s), and other forms (for example, well purging forms).

J. Sample Bottles.

K. Sample preservation supplies (as required by the analytical methods).

L. Sample tags or labels.

M. Well construction data, location map, field data from last sampling event.

N. Well keys.

O. Site specific Sample and Analysis Plan/Quality Assurance Project Plan.

P. PID or FID instrument (if appropriate) to detect VOCs for health and safety purposes, and provide qualitative field evaluations.

III. PRELIMINARY SITE ACTIVITIES

Check well for security damage or evidence of tampering, record pertinent observations.

Lay out sheet of clean polyethylene for monitoring and sampling equipment.

Remove well cap and immediately measure VOCs at the rim of the well with a PID or FID instrument and record the reading in the field logbook.

If the well casing does not have a reference point (usually a V-cut or indelible mark in the well casing), make one. Describe its location and record the date of the mark in the logbook.

A synoptic water level measurement round should be performed (in the shortest possible time) before any purging and sampling activities begin. It is recommended that water level depth (to 0.01 ft.) and

total well depth (to 0.1 ft.) be measured the day before, in order to allow for re-settlement of any particulates in the water column. If measurement of total well depth is not made the day before, it should not be measured until after sampling of the well is complete. All measurements must be taken from the established referenced point. Care should be taken to minimize water column disturbance.

Check newly constructed wells for the presence of LNAPLs or DNAPLs before the initial sampling round. If none are encountered, subsequent check measurements with an interface probe are usually not needed unless analytical data or field head space information signal a worsening situation. Note: procedures for collection of LNAPL and DNAPL samples are not addressed in this SOP.

IV. PURGING AND SAMPLING PROCEDURE

Sampling wells in order of increasing chemical concentrations (known or anticipated) is preferred.

1. Install Pump

Lower pump, safety cable, tubing and electrical lines slowly (to minimize disturbance) into the well to the midpoint of the zone to be sampled. The Sampling and Analysis Plan should specify the sampling depth, or provide criteria for selection of intake depth for each well (see Section I). If possible keep the pump intake at least two feet above the bottom of the well, to minimize mobilization of particulates present in the bottom of the well. Collection of turbid free water samples may be especially difficult if there is two feet or less of standing water in the well.

2. Measure Water Level

Before starting pump, measure water level. If recording pressure transducer is used-initialize starting condition.

3. Purge Well

3a. Initial Low Stress Sampling Event

Start the pump at its lowest speed setting and slowly increase the speed until discharge occurs. Check water level. Adjust pump speed until there is little or no water level drawdown (less than 0.3 feet). If the minimal drawdown that can be achieved exceeds 0.3 feet but remains stable, continue purging until indicator field parameters stabilize.

Monitor and record water level and pumping rate every three to five minutes (or as appropriate) during purging. Record any pumping rate adjustments (both time and flow rate). Pumping rates should, as needed, be reduced to the minimum capabilities of the pump (for example, 0.1 - 0.4 l/min) to ensure stabilization of indicator

parameters. Adjustments are best made in the first fifteen minutes of pumping in order to help minimize purging time. During pump start-up, drawdown may exceed the 0.3 feet target and then "recover" as pump flow adjustments are made. Purge volume calculations should utilize stabilized drawdown value, not the initial drawdown. Do not allow the water level to fall to the intake level (if the static water level is above the well screen, avoid lowering the water level into the screen). The final purge volume must be greater than the stabilized drawdown volume plus the extraction tubing volume.

Wells with low recharge rates may require the use of special pumps capable of attaining very low pumping rates (bladder, peristaltic), and/or the use of dedicated equipment. If the recharge rate of the well is lower than extraction rate capabilities of currently manufactured pumps and the well is essentially dewatered during purging, then the well should be sampled as soon as the water level has recovered sufficiently to collect the appropriate volume needed for all anticipated samples (ideally the intake should not be moved during this recovery period). Samples may then be collected even though the indicator field parameters have not stabilized.

3b. Subsequent Low Stress Sampling Events

After synoptic water level measurement round, check intake depth and drawdown information from previous sampling event(s) for each well. Duplicate, to the extent practicable, the intake depth and extraction rate (use final pump dial setting information) from previous event(s). Perform purging operations as above.

4. Monitor Indicator Field Parameters

During well purging, monitor indicator field parameters (turbidity, temperature, specific conductance, pH, Eh, DO) every three to five minutes (or less frequently, if appropriate). Note: during the early phase of purging emphasis should be put on minimizing and stabilizing pumping stress, and recording those adjustments. Purging is considered complete and sampling may begin when all the above indicator field parameters have stabilized. Stabilization is considered to be achieved when three consecutive readings, taken at three (3) to five (5) minute intervals, are within the following limits:

turbidity (10% for values greater than 1 NTU),
DO (10%),
specific conductance (3%),
temperature (3%),
pH (± 0.1 unit),
ORP/Eh (± 10 millivolts).

All measurements, except turbidity, must be obtained using a flow-through-cell. Transparent flow-through-cells are preferred, because they allow field personnel to watch for particulate build-up within the cell. This build-up may affect indicator field parameter values

measured within the cell and may also cause an underestimation of turbidity values measured after the cell. If the cell needs to be cleaned during purging operations, continue pumping and disconnect cell for cleaning, then reconnect after cleaning and continue monitoring activities.

The flow-through-cell must be designed in a way that prevents air bubble entrapment in the cell. When the pump is turned off or cycling on/off (when using a bladder pump), water in the cell must not drain out. Monitoring probes must be submerged in water at all times. If two flow-through-cells are used in series, the one containing the dissolved oxygen probe should come first (this parameter is most susceptible to error if air leaks into the system).

5. Collect Water Samples

Water samples for laboratory analyses must be collected before water has passed through the flow-through-cell (use a by-pass assembly or disconnect cell to obtain sample).

VOC samples should be collected first and directly into pre-preserved sample containers. Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

During purging and sampling, the tubing should remain filled with water so as to minimize possible changes in water chemistry upon contact with the atmosphere. It is recommended that 1/4 inch or 3/8 inch (inside diameter) tubing be used to help insure that the sample tubing remains water filled. If the pump tubing is not completely filled to the sampling point, use one of the following procedures to collect samples: (1) add clamp, connector (Teflon or stainless steel) or valve to constrict sampling end of tubing; (2) insert small diameter Teflon tubing into water filled portion of pump tubing allowing the end to protrude beyond the end of the pump tubing, collect sample from small diameter tubing; (3) collect non-VOC samples first, then increase flow rate slightly until the water completely fills the tubing, collect sample and record new drawdown, flow rate and new indicator field parameter values.

Add preservative, as required by analytical methods, to samples immediately after they are collected if the sample containers are not pre-preserved. Check analytical methods (e.g. EPA SW-846, water supply, etc.) for additional information on preservation. Check pH for all samples requiring pH adjustment to assure proper pH value. For VOC samples, this will require that a test sample be collected during purging to determine the amount of preservative that needs to be added to the sample containers prior to sampling.

If determination of filtered metal concentrations is a sampling objective, collect filtered water samples using the same low flow procedures. The use of an in-line filter is required, and the filter

size (0.45 um is commonly used) should be based on the sampling objective. Pre-rinse the filter with approximately 25 - 50 ml of ground water prior to sample collection. Preserve filtered water sample immediately. Note: filtered water samples are not an acceptable substitute for unfiltered samples when the monitoring objective is to obtain chemical concentrations of total mobile contaminants in ground water for human health risk calculations.

Label each sample as collected. Samples requiring cooling (volatile organics, cyanide, etc.) will be placed into a cooler with ice or refrigerant for delivery to the laboratory. Metal samples after acidification to a pH less than 2 do not need to be cooled.

6. Post Sampling Activities

If recording pressure transducer is used, remeasure water level with tape.

After collection of the samples, the pump tubing may either be dedicated to the well for resampling (by hanging the tubing inside the well), decontaminated, or properly discarded.

Before securing the well, measure and record the well depth (to 0.1 ft.), if not measured the day before purging began. Note: measurement of total well depth is optional after the initial low stress sampling event. However, it is recommended if the well has a "silting" problem or if confirmation of well identity is needed.

Secure the well.

V. DECONTAMINATION

Decontaminate sampling equipment prior to use in the first well and following sampling of each subsequent well. Pumps will not be removed between purging and sampling operations. The pump and tubing (including support cable and electrical wires which are in contact with the well) will be decontaminated by one of the procedures listed below.

Procedure 1

The decontaminating solutions can be pumped from either buckets or short PVC casing sections through the pump or the pump can be disassembled and flushed with the decontaminating solutions. It is recommended that detergent and isopropyl alcohol be used sparingly in the decontamination process and water flushing steps be extended to ensure that any sediment trapped in the pump is removed. The pump exterior and electrical wires must be rinsed with the decontaminating solutions, as well. The procedure is as follows:

Flush the equipment/pump with potable water.

Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.

Flush with potable or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.

Flush with isopropyl alcohol (pesticide grade). If equipment blank data from the previous sampling event show that the level of contaminants is insignificant, then this step may be skipped.

Flush with distilled/deionized water. The final water rinse must not be recycled.

Procedure 2

Steam clean the outside of the submersible pump.

Pump hot potable water from the steam cleaner through the inside of the pump. This can be accomplished by placing the pump inside a three or four inch diameter PVC pipe with end cap. Hot water from the steam cleaner jet will be directed inside the PVC pipe and the pump exterior will be cleaned. The hot water from the steam cleaner will then be pumped from the PVC pipe through the pump and collected into another container. Note: additives or solutions should not be added to the steam cleaner.

Pump non-phosphate detergent solution through the inside of the pump. If the solution is recycled, the solution must be changed periodically.

Pump potable water through the inside of the pump to remove all of the detergent solution. If the solution is recycled, the solution must be changed periodically.

Pump distilled/deionized water through the pump. The final water rinse must not be recycled.

VI. FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not compromised the quality of the ground water samples. All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. The following quality control samples shall be collected for each batch of samples (a batch may not exceed 20 samples). Trip blanks are required for the VOC samples at a frequency of one set per VOC sample cooler.

Field duplicate.

Matrix spike.

Matrix spike duplicate.

Equipment blank.

Trip blank (VOCs).

Temperature blank (one per sample cooler).

Equipment blank shall include the pump and the pump's tubing. If tubing is dedicated to the well, the equipment blank will only include the pump in subsequent sampling rounds.

Collect samples in order from wells with lowest contaminant concentration to highest concentration. Collect equipment blanks after sampling from contaminated wells and not after background wells.

Field duplicates are collected to determine precision of sampling procedure. For this procedure, collect duplicate for each analyte group in consecutive order (VOC original, VOC duplicate, SVOC original, SVOC duplicate, etc.).

If split samples are to be collected, collect split for each analyte group in consecutive order (VOC original, VOC split, etc.). Split sample should be as identical as possible to original sample.

All monitoring instrumentation shall be operated in accordance with EPA analytical methods and manufacturer's operating instructions. EPA analytical methods are listed in 40 CFR 136, 40 CFR 141, and SW-846 with exception of Eh, for which the manufacturer's instructions are to be followed. Instruments shall be calibrated at the beginning of each day. If a measurement falls outside the calibration range, the instrument should be re-calibrated so that all measurements fall within the calibration range. At the end of each day, check calibration to verify that instruments remained in calibration. Temperature measuring equipment, thermometers and thermistors, need not be calibrated to the above frequency. They should be checked for accuracy prior to field use according to EPA Methods and the manufacturer's instructions.

VII. FIELD LOGBOOK

A field log shall be kept to document all ground water field monitoring activities (see attached example matrix), and record all of the following:

Well identification.

Well depth, and measurement technique.

Static water level depth, date, time and measurement technique.

Presence and thickness of immiscible liquid (NAPL) layers and

detection method.

Pumping rate, drawdown, indicator parameters values, and clock time, at the appropriate time intervals; calculated or measured total volume pumped.

Well sampling sequence and time of each sample collection.

Types of sample bottles used and sample identification numbers.

Preservatives used.

Parameters requested for analysis.

Field observations during sampling event.

Name of sample collector(s).

Weather conditions.

QA/QC data for field instruments.

Any problems encountered should be highlighted.

Description of all sampling equipment used, including trade names, model numbers, diameters, material composition, etc.

VIII. DATA REPORT

Data reports are to include laboratory analytical results, QA/QC information, and whatever field logbook information is needed to allow for a full evaluation of data useability.

EXAMPLE (Minimum Requirements) Page___of___

Well PURGING-FIELD WATER QUALITY MEASUREMENTS FORM

(Site/Facility Name)

Date

Depth to _____/_____ of screen
(below MP) top bottom
Pump Intake at (ft. below MP)
Purging Device; (pump type)

24 HR	Water Depth below MP ft	Pump Dial[1]	Purge Rate ml/min	Cum. Volume Purged liters	Temp. °C	Spec. Cond.[2] µS/cm	pH	ORP, Eh[3] mv	DO mg/L	Turb-idity NTU	Comments

1. Pump dial setting (for example: hertz, cycles/min, etc).
2. µSiemens per cm(same as µmhos/cm)at 25 °C.
3. Oxidation reduction potential (stand in for Eh).