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# **PEND OREILLE RIVER WATER QUALITY MONITORING PROGRAM**

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## *Quality Assurance Project Plan*

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## 1.0 PROJECT MANAGEMENT

The purpose of this document is to present a quality assurance project plan (QAPP) for water quality monitoring of the Idaho portion of the Pend Oreille River by the Tri-State Water Quality Council (TSWQC) and its subcontractors in cooperation with the Idaho Department of Environmental Quality (IDEQ). This QAPP describes the quality assurance (QA) program associated with the monitoring program. It presents details regarding the project organization, data quality objectives, data documentation, sample collection, field measurements, and laboratory analyses. The QAPP is intended to outline a consistent and acceptable approach to data collection and management to achieve the program objectives. Implementation of this QAPP will ensure that all water quality samples and related data collected, compiled, or generated for this project are complete, accurate, and of the type, quantity, and quality required for their intended use.

Under U.S. Environmental Protection Agency (EPA) Order 5360.1 A2, all organizations conducting environmental programs funded by EPA are required to establish and implement a quality system. In addition, EPA requires that all data used for purposes of environmental decision-making must be supported by an approved QAPP. Although no EPA funding has been received specifically for monitoring the Pend Oreille River, IDEQ has provided funding for the 2003/2004 water quality sampling to aid in the development of a subbasin assessment and possible Total Maximum Daily Load (TMDL) for submission to EPA. Therefore, this QAPP is intended to satisfy both EPA's and IDEQ's QA requirements and has been prepared according to guidance provided in *EPA Requirements for Quality Assurance Project Plans* and *EPA Guidance for Quality Assurance Project Plans* (USEPA 2001, 2002).

### 1.1 Project Background

#### *History*

Public concerns over degrading water quality in the Clark Fork–Pend Oreille Basin in the late 1980s resulted in a congressional mandate to EPA to conduct a comprehensive water quality study in the basin. As a result of that study, the TSWQC was established to help implement and oversee environmental projects and programs in the basin. Since its inception, the TSWQC has facilitated various water quality studies in the Clark Fork–Pend Oreille Basin and has regularly worked with EPA and the states of Montana, Idaho, and Washington to better understand environmental issues and remedies within the basin. The TSWQC hired Tetra Tech, Inc., to help with data collection, data compilation, and analysis of water quality in the Pend Oreille River for the 2003 and 2004 field seasons because of the company's previous work with the TSWQC and in the Clark Fork Pend Oreille watershed.

The Pend Oreille River is on Idaho's section 303(d) list for sediment, total dissolved gas (TDG), and temperature. IDEQ and EPA collectively agreed in 2002 to fund water quality monitoring on the Pend Oreille River in Idaho to aid in developing a subbasin assessment and possible TMDL. Little scientific research has been conducted on the Idaho portion of the Pend Oreille River, and as a result only limited scientific data are available on which to base conclusions regarding the quality of the water and the overall health of the river.

The TSWQC applied for and received \$50,000 in grant funding from EPA to work with IDEQ on TMDL development for the Pend Oreille River that would coincide with other water quality work being conducted on Lake Pend Oreille and the Clark Fork River. The IDEQ in turn agreed to provide \$25,000 to the TSWQC specifically to fund pre-TMDL monitoring and data collection to establish the baseline water quality conditions of the Pend Oreille River. The overall objective of this project is to monitor water quality parameters in the Idaho portion of the Pend Oreille River to provide IDEQ with information to help determine the beneficial use support status.

### ***Monitoring Program Goals***

The scope of work developed by the TSWQC, its subcontractors, and IDEQ established monitoring goals for the Pend Oreille River that include physical, chemical, and biological monitoring at five locations (four sites above Albeni Falls Dam and one site below the dam in Idaho), as well as temperature monitoring at a site in Lake Pend Oreille prior to U.S. Highway 95 and the start of the Pend Oreille River (Figure 1). Monitoring was scheduled to begin in late July or early August of 2003, and additional temperature monitoring was planned for 2004. Because of various constraints and delays, only temperature recording was conducted in 2003. Temperature and other parameters will be monitored during the summer of 2004, and the monitoring will include the following:

Physical water quality monitoring at five locations (Figure 1), including:

- Temperature
- Total suspended solids
- Eurasian milfoil identification and mapping
- River substrate characterization

Chemical water quality monitoring at five locations, including:

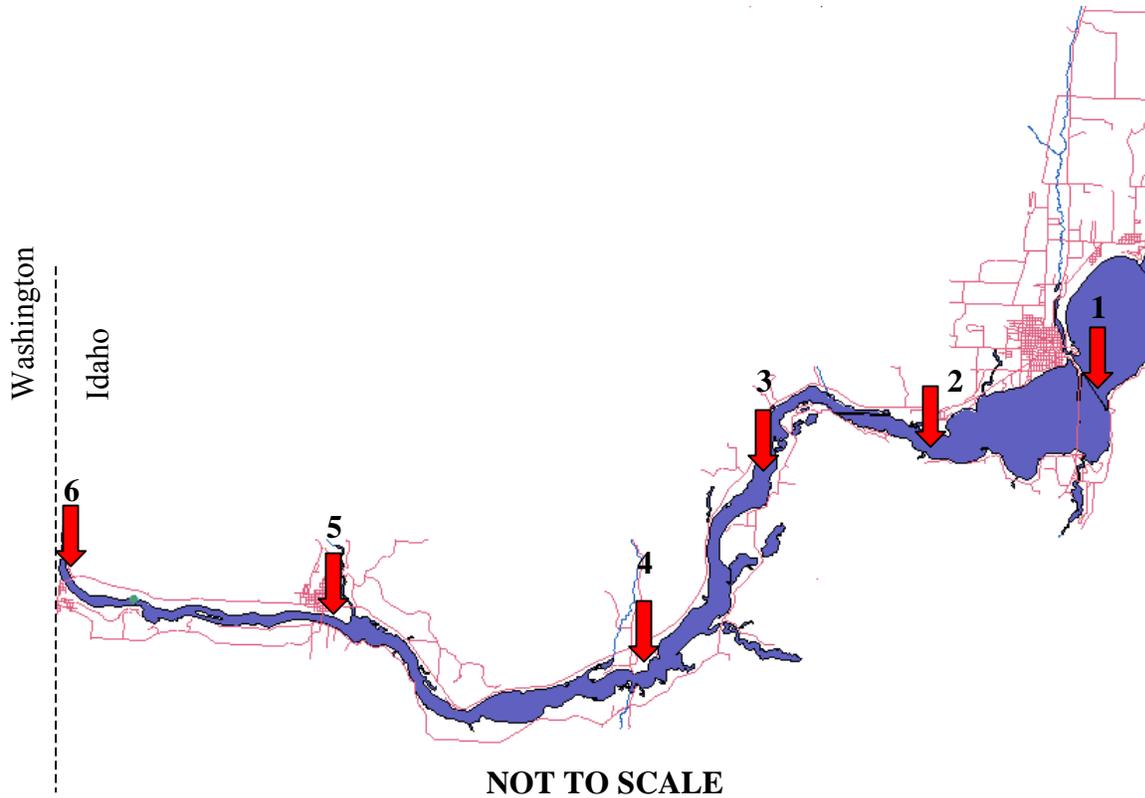
- Dissolved oxygen
- pH
- Conductivity
- Total nitrogen (TN)
- Total phosphorus (TP)

Biological water quality monitoring at five locations, including:

- Chlorophyll *a*

In addition to the chlorophyll *a* data evaluation, macroinvertebrate data previously collected by IDEQ in the Pend Oreille River will be reviewed for a professional biological opinion based on the available information. The biological opinion will be included in the summary of findings report. Fisheries data collected by the Idaho Department of Fish and Game will be compiled and included as an appendix to the summary of findings report as well.

The primary goal of data collection and analysis is to provide IDEQ with enough baseline data to assist in determining the beneficial use support status of the Pend Oreille River.



- 1: Lake Pend Oreille (temperature only)
- 2: Latitude: 48° 14'37"N Longitude: 116° 36'50"W
- 3: Latitude: 48° 15'10"N Longitude: 116° 39'46"W
- 4: Latitude: 48° 09'40"N Longitude: 116° 45'13"W
- 5: Latitude: 48° 10'35"N Longitude: 116° 54'32"W
- 6: Latitude: 48° 11'08"N Longitude: 117° 01'58"W

**Figure 1. Pend Oreille River Sampling Sites**

## 1.2 Project Organization

This section outlines the project personnel and organizations associated with the various elements of the water quality monitoring program (Figure 2). The Tetra Tech Project Manager will be responsible for coordination, oversight, and management of all aspects of the project. IDEQ will review and approve all aspects of the project; the TSWQC is responsible for financial oversight and may periodically provide input regarding various project tasks, procedures, and products.

The Tetra Tech Project Manager will provide oversight of all project monitoring activities. She will be responsible for scheduling and coordinating the sampling performed by the various project personnel and organizations. Adherence to sampling and equipment handling procedures outlined in this QAPP is the responsibility of the persons performing the sampling, under the

leadership of DVS Environmental, with review and approval provided by the Tetra Tech QA Officer. The QA Officer, or her authorized designee, will also be responsible for reviewing the laboratory procedures and analytical results to ensure that data quality objectives (DQOs) and quality control (QC) requirements are met.

DVS Environmental selected SVL Analytical to perform the analytical chemistry for this project. The QA Coordinator and Classical Chemistry Supervisor for SVL Analytical and the Project Manager are responsible for all aspects of laboratory QA/QC, data validation, and reporting.

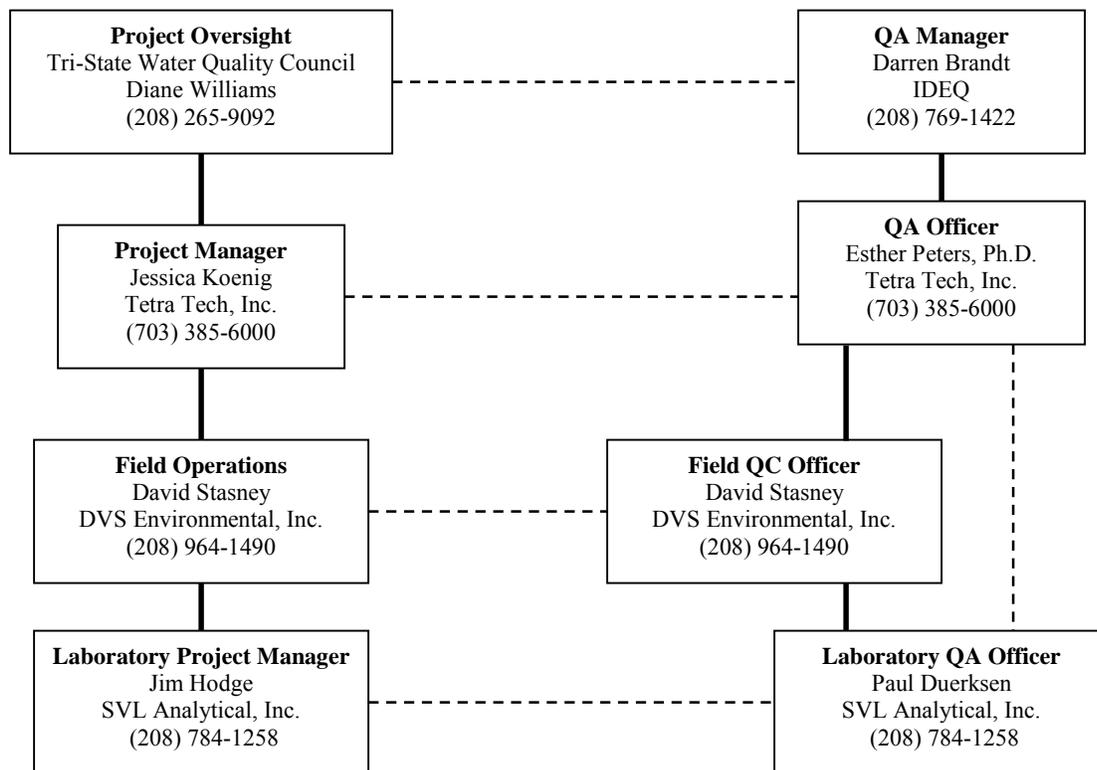
### **1.3 Project Description**

This section provides a summary of the study area and the tasks involved in the water quality monitoring program. More detailed descriptions of the program design, sampling methods, sample handling, and analytical procedures are provided in Section 2.0.

The study area includes five monitoring locations on the Pend Oreille River in Idaho and one temperature station on Lake Pend Oreille (Figure 1). All locations have been selected to provide distributed spatial coverage, and they have been assigned location numbers with corresponding latitudes and longitudes obtained by global positioning system satellites (Figure 1).

Based on the current level of available funding, the 2004 work plan will consist of the tasks described below:

1. Continuous temperature recording at six sites in the Pend Oreille River, June through September 2004.
2. Monthly total suspended solids (TSS) at sites 2 to 6 in the Pend Oreille River, June through September 2004.
3. Monthly water quality monitoring for dissolved oxygen, pH, conductivity, and nutrients, including total phosphorus and total nitrogen, at sites 2 to 6 in the Pend Oreille River, June through September 2004.
4. Monthly collection of chlorophyll *a* at sites 2 to 6 in the Pend Oreille River, June through September 2004.
5. One-time river substrate characterization at sites 2 to 6 in the Pend Oreille River.
6. Monthly visual identification for mapping of Eurasian milfoil at sites 2 to 6 in the Pend Oreille River, June through September 2004.



**Figure 2. Project Personnel Organization**

### 1.4 Data Quality Objectives and Criteria for Monitoring Data

Data quality objectives (DQOs) are the quantitative and qualitative terms used to specify how good the data need to be to meet the project’s specific monitoring objectives. The DQOs for measurement data, also referred to as data quality indicators, are precision, accuracy, measurement range, representativeness, completeness, and comparability. The DQOs for the Pend Oreille River monitoring program are addressed below. DQOs for precision, accuracy and measurement range are also summarized in Table 1.

**Table 1. Initial Project Precision, Accuracy, and Measurement Range Goals**

Data	Parameters	Precision	Accuracy	Measurement Range
Field	Temperature, DO, conductivity, pH	15%	10%	Specified by equipment manuals
Laboratory	TP, NO <sub>2</sub> +NO <sub>3</sub> , NH <sub>3</sub> +NH <sub>4</sub>	≤ 20%	80%–120%	Specified by lab performing analyses
Laboratory	TKN	≤ 25%	80%–120%	Specified by lab performing analyses
Periphyton	Chlorophyll <i>a</i>	≤ 20%	Not determined	

Note: DO = dissolved oxygen, TP = total phosphorus, NO<sub>2</sub>+NO<sub>3</sub> = nitrate + nitrite nitrogen, NH<sub>3</sub>+NH<sub>4</sub> = total ammonia-nitrogen, TKN = total Kjeldahl nitrogen.

**Precision**

*Precision* refers to the degree of variability in replicate measurements. Precision for laboratory analyses of samples will be evaluated through laboratory reporting of relative percent differences (RPDs) in duplicate sample analyses. RPD is calculated as follows:

$$\text{RPD} = [(O-D)] / ((O+D)/2) \times 100$$

where O = original and D = duplicate  
[ABSOLUTE VALUE OF O-D]

This project establishes initial precision goals of RPD  $\leq$  25 percent for TKN,  $\leq$  20 percent for all other water chemistry analyses, and  $\leq$  20 percent for periphyton (chlorophyll *a*) analyses.

**Accuracy**

*Accuracy* is a measure of confidence that describes how close an analytical measurement is to its “true” value, or the combination of high precision and low bias. Potential bias in the monitoring program procedures will be minimized through strict adherence to the QAPP. Because the “true” value of a field sample cannot be known, the primary tool for assessing the accuracy of laboratory analyses will be the percent recovery of matrix spikes and control standards compared against the field sample. Percent recovery is calculated as follows:

$$\%R \text{ for matrix spikes} = ((SSR - SR)/SA) \times 100$$

where SSR = spiked sample result, SR = sample result, and SA = spike amount added

$$\%R \text{ for control standards} = (FC/TC) \times 100$$

where FC = found concentration and TC = true concentration

For this project, an initial accuracy goal of 80 to 120 percent recovery will be established for water chemistry analyses (see Appendix A).

*Measurement Range* is the range of reliable readings of an instrument or measuring device, as specified by the manufacturer. Laboratory measurement ranges are specified by the laboratory in accordance with the manufacturer’s instructions for the analytical equipment.

**Representativeness**

*Representativeness* is the extent to which the measurements actually represent the true environmental conditions. For this monitoring effort, the sampling locations have been chosen to best represent the main stem Pend Oreille River in Idaho and minimize site-specific bias. Depth-integrated sample collection, a preferred method, will be used for water chemistry samples.

**Completeness**

*Completeness* is the comparison of the amount of data planned to be collected versus how much usable data actually was collected, expressed as a percentage. Data may be determined to be

unusable in the validation process. A project completeness of greater than 90 percent is expected under normal operating conditions. If project completeness falls below 90 percent, corrective measures, including resampling or reanalysis, will be employed.

### **Comparability**

*Comparability* is the degree to which data can be compared directly to previously collected data. The temperature data collected in 2004 can be compared to temperature data collected in 2003 at sites 2 and 5. Water chemistry data for the main stem Pend Oreille River in Idaho are extremely sparse so comparability will be achieved for these parameters through consistent sampling locations, procedures, and analyses as outlined in this QAPP.

## **1.5 Training Needs and Certifications**

No special training or certifications are required for the samplers or data managers of this project; however, strict adherence to the sampling methods described in Section 2.0 of the QAPP is required to ensure compliance with the DQOs. All personnel listed in Figure 2 are qualified scientists with the relevant education and experience needed to carry out the field sampling program. Laboratory staff have been appropriately trained and certified to perform the required analytical techniques.

## **1.6 Record Management**

The following documents will be generated during this monitoring program:

1. *Field Notebooks and Related Forms.* These documents will be generated during the course of the field component of the monitoring program, and copies will be provided to IDEQ and the TSWQC as needed. Upon completion of the project, the original field notes and related forms will be provided to IDEQ; Tetra Tech and DVS Environmental will retain copies.
2. *Chain-of-Custody Forms.* These forms will be completed during the field component of the monitoring program. Every effort will be made to hand-deliver the samples to the laboratory within 24 hours of collection, and shipping will not be needed; that is, samples will not leave the custody of field personnel. DVS will provide copies of the completed forms to Tetra Tech for the central project file.
3. *Laboratory Data.* These data will be prepared by the analytical laboratory and will include copies of the results of sample analyses and related QA/QC information. Original laboratory records, including instrument printouts, will be kept under the custody of the Laboratory Manager for possible use during data validation. Tetra Tech will provide the validated data to IDEQ.
4. *Project Report.* This report will include the final summary of findings report prepared by DVS (as subcontracted by Tetra Tech) as well as supporting data analyses, spreadsheets, documents, and photographs. The report will be delivered to IDEQ in the following formats: one bound hard copy, one unbound hard copy, one electronic copy in Microsoft Word, and one electronic copy in Portable Document Format (PDF).

Additional project documents might be generated during the course of the monitoring program and will be maintained by the Tetra Tech Project Manager. Such documents include communication records such as telephone, fax, and written correspondence between project team members, agencies, and program sponsors, IDEQ, and the TSWQC and its Water Quality Monitoring Committee.

In addition to hard copy or paper documents, computer files will be generated during the course of the monitoring program. Tetra Tech will maintain the original files during the course of the program, and copies will be provided to the TSWQC as the data are generated.

## 2.0 DATA GENERATION AND ACQUISITION

This section presents additional details pertaining to data generation and acquisition for the Pend Oreille River water quality monitoring program. The 2004 program components, described in this section, include the following:

- Monitoring Design and Schedule (2.1)
- Sampling Methods (2.2)
- Analytical Methods (2.3)
- Quality Control (2.4)
- Inspection of Lab and Field Supplies and Materials (2.5)
- Data Management (2.6)

### 2.1 Monitoring Design and Schedule

The monitoring program described in this QAPP reflects a sampling strategy designed to obtain minimum baseline water quality data and to meet specific monitoring objectives established by IDEQ in support of TMDL development for the Pend Oreille River in Idaho. The monitoring design has been developed in coordination with IDEQ to address the most critical physical, chemical, and biological components of water quality to aid in the determination of beneficial use support status and/or to document exceedances of Idaho water quality standards.

The timeline of monitoring activities for the 2004 field season is shown in Table 2.

**Table 2. Calendar of Water Quality Monitoring Activities**

June 2004	Deploy temperature data loggers; TN, TP, chlorophyll <i>a</i> , DO, TSS, pH, conductivity, milfoil identification, river bottom sampling
July 2004	TN, TP, chlorophyll <i>a</i> , DO, TSS, pH, conductivity, milfoil identification
August 2004	TN, TP, chlorophyll <i>a</i> , DO, TSS, pH, conductivity, milfoil identification
September 2004	Retrieve temperature data loggers; TN, TP, chlorophyll <i>a</i> , DO, TSS, pH, conductivity, milfoil identification

Sampling is scheduled to begin the first week of June 2004, and an effort will be made to standardize collection times for nutrients and field parameters with respect to time of the month and time of day. Temperature data loggers are scheduled to be deployed on the first day of

sampling in June 2004. They will be retrieved as late as possible, but before drafting of Lake Pend Oreille and the Pend Oreille River in September 2004.

## 2.2 Sampling Methods

### *Field Parameters*

Field parameters on the Pend Oreille River, including temperature (in degrees Celsius, °C), dissolved oxygen (in mg/L), pH (in standard units), and conductivity (in mS) will be collected using a SPER Scientific multimeter. Details and specifications are provided in Appendix B.

### *Laboratory Parameters*

Water samples for total phosphorus (TP) and total nitrogen (TN), including nitrate + nitrite nitrogen (NO<sub>2</sub>+NO<sub>3</sub>), total ammonia-nitrogen (NH<sub>3</sub>+NH<sub>4</sub>), total suspended solids (TSS), and chlorophyll *a* will be collected using a depth-integrated sampling technique and Kemmerer-type sampler. The sampler will be rinsed at least three times with native water prior to collecting each sample. Samples (except chlorophyll *a* and TSS) must be acidified to a pH of less than 2 by adding concentrated sulfuric acid (H<sub>2</sub>SO<sub>4</sub>). Samples must be clearly labeled with a waterproof marker or preprinted labels. The label information must include the site identification number, date and time, sample type, preservative, and sampler's initials. All samples will be stored in coolers and chilled to 4 °C or less for transport to the lab.

**Table 3. Sample Volumes, Containers, Preservation and Holding Times**

Analyte	Sample Volume	Container	Preservation	Holding Time
TP	250 mL	Acid-washed polyethylene	Add H <sub>2</sub> SO <sub>4</sub> to pH<2, cool to 4°C	28 days
TN	250 mL	Acid-washed polyethylene	Add H <sub>2</sub> SO <sub>4</sub> to pH<2, cool to 4°C	28 days
TSS	250 mL	Acid-washed polyethylene	None	7 days
Chlorophyll <i>a</i>	250 mL	Acid-washed amber glass	None	Unfiltered: 24–48 hours in the dark at 4 °C; filtered: frozen at -20 °C in dark, non-frost-free freezer

### *River Substrate Sampling*

The substrate of the river will be characterized by a one-time sampling of river bottom sediments at sampling sites 2 to 6 (Figure 1) using a mini-ponar grab sampler. The grab sampler will be lowered from a boat by rope or cable until it reaches the river bottom. Two mechanical jaws will be released upon impact and close as the sampler is pulled back to the surface. At each sampling location three to five samples will be collected along a cross section of the river and placed in clean, labeled 2-gallon buckets with sealed lids for transport and analysis. The actual depth of the samples will likely vary depending on the type and density of river bottom substrate to a minimum of 6 inches whenever possible for analysis. All samples will be photo-documented before they are sealed, and field notes will be taken to document the type and quantity of

macroinvertebrates present. The samples will then be allowed to air dry and will be weighed before being passed through a series of sieves to determine particle size distribution following American Society for Testing and Materials (ASTM) standards. Analyses will determine the mean particle size of the substrate in each individual sample, and no composite sampling will be done; however, the final report might include a mean particle size for each river transect.

### 2.3 Analytical Methods

All nutrient and chlorophyll *a* analyses will be performed by a state-certified laboratory using approved EPA or other standard methods. The methods listed in Table 4 are those currently used by the laboratory conducting the analyses for this project. Details regarding these methods are not included in this QAPP but are described in the EPA methods documents cited in Table 4. Further information regarding analytical methods can be obtained by contacting SVL Analytical at 1-800-597-7144.

**Table 4. Method Reporting Limits**

Analyte	Method	Method Detection Limit
Total phosphorus (TP)	EPA 365.2	2 µg/L
Total Kjeldahl nitrogen (TKN)	EPA 351.4	100 µg/L
Nitrate + nitrite-nitrogen (NO <sub>2</sub> +NO <sub>3</sub> -N)	EPA 353.2	20 µg/L
Total ammonia-nitrogen (NH <sub>3</sub> +NH <sub>4</sub> -N)	EPA 350.1	10 µg/L
Total suspended solids (TSS)	EPA 160.2	5000 µg/L
Chlorophyll <i>a</i>	SM 10200H	N/A

### 2.4 Quality Control

#### *Field Quality Control*

During each monitoring event, QC will be monitored by submitting a field duplicate sample for analysis. A duplicate sample will be taken for each analyte from a randomly selected site of the five sampling stations and submitted as a QC on lab procedures. Duplicate samples will be taken simultaneously and handled with the same procedures used for the original.

#### *Laboratory Quality Control*

Immediately upon receipt of the samples from the field, the laboratory will:

1. Review the chain-of-custody form for completeness and for clarity of instruction.
2. Inspect the cooler to make sure the samples have been kept at the proper temperature.
3. Inspect the samples for leakage or breakage and to confirm that the sample labels are consistent with the chain-of-custody forms.

The samples will then be logged in and stored in accordance with the laboratory's procedures. The Tetra Tech QA Officer will be notified immediately if any deficiencies are observed upon sample receipt.

The project lab must follow procedures consistent with its QA plan (Appendix A) and laboratory certification requirements, including sample tracking and chain-of-custody procedures. The results of laboratory QA and QC checks will be provided with the results of each monthly sampling event. The relative percent differences (RPD) from replicate samples will be calculated to determine precision. The percent recovery (%R) from matrix spikes and known standards will be used to determine accuracy. Any water chemistry samples with unacceptable precision (RPD > 20%) will be flagged in the sample report, and those results must be interpreted with caution.

## **2.5 Instrument Calibration, Testing, and Maintenance**

All field instruments and sampling equipment will be maintained in proper working order, and scheduled maintenance will be performed as required by the manufacturer. Field instrument calibration will be performed at the beginning of every sampling day and more frequently if deemed necessary by field personnel. Any changes, or proposed changes, to field instruments or sampling equipment will be approved first by IDEQ, and the QAPP will be modified accordingly (see Section 5.2).

## **2.6 Inspection of Lab and Field Supplies and Materials**

Before mobilization to the field, all field monitoring supplies and materials will be inspected by the Field Operations Leader to ensure they are in good condition and proper working order. Extra monitoring supplies and containers will be brought into the field so they are available in the unlikely event that contamination or damage occurs.

## **2.7 Data Management**

The Tetra Tech Project Manager will ensure that the data are provided to the Idaho IDEQ and TSWQC staff in hard copy or electronic format. The data will also be included in a final summary of findings report to be submitted to IDEQ.

## **3.0 QUALITY ASSURANCE OVERSIGHT PROCESS**

### **3.1 Quality Assurance Review Process**

The primary mechanism through which project DQOs will be met is prevention. Planning and design of the project, documented instructions and procedures, and use of qualified and experienced personnel as outlined in this QAPP are expected to prevent most problems associated with data quality or quantity. IDEQ personnel might participate in some of the field monitoring and will identify any problems with the sampling plan to help refine the procedures outlined in this QAPP, if necessary, for the duration of this project and for future use.

### 3.2 Quality Assurance Response Actions

In the event that any party identifies problems with project data, response actions will be triggered. The nature of these actions will depend on the severity and type of problem. The actions will begin with a review of project procedures related to the identified problem(s). Additional response actions might include the following:

- **Preventive Response Actions**

These measures would be directed at preventing the identified problem from being repeated, and they include

- implementing higher-level oversight of project activities associated with the problem to prevent further deviations.
- initiating a system of audits that will include random and unannounced evaluations of personnel, equipment, or organizations to determine whether procedures outlined in the QAPP are being adhered to. The Tetra Tech Project Manager and the Field Operations Leader will be responsible for implementing corrective measures to address any deviations from the QAPP identified.

- **Corrective Response Actions**

These measures will result in correction of the problem and replacement of the problematic data with data that meet the project DQOs. Potential corrective actions include

- reanalysis if the problem identified is or could be related to laboratory procedures and sample holding times allow this.
- resampling if the problem is related to field procedures or if a new sample is required for laboratory analysis.

## 4.0 DATA VALIDATION

### 4.1 Data Review Process

To ensure the timeliest review of the data, the original results of lab analyses will be sent directly to the Tetra Tech Project Manager to be checked for measurements within calibration range, calculation and transformation errors, and any other data errors. Copies will be sent to the Field Operations Leader and IDEQ QA Manager for review.

### 4.2 Data Verification and Validation

Data verification refers to the routine checks the IDEQ QA Manger or Tetra Tech Project Manager may conduct to ensure that the QAPP, as well as the QC procedures of the analytical laboratory, is followed. At a minimum, data verification will include evaluation of sampling documentation, compliance with sample holding times, method QC sample results, field duplicates analyzed, and the presence of any elevated detection limits.

Data validation refers to confirming by examination and providing objective evidence that the particular requirements for the intended use of data have been met. Data validation is conducted

on verified data, and the methodology differs for each parameter according to the project DQOs. All incoming data must pass the validation process, which will address at a minimum the following:

- Chain-of-custody forms and laboratory data sheets will be checked to verify that appropriate analyses were run and that the samples were analyzed within specified holding times.
- A comprehensive review of the sample delivery group will be conducted to evaluate the overall quality of the data. Included will be a review for potential transcription errors, detection limit discrepancies, data omissions, and suspect or anomalous values.
- Field data will be reviewed, and anomalous or suspect values will be noted and an explanation provided.

A flow chart describing the data validation process is provided as Figure 3.

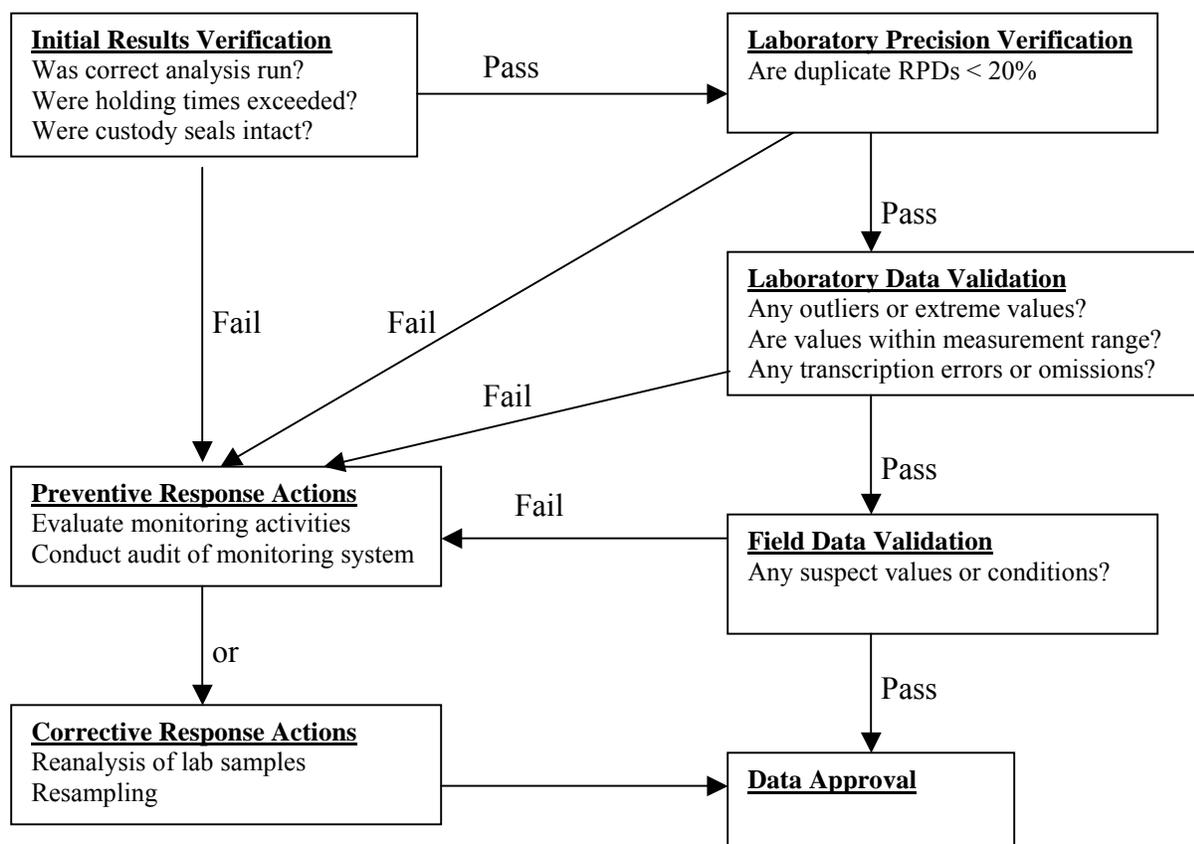
## **5.0 QUALITY ASSURANCE PROJECT PLAN IMPLEMENTATION**

### **5.1 Review and Approval Process**

This QAPP is to be distributed to all personnel and organizations listed on the distribution list. All personnel involved in the Pend Oreille River water quality monitoring program are to sign and date the approval section of this document and return the signed portion to the Project Manager. By signing the approval section, the signatory agrees that he or she has read and understands his or her role in the monitoring program and will adhere to all sections of this QAPP. In addition, project leaders are responsible for providing the current version of this QAPP to all personnel involved in the project.

### **5.2 Revision Process**

If any changes or addendums are required during the course of the monitoring program, the recommended changes will be discussed with all responsible staff and a memorandum describing the changes will be circulated for signatures. The memorandum must be attached to the QAPP and changes implemented as described therein. Any modifications to this QAPP will require formal approval by IDEQ and the TSWQC, as well as all original signatories. This QAPP will not be revised unless significant departures from the monitoring program are indicated.



**Figure 3. Data Validation Process**

## 6.0 REFERENCES

APHA/AWWA/WEF (American Public Health Association, American Water Works Association, Water Environment Federation). 1998. *Standard Methods for the Examination of Water and Wastewater*, 20<sup>th</sup> ed. American Public Health Association, Washington, DC.

USEPA (U.S. Environmental Protection Agency). 2001. *EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5)*. U.S. Environmental Protection Agency, Washington, DC.

USEPA (U.S. Environmental Protection Agency). 2002. *Guidance for Quality Assurance Project Plans (EPA QA/G-5)*. U.S. Environmental Protection Agency, Washington, DC.

**APPENDIX A. LABORATORY QA PLAN**



SVL ANALYTICAL, INC.

# Quality Assurance Plan

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© SVL Analytical, Inc.  
One Government Gulch • P.O. Box 929  
Kellogg, ID 83837  
Phone (800) 597-7144 Facsimile (208) 783-0891  
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\_\_\_\_\_  
Signature Laboratory Director

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature Quality Assurance Coordinator

\_\_\_\_\_  
Date

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## 1. INTRODUCTION

This manual describes the quality assurance program (QAP) at SVL Analytical, Inc. (SVL). This program has the unqualified support of SVL management as well as the agreement, acceptance and adherence of the laboratory staff.

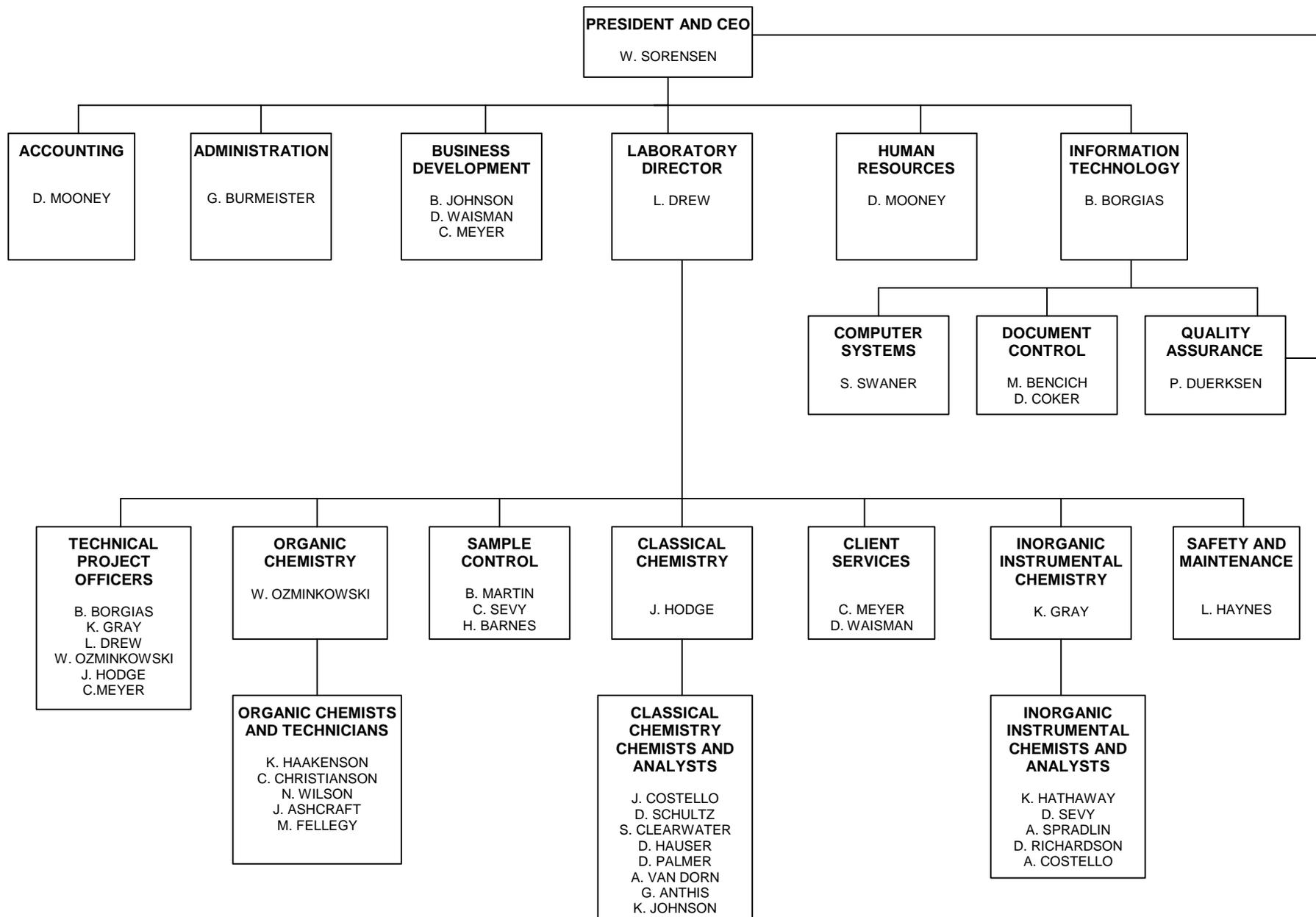
SVL is an analytical laboratory specializing in the performance of tests and parameters used in the characterization of environmental and mining samples. Since 1972, SVL has analyzed water, soil, sediment, sludge, oil, paint, rock, fish and other animal tissues, vegetation, air filters, and other sample types.

SVL occupies modern facilities specifically designed and organized to ensure an efficient mode of operation. The 25,000 square foot laboratory building has been modified to the specific needs of our large capacity analytical laboratory. Building access, security and safety features have been carefully considered. Access through the outside laboratory entrance and to internal areas is limited to laboratory and other essential personnel. Each laboratory division is plumbed and wired separately with easily accessible shut-off stations.

### 1.1 Organizational Chart

The organizational structure of SVL follows a traditional scheme of management with a few modifications. The President and CEO is at the top of the chain of command followed by the Laboratory Director. The Business Development, Human Resources, Administration, Accounting, and Information Technology groups report directly to the President. Quality Assurance reports to both the Information Technology group and to the President. Client Services, Safety, the Classical Chemistry Department, the Inorganic Instrumental Department, and the Organics Department report to the Laboratory Director. A complete organizational chart for SVL Analytical, Inc. is contained on the following page.

# ORGANIZATIONAL CHART



## 1.2 Personnel

Position	Employee	Degree	Lab Experience
President	Wayne Sorensen	BS 1962	37
Laboratory Director	Larry A. Drew	Ph.D. 1973	2
Supervisor Inorganic Instrumental Chemistry	Kirby Gray	BS 1972	19
Supervisor Organic Chemistry	Wendy Ozminkowski	BS 1997	5
Supervisor Classical Chemistry	James L. Hodge		31
Inorganic Instrument Operator (IC)	Ann Costello	BS 1971	17
ICP Spectroscopist	Anne L. Spradlin	BA 1983	18
Inorganic Instrument Operator (ICP)	Danny Sevy		16
Inorganic Instrument Operator (GFAA)	Kevin Hathaway		16
Inorganic Instrument Operator (CVAA)	Diana Richardson	BS 1971	6
Classical Chemistry Department Analyst	Alice Van Dorn		12
6Classical Chemistry Department Analyst	Dean Palmer	BS 1979	6
Classical Chemistry Department Analyst	Gordon Anthis		14
Classical Chemistry Department Analyst	Debbie Schulz		2
Classical Chemistry Department Analyst	Kay Johnson		14
Classical Chemistry Department Analyst	Joe Costello		28
Classical Chemistry Department Chemist	David Hauser	BS 1996	2
Organic Chemistry Department Chemist	Kristine Haakenson	BS 1991	11
Organic Chemistry Department Chemist	Stephanie Clearwater	BS 2000	2
Organic Chemistry Department Analyst	Mark Fellegly		14
Organic Chemistry Department Analyst	Judy Ashcraft		34
Quality Assurance Coordinator	Paul Duerksen	BS 1977	22
Safety Director	Lee Haynes		13
Document Control Manager	Melba Bencich		23
Document Processing and Reporting	Dee Coker		14
Client Services Manager	G. Christine Meyer		25
Business Development Manager	Dave Waisman	MS 1985	10
Business Development	Blake Johnson	Ph.D. 1971	19
Information Technology Manager	Brandan Borgias	Ph.D. 1985	23
Systems Analyst	Scott Swaner		1
Accounting	Donella Mooney		13
Sample Receiving	Crystal Sevy		1
Sample Receiving	Heidi Barnes		1
Sample Control	Ben Martin		1

Refer to Section 9 for resumes



## 2. INSTRUMENTATION AND ANALYSIS

### 2.1 Instruments for Trace Metal Analysis

INSTRUMENT	MANUFACTURER	MODEL
Inductively Coupled Plasma Spectrometer	Perkin-Elmer	Optima
Inductively Coupled Plasma Spectrometer	Perkin-Elmer	Optima
Atomic Absorption Spectrometer with Graphite Furnace Atomizer	Varian	SpectrAA 300Z
Atomic Absorption Spectrometer with Graphite Furnace Atomizer	Varian	SpectrAA 300Z
Atomic Absorption Spectrometer with Graphite Furnace Atomizer	Varian	SpectrAA 400Z
Atomic Absorption Spectrometer with Graphite Furnace Atomizer	Varian	SpectrAA 40Z
Atomic Absorption Spectrometer with Graphite Furnace Atomizer	Varian	SpectrAA 20
Atomic Absorption Spectrometer with Vapor Generation Assembly	Varian	SpectrAA 20
Atomic Absorption Spectrometer with Vapor Generation Assembly	Varian	SpectrAA 20
Mercury Analyzer	CETAC	M-6000A
ICP/MS	Perkin-Elmer	ELAN 5000

## 2.2 Instruments for Organic Analysis

INSTRUMENT	MANUFACTURER	MODEL
Gas Chromatograph with Dual ECD and Autosampler	Hewlett-Packard Hewlett-Packard	5890 Series II Plus HP 7673
Gas Chromatograph with FID Detector and Autosampler	Hewlett-Packard Hewlett-Packard	5890 Series II HP 7673
Gas Chromatograph with PID and FID and Liquid Sample Concentrator/Autosampler	Hewlett-Packard Tekmar	5890 Series II LSC 2000/ ALS 2016
Gas Chromatograph with MS Detector and Purge and Trap Concentrator	Hewlett-Packard Tekmar	5890 Series II Plus with 5972 MS LSC 3000/ ALS 2016
Gas Chromatograph with MS Detector and Purge and Trap Concentrator/Autosampler	Hewlett-Packard Tekmar	5890 Series II with 5971 MSD LSC 3100/ Solatek 72
Gas Chromatograph with MS Detector and Autosampler	Hewlett-Packard Hewlett-Packard	5890 Series II 7673
Gas Chromatograph with Dual Micro ECD And Autosampler	Agilent Agilent	6890A 7683
Gas Chromatograph with PID with Liquid Sample Concentrator/Autosampler	Hewlett-Packard Tekmar	5890 Series II LSC 2000/ ALS 2016
Gas Chromatograph with FID and Autosampler	Hewlett-Packard Hewlett-Packard	5890 Series II 7673A
HPLC	Hewlett-Packard	1050
Accelerated Solvent Extractor	Dionex	ASE200
Zero Head Space Extractor	Millipore	

## 2.3 Instruments for Inorganic Analysis

INSTRUMENT	MANUFACTURER	MODEL
Ion Chromatograph	Dionex	2000i
Ion Chromatograph	Dionex	DX-100
Ion Chromatograph	Dionex	4000i
Automated Flow Analyzer with Autosampler	Alpkem	FS3000
Automated Flow Analyzer with Autosampler	Alpkem	FS3000
MIDI Distillation Units	BSL	
Ammonia Distillation Unit	Andrews Glass	
Auto Titrator with Autosampler	Brinkmann	Titrimo 716
Auto Titrator with Autosampler	Brinkmann	Titrimo 716
UV/Visible Spectrophotometer	Bausch & Lomb	501
Turbidimeter	Hach	2100
COD Reactor	Hach	COD
COD Reactor	Hach	COD
pH Meter	Corning	150
pH/Ion Meter	Corning	450
Dissecting Microscope	Nikon	104
Polarizing Microscope	Nikon	106
Conductance Meter	YSI	32
Dissolved Oxygen Meter	YSI	50B
Elemental Analyzer	LECO	SC444
Carbon Analyzer (TOC)	Shimadzu	TOC-5000A
Organic Halogen Analyzer (TOX)	MCI (Mitsubishi)	TOX-10

## 2.4 Routine Analyses Performed

ANALYTE	METHOD	TECHNIQUE
Aluminum	EPA 200.7, SW846 6010B	ICP
Antimony	EPA 200.7, SW846 6010B	ICP
Antimony	EPA 200.9, 204.2, SW846 7040	GFAA
Arsenic	EPA 200.7, SW816 6010B	ICP
Arsenic	EPA 200.9, 206.2, SW846 7060A	GFAA
Barium	EPA 200.7, SW846 6010B	ICP
Beryllium	EPA 200.7, SW846 6010B	ICP
Boron	EPA 200.7, SW846 6010B	ICP
Cadmium	EPA 200.7, SW846 6010B	ICP
Cadmium	EPA 200.9, 213.2, SW846 7131A	GFAA
Calcium	EPA 200.7, SW846 6010B	ICP
Chromium	EPA 200.7, SW846 6010B	ICP
Chromium	EPA 200.9, 218.2, SW846 7191	GFAA
Cobalt	EPA 200.7, SW846 6010B	ICP
Copper	EPA 200.7, SW846 6010B	ICP
Gold	EPA 231.2	GFAA
Iron	EPA 200.7, SW846 6010B	ICP
Lead	EPA 200.7, SW846 6010B	ICP
Lead	EPA 200.9, 239.2, SW846 7420	GFAA
Magnesium	EPA 200.7, SW846 6010B	ICP
Manganese	EPA 200.7, SW846 6010B	ICP
Mercury	EPA 245.1, SW846 7470A, 7471A	CVAA
Nickel	EPA 200.7, SW846 6010B	ICP
Potassium	EPA 200.7, SW8946 6010B	ICP
Selenium	EPA 200.7, SW846 6010B	ICP
Selenium	EPA 200.9, 270.2, SW846 7740	GFAA

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ANALYTE	METHOD	TECHNIQUE
Silica	EPA 200.7	ICP
Silver	EPA 200.7, SW846 6010B	ICP
Silver	EPA 200.9, 272.2, SW846 7761	GFAA
Sodium	EPA 200.7, SW846 6010B	ICP
Strontium	EPA 200.7, SW846 6010B	ICP
Thallium	EPA 200.7, SW846 6010B	ICP
Thallium	EPA 200.9, 279.2, SW846 7840	GFAA
Tin	EPA 200.7, SW846 6010B	ICP
Titanium	EPA 200.7, SW846 6010B	ICP
Vanadium	EPA 200.7, SW846 6010B	ICP
Zinc	EPA 200.7, SW846 6010B	ICP
Acidity	SM 2310B	Titration
Alkalinity	SM 2320B	Titration
Ammonia	EPA 350.1	Automated Colorimetry
Ammonia	EPA 350.3	Ion Specific Electrode
Biochemical Oxygen Demand	SM 5210B	D.O. Meter
Bromide	EPA 300.0	Ion Chromatography
Chemical Oxygen Demand	EPA 410.4	Colorimetry
Chloride	EPA 300.0	Ion Chromatography
Color	EPA 110.2	Colorimetric
Corrosivity	SM 2330 (B)	Langlier Index
Corrosivity to Steel	SW846 1110	Coupon
Cyanide, Total	EPA 335.2, 335.4, SW846 9012A	Automated Colorimetry
Cyanide, WAD	SM 4500 CN (I)	Automated Colorimetry
Cyanide, Available	1677	Automated Colorimetry

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ANALYTE	METHOD	TECHNIQUE
Fluoride	EPA 300.0	Ion Chromatography
Fluoride	EPA 340.2	Ion Specific Electrode
Hardness	SM 2340B	ICP Sum
Hexane Extractable Materials	EPA 1664	Gravimetric
Ignitability	SW846 1010	Pensky-Martens
Nitrate	EPA 300.0	Ion Chromatography
Nitrate	EPA 353.2	Automated Colorimetry
Nitrate + Nitrite	EPA 353.2	Automated Colorimetry
Nitrite	EPA 300.0	Ion Chromatography
Nitrite	EPA 353.2	Automated Colorimetry
Oil & Grease	EPA 1664	Gravimetric
ortho-Phosphate	EPA 365.2	Colorimetry
pH	EPA 150.1	Electrometric
Phenolics, Total	EPA 420.1	Colorimetric
Phosphate, Total	EPA 365.2	Persulfate Digestion
Residue, Filterable	EPA 160.1, SM2540C	Gravimetric
Residue, Nonfilterable	EPA 160.2	Gravimetric
Specific Conductance	EPA 120.1	Wheatstone Bridge
Sulfate	EPA 300.0	Ion Chromatography
Sulfide	EPA 376.1	Titrimetric
Suspended Solids	EPA 160.2	Gravimetric
TCLP	SW846 1311	Extraction
Total Dissolved Solids	EPA 160.1, SM2540C	Gravimetric
Total Solids	EPA 160.4	Gravimetric
Total Volatile Solids	EPA 160.2	Gravimetric
Total Kjeldahl Nitrogen	EPA 351.4	Ion Selective Electrode

ANALYTE	METHOD	TECHNIQUE
Total Organic Carbon	EPA 415.1	Combustion
Total Organic Halides in Waste	SW846 9076	Adsorption-Pyrolysis, Titrimetric
Organochlorine Pesticides and PCBs	EPA 608	GC/ECD
Organochlorine Pesticides	EPA 8081A	GC/ECD
PCBs	EPA 8082	GC/ECD
Semivolatile Organic Compounds	EPA 625	GC/MSD
Semivolatile Organic Compounds	EPA 8270C	GC/MSD
Volatile Organic Compounds	EPA 524.2	GC/MSD
Volatile Organic Compounds	EPA 624	GC/MSD
Volatile Organic Compounds	EPA 8260B	GC/MSD
BTEX and Naphthalene	EPA 8021B	GC/PID
Total Petroleum Hydrocarbons-- Gasoline	EPA 8015, NWTPH-Gx	GC/FID
Total Petroleum Hydrocarbons-- Diesel	EPA 8015, NWTPH-Dx	GC/FID
Total Petroleum Hydrocarbons	8015AZ	GC/FID

## 3. ANALYTICAL PROCEDURES

Analysis of samples is performed according to SVL Standard Operating Procedures (SOPs). The SOPs are created using established procedures such as those referenced in the following section.

### 3.1 References

Methods for Chemical Analysis of Water and Wastes, revised March 1983, EPA-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 Supplement I, EPA/600/4-88/039, July 1990.

Methods for the Determination of Organic Compounds in Drinking Water Supplement III, EPA/600R-95-131, August 1995.

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW 846), Third Edition, Update III, December 1996.

Standard Methods for the Examination of Water and Wastewater, 16th Edition, 1985

Standard Methods for the Examination of Water and Wastewater, 19th Edition, 1995.

ASTM Book of Standards, part 31

USEPA CLP Inorganic Statement of Work ILM04.0

## 3.2 Standard Operating Procedures

<u>SVL 3001</u>	GLASSWARE WASHING INSTRUCTIONS
<u>SVL 3004</u>	SAMPLE PREPARATION FOR TPH DIESEL/MOTOR OIL
<u>SVL 3005</u>	SAMPLE PREP: TPH-DRO
<u>SVL 3007</u>	SAMPLE PREPARATION FOR SVOCs (625 and 8270C)
<u>SVL 3008</u>	SAMPLE PREP FOR CHLORINATED PESTICIDES AND PCBS
<u>SVL 3011</u>	SAMPLE PREP: TCLP (1311)
<u>SVL 3013</u>	SAMPLE PREP: WTPH-HCID (WA STATE DOE)
<u>SVL 3014</u>	SAMPLE PREP: TOTAL PETROLEUM HYDROCARBONS (8015AZ)
<u>SVL 3023</u>	ANALYSIS OF VOCs IN DW BY GC/MSD
<u>SVL 3024</u>	ANALYSIS OF TPH--DIESEL/MOTOR OIL
<u>SVL 3025</u>	ANALYSIS: TPH-DRO
<u>SVL 3027</u>	ANALYSIS OF SVOCs IN GROUNDWATER AND HAZARDOUS WASTES (8270C)
<u>SVL 3028</u>	ANALYSIS OF VOCs IN GROUNDWATER AND HAZARDOUS WASTES (8260B)
<u>SVL 3029</u>	ANALYSIS OF CHLORINATED PESTICIDES IN GW AND HAZ WASTES(8081A)
<u>SVL 3031</u>	ANALYSIS OF TOX IN OIL (9076)
<u>SVL 3032</u>	ANALYSIS OF PCBs IN OIL (8081)
<u>SVL 3033</u>	ANALYSIS OF WTPH-HCID
<u>SVL 3050</u>	ANALYSIS: TOC (415.1)
<u>SVL 3051</u>	BIOCHEMICAL OXYGEN DEMAND
<u>SVL 3053</u>	ANALYSIS OF BTEX AND NAPHTHALENE BY GC (8021B)
<u>SVL 3056</u>	ANALYSIS OF VOC's IN WASTEWATER BY GC/MSD (624)
<u>SVL 3057</u>	ANALYSIS OF CHLORINATED PESTICIDES IN WASTEWATER (608)
<u>SVL 3058</u>	ANALYSIS OF PCBs IN WASTE SAMPLES (8082)
<u>SVL 3059</u>	ANALYSIS OF SVOCs IN WASTEWATER (625)
<u>SVL 3062</u>	ANALYSIS OF TOTAL PETROLEUM HYDROCARBONS (8015AZ)
<u>SVL 3064</u>	DETERMINATION OF RETENTION TIME
<u>SVL 4009</u>	OPERATION OF VARIAN GFAA
<u>SVL 4010</u>	DETERMINATION OF MERCURY (CVAA)
<u>SVL 4012</u>	TOTAL CYANIDE BY MIDI DISTILLATION FOLLOWED BY AUTOMATED COLORIM
<u>SVL 4013</u>	GLASSWARE WASHING FOR CLASSICAL CHEMISTRY AND TRACE METALS
<u>SVL 4021</u>	FILTER DIGESTION
<u>SVL 4022</u>	PERCENT SOLIDS
<u>SVL 4023</u>	ICP SCAN (SVL METHOD)
<u>SVL 4024</u>	COLOR (110.2)
<u>SVL 4025</u>	CONDUCTIVITY (METHOD 120.1)
<u>SVL 4026</u>	TURBIDITY (METHOD 180.1)
<u>SVL 4032</u>	SULFIDES BY TITRATION
<u>SVL 4033</u>	HYDROGEN SULFIDE GAS GENERATION
<u>SVL 4034</u>	TOTAL DISSOLVED SOLIDS AND SUSPENDED SOLIDS
<u>SVL 4035</u>	TOTAL AND VOLATILE SOLIDS
<u>SVL 4038</u>	PHENOLS
<u>SVL 4039</u>	HEXANE EXTRACTABLE MATERIAL (OIL & GREASE)
<u>SVL 4040</u>	TOTAL PHOSPHORUS (AQUEOUS SAMPLES)
<u>SVL 4041</u>	TOTAL PHOSPHORUS DIGESTION FOR SOLIDS
<u>SVL 4042</u>	DETERMINATION OF ORTHO-PHOSPHATE (AS P)
<u>SVL 4043</u>	CHEMICAL OXYGEN DEMAND

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<u>SVL 4044</u>	TOTAL ORGANIC MATTER (TOM & TOC)
<u>SVL 4045</u>	TOTAL KJELDAHL NITROGEN
<u>SVL 4046</u>	AMMONIA: SELECTIVE ION ELECTRODE METHOD
<u>SVL 4048</u>	NITRATE/NITRITE AS N: AUTOMATED CADMIUM RE REDUCTION
<u>SVL 4049</u>	CATION EXCHANGE CAPACITY BY METHOD 9081
<u>SVL 4054</u>	CYANIDE AMENABLE TO CHLORINATION (335.1)
<u>SVL 4056</u>	FREE CYANIDE BY METHOD 4500-CN D
<u>SVL 4058</u>	ELEMENTAL SULFUR (SVL METHOD)
<u>SVL 4060</u>	LOSS ON IGNITION (SVL METHOD)
<u>SVL 4061</u>	DETERMINATION OF ACID GENERATING POTENTIAL
<u>SVL 4064</u>	PROCESSING YARD SAMPLES
<u>SVL 4065</u>	METEORIC WATER MOBILITY TEST
<u>SVL 4068</u>	SPLP (METHOD 1312)
<u>SVL 4070</u>	TOTAL SUSPENDED PARTICULATES
<u>SVL 4072</u>	ACID NEUTRALIZATION POTENTIAL
<u>SVL 4073</u>	ACID BASE ACCOUNT
<u>SVL 4074</u>	AMMONIA: BORATE TECATOR DISTILLATION
<u>SVL 4075</u>	WAD CYANIDE BY MIDI DISTILLATION/RFA
<u>SVL 4077</u>	DISSOLUTION OF OILS, GREASE, & WAXES (3040)
<u>SVL 4078</u>	SAMPLE DIG FOR TOTAL RECOVERABLE METALS IN AQUEOUS SAMPLES GFAA
<u>SVL 4079</u>	SAMPLE DIG FOR TOTAL METALS IN AQUEOUS SAMPLES FOR ICP
<u>SVL 4080</u>	SAMPLE DIG FOR TOTAL RECOVERABLE METALS IN AQUEOUS SAMPLES ICP
<u>SVL 4081</u>	HEXAVALENT CHROMIUM (METHOD D-1687)
<u>SVL 4082</u>	ARSENIC SPECIATION (ASIII AND ASV)
<u>SVL 4083</u>	INORGANIC IONS BY ION CHROMATOGRAPHY
<u>SVL 4084</u>	OPERATION OF THE AUTOTITRATOR (ALKALINITY)
<u>SVL 4087</u>	FLUORIDE BY ION-SELECTIVE ELECTRODE
<u>SVL 4088</u>	DIGESTION OF DRINKING WATER SAMPLES
<u>SVL 4090</u>	FILTER PREPARATION
<u>SVL 4092</u>	EXTRACTION FOR Cr(VI) SOLID SAMPLES (3060A)
<u>SVL 4093</u>	CASSETTE FILTER DIGESTION
<u>SVL 4094</u>	SAMPLE DIGESTION FOR METALS IN SOILS
<u>SVL 4095</u>	FLASHPOINT PENSKEY-MARTENS CLOSED TESTER
<u>SVL 4096</u>	PASTE pH DETERMINATION FOR SOILS
<u>SVL 4097</u>	TOTAL SULFUR, TOTAL CARBON
<u>SVL 4099</u>	AMMONIA BY SEMI-AUTOMATED COLORIMETRY
<u>SVL 4101</u>	ANALYSIS OF AVAILABLE CYANIDE BY FLOW INJECTION AND
<u>SVL 4102</u>	ANALYSIS OF METALS BY PERKIN-ELM OPTIMA ICP
<u>SVL 4103</u>	ACID VOLATILE SULFIDE

## 4. ETHICS AND DATA INTEGRITY AGREEMENT

SVL Analytical, Inc. is committed to providing its clients with accurate and defensible data and meeting all client requirements for data quality and integrity. To achieve this commitment, and as a condition for employment, all employees agree to follow SVL's policy regarding ethics and data integrity which is characterized in the items listed below.

All work performed shall be in accordance with appropriate work order agreements, specified methods, SOP's, and contracts.

All reported data, including analysis dates and times, shall represent actual values obtained and are not modified, or manipulated in any manner which is not described in the referenced method.

Analysts performing technical methods in the name of SVL shall not represent work which was performed by other individuals as their own.

Client results shall be kept strictly confidential and released to a third party only with written permission by the client, except as required by law.

Violation of these standards is grounds for disciplinary action as stated in section II of SVL's Employee Handbook, including termination.

## 5. QUALITY ASSURANCE AND QUALITY CONTROL

SVL recognizes that an effective and vigorously pursued quality program is key to providing analytical data which is legally defensible, technically accurate, and scientifically meaningful.

At SVL, quality control begins as soon as data quality objectives are defined and proceeds through data reporting. Control procedures are defined for every step of the program and detailed in current standard operating procedures (SOPs).

SVL realizes that without these controls in all phases of the laboratory and analytical process, data becomes suspect and hence, of less value to our client. Therefore, SVL is dedicated to providing data of the highest quality, usability, and defensibility for every project we undertake.

### 5.1 Quality Assurance Policy and Objectives

The primary emphasis of the QAP is twofold. The first of these is to define quality control procedures for all activities that take place in the laboratory. These include the following: receipt, handling, and storage of samples; preparation and maintenance of standards, reagents, gases, and water; calibration and maintenance of analytical equipment; performance, and evaluation of analytical methodologies (in conformance with the parameters defined by the appropriate regulatory agency; and the compilation and generation of reportable data packages.

The other emphasis of the QAP is to characterize the documentation practices utilized in all facets of the laboratory process. The objective is to provide a uniform basis for instrument maintenance, document control, analytical methodologies, data generation, quality assurance, and quality control.

### 5.2 Quality Assurance Management

SVL employs one full time Quality Assurance Coordinator who reports to the Information Technology Manager and the President, providing independence from the routine operation of the individual departments of the laboratory. The Quality Assurance Coordinator is responsible for the management and implementation of the quality assurance program. He is responsible for monitoring the overall adequacy of the program as well as determining departmental conformance to the QA program. The QA Coordinator is responsible for recommending corrective actions as necessary.

In addition, the Quality Assurance Coordinator develops quality control programs; monitors quality assurance activities to determine conformance with policies and procedures; evaluates and maintains records of data quality and other pertinent performance information; and coordinates investigations of quality problems. Supervisors are responsible for seeing that their staff receive adequate training in and follow the specific procedures outlined in this QAP.

## 5.3 Sample Collection and Handling

This section describes the quality control procedures to be followed in the collection and handling of samples for SVL. These procedures are recommended to all clients submitting samples for chemical analysis. It is assumed that data quality objectives have been developed and the number of samples, types of samples, frequency of collection, and duration of the sampling program have been established. Finally, it is assumed that all personnel involved in sample acquisition are aware of the above factors.

If utilized, the procedures characterized here result in more confidence in the data produced and the samples are processed more efficiently. The result of standardizing sample collection and handling procedures is less confusion for the project manager, field personnel, and laboratory staff.

### 5.3.1 Sample Preservation

Sample preservation is critical for sample integrity. Chemical reactions may occur and some chemical species begin to change upon sample collection. Unfortunately, for most samples immediate analysis is neither economically feasible nor logistically possible. Although no miracle chemical preservative valid for every parameter exists, SVL strongly recommends the preservation methods, container type, sample size and estimated maximum holding times for collection of water and wastewater samples summarized in Table 5-1.

Solid samples are best preserved by refrigeration at  $4\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ . Analysis begins as soon as possible after lab receipt of samples. SVL does its utmost to ensure that all holding times are met for water samples as listed in Table 5-1. A complete record is maintained on each sample to provide a history of handling from the time of sample receipt through analysis and disposal.

Table 5-1 Recommended Sampling and Preservation

## PHYSICAL PROPERTIES

Analysis	Volume Required (mL)	Container	Preservative	Holding Time
Color	50	P,G <sup>1</sup>	Cool to 4 °C	48 Hours
Conductance	100	P,G	Cool to 4 °C	28 Days
Hardness	100	P,G	HNO <sub>3</sub> to pH<2	6 Months
Odor	200	G only	Cool to 4 °C	24 Hours
pH	25	P,G	None Required	Analyze Immediately
Temperature	1000	P,G	None Required	Analyze Immediately
Turbidity	100	P,G	Cool to 4 °C	48 Hours

## RESIDUES

Analysis	Volume Required (mL)	Container	Preservative	Holding Time
Filterable Residue (TDS)	100	P,G	Cool to 4 °C	7 Days
Non-Filterable Residue (TSS)	100	P,G	Cool to 4 °C	7 Days
Total Residue	100	P,G	Cool to 4 °C	7 Days
Volatile Residue	100	P,G	Cool to 4 °C	7 Days
Settleable Matter	1000	P,G	Cool to 4 °C	48 Hours

## METALS

Analysis	Volume Required (mL)	Container	Preservative	Holding Time
Dissolved	200	P,G	Filter on site; HNO <sub>3</sub> to pH<2	6 Months
Suspended	200	P,G	Filter on site	6 Months
Total	100	P,G	HNO <sub>3</sub> to pH<2	6 Months
Chromium (VI)	200	P,G	Cool to 4 °C	24 Hours
Mercury, Dissolved	100	P,G	Filter; HNO <sub>3</sub> to pH<2	28 Days
Mercury, Total	100	P,G	HNO <sub>3</sub> to pH<2	28 Days

## INORGANIC

Analysis	Volume Required (mL)	Container	Preservative	Holding Time
Acidity	100	P,G	Cool to 4 °C	14 Days
Alkalinity	100	P,G	Cool to 4 °C	14 Days
Bromide	100	P,G	None Required	28 Days
Chloride	50	P,G	None Required	28 Days
Cyanide	500	P,G	Cool to 4 °C; NaOH to pH>12	14 Days
Fluoride	300	P	None Required	28 Days
Ammonia	400	P,G	Cool to 4 °C H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days
Total Kjeldahl Nitrogen	500	P,G	Cool to 4 °C H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days
Nitrate plus Nitrite	100	P,G	Cool to 4 °C H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days
Nitrate	100	P,G	Cool to 4 °C	48 Hours
Nitrite	50	P,G	Cool to 4 °C	48 Hours
Ortho-Phosphate Dissolved	50	P,G	Filter on site; Cool to 4 °C	48 Hours
Total Phosphate	50	P,G	Cool to 4 °C; H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days
Total Dissolved Phosphate	50	P,G	Filter on site; Cool to 4 °C; H <sub>2</sub> SO <sub>4</sub> to pH<2	24 Hours
Silica	50	P only	Cool to 4 °C	28 Days
Sulfate	50	P,G	Cool to 4 °C	28 Days
Sulfide	500	P,G	Cool to 4 °C add 2 mL zinc acetate plus NaOH to pH>9	7 Days
COD	50	P,G	Cool to 4 °C H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days
Oil & Grease (Hexane Extractable Materials)	1000	G only	Cool to 4 °C H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days
Organic Carbon	25	P,G	Cool to 4 °C H <sub>2</sub> SO <sub>4</sub> or HCl to pH<2	
Phenolics	500	G only	Cool to 4 °C H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days
MBAS	250	P,G	Cool to 4 °C	48 Hours

## ORGANICS

Analysis	Amount Required	Container	Preservative	Holding Time Until Extraction	Holding Time After Extraction Until Analysis
524.2 (Volatile Organic Compounds)	2x40mL vials	G,T	Cool to 4 °C; HCl pH<2	14 days	NA
608 (Pesticides and/or PCBs)	1 L	amber G,T	Cool to 4 °C	7 days	40 days
624 (Volatile Organic Compounds)	2x40mL vials	G,T	Cool to 4 °C; HCl pH<2	14 days	NA
625 (Semivolatile Organic Compounds)	1 L	amber G,T	Cool to 4 °C	7 days	40 days
8081A (Pesticides)	8 oz (soil) 1L (aqueous)	amber G,T	Cool to 4 °C	14 days	40 days
8082 (PCBs)	8 oz (soil) 1 L (aqueous)	G,T	Cool to 4 °C	14 days	40 days
8260B (Volatile Organic Compounds)	4 oz (soil) 2x40mL (aqu)	G,T	Cool to 4 °C; HCl pH<2	14 days	NA
8270C (Semivolatile Organic Compounds)	8 oz (soil) 1 L (aqueous)	amber G,T	Cool to 4 °C	14 days	40 days
8015 (TPH-Gasoline)	4 oz (soil) 2x40 mL (aqu)	amber G,T	Cool to 4 °C	14 days	35 days
8015AZ	8 oz (soil)	G,T	Cool to 4 °C		14 days for extraction and analysis
8015 (TPH-Diesel Motor Oil)	1 L (aqu) 8 oz (soil)	amber G,T	Cool to 4 °C	14 days	35 days

NOTES: - <sup>1</sup>Plastic (P), Glass (G), Teflon-lined cap (T). For metals, polyethylene with a polypropylene cap (no liner) is preferred.

Preservation: - Sample preservation should be performed immediately upon sample collection. For composite samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, the samples may be preserved by maintaining at 4 °C until compositing and sample splitting is completed.

Holding Time: - Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid.

### 5.3.2 Sample Contamination

Field blanks allow identification of systematic and random sample contamination that may result from the sampling equipment, storage containers, sampling agents, or chemicals added to preserve samples. Field blanks consist of a sample container of distilled or deionized water with the appropriate chemical preservative. Preservation, filtration, storage, handling, and analysis are performed as if the field blanks were samples. To achieve accurate and meaningful data, field blank containers should be filled at the sampling site.

Sources of sample contamination include unclean sample containers and filters; Impure solvents and reagents; and use of cleaning products inappropriate for the proposed analysis. Hair, tobacco smoke, and dust are also appreciable sources of contamination, so sampling should be conducted in as careful a manner as possible.

Before filtering samples for dissolved parameters, the filter paper should be rinsed with deionized or distilled water and with a small portion of sample. The filtration apparatus should also be rinsed with deionized or distilled water between samples. Handle filter paper only on the edge, using appropriate forceps (plastic for trace metals analysis, metal for organic analysis).

Use the proper sample container for the parameter specified. Trace metals samples must not come into contact with any metallic surface; samples for organic analysis must not come into contact with any plastic surface.

### 5.3.3 Cleaning Procedures for Sample Containers

Immerse glassware in a solution of synthetic detergent. Scrub it with a brush, rinse it several times with tap water, and then with deionized water. Glassware for samples to be analyzed for trace metals may also require treatment with nitric acid. Glassware for samples to be analyzed for organic analysis may also require solvent rinses and baking.

### 5.3.4 Sample Receipt and Storage

Sampling personnel should complete a chain-of-custody form that documents sample identification, sampling date and time, matrix type, number of sample containers, type of preservation, whether samples have been filtered, and the parameters to be analyzed.

A temperature reading is taken by the SVL sample custodian for all sample shipping containers (coolers) upon initial receipt and opening. Each sample is checked for visible damage and the presence of an intact custody seal. Each sample is assigned a unique sample identification number batched with other samples which have been received from the same client and assigned a job number. Sample containers are labeled and stored in a secured area.

Each batch of samples received at SVL is given a unique job number (e.g., "100001"). This job number remains with the sample throughout the analytical process. Each sample is also given a unique, sequential laboratory identification number. Samples are labeled with sample and Job identification numbers before being stored.

Samples that require refrigeration are stored in a walk-in cooler at  $4 \pm 2$  °C, except at times of sample preparation or analysis. Samples that do not require refrigeration are stored in a sample storage annex. Samples are retained at SVL for a minimum of 30 days (or longer if required by the client) after a data report is issued to the client. At the end of the specified period, samples are returned to the client or discarded.

## 5.4 Reagents, Standards, Gases, and Water

### 5.4.1 Reagent Chemicals

The most significant source of sample contamination for trace metal and organic analyses results from the acids and solvents used in digestion and extraction, respectively. To minimize this potential for contamination, SVL uses Analytical Reagent Grade or better reagents for all environmental analyses. Solvents used for organic analyses are of GC grade purity.

Spatulas and pipettes are never used in reagent bottles; an approximate amount of reagent required is dispensed into a secondary vessel; reagents are never dispensed directly from the reagent container; and excess reagent is discarded, not returned to the bottle.

### 5.4.2 Standards

The sources and quality of all standards, reagents, and chemicals used by SVL are documented. A record is maintained which indicates the name of the person preparing a standard, the source of the standard being used, weight or volume measurements, units, and dilutions. Standards are not stored in sample storage areas.

External reference standards are routinely obtained from commercial sources. A Certificate of Analysis is required. These standards are used to check and document the concentration of calibration standards and for method validation.

### 5.4.3 Laboratory Gases

All carrier, oxidant, and fuel gases used by SVL meet or exceed instrument manufacturers' specifications. Gases are stored in a remote, secure area of the laboratory. Appropriate precautions are taken to prevent attaching incorrect cylinders to manifold systems.

### 5.4.4 Laboratory Water

The primary general use water in the laboratory is furnished by a reverse osmosis system followed by a micropore filter with an ion-exchange resin cartridge. This satisfies the specifications of ASTM Type II water. When Type I (16.67 M $\Omega$ -cm) water is required, SVL uses a four-cartridge ion-exchange system. Reagent water used for organic analyses is obtained via a Nano-Pure™ water purifier system. This water source is regularly screened for method specific contaminants.

## 5.5 Calibration and Maintenance of Analytical Equipment

The following are descriptions of key instruments of concern which detail the routine calibration and maintenance procedures employed at SVL.

### 5.5.1 Analytical Balances

The calibration of each balance is checked each day of use with a single class A weight. The class A weights are checked monthly with Class "S" weights. Class "S" weights are calibrated annually by an independent contractor. Balances are serviced and calibrated annually by an independent contractor. Upon completion of this annual calibration, a calibration status label is affixed to each balance.

### 5.5.2 UV/Visible Spectrometers

Spectrometers are operated in accordance with the manufacturer's instructions. They are serviced and calibrated annually by an independent contractor. All absorption cells are optically matched and kept scrupulously clean, free of scratches, fingerprints, smudges, and evaporated film residues. Method specific verification or confirmation is performed as prescribed by each method.

### 5.5.3 Atomic Absorption Spectrometers

Maintenance of Atomic Absorption Spectrophotometers is performed according to manufacturer's recommendations and recorded in an instrument specific maintenance logbook. Calibration curves are established from analysis of three standards. The initial calibration verification (ICV) is made from a second source standard. A continuing calibration blank (CCB) and a continuing calibration verification (CCV) are analyzed at a frequency of 10%.

### 5.5.4 Inductively Coupled Plasma Spectrometers

Maintenance of the Inductively Coupled Plasma Spectrometers is performed according to manufacturer's specifications and recorded in an instrument specific logbook. The calibration procedure includes the establishment of a two point calibration curve, a CCB, CCV, and a second source ICV. Check samples are performed at a frequency of 10%.

### 5.5.5 Ion Chromatographs

The Ion Chromatographs are operated in accordance with manufacturer's instructions. The instrument is calibrated with a minimum of four standards. The calibration curve is verified daily with a standard from an independent source. In addition, a CCB and a CCV are performed at a frequency of 10%.

### 5.5.6 Gas Chromatographs

Operation and maintenance of the various Gas Chromatographs are detailed in standard operating procedures (SOPs). Recommended manufacturer's maintenance schedules are followed and documented in the instrument-specific logbooks. A routine GC & GC/MS calibration consists of an initial multi-point calibration to establish the calibration curve, a daily or continuing calibration to verify the calibration, and a calibration verification at the end of the analytical sequence. The frequency of the continuing calibration for the GC is, at a minimum, once every twenty samples. Continuing calibration for the GC/MS occurs at least every twelve hours.

## 5.6 Quality Control Parameters

SVL offers three levels of data report packages. A Level 1 report consists of analytical results; associated QC data are not included in this report. A Level 2 report consists of a standard report of analytical results with associated QC data (blank, replicate, spike, and control standard, as appropriate). A Level 3 report is virtually identical to a USEPA CLP data package.

### 5.6.1 Blanks

Preparation blanks are analyzed with every batch of twenty or fewer samples, or more frequently if required by the method. A preparation blank consists of laboratory pure water that is processed through all procedures, materials, and labware used for sample preparation and analysis. In cases of non-aqueous samples, reagent blanks serve as preparation blanks. Sample batches that contain contaminated blanks are routinely re-prepared, if sufficient sample remains.

### 5.6.2 Laboratory Control Samples

A laboratory control sample (LCS) is a sample of known value, usually from a source different from the calibration standards, used to validate the analytical procedure. One LCS is analyzed with every batch of twenty or fewer samples, or more frequently if required by the method. Sample batches containing LCS's that are out of control limits are re-analyzed, if sufficient sample remains. Control limits for solid LCS's are set by the manufacturer. Aqueous LCS's have control limits as specified in the appropriate SOP, or determined statistically.

### 5.6.3 Sample Replicates

These are aliquots made in the laboratory of the same sample, each aliquot is treated exactly the same throughout the analytical method. The relative percent difference (RPD) between the values of the duplicates, as calculated below, is taken as a measure of the precision of the analytical method.

$$RPD = \frac{|S - D|}{(S + D) \div 2} \times 100$$

where RPD = Relative Percent Difference

S = First Sample Value (original)

D = Second Sample Value (duplicate)

One duplicate sample or matrix spike duplicate is analyzed with every batch of twenty or fewer samples, or more frequently if required by the method. The acceptance limit for RPD is typically less than 20%. The duplicate is also a measure of the homogeneity of the sample matrix. An abnormally high RPD may be an indication of a non-homogeneous sample.

## 5.6.4 Matrix Spikes

A matrix spike is prepared by adding a known amount of an analyte to the sample prior to digestion or extraction. The calculated percent recovery of the matrix spike is considered to be a measure of the relative accuracy of the total analytical method, i.e., sample preparation and analytical procedure.

An analytical spike is prepared by adding a known amount of analyte to a digestate or extract of a sample for which the analyte concentration has been determined. This spike reveals the interferences found in the prepared sample matrix. The calculated percent recovery of the analytical spike is considered to reflect the accuracy of the analytical procedure only.

Both the matrix spike and the analytical spike are also an indication of the effect of the sample matrix on the ability of the methodology to detect the specific analyte. When no change in volume due to the spike occurs, it is calculated as follows:

$$\% \text{ Recovery} = \frac{(\text{SSR} - \text{SR})}{\text{SA}} \times 100$$

where SSR = Spiked Sample Result  
SR = Sample Result  
SA = Spike Added

Acceptance limits for percent recoveries are as specified in the appropriate SOP, but typically 80 to 120% or 75 to 125%. Matrix spike samples are prepared for every batch of twenty or fewer samples, or more frequently if required by the method.

## 5.6.5 Surrogates

Surrogates measure extraction efficiency. They must be a compound not expected to be present in the sample. The recovery of a surrogate compound must meet the control limits specified in the appropriate SOP.

## 5.6.6 Interference Check Samples

For analytes determined by ICP spectroscopy, an interference check sample (ICS) is analyzed at the beginning and at the end of an analysis sequence. This sample consists of elements at elevated levels to check for interferences due to common matrix elements.

## 5.6.7 Completeness and Usability

Completeness describes the percentage of measurements that meet quality control acceptance criteria for requested determinations. Percentage completeness is defined by client data quality objectives, but SVL strives for 100% completeness of calibration verification, laboratory control samples, blanks, interference check samples, and low-level standards. For spikes, duplicates, duplicate spikes, and other QC samples that are matrix dependent, SVL follows CLP guidelines to qualify data. Clients may define more rigid acceptance limits and corrective action. A completeness criteria of 90% is used for aqueous matrices, excluding Sb and Ag.

Usability describes the percentage of measurements that can be used for making decisions based on reported values. In many cases, estimated values are sufficient to characterize certain analytes in a sample. We believe the client is the best judge in interpreting the usability of their data and therefore make no attempt to set guidelines for this parameter.

## 5.6.8 Control Charts

Control charts are maintained for Laboratory Control Samples for selected analytes. A standard X bar control chart is used to plot LCS results. Upper and lower warning limits of  $\pm 2s$  (where  $s$  equals standard deviation) and upper and lower control limits of  $\pm 3s$  are calculated with no less than fifteen measurements. An analytical run is considered out of control when: any one point is outside control limits or when any obvious cyclic pattern is seen in the points.

## 5.7 Audits

### 5.7.1 Performance Evaluations

The Quality Assurance Coordinator conducts internal performance evaluations for commonly analyzed parameters. The PE samples are logged-in as double-blinds. Results are reported to the Laboratory Director.

SVL participates in two WS and two WP performance evaluation studies each year. We also participate in SOIL and Underground Storage Tank (UST) studies. These PE samples are logged in as single-blinds.

### 5.7.2 System Audits

The Quality Assurance Coordinator conducts an internal system audit each year. These audits provide a thorough overview of implementation of the Quality Assurance Plan within the laboratory.

The Quality Assurance Coordinator prepares an audit plan, with consideration of information gained during previous audits. The audit plan defines participating auditors, applicable documents, the audit schedule, and the scope of laboratory activities to be audited. The Quality Assurance Coordinator uses a written checklist of audit questions. Each question must be answered yes, no, or not applicable, and may be accompanied by appropriate comments.

At the close of the audit, a post-audit meeting is held to discuss the audit findings. The auditor can close a finding during this discussion if the laboratory staff can satisfactorily demonstrate that the finding is inappropriate.

The Quality Assurance Coordinator prepares an audit report for the Laboratory Director which documents the date and location of audit; persons contacted in the laboratory; laboratory operations audited; findings requiring corrective action; and a due date for the corrective action plan. Each finding must then be corrected and closed. The Quality Assurance Coordinator verifies that corrective action has been successful by direct observation.

During the course of system audits, the Quality Assurance Coordinator is cognizant of recurring quality issues and trends that can affect quality. Recurring issues and trends should be addressed in the audit report. Correction for such events may require a review of the adequacy of the QAP. If the inherent problem lies within the QAP, the plan will be amended through appropriate revision of Quality Assurance documents.

### 5.7.3 Data Audits

The QA Coordinator performs a data audit of at least ten data packages each year. The purpose of the data audit is to alert the QA Coordinator to chronic problems and trends that may be developing. The QA Coordinator performs a complete review of the data contained in the report, verification of the chain-of-custody holding times, and quality control.

## 5.8 Corrective Action

When a QC parameter fails acceptance criteria during the course of analysis, the analyst or supervisor resolves the problem before reporting data. The supervisor may arrange for service or repair of instrumentation, if needed.

Any employee may initiate a Corrective Action Report to support the quality program. Typical reasons are the need for an SOP revision, overdue MDL study, overdue training, incorrect data reduction or review, improper instrument calibration, or incorrect analytical method.

If there is a non-acceptable result in a performance evaluation sample, the Quality Assurance Coordinator documents the failure on a Corrective Action Report and works with the analysts and supervisors to discover the cause. If there are findings from an internal or external audit, the Quality Assurance Coordinator issues a Corrective Action Report to appropriate staff members to prepare a corrective action plan.

## 5.9 QA Reports to Management

The QA Coordinator shall prepare a written report to the Laboratory Director and technical staff on a quarterly basis. The report will review recurring QA issues, discuss performance evaluation samples, summarize the findings from any internal audits, and summarize issues regarding state accreditations or arising from site visits. In addition, the report will cover recent modifications in QA policy and general lab practices.



## 6. DATA MANAGEMENT

### 6.1 Laboratory Information Management

SVL has a laboratory network (with Novell NetWare and Windows 2000 servers) comprised of about 50 PCs and instruments. This enables us to integrate laboratory operations from sample receiving to report generation. Automation and connectivity enables SVL to rapidly process and manage large amounts of data. Network linked PCs are located in analytical laboratories to enable personnel to review data on individual jobs and samples, methods, and SOPs.

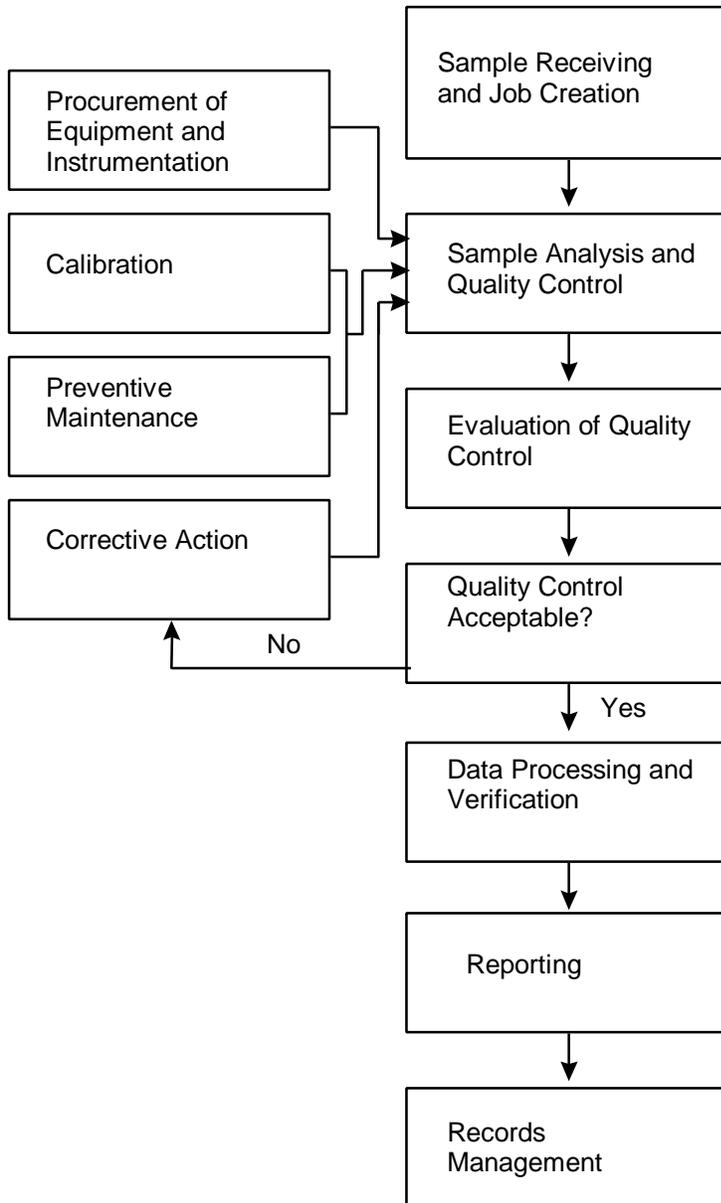
Analysts perform specific analyses and enter data onto benchsheets, Excel worksheets, or directly into the SVL's proprietary Sample Management LIMS either manually or using automated instrument upload processes. After a set of analyses has been completed, the results are calculated according to the methods specified in the standard operating procedures.

SVL's Sample Management system is used to generate standard reports. Reports are available in a number of routine and custom hardcopy formats. Electronic data deliverables (EDDs) are also available in ASCII, spreadsheet, and database formats, including EQWin, GIS/Key, and EnviroData Solutions. If a client has a specific format, we are usually able to provide data that will merge into their previous records without problems.

Data that will be used to create CLP-like deliverables package are loaded into a third party data review and reporting system that generates all the forms for a full data package. SVL has the capability of providing both hardcopy and EDDs. EDDs are available in standard EPA CLP formats, as well as popular spreadsheet and database files.

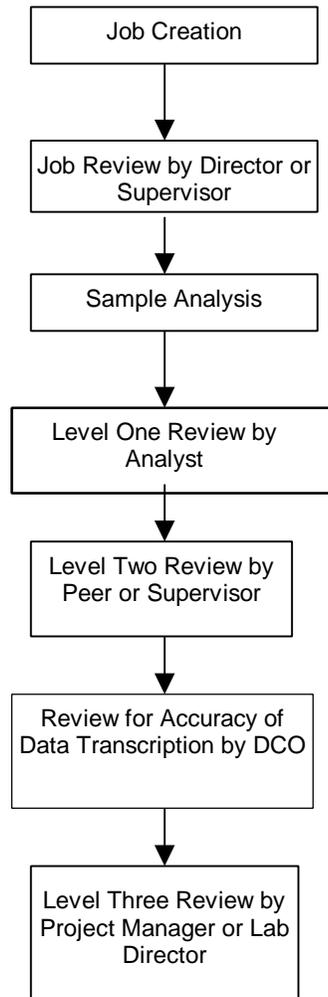
All data related to each job are archived for at least 12 months after reports have been issued. This period may be longer or shorter, at the client's discretion. Final results are available in the LIMS for at least five years.

## 6.2 Laboratory Analysis Flow Chart



## 6.3 Data Review Flow

SVL uses a three-tier system for data review documented on checklists. The first level is conducted by the analyst, the second level by a peer or supervisor, the third by a project manager or the Lab Director.



## 7. CERTIFICATIONS

### 7.1 Drinking Water Accreditations

- ? Idaho
- ? Texas
- ? Montana
- ? Nevada
- ? Washington
- ? California
- ? Colorado
- ? Arizona

### 7.2 Environmental Accreditations

- ? Nevada
- ? Washington
- ? California
- ? Arizona

Refer to supporting documents section for copies of certificates.



## 8. GLOSSARY

**Accuracy** The degree of agreement of a measured value with the true or expected value of the quantity of concern.

**Aliquot** An exact fraction of a solution or suspension.

**Bias** A systematic error inherent in a method or caused by some artifact or idiosyncrasy of the measurement system. Temperature effects and extraction efficiencies are examples of the first kind. Blanks, contamination, mechanical losses, and calibration errors are examples of the latter kinds. Bias may be both positive and negative, and several kinds can exist concurrently so that net bias is all that can be evaluated, except under special conditions.

**Blank** An artificial sample designed to monitor the introduction of artifacts into the process. For aqueous samples, reagent water is used as a blank matrix; however, a universal blank matrix does not exist for solid samples, and therefore, no matrix is used.

**Reagent Blank** Aliquot of analyte-free water or solvent analyzed with the analytical batch. Prep Blanks are reagent blanks which are created at the time of sample preparation using all the reagents used in the preparation of the samples (i.e., digestion, distillation or extraction)

**Method Blank** Reagent blank which are put through all the steps of a specific method along with the samples.

**Field Blank** Randomly selected sample container that is filled with distilled water and the appropriate chemical preservative in the field.

**Trip Blank** A specific type of field blank. A trip blanks is not opened in the field. It is a check on sample contamination originating from sample transport, shipping, and site conditions.

**Blind Sample** A sample submitted for analysis whose composition is known to the submitter but unknown to the analyst. A blind sample is one way to test proficiency of a measurement process.

**Calibration** Comparison of a measurement standard or instrument with another standard or instrument to report or eliminate by adjustment any variation (deviation) in the accuracy of the item being compared.

**Contamination** There are two general classifications of contamination; random and systematic. Random contamination causes imprecision in analytical results as noted by significant differences between results of duplicate analyses. Systematic contamination generally results in consistent shifts in baseline concentrations as demonstrated by field, trip or equipment blanks.

**Control Limits** The limits shown on a control chart beyond which it is highly improbable (within a 99.7 % probability) that a point could lie while the system remains in a state of statistical control.

**Control Chart** A graphical plot of test results with respect to time or sequence of measurement, together with limits within which they are expected to lie when the system is in a state of statistical control.

**Detection Limit** The smallest concentration/amount of some component of interest that can be measured by a single measurement with a stated level of confidence.

**Double Blind** A sample known by the submitter but submitted to an analyst in such a way that neither its composition nor its identification as a check sample are known to the latter.

**Duplicate Samples** Aliquot taken in the laboratory of the same sample, treated exactly the same throughout the analytical method. The relative percent difference (RPD) between the values of the duplicates, as calculated below, is taken as a measure of the precision of the analytical method. The relative percent difference for original sample and duplicate is calculated as follows:

$$RPD = \left[ \frac{|S - D|}{\left[ \frac{(S + D)}{2} \right]} \right] \times 100$$

where

RPD=Relative Percent Difference

S=First Sample Value (original)

D=Second Sample Value (duplicate)

**Homogeneity** The degree to which a property or substance is randomly distributed throughout a material. Homogeneity depends on the size of the sample under consideration. Thus a mixture of two minerals may be nonhomogeneous at the molecular or atomic level but homogeneous at the particulate level.

**Instrument Detection Limit (IDL)** The smallest concentration detectable on a specific instrument.

**Laboratory Control Sample** A material of known composition that is analyzed concurrently with test samples to evaluate a measurement process.

**Matrix Spike** A sample to which a known amount of analyte(s) has been added. Designed to provide information about the effect of the sample matrix on the digestion and measurement methodology. The spike is added prior to sample extraction/digestion and analysis. Individual component sample recoveries are calculated as follows:

$$\% \text{Recovery} = \left[ \frac{(SSR - SR)}{SA} \right] \times 100$$

where

SSR = Spiked Sample Result

SR = Sample Result

SA = Spike Added

**Mean** The sum of all observations divided by the number of observations.

**Method** An assemblage of measurement techniques and the order in which they are used.

**Method Detection Limit (MDL)** The smallest concentration detectable by a specific method (the standards used for this determination are carried through all the steps required by the method).

**Performance Audit** A process to evaluate the proficiency of an analyst or laboratory by evaluation of the results obtained on known test materials.

**Precision** The degree of mutual agreement characteristic of independent measurements as the results of repeated application of the process under specified conditions.

**Procedure** A set of systematic instructions for using a method of measurement or sampling or the steps or operations associated with them.

**Quality Assurance** A system of activities which the purpose is to provide to the producer or user of a service the assurance that it meets defined standards of quality.

**Quality Control** The overall system of activities whose purpose is to control the quality of a service so that it meets the needs of users.

**Relative Standard Deviation** The standard deviation divided by the mean and multiplied by 100.

$$\text{RSD} = \left[ \frac{s}{\bar{x}} \right] \times 100$$

**Sample** A representative sample of any material (aqueous, nonaqueous, or multimedia) collected from any source for which determination of composition or contamination is requested or required.

**Standard Operating Procedure** A procedure adopted for repetitive use when performing a specific measurement or sampling operation. It may be a standard method or one developed by the user.

**Subsample** A portion taken from a sample. A laboratory sample may be a subsample of a gross sample; similarly, a test portion may be a subsample of a laboratory sample.

**Standard Deviation** The positive square root of the variance (i.e.,  $\sigma$  for populations and  $s$  for a sample set of the population). A measure of the average spread around the mean.

**Variance** The value approached by the average of the sum of the squares of deviations of individual measurements from the mean. Mathematically, it may be expressed as:

$$\frac{\sum (X_i - m)^2}{n} \rightarrow s^2 \text{ as } n \rightarrow \infty$$

Ordinarily, it cannot be known but only its estimate  $s^2$ , which is calculated by the expression:

$$s^2 = \frac{\sum (X_i - \bar{X})^2}{n - 1}$$

**Warning Limits** The limits on a control chart within which most of the test results are expected to lie (within a 95% probability) while the system remains in a state of statistical control.



## 9. RESUMES

## WAYNE R. SORENSEN

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical, Inc. - Kellogg, ID 1973- Present

President: Owner and founder of the laboratory. Administers company policies and formulates business strategies.

#### The Bunker Hill Company - Kellogg, ID October 1969-April 1973

Supervised a large integrated mine, mill and smelter analytical laboratory and trained personnel.

#### Kennecott Copper, Ray Mines Division March 1968-October 1969

Chief Chemist: Supervised an assay lab, trained assayers for new analytical methods and conducted applied research.

#### Kennecott Copper, Western Mining Division Research Center May 1965-March 1968

Analytical Chemist: Analytical methods development and applied metallurgical research on copper.

### EDUCATION:

#### Utah State University - Logan, UT 1958-1962

B.S. Chemistry (minor: mathematics, physics)

#### Salt Lake Trade Tech - Salt Lake City, UT 1965

Basic Industrial Statistics

#### University of Utah - Salt Lake City, UT 1966-1967

MBA program

#### Arizona State University - Tempe, AZ 1968

Modern Industrial Spectroscopy

#### Arizona State University - Tempe, AZ 1969

Creative Management

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SVL ANALYTICAL, INC.

WAYNE R. SORENSON (continued)

**PUBLICATIONS:**

"A Study of Variables Affecting the Quality of Electrowon Copper" paper presented at the 1968 meeting of the Electrolytic Process Committee and the 1969 National AIME Conference.

**PATENTS:**

Electrolyte circulation system for an electrolytic cell.

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## LARRY A. DREW

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical, Inc. - Kellogg, ID May 2003-Present

Laboratory Director—Manages and directs the activities of the laboratory

#### Environmental Consultant 2002-2003

Environmental Consultant on project management, permitting, compliance programs and manuals, compliance inspections, and reclamation planning

#### Hecla Mining Company— Coeur d'Alene, ID 1989-2001

Director of Corporate Environmental Services—Coordinated environmental programs, assisted in compliance with permitting and compliance activities, assisted in pre-acquisition audits, supervised the development and implementation of a company-wide auditing program, developed and managed budgets for superfund project, provided for permitting, reclamation, and maintenance of properties

#### Shell Mining Company— Houston, TX 1984-1989

Manager Environmental Conservation—Coordinated environmental and permitting activities for developing mines and acquisitions, supervised and evaluated environmental studies and reclamation research, auditing operations for compliance with environmental laws and regulations, supervised the environmental, safety, and geology programs

#### Shell Oil Company— Houston, TX 1982-1984

Manager, Public Affairs, E&P Government Relations—Coordinated policy development for oil and gas exploration and production

#### Triton Coal Company— Gillette, WY 1980-1982

Technical Superintendent—Provided permits and environmental studies necessary to develop and operate a major coal mine, supervised engineering, surveying, and environmental activities, audited construction and operating activities to ensure environmental compliance

#### Shell Oil Company— Houston, TX 1974-1980

Environmental Specialist—Obtained permits necessary to develop mines in compliance with environmental laws and regulations

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LARRY A. DREW (continued)

EDUCATION:

University of Minnesota— Minneapolis, MN 1967-1973

Ph.D. Forest Ecology (minor in Statistics)

University of Idaho— Moscow, ID 1965-1967

M.S. Forest Management (minor in Watershed Management)

University of Idaho— Moscow, ID 1961-1965

B.S. Forest Management

ADDITIONAL TRAINING:

Hazardous Waste Operations and Emergency Response (40 hr OSHA)

Hazardous Waste Operations and Emergency Response Supervisor

DOT Hazardous Materials Training

AFFILIATIONS:

Northwest Scientific Association

Sigma Xi—the Scientific Research Society

Gamma Sigma Delta (Agricultural Honorary)

Phi Sigma Society (Biological Society)

Xi Sigma Pi (Forestry Honorary)

PUBLICATIONS:

1974 "Some synecological characteristics of the prairie-forest transition zone in Minnesota", Minnesota Forestry Research Notes No. 250. 4 pages.

1974 "Tabulated values of the Stefan-Boltzman function", Minnesota Forestry Research Notes No. 249. 4 pages.

1973 "Bulk density estimation based on organic matter content of some Minnesota soils", Minnesota Forestry Research Notes No. 243. 4 pages.

1973 "Vegetation-Environment Relationships in the Prairie-Forest Transition Zone in Minnesota" (Doctoral Dissertation, Dissertations Abstracts International, Volume XXXIV (II), 1974)

1967 "Comparative Phenology of Seral Shrub Communities in the Cedar/Hemlock Zone", (Masters Thesis)

---

## G. CHRISTINE MEYER

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical - Kellogg, ID 1993-Present

Client Services Manager -- Secures commercial contracts; confers with technical staff and assigns project management for contracts. Primary in-house service representative, responsible for developing and distributing company literature to existing and potential clients.

#### SVL Analytical - Kellogg, ID 1978-1993

Project Manager, Minerals Division -- Secured contracts with clients; supervised data generation and reporting to ensure quality control, expedited deliverables, and maintained customer service. Monitored all phases of Minerals Division projects.

#### Gary's Drug Center - Kellogg, ID 1977-1978

Pharmaceutical Aide -- Assisted in dispensing prescriptions.

#### Shoshone School District #391 - Kellogg, ID 1975-1977

Substitute Teacher -- Classroom instruction.

#### Idaho State Department of Lands - Kingston, ID 1975

Office Manager -- Responsible for fire dispatch, clerical duties, payroll, and customer service.

### EDUCATION:

#### North Idaho College - Coeur d'Alene, Idaho 1973-1974

Social services studies

Customer service training seminar 1989

MS-DOS Computer class 1990

### PRESENTATIONS:

"Everything You Always Wanted to Know About Fire Assaying, But Were Afraid to Ask", Geological Society Meeting, 1992.

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## BRANDAN A. BORGIAS

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical, Inc. - Kellogg, ID 1991-Present

Systems Manager, Computational Chemist -- Responsibilities include developing and implementing SVL's Laboratory Information Management System (LIMS).

#### Cray Research - San Ramon, CA 1989-1990

Software Technical Support Analyst -- Co-administrator of network composed of eight file servers and over 50 client work stations distributed throughout the western U.S. Unix (Sun OS and Cray UNICOS) operating systems experience.

#### University of California, UCSF - San Francisco, CA 1985-1989

Postdoctoral Scholar -- Developed computer programs (FORTRAN) for the refinement and analysis of macromolecular structure. VAX, Sun, and Cray computers and VMS and UNIX operating systems.

#### University of California, Berkeley - Berkeley, CA 1979-1985

Graduate Research and Teaching Assistant -- Dissertation on coordination isomers of highly efficient chelating agents for Fe. Teaching Assistant for X-ray Crystallography, and General, Analytical, and Biophysical Chemistry.

### EDUCATION:

#### University of California, Berkeley - Berkeley, CA 1979-1985

Ph.D. Chemistry, 12/85 - Elected to Sigma Xi.

#### Reed College - Portland, OR 1975-1979

BA Chemistry/Physics, 5/79 - Elected to Phi Beta Kappa, 1979.

### COMPUTER/PROFESSIONAL TRAINING

#### Competitive Edge Environmental Management Systems August 1996

Introduction to ISO14000

#### North Idaho College April 1995

Intermediate Access

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## BRANDAN A. BORGIAS (continued)

### Clarion Software February 1992

Upgrading to Clarion Professional Developer 3.0.

### ACS Short Course March 1992

Laboratory Information Management Systems: From Problem Definition to System Evaluation.

### Cray Research August-December 1989

Cray Y-MP Series System Architecture for Systems Analysts. Designing For Speed. Advanced Fortran Features and Optimization.

### National Center for Supercomputing Applications (NCSA) Summer 1988

NSF Summer Institute in Supercomputing.

### Pittsburgh Supercomputing Center Spring 1988

NIH Biomedical Super-computing Workshop.

### Reed College Fall 1979

Fortran Programming.

## PUBLICATIONS:

The Characterization & Structure of  $[\text{H}_7\text{O}_3]^+[\text{As}(\text{catecholate})_3]^-$  p-dioxane, B.A. Borgias, G.G. Hardin and K.N. Raymond, Inorg. Chem., (1986) **24**, 1057-1060.

Structural Chemistry of Gallium(III). Crystal Structures of  $\text{K}_3[\text{Ga}(\text{catecholate})_3] \cdot 1.5\text{H}_2\text{O}$  and  $[\text{Ga}(\text{benzohydroxamate})_3] \cdot \text{H}_2\text{O} \cdot \text{CH}_3\text{CH}_2\text{OH}$ , B.A. Borgias, S.J. Barclay and K.N. Raymond, J. Coord. Chem. (1986) **15**, 109-123.

Isomerization and Solution Structures of Desferrioxamine B Complexes of Al and Ga, B.A. Borgias, A.D. Hugi and K.N. Raymond, Inorg. Chem. (1989), **28**, 3538-3545.

COMATOSE: A Method For Constrained Refinement of Macromolecular Structure Based on Two- Dimensional Nuclear Overhauser Effect Spectra, B.A. Borgias and T.L. James, J. Magn. Reson. (1988) **79**, 493-512.

2D NOE Complete Relaxation Matrix Analysis, B.A. Borgias and T.L. James, in NMR in Enzymology, **176** in Methods in Enzymology (N.J. Oppenheimer and T.L. James, eds.) Academic Press, Orlando, 169-183 (1989).

MARDIGRAS: Matrix Analysis of Relaxation for Discerning GeometRy of an Aqueous Structure, B.A. Borgias and T.L. James, J. Magn. Reson. (1990) **87**, 475-487.

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## DAVE WAISMAN

### PROFESSIONAL EXPERIENCE:

SVL Analytical, Inc. - Kellogg, ID April 1993-Present  
Business Development Manager

Hecla Mining Company - Republic, WA March 1988-April 1993  
Senior Exploration Geologist -- Managed Exploration Office. Responsible for project cost tracking, drilling performance tracking, supervision of abandonment and reclamation of drill sites, design, budget and management of exploration efforts.

Golder Associates, Inc. - Seattle, WA April 1987-November 1987  
Geologist, Geotechnical Engineer -- Well-site geologist for water monitoring wells at Hanford Nuclear Reservation. Well construction and QA review for Test and Operating Procedures for Basalt Waste Isolation Project.

Consulting Geologist - Missoula, MT May 1985-January 1987  
Geological consulting in SW Montana for two major mining companies. Responsibilities included property evaluations, mapping and sampling. Experienced in reverse circulation and diamond drilling, and trace element geochemistry.

Meridian Minerals Co. - Billings, MT June 1984-January 1985  
Geologist -- Conducted precious metals reconnaissance in Belt and volcanic rocks of SW Montana, property submittal evaluations, trace element geochemistry.

### EDUCATION:

University of Montana, Missoula MT 1982-1985  
MS Geology 1985

Colorado State University, Fort Collins 1975-1979  
BS Geology 1979

### PUBLICATIONS:

Waisman, D.J., 1990, "Hecla's Golden Eagle Deposit, Republic Mining District", presented at the 96th Annual Northwest Mining Association Convention, 1990.

Waisman, D.J., 1992, "Minerals of the Black Pine Mine, Granite County, Montana", The Mineralogical Record, December 1992 (Vol. 23, No. 6, pp, 477-483).

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SVL ANALYTICAL, INC.

M. LEE HAYNES

PROFESSIONAL EXPERIENCE:

SVL Analytical, Inc. - Kellogg, ID November 1989-Present

Safety Director -- Responsible for corporate health and safety policy, implementation of Chemical Hygiene Plan, waste disposal, and recycling.

Private Instructor January 1991- Present

Hazardous Materials, Hazardous Waste, and Emergency Response -- Edwards & Associates

Shoshone County Assessor's Office - Wallace, ID Sept 1978-Oct 1989

Senior Appraiser, Director of Disaster Services

EDUCATION:

OSHA 1997, 1998-1999

40 Hour Hazardous Waste Operation & Emergency Response Course and Refreshers

UPS 1996

HM126F - Shipping Hazardous Materials

J.T. Baker 1995, 1996

Laboratory Safety/Hazardous Chemicals Safety/Spill Response/Hazardous Chemicals

Emergency Management Institute 1989

Basic Course 3 and 4/Hazmat-Advanced course/PDS Capstone on National Security

Shoshone County Hospital 1988

Emergency Medical Technician

Emergency Management Institute 1988

Management Principles/Exercise Design

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SVL ANALYTICAL, INC.

M. LEE HAYNES, cont.

Dale Carnegie Course 1977

Graduated 1977

Burroughs Computer School - Chicago, IL 1970

Diploma

Officers Candidate School - U.S. Army 1967

Commissioned - 2nd Lieutenant

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## KIRBY L. GRAY

### PROFESSIONAL EXPERIENCE:

SVL Analytical, Inc. - Kellogg, ID March 1987-Present

Inorganic Instrumental Chemistry Department Supervisor -- Responsible for sample analysis by ICP, GFAA, FLAA, IC and CVAA.

Radersburg Mining Co. - Toston, MT September 1986-March 1987

Chemist: -- Responsible for fire assay, FLAA, and sample preparation.

IDHW, State of Idaho - Kellogg, ID August 1986

Environmental Technician: -- Operated X-ray fluorescence meter and collected soil samples.

Sunshine Mining Co. - Kellogg, ID May 1984-May 1986

Chemist -- Responsible for fire assay, FLAA, and classical chemistry.

The Bunker Hill Co. - Kellogg, ID May 1972-May 1982

Material Recovery Supervisor -- Responsible for operation and maintenance of water treatment plant, sulfuric acid plant, baghouse, cadmium refinery, and electric reverberatory furnace at a lead smelter.

### EDUCATION:

University of Idaho - Moscow, ID Sept 1968-May 1972

B.S. Geological Engineering

North Idaho College-Coeur d'Alene, ID Sept 1966-June 1968

Engineering major

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## NAN WILSON

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical, Inc. - Kellogg, ID March 2003-Present

Organics Department Chemist—Analyzes samples for volatile organic compounds by GC

#### LC Resources— McMinnville, OR July 2001-January 2003

Manager, Pharmaceutical Analysis—Supervised HPLC method development; coordinated work for chemists and technicians; directed method validation; wrote SOPs and validated protocols; prepared client reports; trained chemists and technicians on SOPs and computer software; presented data and reports; responsible for client contact; administered Millennium32 chromatography software

#### LC Resources— McMinnville, OR September 1997-June 2001

Chemist—Developed HPLC methods for pharmaceuticals; operated, calibrated, and maintained HPLC, UV/Vis, pH meters, balances, pipettes; wrote client reports; administered Millennium32 chromatography software

#### SVL Analytical— Kellogg, ID 1987-1996

Laboratory Technician—Performed meteoric water mobility tests; analyzed for acid base accounting; alkalinity, acidity, pH, sulfur forms by LECO, carbonate, oil and grease, TSS, TDS, gravimetric and colorimetric methods

#### Willamette University— Salem, OR 1995-1996

Laboratory Teaching Assistant—Assisted organic chemistry students in successfully carrying out lab experiments

### EDUCATION:

#### Willamette University— Salem, OR 1992-1996

B.A. Chemistry and Russian

#### Simferopol State University— Simferopol, Ukraine 1995

Semester abroad

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## NAN WILSON (continued)

### ADDITIONAL COURSES:

LC Resources--Monterrey, CA 2001  
Bioanalytical LC-MS

American Chemical Society-- New Orleans, LA 2000  
Statistical Analysis of Laboratory Data

LC Resources--Monterrey, CA 1998  
Practical HPLC Troubleshooting

LC Resources--Monterrey, CA 1998  
Advanced HPLC Method Development

U.S. EPA, U.S. DOE, U.S. Bureau of Mines 1995  
Mine Waste Field Camp

## CHAD D. CHRISTIANSON

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical, Inc. --Kellogg, ID March 2003-Present

Organic Chemist—Analyzes samples for Pesticides and PCBs by methods 608, 8081A, and 8082. Analyzes samples for Diesel/Motor Oil and Ethylene Glycol.

#### Laucks Testing Labs— Seattle, WA December 2000-March 2003

Organic Chemist—Analyzed water and soil extracts for pesticides, PCB's, and herbicides by gas chromatography by SW846 methods. Also analyzed samples for semi-volatile fuels by GC, and explosives by HPLC

#### Onsite Environmental, Inc.— Redmond, WA Sept 2000-December 2000

Lab Technician—Performed digestions, dilutions, filtrations, sieving, and sample preparation of water and soil matrices for metals analysis

### EDUCATION:

#### Washington State University— Pullman, WA May 2000

B.S. Chemical Engineering

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## PAUL E. DUERKSEN

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical, Inc. - Kellogg, ID December 1999-Present

Quality Assurance Coordinator -- Coordinates quality assurance and training programs for the laboratory, maintains laboratory accreditations, writes standard operating procedures, calibrates equipment, reviews data, conducts audits, performs root cause analysis.

#### Private Consultant – Silverdale, WA May 1998-December 1999

Provided instruction in math and science courses

#### Environmental Science Department, Washington State University – Richland, WA 1995-May 1999

Graduate coursework in Environmental Science

#### Northwest Technical Resources – Richland, WA October 1995-February 1996

Quality Assurance Coordinator – Conducted audits of environmental laboratory; prepared analytical data packages; maintained training records.

#### Hanford Environmental Health Foundation – Richland, WA March 1990-May 1995

Quality Assurance Coordinator – Prepared and reviewed written procedures; conducted audits of industrial hygiene laboratory; conducted technical training courses; created document control and records handling systems; conducted audits of suppliers and sub-contractors

#### Brown and Caldwell Analytical Laboratories – Glendale, CA January 1983- March 1990

Quality Assurance Coordinator and Chemist – Reviewed written procedures; prepared analytical data packages; coordinated performance evaluation sample program. Analyzed water, wastewater, soil, and waste samples for trace metals by inductively coupled plasma and graphite furnace atomic absorption spectroscopy; calibrated and maintained analytical instrumentation; directed work activities for two technicians.

#### Jacobs Laboratories – Pasadena, CA November 1980-January 1983

Chemist – Analyzed water, wastewater, soil, and waste samples for trace metals by atomic absorption spectroscopy; analyzed wastewater samples for cyanide, BOD, and COD.

SVL ANALYTICAL, INC.

PAUL E. DUERKSEN, cont.

EDUCATION:

Washington State University – Richland, WA 1995-1998  
40 credits coursework toward M.S. in Environmental Science

Columbia Basin College – Richland, WA 1995  
Occupational Instruction

Columbia Basin College – Richland, WA 1993  
Principles of Industrial Hygiene

U.S. Department of Energy – Richland, WA 1992  
Introduction to Root Cause Analysis

U.S. Department of Energy – Richland, WA 1990  
Auditing for Lead Auditors

University of California – Berkeley 1973-1977  
B.S. Chemistry, June 1977

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SVL ANALYTICAL, INC.

## JOSEPH L. COSTELLO

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical, Inc. - Kellogg, ID October 1987-Present

Classical Chemistry Department Chemist – Analyzes samples for Phenols, COD, Ammonia, Sulfide, Fluoride, Phosphates

#### Energy Laboratories - Billings, MT 1978-1987

Chemist: -- Supervised soil testing laboratory and performed instrumental and classical analysis of water, geological and environmental samples.

#### Northern Testing Laboratories - Billings, MT 1975-1978

Laboratory Technician -- Responsible for sample preparation and analysis of environmental, industrial and agricultural constituents.

### EDUCATION:

#### College of Great Falls - Great Falls, MT 1968-1971

Chemistry

#### Thermo-Jarrell Ash May 1985

ICP Atomic Spectroscopy Theory & Practice Seminar

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## JAMES L. HODGE

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical, Inc. - Kellogg, ID November 2002-Present

Supervisor of Classical Chemistry Department; reviews and approves data; analyzes samples for Ammonia, Fluoride, COD

#### SVL Analytical, Inc. - Kellogg, ID March 2001-November 2002

Classical Chemistry Department Chemist—Analyzed soil and aqueous samples for Cyanide

#### Sunshine Mining and Refining Co. – Kellogg, ID October 1995-March 2001

Analyzed samples for silver and gold by fire assay; conducted atomic absorption and ICP analysis

#### Morrison Knudson Corporation September 1993-October 1995

Conducted soil sampling; tested and maintained respirators; operated Bobcat loader

#### Pintlar Corporation July 1991-September 1993

Environmental and Health & Safety Manager—Responsible for health and safety; wrote health and safety plans; oversaw environmental and reclamation projects

#### Bunker Limited Partnership June 1983-July 1991

Laboratory Manager-- Operated water treatment plant; oversaw environmental reclamation projects

#### Bunker Hill Mining Company June 1967-October 1982

Laboratory Technician – Analyzed samples by fire assay; conducted wet chemical and atomic absorption analysis

### EDUCATION:

#### Urie Environmental Health, Inc. April 1993

40-hour Hazardous Materials

#### MCS Environmental July 1993

40-hour Asbestos Contractor Supervisor

#### Urie Environmental Health, Inc. April 1993

80-hour Industrial Hygiene

---

## DEAN PALMER

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical, Inc. - Kellogg, ID March 1996-Present

Classical Chemistry Department Analyst -- Digests aqueous samples and extracts for analysis by ICP and GFAA

#### Northern States Power Company - Welch, MN 1983-1994

Prairie Island Nuclear Plant Training Center, Production Engineer -- Instruction of employees in the areas of math and physics as well as general employee training. Developed and taught course on site orientation, power plant fundamentals, industrial safety, radiological protection and respirator use.

#### Kerr-McGee Nuclear - Grants, NM 1980-1982

Associate Mechanical Engineer: -- Design and modification of mine mechanical equipment such as pumping, hydraulics, noise abatement, hoisting.

### EDUCATION:

#### North Dakota State University - Fargo, ND 1969-1972

B.S. Social Science - Secondary Ed; Minor - Mathematics

#### South Dakota School of Mines and Technology - Rapid City, SD 1976-1979

B.S. Mechanical Engineering

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## DIANA RICHARDSON

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical, Inc. - Kellogg, ID September 2002-Present

Classical Chemistry Department Technician—Analyzes samples for Mercury by methods 245.1, 7470A, 7471A

#### On-Site Environmental Service— Salt Lake City, UT 1995

Sampling Chemical Technician—Obtained run-off samples, maintained documentation, conducted lab work

#### PMT Services— Salt Lake City, UT 1992-1994

Hazmat Chemist—Identified hazard class of chemicals for disposal, conducted sampling, lab packing, .conducting training in hazardous material handling

#### Ecological Analysts— Lincoln, NE 1983

Student Intern—Performed lab work under supervision, testing for PCBs; cleaned and maintained lab equipment

#### Nebraska Department of Environmental Quality— Lincoln, NE 1983

Student Intern—Performed lab tests for BOD, COD, Carbon, Solids, and Metals; cleaned and maintained lab equipment

### EDUCATION:

#### Virginia Polytechnical Institute— Blacksburg, VA 1984-1985

Graduate work in Environmental Science and Engineering

#### Southeast Community College— Lincoln, NE 1984

Associate of Applied Science, Environmental Lab Technolgy

#### Metro State College— Denver, CO 1972

B.S. Applied Math

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SVL ANALYTICAL, INC.

## ALICE VAN DORN

### PROFESSIONAL EXPERIENCE:

SVL Analytical, Inc. - Kellogg, ID May 1990-Present

Classical Chemistry Department Analyst -- Conducts TDS, TSS, TVS, pH, Turbidity, and Conductivity analyses; air filter monitoring and digestions.

### EDUCATION:

Green River Community College - Auburn, WA 1970

General Studies

Southwestern Oregon Community College - Coos Bay, OR 1970-1972

AA Business Science; including Biology course work.

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## GORDON ANTHIS

### PROFESSIONAL EXPERIENCE:

SVL Analytical, Inc. - Kellogg, ID July 1988- Present

Classical Chemistry Department Analyst -- Conducts TCLP and SPLP extractions, and meteoric water mobility studies.

### EDUCATION:

North Idaho College – Coeur d'Alene, ID 1999

Course work in Algebra, Computer Programs

Kellogg North Idaho College – Kellogg, ID 1998

Windows 95

Edwards & Associates--Wallace, ID 1997

Hazardous Materials and Hazardous Waste

North Idaho College--Kellogg, ID 1983-1984

Diesel Mechanics

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SVL ANALYTICAL, INC.

## DAVID HAUSER

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical, Inc. -- Kellogg, ID August 2001-Present

Classical Chemistry Department Chemist – Analyzes samples for Total and WAD Cyanide; trained in the analysis of Fluoride, Ammonia, and Phosphate; operates LECO instrument to analyze samples for ABA and Sulfur Forms

#### North Idaho Fitness – Coeur d'Alene, ID August 1997-August 2000

Developed training and nutrition programs for customers; assessed customer progress

### EDUCATION:

#### University of Idaho – Moscow, ID 1993-1996

B.S. Secondary Education

#### North Idaho College – Coeur d'Alene, ID 1993

A.A.S. Secondary Education

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## MARK FELLEGY

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical, Inc. -- Kellogg, ID October 2001-Present

Organic Chemistry Department Analyst – Repairs and calibrates gas chromatographs and analytical instrumentation

#### Cargill, Inc. – Wayzata, MN August 1979-May 2001

Instrument Specialist VII – Installed, repaired, and maintained analytical instrumentation, including gas chromatographs and mass spectrometers; developed analytical methods for pesticide residues and olfactory and flavor compounds

### EDUCATION:

#### South Hennepin Technical College – Eden Prairie, MN July 1974-July 1975

Environmental Technology Program

#### Agilent Technologies April 2001

HP 5973 GC-MSD Troubleshooting and Maintenance (H2294-A)

#### Transportation Skills Program, Inc. March 2001

Hazardous Materials and Waste

#### Training Masters August 2000

High Performance Liquid Chromatography

#### Minnesota Chromatography Forum May 2000

Mass Spectral Interpretation

#### Enigma Analytical March 1998

Applied Statistics and QC/QC Principles

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## STEPHANIE CLEARWATER

### PROFESSIONAL EXPERIENCE:

SVL Analytical, Inc. - Kellogg, ID June 2001-Present

Organic Chemistry Department Chemist -- Performs sample extractions for 608, 625, 8081A, 8141A, and 8270C analyses

Christian Supply – Spokane, WA November 2000-June 2001

Sales Associate – assisted customers, sold merchandise

USDA Forest Service – Avery, ID June 2000-September 2000

Forestry Technician – located timber sales; sprayed for noxious weeds, maintained vehicles

Christian Supply – Spokane, WA June 1999-October 1999

Sales Associate – assisted customers; maintained book stock; faxed customer orders

EyeMasters – Spokane, WA May 1997-September 1998

Lab Technician – fashioned prescription eyewear; maintained and calibrated equipment

### EDUCATION:

Eastern Washington University – Cheney, WA September 1998-June 2000

B.S. Environmental Biology

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## KRISTINE B. HAAKENSEN

### PROFESSIONAL EXPERIENCE

#### SVL Analytical, Inc. - Kellogg, ID July 1998-Present

Organic Chemistry Department Chemist -- GC/MS Operator: Responsible for analysis of environmental matrices for organic compounds according to standard EPA procedures using GC and GC/MS systems. Experienced in EPA methods 504.1, 524.2, 601/602, 608, 624, 625, 8015, 8021B, 8260B, 8270C, and the associated sample preparation requirements of the analyses. Duties include instrument set-up and maintenance, methods development, and report generation.

#### Bayer Corporation - Spokane, WA October 1997-July 1998

Quality Control Chemist -- Executed analytical assays of injectable finished products and raw materials according to Standard Operating Procedures (SOP) and Good Manufacturing Practices (GMP) to ensure product specifications are met. Utilized various analytical instrumentation to perform analytical assays: HPLC, GC, and UV/VIS spectrophotometer.

#### Analytical Sciences Laboratory, University of Idaho - Moscow, ID

##### September 1992-October 1997

Senior Organic Chemist -- Supervised and managed the organic analytical laboratory division under all principles of Good Laboratory Practices (GLP) and EPA regulations for the routine determination of pesticides, herbicides, and various volatile and semi-volatile organic compounds in water, soil, environmental, and veterinary samples. Delegated and organized all analytical chemists' daily routine and non-routine analyses in the organic analytical group. Primary responsible person for the operation, maintenance, and troubleshooting of all primary analytical instrumentation in the organic laboratory including: GC's, GC/MS, HPLC, UV/VIS spectrophotometer, purge and trap with cryofocusing, high pressure gel permeation chromatograph. Primary responsible person for the performance of method validation and method detection limit studies for all EPA regulated and non-regulated methods under full GLP compliance. Responsible for performing standard recertification studies to guarantee the integrity of all pesticide, herbicide, and residue standards.

### EDUCATION:

#### Arizona State University - Tempe, AZ 1987-1991

BS Chemistry, Emphasis in Biochemistry

#### Northwest Quality Symposium 1992

Good Laboratory Practices Tutorial

#### University of Idaho 1995

Hazardous Waste Management

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## WENDY OZMINKOWSKI

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical, Inc. - Kellogg, ID January 2002-Present

Supervisor Organic Chemistry Department – Responsible for analyses of soil and water samples for organic contaminants; reviews and approves data; operates GC and GC/MS instruments; interprets and reports data.

#### SVL Analytical, Inc. - Kellogg, ID December 1998-January 2002

Organic Chemistry Chemist -- Performs analyses of soil and water samples for volatile organic compounds; operates GC and GC/MS instruments; interprets and reports data.

#### Quality Coatings – Post Falls, ID June 1998-August 1998

Laboratory technician -- Developed Chemical Hygiene Plan, standardized chemical solutions; conducted titrimetric analyses, controlled pH, temperature, and chemical concentrations of industrial processes.

#### A.C. Data Systems -- Post Falls, ID January 1997-August 1999

Mechanical assembly worker -- Performed component soldering and mechanical assembly of panels and circuitry quality inspections, training, developed process documentation.

#### North Idaho College -- Coeur d'Alene, ID September 1993-August 1995

Lab Assistant -- Prepared reagents for laboratory demonstrations, standardized chemical solutions, conducted chemical and equipment inventory, supervised students, set-up laboratory demonstrations

### EDUCATION:

#### North Idaho College – Coeur d'Alene, ID 1997-1998

A.S. in Premedical Studies 1998

#### University of Idaho -- Moscow, ID 1994-1996

B.S. in Chemistry 1996

#### North Idaho College -- Coeur d'Alene, ID 1991-1995

A.S. in Chemistry 1995

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## JUDY ASHCRAFT

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical, Inc. - Kellogg, ID November 1994-Present

Organic Chemistry Department Analyst – Performs solid phase extractions and liquid/liquid extractions of soil, water, and waste.

#### Minnesota Valley Testing Laboratories, Inc. - New Ulm, MN 1968-1994

GLP Laboratory Technician -- Performed organic extractions including liquid-liquid partition, solid phase extraction, gel permeation, and open column chromatography. Matrices included soil, water, plants, and food products. Performed routine record keeping and data entry as well as training lab personnel.

Previous positions with this employer included:

Soils Lab Assistant to the Nutrients and Minerals supervisor and experience in the inorganic lab covering areas such as domestic & waste water, plant nutrients & minerals, feed nutrients, and used oil analysis.

Training included: techniques in "Good Laboratory Practices Standards" (GLP) as delineated in 40 CFR, Part 160 (US EPA), Laboratory Safety, Quality Assurance, and familiarity with the following instruments: color spectrophotometer, atomic absorption spectrophotometer, ultrasonic processor, electric kiln, flash point detector, analytical balances, pH meters, vacuum box, centrifuge, heating & distilling units, rotary evaporator, steam water bath, and gas chromatography (limited).

### EDUCATION:

#### Mankato Commercial College - Mankato, MN 1968

General Business Course work

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SVL ANALYTICAL, INC.

## KEVIN HATHAWAY

### PROFESSIONAL EXPERIENCE:

SVL Analytical, Inc. -- Kellogg, ID March 1987-Present

Inorganic Instrument Operator -- Operates GFAA instruments; also trained in Ion Chromatography and Mercury analysis by Cold Vapor Atomic Absorption.

### EDUCATION:

North Idaho College -- Coeur d' Alene, ID 1993-1994

Basic Concepts in Chemistry

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## ANNE L. SPRADLIN

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical, Inc. - Kellogg, ID March 1997-Present

Inorganic Instrument Operator -- Operates ICP utilizing standard methods of analysis such as SW846 as well as USEPA CLP procedures.

#### Quanterra Environmental Services - Richland, WA 1993-1997

Chemist III -- Operated radiation detection instrumentation such as Alpha Spectrometers, Gamma detectors, Gas Proportional Counters and Liquid Scintillation analyzers. Utilized computers in acquisition and reporting of data and performed data review.

#### National Environmental Testing, Inc. - Dallas, TX 1985-1993

Supervisor Metals Department -- Supervised analysts, delegated work distribution, implemented company QA/QC program, evaluated accuracy of reported data, trained new employees. Analyzed for metals utilizing Thermo Jarrell-Ash ICP, Perkin Elmer 5000 ICP, Perkin Elmer 5000 AA, Hitachi Z-9000 and Perkin Elmer 3030 graphite furnaces. In addition, performed Cold-vapor Mercury Analyses, sample prep, routine maintenance and troubleshooting of instrumentation. Also performed Wet Chemistry analyses for two years; parameters included BOD, COD, cyanide, TPH and many other common wet chem analyses. Interpreted and reported data.

#### Environment Protection Laboratories - St. Cloud, MN 1984-1985

Performed wet chemistry and microbiological analyses.

### EDUCATION:

#### Perkin Elmer October 2001

Optima Instrument Series with ICP WinLab Software

#### Concordia College, Moorhead, MN 1979-1981

General Studies

#### Saint Cloud State University - Saint Cloud, MN 1981-1983

B.A. Biology (with emphasis in Microbiology)

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## ANN MARIE COSTELLO

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical, Inc. - Kellogg, ID November 1991-Present

Inorganic Instrument Operator -- Analyzes samples by Ion Chromatography; operates GFAA using USEPA CLP procedures. Also trained in the operation of the ICP instrument for CLP samples of both water and soil matrices.

#### Energy Laboratories - Billings, MT 1979-1980

Lab Technician -- Plant and soil analysis using classical chemistry and AA techniques.

#### Chen Northern - Billings, MT 1975-1977

Lab Technician -- Plant and soil analysis using classical chemistry and AA techniques.

#### Montana State University Plant Research Center - Bozeman, MT 1972-1975

Lab Technician -- Plant and soil analysis using classical chemistry and AA techniques.

### EDUCATION:

#### Montana State University, Bozeman, MT 1967-1971

B.S. Microbiology

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## DANNY J. SEVY

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical, Inc. - Kellogg, ID 1996-Present

Inorganic Instrument Operator -- Performs metals analysis by ICP; trained on Ion Chromatography

#### SVL Analytical, Inc. - Kellogg, ID 1994-1996

Classical Chemistry Analyst -- Performed classical Wet Chemistry analyses on water and soil sample, including the preparation and analysis of Cyanide and Nitrate/Nitrite (as N) tests for soil and water samples.

#### SVL Analytical, Inc. - Kellogg, ID 1988-1994

Instrument Operator -- Analyzed samples using Cold Vapor Atomic Absorption and Ion Chromatography

#### SVL Analytical, Inc. - Kellogg, ID 1987-1988

Laboratory Technician -- Performed inorganic sample preparation and operated CVAA and GFAA instruments.

### EDUCATION:

#### Perkin Elmer November 2001

Optima Instrument Series with ICP WinLab Software

#### OI Corporation January 2001

Operation of FS-3000 Auto-analyzer

#### North Idaho College - Coeur d' Alene, ID 1989-1990

Chemistry and Mathematics courses

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## KAY JOHNSON

### PROFESSIONAL EXPERIENCE:

#### SVL Analytical, Inc. - Kellogg, ID June 1992-Present

Classical Chemistry Department Analyst -- Performs fire assays of ore and mineral samples; analyzes ore and mineral samples for metal content by atomic absorption; performs analyses of samples for TKN and Hexavalent Chromium

#### Idaho Bureau of Mines and Geology – Moscow, ID 1967-1969

Lab Technician – performed sample preparation and chemical analysis

### EDUCATION:

#### Whitworth College – Spokane, WA 1964-1965

Evening courses

#### Spokane Community College – Spokane, WA 1959-1960

Dental Technician program

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SVL ANALYTICAL, INC.

## MELBA BENCICH

### PROFESSIONAL EXPERIENCE:

SVL Analytical, Inc. - Kellogg, ID February 1988-Present

Document Control Manager -- Supervises data reporting, utilizing USEPA CLP procedures for deliverables and compliance screening.

Shoshone Insurance - Kellogg, ID 1984-1988

Duties included accounting, customer service relations and updating manuals.

Time To Travel - Wallace, ID 1982-1984

Travel Consultant

The Bunker Hill Company - Kellogg, ID 1974-1981

Data Control Analyst

### EDUCATION:

North Idaho College - Coeur d' Alene, ID 1967-1968

General Studies

International Correspondence School 1980

Mathematics

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APPENDIX

**APPENDIX B. FIELD INSTRUMENT MANUALS**



# Water Quality Meter

850081

Instruction Manual

## 5 YEAR METER WARRANTY

Sper Scientific warrants this product against defects in materials and workmanship for a period of five (5) years from the date of purchase, and agrees to repair or replace any defective unit without charge. If your model has since been discontinued, an equivalent Sper Scientific product will be substituted if available. This warranty does not cover probes, batteries, or damage resulting from accident, misuse, or abuse of the product. In order to obtain warranty service, simply ship the unit postage prepaid to:

### SPER SCIENTIFIC LTD.

7720 East Redfield, Suite 7  
Scottsdale, Arizona 85260  
(480) 948-4448  
[www.sperscientific.com](http://www.sperscientific.com)

**SPER  
SCIENTIFIC LTD.**

The 16 digits data stream will be displayed in the following format:	
<b>D15 D14 D13 D12 D11 D10 D9 D8 D7 D6 D5 D4 D3 D2 D1 D0</b>	
Each digit indicates the following status:	
D0	End Word
D1 & D8	Display reading, D1 = LSD, D8 = MSD E.g: If the display reading is 1234, then 08 to Ohs: 00001234
D9	Decimal Point (DP), position from right to the left 0 = No DP, 1 = 1 DP, 2 = 2 DP, 3 = 3 DP
D10	Polarity: 0 = Positive 1 = Negative
D11 & D12	Annunciator for Display °C=01 F=02 mV=18 mS=14 0-6F1 = 06 mg/L = 07
D13	The upper display data = 1, The lower display data = 2
D14	4
D15	Start Word
RS232 FORMAT: 9600, N, 8, 1	

### V. SPECIFICATIONS

Circuit	Custom one-chip microprocessor LSI circuit.	
Display	51 mm x 32 mm, dual function LCD display, 15mm (0.6") digit size.	
Input Impedance	10 <sup>12</sup> ohm	
Temperature Compensation for pH measurement	Manual	0-100°C, adjusted by the °C/°F button.
	Automatic (ATC)	With optional probe, 1-65°C
Ph Calibration	pH 7, pH 4, & pH 10, 3 points calibration ensures the best linearity and accuracy.	
PH Electrode	Opt., any pH electrode with BNC connector.	
Operating Temperature	0°C to 50°C (32°F to 122°F).	
Operating Humidity	Max. 80% RH.	

Sampling Time	Approximately 0.8 seconds.
Power Supply	006F DC 9V battery (Alkaline or heavy duty).
Power Current	Approximately DC 7 mA.
Weight (meter)	8.8 oz (250 g).
Size (meter)	7 ¾" x 2 ½" x 1" (195 x 68 x 30 mm).
Standard Accessories	Hard-shell foam-lined Case & 9V Battery.

### VI. PROBES

Item	Unit of Msrmt.	Range	Resolution	Accuracy
pH & ORP BNC connector	pH	0 ~ 14	0.01	±(0.02PH + 2d)
	mV	0 ~ 1999	1	±(0.5% + 2d)
ATC Temp. Probe 850082	°C	0 ~ 65	0.1	± 0.8
	°F	32 ~ 149		± 1.5
Conductivity Probe 850083	mS	0.2 ~ 1.999	0.001	±(3%fs + 1d)
	mS	2 ~ 19.99	0.01	
	°C	0 ~ 60	0.1	
Conductivity/TDS Probe 850084	°F	32 ~ 140	0.1	±(3%fs + 1d)
	mS	0.2 ~ 2.000	0.001	
	mS	2 ~ 20.00	0.01	
	PPM	132 ~ 1320	1	
	PPM	1320 ~ 13,200	10	
	°C	0 ~ 60	0.1	
DO Probe 850085	°F	32 ~ 140	0.1	±0.4
	mg/L	0 ~ 20	0.1	
	°C	0 ~ 50	0.1	
	°F	32 ~ 122	0.1	0.8
				1.5

### VII. OPTIONAL ACCESSORIES (item number and description)

840090	Water Resistant Instrument Pouch.
840092	Bench-Top Tripod.
840093	Field Tripod.
850080	Software and RS232 Cable.
840057	RS232 Cable Only.

**V. SPECIFICATIONS**

Unit of Mismt.	Range	Resolution	Accuracy
mS	0.2 ~ 1.999	0.001	±(3%fs + 1d) Full Scale
mS	2 ~ 19.99	0.01	
°C	0 ~ 60	0.1	0.8
°F	32 ~ 140		1.5

**Conductivity Probe**

850083

Instruction Manual

Operating Temperature (meter)	0°C to 50°C (32°F to 122°F).
Operating Humidity	Max. 80% RH.
Probe Size	Diameter: " (22mm). Length: " (120mm).
Refer to the Water Quality Meter 850081 Instruction Manual for meter specifications.	

**ONE YEAR WARRANTY**

Sper Scientific warrants this product against defects in materials and workmanship for a period of one year from the date of purchase, and agrees to repair or replace any defective unit without charge. If your model has since been discontinued, an equivalent Sper Scientific product will be substituted if available. This warranty does not cover damage resulting from accident, misuse, or abuse of the product. In order to obtain warranty service, simply ship the unit postage prepaid to:

**SPER SCIENTIFIC LTD.**  
 7720 East Redfield, Suite 7  
 Scottsdale, Arizona 85260  
 (480) 948-4448  
[www.sperscientific.com](http://www.sperscientific.com)

**SPER  
 SCIENTIFIC LTD.**

# ATC Probe

850082

Instruction Manual

**SPER  
SCIENTIFIC LTD.**

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### III. MEASUREMENT PROCEDURES

- Plug probe into the **PROBE INPUT SOCKET**.
- Make sure the **PROBE LOCK** is in the lock position. 
- Turn on the instrument by pressing the **POWER** button.
- Immerse the **PROBE HEAD** into the solution to be measured.
- Press the **A (°C/°F)** button to select Centigrade or Fahrenheit. The temperature is shown on the lower display.

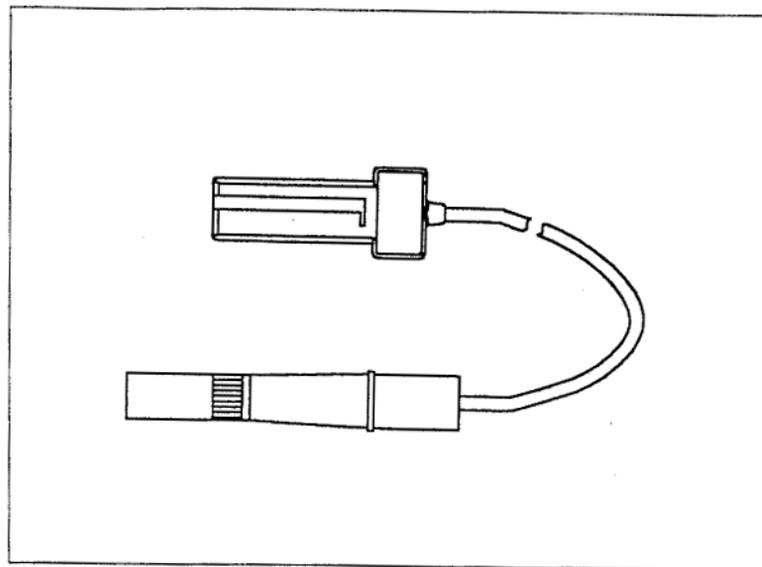
Refer to the Water Quality Meter 850081 Instruction Manual for complete instructions about Hold, Max./Min, RS232, Auto Shut Off, and other functions.

### IV. SPECIFICATIONS

Unit of Measure	Probe Range	Resolution	Accuracy
°C	0 ~ 65	0.1	± 0.8
°F	32 ~ 149		± 1.5
pH (w/opt. probe)	0 ~ 14	0.01	±(0.02PH + 2d)

Operating Temperature (meter)	0°C to 50°C (32°F to 122°F).
Operating Humidity	Max. 80% RH.
Sensor Type	Precision thermister.
Probe Size	Head Diameter: 0.15" (3.9mm). Head Length: 4.2" (106mm).
	Handle Diameter: 0.4" (11mm). Handle Length: 2.4" (60mm).
Refer to the Water Quality Meter 850081 Instruction Manual for meter specifications.	

**DISSOLVED  
OXYGEN PROBE**



### 3. SPECIFICATIONS

Circuit	Custom one-chip of microprocessor LSI circuit.
Measurement & Range	Dissolved Oxygen 0 to 20.0 mg/L(liter). Temperature 0 to 50 °C.
Resolution	Dissolved Oxygen 0.1 mg/L.
Accuracy (23 ± 5 °C)	Temperature 0.1 °C. Dissolved Oxygen ± 0.4 mg/L. Temperature ± 0.8 °C/1.5 °F.
Sensor Structure	The polarographic type oxygen probe with an incorporated temperature sensor.
Probe Temp.	0 to 50 °C.
Compensation	Automatic.
Memory Recall	Records Maximum and Minimum readings with recall.
Power off	Auto shut off saves battery life, or manual off by push button.
Data Output	RS 232 PC serial interface.
Over input indication	Indication of " - - - - - "
Operating Temperature	0 °C to 50 °C ( 32 °F to 122 °F ).
Operating Humidity	Max. 80% RH.
Sample Time	Approx. 0.4 sec.

Size	Oxygen probe : 125 mm x 20 mm Dia. (4.9" x 0.8" Dia.)
Accessories included	Oxygen probe..... 1 PC. Operation manual..... 1 PC. Spare Diaphragm(5 PCs per pack) OXDP - 02..... 1 set Probe - filling Electrolyte OXEL-03..... 1 set Spare Diaphragm(5 PCs per pack) .....OXDP -02 Probe - filling Electrolyte .....OXEL -03
Optional Accessories	