

# Quality Manual

SVL ANALYTICAL, INC.

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January 2010



President and CEO

Wayne R. Sorensen

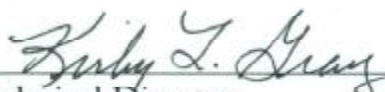
2/4/10  
Date



Laboratory Director

John R. Kern

12-10-09  
Date



Technical Director

Kirby L. Gray

12/21/2009  
Date



Systems Manager

Brandan A. Borgias, Ph.D.

12/14/09  
Date



Quality Assurance Manager

Michael Desmarais

12-10-2009  
Date



Supervisor Inorganic Instrument Department

Danny Sevy

12/10/2009  
Date

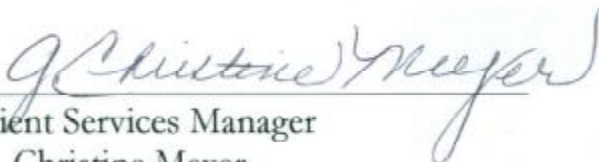


Supervisor Classical Chemistry Department

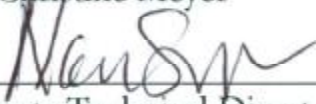
James L. Hodge

12/14/2009  
Date

Additional Signatories

  
\_\_\_\_\_  
Client Services Manager  
G. Christine Meyer

1/4/10  
Date

  
\_\_\_\_\_  
Deputy Technical Director  
Nan S. Wilson

2/8/10  
Date

  
\_\_\_\_\_  
Deputy Technical Director  
Larry Drew, Ph.D.

12/15/09  
Date

Changes (in bold) to QM completed on 12/09/2009

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## 1.0 QUALITY POLICY STATEMENT

SVL Analytical, Inc. (SVL) recognizes that an effective quality system is paramount to providing analytical data that is legally defensible, technically accurate, and scientifically meaningful.

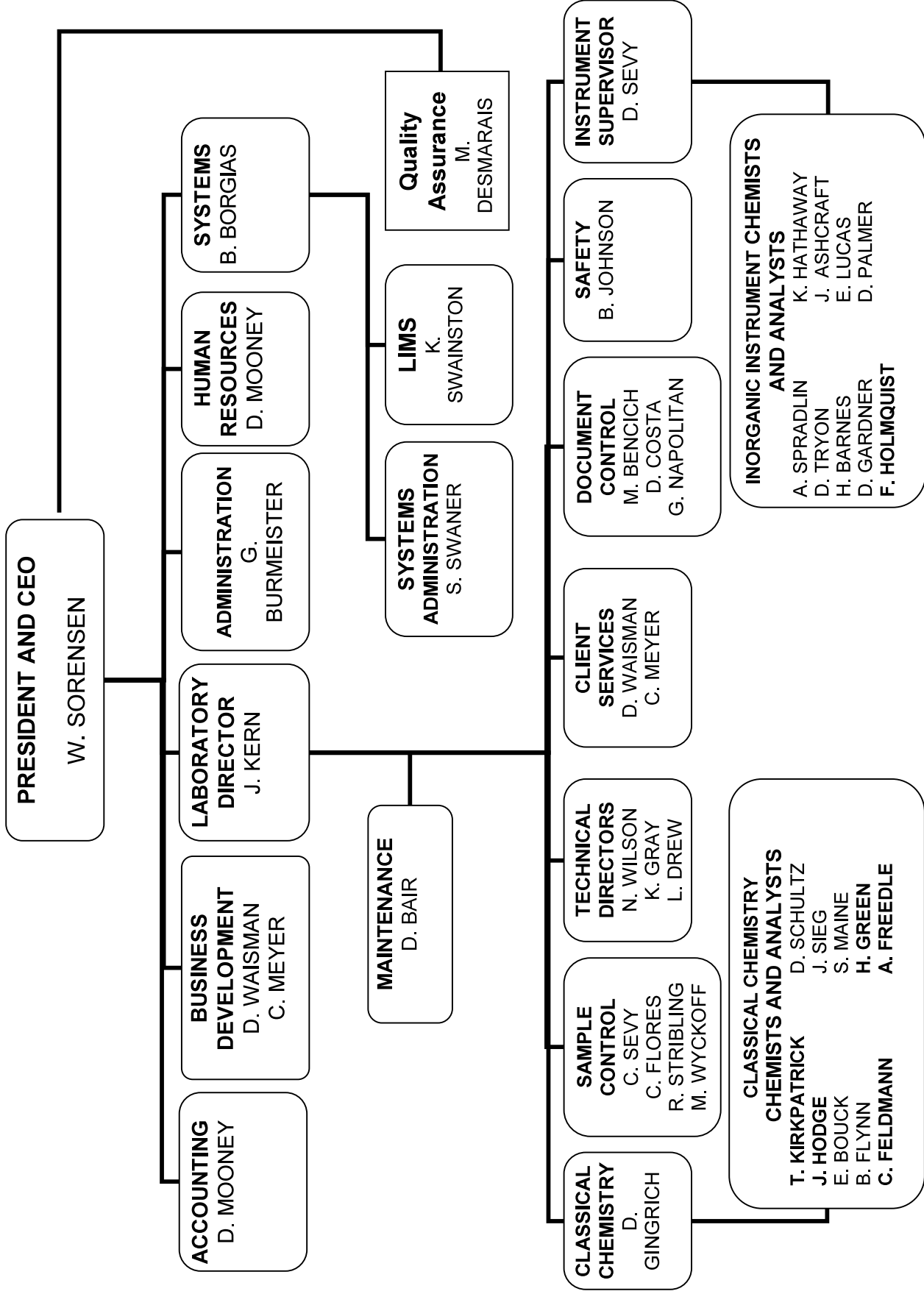
The emphasis of SVL's Quality Manual (QM) is to define control procedures for receipt, handling, and storage of samples; preparation and storage of standards; calibration and maintenance of analytical equipment; performance of analytical methods; and the generation, review, and reporting of analytical data.

At SVL, quality assurance begins with the definition of Data Quality Objectives (DQO) and continues on through data reporting. Control procedures are defined for every step of the program as detailed in SVL's Standard Operating Procedures (SOPs). SVL realizes that without these controls in all phases of the analytical process, data become suspect and hence of less value to our clients. Therefore, SVL is committed to providing data of the highest quality, usability, and defensibility for every project undertaken.

SVL's Management ensures that this QM complies with all applicable NELAC Quality System Standards and sees that it is reviewed annually and revised as needed. **Evidence of signatory approval by senior management of this QM and SVL SOPs are available in PDF format by request.**

## 2.0 ORGANIZATION AND STRUCTURE

The organizational structure of SVL follows a traditional scheme of management with a few modifications. The President/CEO is at the top of the chain of command followed immediately by the Laboratory Director, Systems Manager, Business Development, Human Resources, Administration and Accounting. The Quality Assurance Manager reports directly to the President/CEO. Technical Directors, Client Services, Sample Control, Classical Chemistry Department, Inorganic Instrument Department, Safety, Document Control and Maintenance Department report to the Laboratory Director. Systems Administrator and LIMS Chemist report to the Systems Manager.



## 2.2 Employee List

Position	Employee	Degree	Years of Lab Experience
President and CEO	Wayne Sorensen	BS 1962	43
Laboratory Director	John R. Kern	MS 1982	27
Business Development/Safety Officer	Blake Johnson	PhD 1971	25
Systems Manager	Brandan A. Borgias	PhD 1985	29
Document Control Officer	Melba Bencich		29
Client Services Manager	G. Christine Meyer		31
Business Development Manager	Dave Waisman	MS 1985	16
Technical Director	Kirby L. Gray	BS 1972	25
Deputy Technical Director/Safety Director	Nan Wilson	BS 1996	14
Deputy Technical Director	Larry Drew	PhD 1973	7
Supervisor Inorganic Instrument	Danny Sevy		22
<b>Supervisor Classical Chemistry</b>	<b>Daniel K. Gingrich II</b>	<b>BS 2008</b>	<b>3</b>
Systems Administrator	Scott Swaner		7
LIMS Chemist	Kale Swainston	BS 1998	7
Accounting and Human Resources	Donella Mooney		19
Quality Assurance Manager	Michael Desmarais	BS 1995	13
ICP Spectroptomist	Anne L. Spradlin	BA 1983	24
<b>ICP Chemist</b>	<b>Felicia Holmquist</b>	<b>BS 2008</b>	<b>2</b>
ICP Analyst	David Tryon		6
ICP and ICP-MS Chemist	Dianne Gardner	BA 1987	6
ICP-MS and GFAA Analyst	Kevin Hathaway		22
CVAA Analyst	Judy Ashcraft		40
<b>Chemist</b>	<b>Theresa Kirkpatrick</b>	<b>BS 2006</b>	<b>3</b>
Chemist	Brian Flynn	MS 2003	4
<b>Chemist</b>	<b>Jim Hodge</b>		<b>43</b>
<b>Chemist</b>	<b>Charles Feldmann</b>	<b>BA 2007</b>	<b>4</b>
Chemist	Sherry Maine	MS 2004	9
Chemist	Emily Lucas	BA 2005	2
<b>Chemist</b>	<b>Heather Green</b>	<b>BS 2009</b>	<b>2</b>
<b>Analyst</b>	<b>Anita Guzman-</b>	<b>BS 1979</b>	<b>2</b>
Analyst	Dean Palmer	BS 1979	11
Analyst	Eric Bouck		2
Analyst	Debbie Schultz		8
Analyst	Heidi Barnes		7
Analyst	Jennifer Sieg		3
Sample Control Officer	Crystal Sevy		7
Sample Receiving	Cindy Flores		8
Sample Receiving	Robin Stribling		4
Sample Receiving	Merrilyn Wyckoff		2
Document Control	Dianne Costa		3
Document Control	Gerri Napolitan		4
Maintenance	Dan Bair		3
Receptionist	Gloria Burmeister		7

## 2.3 Key Employee Resumes

**Resumes of key employees are in Section 27.0.**

### **3.0 JOB DESCRIPTIONS**

#### **3.1 Laboratory Director**

The Laboratory Director supervises day-to-day operations of the laboratory. Responsible for monitoring standards of performance in quality control and quality assurance, and for monitoring the validity of the analyses performed and data generated in the laboratory. The Laboratory Director holds a weekly staff meeting to discuss client and technical issues.

#### **3.2 Systems Manager**

The Systems Manager supervises operations of the Information Technology groups. The Systems Manager uses Excel, Crystal Reports and other database programs to develop and maintain client reports and electronic data deliverables. Element is the laboratory's LIMS and the Systems Manager works with the LIMS Chemist to make sure that Element meets the needs of SVL. The Systems Manager is responsible for the development of IS/IT protocols.

#### **3.3 Department Supervisor**

Department supervisors conduct the day-to-day operations of our analytical departments. They are responsible for department safety and analyst training. They are also responsible for review of out-going analytical data.

#### **3.4 Quality Assurance Manager (QAM)**

The QAM is responsible for implementation of the quality system. The QAM manages the performance evaluation sample program and conducts laboratory audits. The QAM obtains and maintains laboratory accreditations, reviews and approves SOPs, and conducts staff training in integrity and quality systems.

#### **3.5 Document Control Officer (DCO)**

DCO is responsible for the generation and the retention of analytical reports and records, including but not limited to Chains-of-Custody and

sample shipping documents. DCO is also responsible for delivering electronic data deliverables.

### **3.6 Sample Control Officer (SCO)**

SCO is responsible for sample receipt, job creation/verification, sample storage and sample disposal.

### **3.7 Technical Director**

Technical Directors provide technical support to laboratory staff and provide final reviews of analytical data packages.

## **4.0 APPROVED LABORATORY SIGNATORIES**

The Laboratory Director John Kern, Systems Manager Brandan Borgias, Technical Director Kirby Gray, Deputy Technical Directors, Larry Drew and Nan Wilson, Department Supervisors Jim Hodge and Danny Sevy are approved laboratory signatories for analytical reports. QAM Michael Desmarais has report generation privileges.

## **5.0 RECORDS AND DOCUMENT CONTROL**

### **5.1 Standard Operating Procedures (SOPs)**

The QAM retains the master copies of SOPs. Electronic copies are available on the laboratory's computer network. **Signed and dated SOPs are available by request in PDF format.** All SOPs are scheduled for review each year. Electronic copies are available on the laboratory network on the date of the QAM's review with promulgation two weeks after that date. When a revision is created, the previous version is removed from the master file and electronic database, with a hard copy retained for the SOP archive file.

### **5.2 Quality Manual (QM)**

The QAM retains the master copy of the QM. The QM is scheduled for review annually or when revisions are needed. Management may make hard copies available to Accrediting Authorities, laboratory staff and clients as needed; otherwise, the QM is available in electronic format. **A signed and dated QM is available by request in PDF format.** When

a revision is created, previous versions are removed from use, and a copy is retained in the QM archive file.

### **5.3 Analytical Data**

The Document Control Officer (DCO) retains analytical data, including calibration records and quality control, for five years, unless a longer period is required by contract.

### **5.4 Training Records**

The QAM maintains records of analyst training and proficiency; ref, SOP SVL 1010.

### **5.5 Performance Evaluation Samples**

The QAM maintains records of analysis of performance evaluation samples and the reports associated with the analyses.

### **5.6 External and Internal Audits**

The QAM retains records of external and internal audits.

### **5.7 Corrective Action Reports**

Are kept electronically and filed by hardcopy.

### **5.8 Laboratory Logbooks**

SVL controls the issue, use, and closure of laboratory logbooks. The process is described in SOP SVL 2017. Examples of logbooks may include: the conductivity of laboratory water, preparation of reagents and standards, preparation of samples, calibration of balances, calibration of micropipets, volumetric pipets, repipettors, maintenance of instruments, and temperatures of ovens and refrigerators. The QAM assigns and archives logbooks.

### **5.9 Chain of Custody (COC)**

The DCO is in charge of COC retention; they are currently held for five years, unless a longer time is required by contract. Sample log-in and job creation are maintained in SVL's LIMS. **COCs are scanned into PDF format, which can be accessed through Element.**

## 5.10 Analytical Reports

The DCO retains photocopies of CLP analytical reports for five years, unless a longer time is required by contract. **Copies of CLP-like and non CLP reports are saved as PDF files; the files are backed up and archived for five years.** Archived analytical reports are stored in a secured environment to protect them from damage.

## 5.11 Backup and Storage of Electronic Data

**5.11.1 Electronic Data Collection:** Currently the backup server is protected with an administrative password, which is changed every 6 months; it is in control of the Systems Administrator; **ref, SOPs SVL 2020 and 2021.**

**5.11.2 Archives of Electronic Data:** Data files that reside on the SVL file servers are backed up on a daily basis and kept onsite for 90 days: a full backup of the data files residing on the server is done monthly and sent to an offsite storage facility for 5 years. All software used to recover data files is also stored at the offsite facility.

**5.11.3 Offsite Backup Storage:** A secure offsite facility is maintained to house the electronic data collected by the current backup system.

## 6.0 TRACEABILITY OF MEASUREMENTS

### 6.1 Chemicals and Reagents

SVL uses reagent grade or better chemicals. Some equivalent grades are “Fisher Trace Metals”, “Baker Instra-Analyzed”, “Baker A.C.S.”, “Baker Analyzed”, “Fisher A.C.S.”, and “Fisher Certified”. SVL requires a certificate of analysis or purity, for stock calibration standards. Upon receipt the chemicals are labeled and entered into SVL’s LIMS.

SVL records the preparation of reagents and standards in controlled logbooks or electronically in the LIMS. The initials of the preparer, the date prepared, the lot number and amount of stock materials, the final volume, the matrix, and the expiration date are all recorded. A label is created within the LIMS and is attached to all aliquots of the standard.

Preparation instructions are included in the SOPs for the analytical methods. **EPA supplied reference material solutions are prepared**

**following EPA QATS specific instructions for diluting these solutions.**

SVL labels containers of prepared reagents and standards with their contents, a unique reference number, date prepared, disposal (expiration) date and a perceived hazard warning.

SVL routinely obtains reference standards from commercial sources. These standards are used to check and document the concentration of calibration standards and validate method QC requirements.

SVL stores reagents and standards separately from samples.

## **6.2 Water**

The primary reagent 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 MΩ-cm) water is required, SVL inserts a four-cartridge ion-exchange system into the line. SVL measures and records the resistivity of the laboratory water each weekday.

## **7.0 TEST METHODS**

### **7.1 Analyses Performed by SVL**

**SVL routinely performs the following analytical methods.**

<b>ANALYTE</b>	<b>METHOD</b>	<b>TECHNIQUE</b>
Aluminum	EPA 200.7, SW846 6010B	ICP
Antimony	EPA 200.7, SW846 6010B	ICP
Antimony	EPA 200.8, SW846 6020	ICPMS
Arsenic	EPA 200.7, SW846 6010B	ICP
Arsenic	EPA 200.8, SW846 6020	ICPMS
Barium	EPA 200.7, SW846 6010B	ICP
Barium	EPA 200.8, SW846 6020	ICPMS
Beryllium	EPA 200.7, SW846 6010B	ICP
Beryllium	EPA 200.8, SW846 6020	ICPMS
Boron	EPA 200.7, SW846 6010B	ICP
Boron	EPA 200.8, SW846 6020	ICPMS
Cadmium	EPA 200.7, SW846 6010B	ICP
Cadmium	EPA 200.8, SW846 6020	ICPMS
Calcium	EPA 200.7, SW846 6010B	ICP
Chromium	EPA 200.7, SW846 6010B	ICP
Chromium	EPA 200.8, SW846 6020	ICPMS

<b>ANALYTE</b>	<b>METHOD</b>	<b>TECHNIQUE</b>
Chromium, Hexavalent	SM 3500 CR B , D	Colorimetry
Cobalt	EPA 200.7, SW846 6010B	ICP
Cobalt	EPA 200.8, SW846 6020	ICPMS
Copper	EPA 200.7, SW846 6010B	ICP
Copper	EPA 200.8, SW846 6020	ICPMS
Gallium	EPA 200.7, SW846 6010	ICP
Gold	EPA 231.2	GFAA
Iron	EPA 200.7, SW846 6010B	ICP
Lanthanum	EPA 200.7, SW846 6010B	ICP
Lead	EPA 200.7, SW846 6010B	ICP
Lead	EPA 200.8, SW846 6020	ICPMS
Lithium	EPA 200.7, SW846 6010B	ICP
Magnesium	EPA 200.7, SW846 6010B	ICP
Manganese	EPA 200.7, SW846 6010B	ICP
Manganese	EPA 200.8, SW846 6020	ICPMS
Mercury	EPA 245.1, SW846 7470A, 7471A	CVAA
Molybdenum	EPA 200.7, SW846 6010B	ICP
Molybdenum	EPA 200.8, SW846 6020	ICPMS
Nickel	EPA 200.7, SW846 6010B	ICP
Nickel	EPA 200.8, SW846 6020	ICPMS
Potassium	EPA 200.7, SW846 6010B	ICP
Scandium	EPA 200.7, SW846 6010B	ICP
Selenium	SM 3114C	Hydride AA
Selenium	EPA 200.7, SW846 6010B	ICP
Selenium	EPA 200.8, SW846 6020	ICPMS
Silica	EPA 200.7	ICP
Silver	EPA 200.7, SW846 6010B	ICP
Silver	EPA 200.8, SW846 6020	ICPMS
Sodium	EPA 200.7, SW846 6010B	ICP
Strontium	EPA 200.7, SW846 6010B	ICP
Thallium	EPA 200.7, SW846 6010B	ICP
Thallium	EPA 200.8, SW846 6020	ICPMS
Tin	EPA 200.7, SW846 6010B	ICP
Titanium	EPA 200.7, SW846 6010B	ICP
Uranium	EPA 200.8	ICPMS
Vanadium	EPA 200.7, SW846 6010B	ICP
Vanadium	EPA 200.8, SW846 6020	ICPMS
Zinc	EPA 200.7, SW846 6010B	ICP
Zinc	EPA 200.8, SW846 6020	ICPMS
Acidity	SM 2310 B	Automated Titration
Alkalinity	SM 2320 B	Automated Titration
Ammonia	EPA 350.1	Automated Colorimetry
Bromide	EPA 300.0	Ion Chromatography
Chemical Oxygen Demand	EPA 410.4	Colorimetry
Chloride	EPA 300.0	Ion Chromatography
Color	SM 2120 B	Colorimetry
Conductivity	EPA 120.1	Wheatstone Bridge
Corrosivity	SM 2330 B	Langelier Index

<b>ANALYTE</b>	<b>METHOD</b>	<b>TECHNIQUE</b>
Cyanide, Total	EPA 335.4, SW 846 9012B	Automated Colorimetry
Cyanide, Free	SW-846 EPA 9213	Ion Specific Electrode
Cyanide, WAD	SM 4500 CN I	Automated Colorimetry
Cyanide, Available	OIA 1677	Amperometry
Fluoride	EPA 300.0	Ion Chromatography
Hardness	SM 2340B, Ca as CaCO <sub>3</sub> by 200.7	ICP Sum
Nitrate	EPA 300.0	Ion Chromatography
Nitrate + Nitrite	EPA 353.2	Automated Colorimetry
Nitrate + Nitrite	EPA 300.0	Ion Chromatography
Nitrite	EPA 300.0	Ion Chromatography
Nitrite	EPA 353.2	Automated Colorimetry
Odor	SM 2150B	Sniff Panel
ortho-Phosphate	SM 4500 P E, 300.0	Colorimetry, IC
pH (aqueous)	SM 4500-H <sup>+</sup> B	Electrometric
pH (soil)	EPA 9045C, EPA 9045D	Electrometric
Paste pH	ASA Monograph 9	Electrometric
Phosphate, Total	SM 4500 P E	Persulfate Digestion
Residue, Filterable (TDS)	SM 2540 C	Gravimetric
Residue, Non Filterable (TSS)	SM 2540 D	Gravimetric
Settleable Solids	SM 2540 F	Volumetric
Specific Conductance	EPA 120.1, SM 2510 B	Wheatstone Bridge
Sulfate	EPA 300.0	Ion Chromatography
Sulfide	SM 4500 S <sup>-2</sup> F	Titrimetric
Surfactants (MBAS)	SM 5540 C	Colorimetry
Total Solids	SM 2540 B	Gravimetric
Total Kjeldahl Nitrogen	EPA 351.2, SM 4500 NH <sub>3</sub> D	Colorimetry
Total Organic Carbon	SM 5310 B	Combustion
Total Volatile Solids	EPA 160.4	Gravimetric
Turbidity	EPA 180.1	Nephelometric
TCLP (Toxicity Characteristic Leaching)	SW846 1311	Extraction
SPLP (Synthetic Precipitation Leaching)	SW846 1312	Extraction
STLC (Soluble Threshold Limit Concentration)		Extraction
MWMP (Meteoric Water Mobility)	ASTM E2242-02	Extraction
CA-WET (California Waste Extraction Test)		Extraction
CEC (Cation Exchange Capacity)	SW846 9081, 9080	
Textural Analysis (Particle Size)	ASA "Methods of Soil Analysis" Number 9, Part 1	
Specific Gravity		Displacement
TOM/TOC	USDA, HB60(24)	
ANP (Acid Neutralization Potential)		Titration

<b>ANALYTE</b>	<b>METHOD</b>	<b>TECHNIQUE</b>
ABA (Acid Base Account)	ASTM E1915-05	LECO
Total Sulfur + Sulfur Forms	ASTM E1915-05	LECO
Total Carbon	ASTM E1915-05	LECO
Arsenic Speciation	K.S. Subramanian et al.	GFAA
Iron Speciation	HACH-8146	Colorimetry
Gradation		Sieving
Loss on Ignition	Soil & Plant Analysis Council	Gravimetric
Percent Silica	ASTM 2795	Colorimetry
Tot Suspended Particulates	40CFR 50, App B amend 12/6/82	Gravimetric
Flash Point	SW-846 1010, ASTM D93-80	Closed Cup

## **7.2 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**

**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, 18<sup>th</sup> Edition, 1992**

**Standard Methods for the Examination of Water and Wastewater, 19<sup>th</sup> Edition, 1995**

**Standard Methods for the Examination of Water and Wastewater, 20<sup>th</sup> Edition, 1999**

**ASTM Book of Standards, part 31**

**Soil Testing and Plant Analysis, 3<sup>rd</sup> Edition, Soil Sciences Society of America, 1990**

**American Society of Agronomy, "Methods of Soil Analysis" Number 9, Parts 1 and 2**

U.S. Department of Agriculture, Handbook #60

U.S. Department of the Interior, Bureau of Reclamation, Procedure for Determining Moisture, Ash, and Organic Content of Soil, USBR 5430-89

**Manual for the Certification of Laboratories Analyzing Drinking Water, Fifth Edition**

**U.S. Environmental Protection Agency SOW ILMO5.4 for Inorganic Analysis, Multi-Media, Multi-Concentration for CLP**

## **8.0 NEW WORK**

The Business Development group discusses new work with clients before the work is received. If the work being requested involves tests not usually performed by SVL, the project is discussed with Department Supervisors to determine if the work can be accepted. Quotes and projects are logged so that there is no confusion about what is expected by the client. If work is received that does not adhere to the guidelines put forth in the quote or project, the client will be contacted for clarification. Occasionally SVL receives a work order with no prior notification that requests unusual tests, or tests to be conducted in a time frame not suitable for the work requested. When this occurs, the SCO reviews the job with Client Services and/or Department Supervisors to determine if the work can or should be accepted. Routine work from established clients normally is not reviewed with the clients before jobs are set up, unless there is a problem with sample integrity or information on the COC.

SVL reviews and makes available in LIMS, the parameters associated with a client's project (work order memos can be attached when special instructions are involved). A schedule can be derived for the work that has been received; this allows the staff to plan workloads and to track jobs. A Laboratory/Technical Director or Client Services member shall review all work orders. Adjustments to work schedules and staff deployment are made based upon the workload. Department Supervisors keep equipment and supplies on hand for routine work and for many non-routine tests as well.

### **8.1 Sample Acceptance Policy**

**8.1.1** Samples received at SVL will be accepted for testing if the following criteria are met at the time of sample receipt:

A proper SVL or client COC will accompany the sample shipment and must be completed in full (unless a project number is specified and is on file with SVL), including but not limited to; the client's name, address, phone/fax numbers, contact person, unique sample identification of individual samples, sample locations (if applicable), date and time of collection, collector's name, preservative type, sample matrix, filtered or unfiltered, number of bottles, analytes and/or tests to be performed, method of analysis, and any comments concerning sample specifics or QC requirements.

The use of correct sample containers (with proper preservation) for the sample matrices collected and ensuring that sufficient sample volume is provided for the tests requested (including extra volumes for QC requirements).

Accurate labeling of sample bottles using coded, water resistant labels and permanent ink, with said labels being cross referenced with information contained in the COC.

Adherence to holding time requirements as required by test or method requested.

**8.1.2** In the event that a sample is received in non-compliance with this policy, the sample in question will be segregated and the client notified by telephone or email. The client may direct SVL to continue on with analysis of the non-conforming sample(s). Non-conformity will be noted on the Sample Receipt/Chain of Custody and within the Final Report; ref, **SOP SVL 2001**.

**8.1.3** New clients will be informed of this policy through Client Services or Sample Receiving. They will be provided with a copy of the QM (hard copy or electronically) or a hand out on sample acceptance (located in SVL's waiting room or in Sample Receiving).

Current clients will receive a copy of the sample acceptance policy if they bring in samples that do not meet SVL's requirements.

## **9.0 CALIBRATION**

### **9.1 Thermometers**

Calibrating thermometers is described in SOP SVL 1004.

An outside company calibrates SVL's NIST-certified thermometers.

SVL calibrates in-house liquid-in-glass thermometers against a NIST-certified thermometer. Digital thermometers are calibrated against a NIST-certified thermometer. The thermometers are then labeled with a correction factor.

## **9.2 Balances**

Servicing and calibrating balances is described in SOP SVL 1025.

An outside company services and calibrates SVL's balances.

SVL checks the calibration of a balance before each day of use with at least two weights traceable to a NIST traceable standard. For analytical balances, the measured weight must agree with the certified weight within 0.1%. Balances that fail the criterion are checked with Class-1 weights. If they fail again, they are removed from service.

## **9.3 Balance Weights**

Calibrating balance weights is described in SOP SVL 1025.

An outside company calibrates SVL's set of Class-1 weights, with Reference Standards Traceable to NIST.

SVL uses Class-1 weights to certify the Class-4 weights used for the daily calibration of balances.

## **9.4 Micropipets**

The calibration of micropipets is described in SOP SVL 1026.

SVL checks the calibration of variable-volume micropipets each day of use. Fixed-volume micropipets are checked quarterly. The mean of three measured volumes must agree with the expected value within 3%. Micropipets that fail this criterion are repaired or removed from service.

## **9.5 Repipettors**

The calibration of repipettors is described in SOP SVL 1026.

SVL checks the calibration of repipettors quarterly. The measured volume must agree with the expected value within 3%. Repipettors that fail this criterion are repaired or removed from service.

## 9.6 Refrigerators

SVL records the temperature of sample, standard, and reagent storage refrigerators each weekday. The process is described in SOP SVL 2004. The temperature must meet the  $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$  as described in SOP SVL 2001-ILMO5.4 for CLP samples and  $0-6^{\circ}\text{C}$  for non CLP samples. If a temperature is outside this criterion, the temperature is recorded again after one hour. If the temperature is still outside the acceptance range, samples, standards, and reagents are transferred to alternate refrigerators or coolers.

## 9.7 Ovens

SVL records the temperature of ovens for drying solids each weekday. The required temperature is stated in the applicable SOPs.

## 9.8 Inductively Coupled Plasma Mass Spectrometer (ICP-MS)

SVL calibrates its ICP-MS in accordance with EPA methods 200.8, 6020, and CLP SOW ILMO5.4. **In accordance with the CLP SOW, a tune standard analysis is performed prior to calibration.** Five calibration standards and a calibration blank are analyzed at the beginning of a sequence. The software creates a linear calibration curve that must have a correlation coefficient of at least 0.995. An Initial Calibration Verification (ICV) from a secondary source follows to verify the calibration. An Initial Calibration Blank (ICB) indicates the system is clean. A Reporting Limit Check Standard (RLCS) indicates that the results derived at the reporting limit can be recovered within our acceptance criteria. Analysis of a Continuing Calibration Verification (CCV) and a Continuing Calibration Blank (CCB) follow after every ten samples and at the end of the analytical sequence. The acceptance criteria are defined in SOP SVL 4111.

## 9.9 Inductively Coupled Plasma Spectrometer (ICP)

SVL calibrates ICPs in accordance with EPA methods 200.7 and 6010B. A single calibration standard and a calibration blank are analyzed at the beginning of a sequence. A standard at the reporting limit is analyzed to verify that the instrument will detect a response at that level. An ICV from a secondary source follows to verify the calibration. An ICB indicates the system is clean. An RLCS (in this case called a CRI) indicates that the results derived at the reporting limit can be recovered within our acceptance criteria. Analysis of a CCV and a CCB follow

after every ten samples and at the end of the analytical sequence. The acceptance criteria are defined in SOP SVL 4102.

### **9.10 Graphite Furnace Atomic Absorption Spectrometer (GFAA)**

SVL calibrates its GFAA in accordance with EPA method 231.2 for gold and K.S. Subramanian et al. for arsenic speciation. Three calibration standards and a calibration blank are analyzed at the beginning of a sequence. Perkin-Elmer instruments create a linear calibration curve that must have a correlation coefficient of at least 0.995. An ICV from a secondary source follows to verify the calibration. An ICB indicates the system is clean. An RLCS indicates that the results derived at the reporting limit can be recovered within our acceptance criteria. Analysis of a CCV and a CCB follow after every ten samples and at the end of the analytical sequence. The acceptance criteria are defined in SOP SVL 4115.

### **9.11 Mercury Analyzer (CVAA)**

SVL calibrates its CVAA in accordance with EPA methods 245.1, 7470A, and 7471A. Six calibration standards and a calibration blank are analyzed at the beginning of a sequence. The instrument creates a linear calibration curve that must have a correlation coefficient of at least 0.995. An ICV from a secondary source follows to verify the calibration. An Initial Calibration Blank (ICB) indicates the system is clean. An RLCS indicates that the results derived at the reporting limit can be recovered within our acceptance criteria. Analysis of a CCV and a CCB follow after every ten samples and at the end of the analytical sequence. The acceptance criteria are defined in SOP SVL 4010.

### **9.12 Flame Atomic Absorption Spectrometer (FLAA)**

SVL calibrates FLAAs in accordance with analytical method requirements.

### **9.13 Ion Chromatograph (IC)**

SVL calibrates ICs in accordance with EPA method 300.0. Five calibration standards and a calibration blank are analyzed. The instrument creates a linear or quadratic calibration curve that must have a correlation coefficient of at least 0.995. An ICV from a secondary source follows to verify the calibration. An ICB indicates the system is clean. An RLCS indicates that the results derived at the reporting limit can be recovered within our acceptance criteria. A CCV and a CCB

follow after every ten samples and at the end of the analytical sequence. The acceptance criteria are defined in SOP SVL 4122.

#### **9.14 Flow-Injection Auto Analyzer (FIA)**

SVL calibrates FIAs in accordance with EPA methods 335.4 (Total Cyanide), 350.1 (Ammonia), **351.2 TKN**, 353.2 (Nitrate and Nitrite), 9012B (Total Cyanide), and Standard Methods 4500-CN-I (WAD Cyanide), and method OI 1677 (Amperometric Cyanide). A minimum of five calibration standards and a calibration blank are analyzed at the beginning of each analytical sequence. The instrument software creates a linear or quadratic calibration curve that must have a correlation coefficient of at least 0.995. A Laboratory Control Sample (LCS) and an ICB from a secondary source verifies the calibration curve. An ICB indicates the system is clean. An RLCS indicates that the results derived at the reporting limit can be recovered within our acceptance criteria. Analysis of a CCV and a CCB follow after every ten samples and at the end of the analytical sequence. The acceptance criteria are defined in SOPs SVL 4012, **SVL 4045**, SVL 4099, SVL 4048, SVL 4075, and SVL 4101.

#### **9.15 Total Organic Carbon Analyzer (TOC)**

SVL calibrates TOC analyzers in accordance with SM 5310 B. Three calibration standards for total carbon and three calibration standards for inorganic carbon are analyzed to prepare a calibration curve that must have a correlation coefficient of at least 0.995. An RLCS indicates that the results derived at the reporting limit can be recovered within our acceptance criteria. A CCV is analyzed at the beginning of each analytical sequence, after every ten samples and at the end of the analytical sequence. The acceptance criteria are defined in SOP SVL 4116.

#### **9.16 UV/Visible Spectrophotometers (UV/VIS)**

SVL calibrates its UV/Visible spectrophotometer in accordance with the applicable published methods. A minimum of three calibration standards and a calibration blank are analyzed at the beginning of each analytical sequence. The calibration curve must have a correlation coefficient of at least 0.995.

## 9.17 pH and Ion Selective Electrode Meters (ISE)

SVL calibrates pH and ISE meters in accordance with the applicable published methods. For TKN, SVL uses an Excel spreadsheet to create a calibration curve of potential (mV) versus log of concentration.

## 9.18 Class A Glassware

Class A glassware is verified, assigned a unique identifier and logged in upon receipt as described in SOP SVL 1026.

# 10.0 SAMPLING, SAMPLE RECEIVING, AND STORAGE

## 10.1 Sampling

SVL does not conduct sampling. Sampling procedures and contamination in the field are beyond SVL's control. SVL recommends the following procedures to its clients.

Sample preservation is critical for sample integrity. Chemical and biological reactions may occur that begin to change some chemical species upon sample collection. Unfortunately, for most samples, immediate analysis is neither economically feasible nor logistically possible. Although no chemical preservative exists that is valid for every parameter, 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 1. Solid samples are best preserved by cooling the sample to a range between  $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$  for CLP samples and between  $0^{\circ}\text{C}$  and  $6^{\circ}\text{C}$  for non CLP samples.

**Table 1**

Analysis	Volume Required (mL)	Container	Preservative	Holding Time
Color	50	P,G	Cool to $\leq 6^{\circ}\text{C}$	48 Hours
Conductance	100	P,G	Cool to $\leq 6^{\circ}\text{C}$	28 Days
Hardness	100	P,G	$\text{HNO}_3$ to $\text{pH} < 2$	6 Months
Odor	300	G only	Cool to $\leq 6^{\circ}\text{C}$	24 Hours
pH	25	P,G	None Required	* ASAP
Temperature	1000	P,G	None Required	* ASAP
Turbidity	100	P,G	Cool to $\leq 6^{\circ}\text{C}$	48 Hours

Analysis	Volume Required (mL)	Container	Preservative	Holding Time
Filterable Residue (TDS)	100	P,G	Cool to $\leq 6^{\circ}\text{C}$	7 Days
Non-Filterable Residue (TSS)	100	P,G	Cool to $\leq 6^{\circ}\text{C}$	7 Days
Total Residue	100	P,G	Cool to $\leq 6^{\circ}\text{C}$	7 Days
Volatile Residue	100	P,G	Cool to $\leq 6^{\circ}\text{C}$	7 Days
Settleable Matter	1000	P,G	Cool to $\leq 6^{\circ}\text{C}$	48 Hours
Dissolved Metals	200	P,G	Filter on site; $\text{HNO}_3$ to $\text{pH}<2$	6 Months
Total Metals	100	P,G	$\text{HNO}_3$ to $\text{pH}<2$	6 Months
Chromium (VI)	200	P,G	Cool to $\leq 6^{\circ}\text{C}$	24 Hours
Mercury, Dissolved	100	P,G	Filter; $\text{HNO}_3$ to $\text{pH}<2$	28 Days
Mercury, Total	100	P,G	$\text{HNO}_3$ to $\text{pH}<2$	28 Days <b>26 Days (CLP)**</b>
Acidity	100	P,G	Cool to $\leq 6^{\circ}\text{C}$	14 Days
Alkalinity	100	P,G	Cool to $\leq 6^{\circ}\text{C}$	14 Days
Bromide	100	P,G	None Required	28 Days
Chloride	50	P,G	None Required	28 Days
Cyanide	500	P,G	Cool to $\leq 6^{\circ}\text{C}$ ; $\text{NaOH}$ to $\text{pH}>12$	14 Days <b>12 Days (CLP)**</b>
Fluoride	300	P	None Required	28 Days
Ammonia	400	P,G	Cool to $\leq 6^{\circ}\text{C}$ $\text{H}_2\text{SO}_4$ to $\text{pH}<2$	28 Days
Total Kjeldahl Nitrogen	500	P,G	Cool to $\leq 6^{\circ}\text{C}$ $\text{H}_2\text{SO}_4$ to $\text{pH}<2$	28 Days
Nitrate plus Nitrite	100	P,G	Cool to $\leq 6^{\circ}\text{C}$ $\text{H}_2\text{SO}_4$ to $\text{pH}<2$	28 Days
Nitrate	100	P,G	Cool to $\leq 6^{\circ}\text{C}$	48 Hours
Nitrite	50	P,G	Cool to $\leq 6^{\circ}\text{C}$	48 Hours
Ortho-Phosphate Dissolved	50	P,G	Filter on site; Cool to $\leq 6^{\circ}\text{C}$	48 Hours
Total Phosphate	50	P,G	Cool to $\leq 6^{\circ}\text{C}$ ; $\text{H}_2\text{SO}_4$ to $\text{pH}<2$	28 Days
Total Dissolved Phosphate	50	P,G	Filter on site; Cool to $\leq 6^{\circ}\text{C}$ ; $\text{H}_2\text{SO}_4$ to $\text{pH}<2$	28 Days
Silica	50	P only	Cool to $\leq 6^{\circ}\text{C}$	28 Days
Sulfate	50	P,G	Cool to $\leq 6^{\circ}\text{C}$	28 Days
Sulfide	500	P,G	Cool to $\leq 6^{\circ}\text{C}$ add 2 mL zinc acetate plus $\text{NaOH}$ to $\text{pH}>9$	7 Days
COD	50	P,G	Cool to $\leq 6^{\circ}\text{C}$ $\text{H}_2\text{SO}_4$ to $\text{pH}<2$	28 Days

Analysis	Volume Required (mL)	Container	Preservative	Holding Time
Total Organic Carbon	25	40 mL amber vials	Cool to $\leq 6^{\circ}\text{C}$ $\text{H}_2\text{SO}_4$ to $\text{pH}<2$	28 Days
Phenolics	500	G only	Cool to $\leq 6^{\circ}\text{C}$ $\text{H}_2\text{SO}_4$ to $\text{pH}<2$	28 Days
MBAS	400	P,G	Cool to $\leq 6^{\circ}\text{C}$	48 Hours

\* pH and temperature should be measured in the field whenever possible. They are subject to rapid change. Measurements of pH and temperature made in the laboratory will almost always be out of holding time.

\*\* CLP SOW ILMO5.4 holding times are measured from Validated Time of Sample Receipt (VTSR).

SVL has formed alliances with other laboratories for the analysis of organic parameters. The recommended containers and preservatives are

Analysis	Amount Required	Container	Preservative	Holding Time Until Extraction	Holding Time After Extraction Until Analysis
Mercury, Low Level***					
524.2 (Volatile Organic Compounds)	3x40mL vials	G,T	Cool to $\leq 6^{\circ}\text{C}$ ; HCl to $\text{pH}<2$	14 days	NA
608 (Pesticides and/or PCBs)	3 L	amber G,T	Cool to $\leq 6^{\circ}\text{C}$	7 days	40 days
624 (Volatile Organic Compounds)	3x40mL vials	G,T	Cool to $\leq 6^{\circ}\text{C}$ ; HCl to $\text{pH}<2$	14 days	NA
625 (Semi-volatile Organic Compounds)	3 L	amber G,T	Cool to $\leq 6^{\circ}\text{C}$	7 days	40 days
1664 Hexane Extractable Materials	2L	G only	Cool to $\leq 6^{\circ}\text{C}$ $\text{H}_2\text{SO}_4$ or HCl to $\text{pH}<2$	28 days	NA
8081A (Pesticides)	8 oz (soil) 1L (aqueous)	amber G,T	Cool to $\leq 6^{\circ}\text{C}$	14 days 7 days	40 days
8082 (PCBs)	8 oz (soil) 1 L (aqueous)	G,T	Cool to $\leq 6^{\circ}\text{C}$	14 days 7 days	40 days
8260B (Volatile Organic Compounds)	4 oz (soil) 3x40mL (aq)	G,T	Cool to $\leq 6^{\circ}\text{C}$ ; HCl to $\text{pH}<2$	14 days	NA
8270C (Semi-volatile Organic Compounds)	8 oz (soil) 1 L (aqueous)	amber G,T	Cool to $\leq 6^{\circ}\text{C}$	14 days	40 days
8015 (TPH-Gasoline)	4 oz (soil) 3x40 mL (aq)	amber G,T	Cool to $\leq 6^{\circ}\text{C}$ ; HCl to $\text{pH}<2$	14 days	35 days

Analysis	Amount Required	Container	Preservative	Holding Time Until Extraction	Holding Time After Extraction Until Analysis
Mercury, Low Level***					
8015AZ ****	8 oz (soil)	G,T	Cool to $\leq 6$ °C	48 hours	14 days for extraction and analysis
8260BAZ****	4 oz (soil)	G,T	Cool to $\leq 6$ °C	48 hours	NA
8015 (TPH-Diesel Motor Oil)	1 L (aq) 8 oz (soil)	amber G,T	Cool to $\leq 6$ °C: HCl to pH<2	14 days	40 days

\*\*\* Call for sampling and hold time requirements.

\*\*\*\* TPH 8015AZ and 8260AZ (soils) have a 48 hour hold time before extraction.

## 10.1 Sampling Cont'd

Field blanks allow for 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 with analyte-free water and the appropriate preservative 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 also are 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 de-ionized or distilled water and with a small portion of sample. The filtration apparatus should also be rinsed with de-ionized or distilled water between samples. Handle filter paper only on the edge, using appropriate forceps (plastic for trace metals analysis).

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

Sampling personnel should complete a COC 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.

## **10.2 Sample Receiving and Storage**

SOPs SVL 2001, SVL 2003, and SVL 2004 describe sample receiving, job creation, and sample storage, respectively.

SVL takes a temperature reading from the sample shipping containers (coolers) upon receipt and opening. Each sample is checked for visible damage and the presence of an intact custody seal (if required). SVL gives each group of samples a unique job number (e.g., "W8L0202"). This job number remains with the samples throughout the analytical process. Each sample is assigned a unique, sequential identification number. Samples are labeled with a bar code (containing both the sample and job numbers) before storing the sample under the proper preservation requirements.

Samples that require refrigeration are stored in walk-in coolers (which are kept between 0°C and 6°C), except during times of sample preparation or analysis. Samples that do not require refrigeration are stored in an ambient temperature storage room. The laboratory does not refrigerate soil samples that were received without refrigeration. Samples are retained by SVL for a minimum of 30 days (or longer if required by the client) after a data report has been issued to the client. At the end of the specified period, samples are returned to the client or discarded in an appropriate manner (see SOPs SVL 1001 and 1008).

Sample custodians, technicians and analysts use the custody log feature of the LIMS to track sample movement during receipt, preparation, analysis and disposal. SVL personnel are responsible for logging the samples into their custody. They then assume accountability for the sample(s). When use of the sample is complete, personnel must scan samples back into the appropriate home location or another employee may assume custody by scanning/logging the sample into their custody via the LIMS.

## **10.3 Sub-sampling**

Sub-sampling is described in SOP SVL 2018.

## 10.4 Sample Disposal and Hazardous Waste

Procedures for sample disposal are described in SOP SVL 1001. Disposal procedures follow federal and state regulatory requirements. SVL's hazardous waste program is described in SOP SVL 1008.

## 11.0 EQUIPMENT AND INSTRUMENTS

SVL uses the following instruments to generate analytical data and to calibrate other instruments.

**11.1** SVL performs instrument maintenance as recommended by the manufacturer. SVL maintains service contracts with vendors for its major analytical instrumentation. Maintenance logbooks are kept to provide a record of major and minor repairs; as well as, preventative maintenance.

**11.2** The analysts and supervisors will determine if a repair has created a need to update instrument MDLs, linear ranges, calibrations etc.

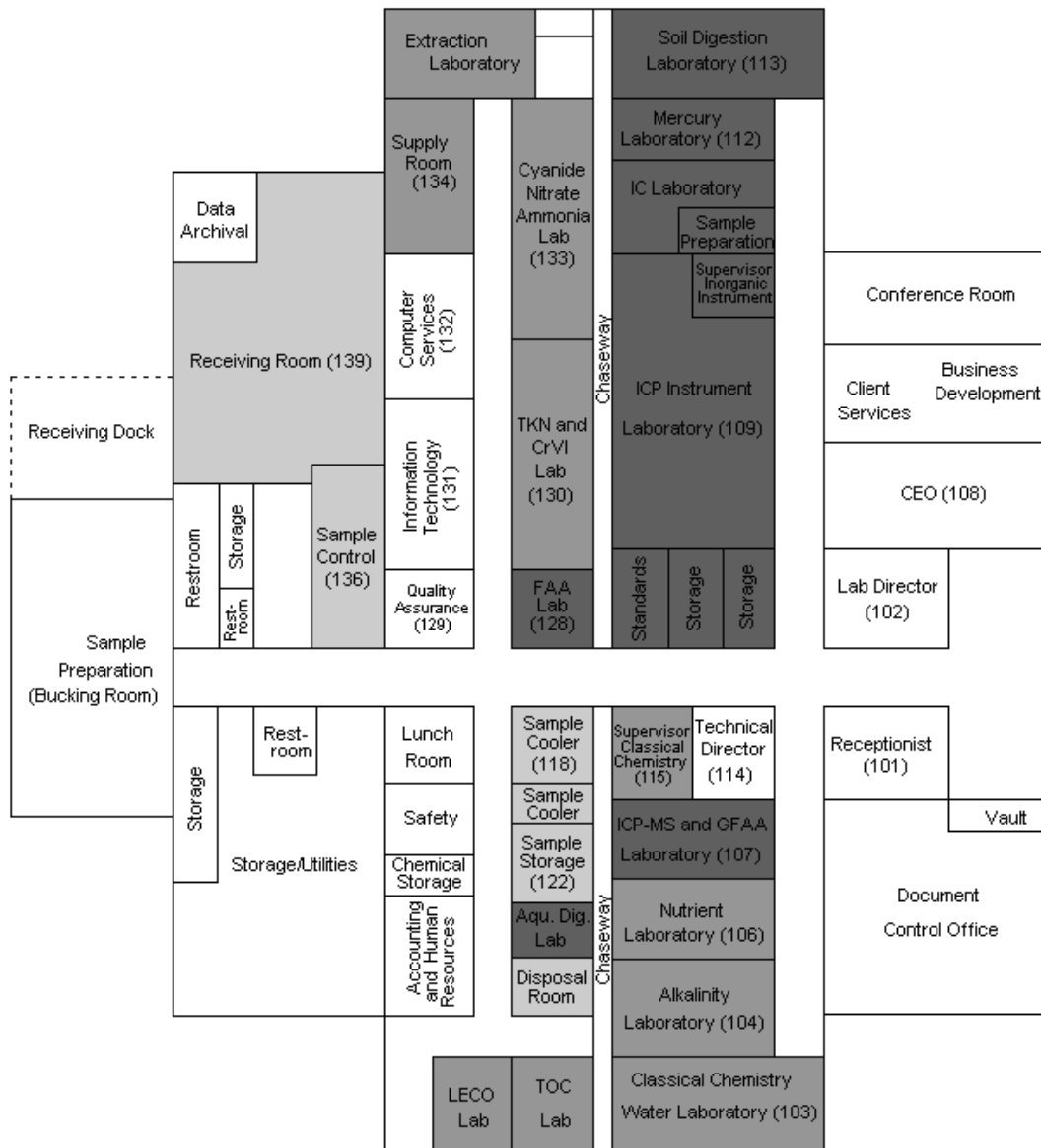
**11.3** In the event that SVL's ICP-MS instrument becomes non-operational, SVL's Technical Director shall contact CLP-SMO for instructions on how to proceed. This situation, should it occur, may require forwarding samples requiring ICP-MS to an alternate CLP contract laboratory.

INSTRUMENT	MANUFACTURER	MODEL	SERIAL NUMBER
Spectrometer (ICP-MS)	Perkin-Elmer	ELAN 5000	W0660402
Spectrometer (ICP) Optima 1	Perkin-Elmer	Optima 4300	077N0061602
Spectrometer (ICP) Optima 5	Perkin-Elmer	Optima 5300	077N5011902
Spectrometer (ICP) Optima 6	Perkin-Elmer	Optima 5300	077N6062101
Spectrometer (ICP) Optima 7	Perkin-Elmer	Optima 5300	077C8011601
<b>Spectrometer (ICP) Optima 8</b>	<b>Perkin-Elmer</b>	<b>Optima 7300</b>	<b>077C9031902</b>
Atomic Absorption Spectrometer with Graphite Furnace	Perkin-Elmer	Analyst 600	601S3090501
Atomic Absorption Spectrometer with Vapor Generation Assembly	Varian	AA 55B	EL03048142
Mercury Analyzer with Autosampler	CETAC	M-6000A	029907MAS
Mercury Analyzer with Autosampler	CETAC	M-7500	110801QTA
11 Digestor Blocks	Environmental Express	Hot Block	
Ion Chromatograph	Dionex	ICS90	4090417
INSTRUMENT	MANUFACTURER	MODEL	SERIAL NUMBER

Ion Chromatograph	Dionex	ICS900	08041118
Ion Chromatograph	Dionex	DX-100	921517
Ion Chromatograph	Dionex	4000i	14421
Automated Flow Analyzer	Alpkem	FS3000	843-1604-758
<b>Automated Flow Analyzer</b>	<b>Astoria Pacific</b>	<b>2-A</b>	<b>200220</b>
<b>Flow Analyzer Autosampler</b>	<b>Astoria Pacific</b>	<b>111</b>	<b>070903A130</b>
2 Micro Distillation Units	Lachat	ID 001	A2000-828 and 081100001017
3 MIDI Distillation Units	BSL		
2 Ammonia Distillation Units	Andrews Glass		
Ammonia/N analyzer	Astoria Pacific	A2	200104
Automated Flow Analyzer	Alpkem	Alpkem TKN	As. # INS0036HW
Block Digestor	Westco Scientific	Easy Digest 40/20	As. # INS0030HW
Auto Titrator with Autosampler	Metrohm	Titrimo 809 Titrimo	
Auto Titrator with Autosampler	Metrohm	Titrimo 809 Titrimo	18090010-07108
UV/Visible Spectrophotometer	Genesys	10	205G261004
UV/Visible Spectrophotometer	Spectronic	501	0283085
Turbidimeter	Hach	2100	95041453
COD Reactor	VELP Scientifica	ECO 25	101448
COD Reactor	Hach	COD	971100016584
pH/Ion Meter	Corning	450	001246
pH/Ion Meter	Corning	150	2173
pH Meter	Accumet	AB15	AB92314557
pH Meter	Beckman		224148
pH Meter	Beckman	11 pH Meter	0224055
pH Meter	Thermo	Orion 2 Star	B06039
pH Meter	Thermo	Orion 320	019525
Dissecting Microscope	Nikon	104	
Polarizing Microscope	Nikon	106	
Centrifuge	Beckman	GS-6 Centrifuge	
Flashpoint detector	Precision Scientific	74537	108A-2
Conductance Meter	Fisher	AB30	AB 92315548
<b>Conductance Meter</b>	<b>Orion</b>	<b>115</b>	<b>002176</b>
Elemental Analyzer	LECO	SC632	3208
Carbon/Nitrogen Analyzer (TOC)	Shimadzu	TOC-VCSH-N	37401162
Semi-Micro Balance	Mettler	AE-240	K89952
Semi-Micro Balance	Mettler	AE-240	G43270
Filter Balance	Mettler	AJ100	N09817
Analytical Balance	Mettler	PJ 360	F89531
Analytical Balance	Mettler	PJ 360	G49684
<b>Analytical Balance</b>	<b>Mettler</b>	<b>PB30</b>	<b>A04506</b>
<b>Analytical Balance</b>	<b>Mettler</b>	<b>PJ360</b>	<b>F39533</b>
Analytical Balance	Mettler	BB 240	L96134
<b>Analytical Balance</b>	<b>Ohaus</b>	<b>EOF110</b>	<b>F2221120252601</b>
<b>INSTRUMENT</b>	<b>MANUFACTURER</b>	<b>MODEL</b>	<b>SERIAL NUMBER</b>
Analytical Balance	Ohaus	AR2140 Adventurer	H2131203121033P

Analytical Balance	Ohaus	AR1530 Adventurer	1203200181P
Analytical Balance	Ohaus	N1D110 Navigator	1122352966
Analytical Balance	Ohaus	AS 513	8028301193
<b>Analytical Balance</b>	<b>Leco</b>	<b>050</b>	<b>329</b>
IR Thermometer	Raytek	Raynger	93660090
<b>IR Thermometer</b>	<b>Control Company</b>	<b>15-077-57</b>	<b>90724477</b>
Thermometer	HBI	68°C to 86°C	4B1321
Thermometer	Ertco	-20°C to 110°C	5283
<b>Thermometer</b>	<b>HB</b>	<b>-10° C to 225°C</b>	<b>K61438</b>

# 12.0 FACILITIES



- Inorganic Instrument Department
- Sample Control
- Classical Chemistry Department
- Administrative, Accounting, QA, Computer, Documents and Other

**12.1** SVL is an analytical laboratory specializing in the performance of tests and methods used in the characterization of environmental and mining samples. Since 1972, SVL has analyzed water, soil, sediment, sludge, oil, paint, rock, animal tissue, vegetation, air filters, and various other sample types. SVL occupies a modern 25,000 square foot laboratory facility architecturally designed and specifically organized to ensure efficient operation and meet the needs of a 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 staff and other essential personnel. Visitors are escorted during their stay at SVL.

### **13.0 STANDARD OPERATING PROCEDURES**

SVL performs work in accordance with the requirements of its SOPs. SVL's SOPs are listed below and describe all aspects of its work performance including Safety and Quality Assurance (1000 Series), Sample and Document Management (2000 Series) and Inorganic Analysis (4000 Series).

<b>SOP NUMBER</b>	<b>DESCRIPTION</b>
SVL 1001	SAMPLE DISPOSAL
SVL 1002	WRITING AND REVISING STANDARD OPERATING PROCEDURES
SVL 1004	CALIBRATING THERMOMETERS
SVL 1005	INTERNAL QUALITY ASSURANCE AUDITS
SVL 1007	SOIL STERILIZATION
SVL 1008	DISPOSAL OF HAZARDOUS WASTE
SVL 1010	TRAINING
SVL 1011	PERFORMING AN MDL STUDY
SVL 1015	PROCUREMENT, RECEIVING, AND SUBCONTRACTING
SVL 1017	RECORDS RETENTION AND PROTECTION
SVL 1019	CORRECTIVE ACTION
SVL 1020	CALIBRATION FOR ANALYTICAL METHODS
SVL 1021	MANUAL INTEGRATION
SVL 1023	SOFTWARE VERIFICATION
SVL 1025	CALIBRATING BALANCES
SVL 1026	CALIBRATING MICROPIPETS, REPIPETTORS, AND GLASSWARE
SVL 1027	CLIENT SERVICES
SVL 1028	CALCULATIONS FOR ANALYTICAL METHODS
SVL 1029	PERFORMANCE TESTING SAMPLES
SVL 1030	INITIAL, PERIODIC AND AFTER-MAINTENANCE CHECKS

<b>SOP NUMBER</b>	<b>DESCRIPTION</b>
SVL 1031	COMPUTER AND INFORMATION SECURITY POLICY
SVL 1032	CHEMICAL REAGENTS, PREPARED STANDARDS, AND QC SOLUTIONS
SVL 1033	ACCEPTANCE LIMITS AND TRENDING
SVL 2001	SAMPLE RECEIVING
SVL 2003	SVL JOB CREATION
SVL 2004	SAMPLE STORAGE AND SECURITY
SVL 2006	DATA CORRECTIONS
SVL 2007	CASE FILE ASSEMBLY
SVL 2007-ILMO5.4	CASE FILE ASSEMBLY ILOM5.4
SVL 2009	DATA REVIEW
SVL 2013	DATA PACKAGE PRODUCTION
SVL 2015	LEVEL 3 – CLP DATA PACKAGE
SVL 2017	LOGBOOK CONTROL
SVL 2018	PREPARATION AND SUBSAMPLING OF EARTH, ROCK, AND TISSUE SAMPLES
SVL 2019	REANALYSIS PROCEDURES
<b>SVL 2020</b>	<b>COMPUTER-RESIDENT SAMPLE DATA CONTROL</b>
<b>SVL 2021</b>	<b>DATA BACKUP AND RESTORE</b>
SVL 4010	DETERMINATION OF MERCURY (CVAA)
SVL 4010-ILMO5.4	DETERMINATION OF MERCURY (CVAA) BY ILMO5.4
SVL 4012	TOTAL CYANIDE BY MIDI DISTILLATION FOLLOWED BY AUTOMATED COLORIMETRY
SVL 4012-ILMO5.4	TOTAL CYANIDE BY MIDI DISTILLATION FOLLOWED BY ILMO5.4
SVL 4013	GLASSWARE WASHING FOR CLASSICAL CHEMISTRY AND TRACE METALS
SVL 4021	FILTER DIGESTION
SVL 4022	PERCENT SOLIDS/PERCENT MOISTURE
SVL 4024	COLOR
SVL 4025	CONDUCTIVITY
SVL 4026	TURBIDITY (METHOD 180.1)
SVL 4028	PH
SVL 4029	SPECIFIC GRAVITY
SVL 4031	ACIDITY
SVL 4032	SULFIDES BY TITRATION
SVL 4034	TOTAL DISSOLVED SOLIDS AND SUSPENDED SOLIDS
SVL 4035	TOTAL AND VOLATILE SOLIDS
SVL 4037	METHYLENE BLUE ACTIVE SUBSTANCES
SVL 4040	TOTAL PHOSPHORUS (AQUEOUS SAMPLES)
SVL 4042	ORTHO-PHOSPHATE (AS P)

<b>SOP NUMBER</b>	<b>DESCRIPTION</b>
SVL 4043	CHEMICAL OXYGEN DEMAND
SVL 4044	TOTAL ORGANIC MATTER
SVL 4045	TOTAL KJELDAHL NITROGEN
SVL 4048	NITRATE/NITRITE AS N: AUTOMATED CADMIUM RE REDUCTION
SVL 4049	CATION EXCHANGE CAPACITY BY METHOD 9081
SVL 4056	FREE CYANIDE BY METHOD 4500-CN F
SVL 4060	LOSS ON IGNITION (SVL METHOD)
SVL 4061	DETERMINATION OF ACID GENERATING POTENTIAL (AGP), ACID NEUTRALIZATION POTENTIAL (ANP), AND ACID BASE ACCOUNTING (ABA)
SVL 4065	METEORIC WATER MOBILITY EXTRACTION
SVL 4068	SYNTHETIC PRECIPITATION LEACHING PROCEDURE (SPLP)
SVL 4070	TOTAL SUSPENDED PARTICULATES
SVL 4075	WAD CYANIDE BY MIDI DISTILLATION FOLLOWED BY SEMI-AUTOMATED COLORIMETRY
SVL 4078	SAMPLE DIGESTION FOR TOTAL METALS IN AQUEOUS SAMPLES FOR ICP-MS (EPA METHOD 3020A)
SVL 4079	SAMPLE DIGESTION FOR TOTAL METALS IN AQUEOUS SAMPLES FOR ICP (3010A)
SVL 4080	SAMPLE DIGESTION FOR TOTAL RECOVERABLE METALS IN AQUEOUS SAMPLES FOR ICP (3005A)
SVL 4082	ARSENIC SPECIATION (ASIII AND ASV)
SVL 4084	DETERMINATION OF ALKALINITY AND pH USING THE AUTOTITRATOR
SVL 4093	CASSETTE FILTER DIGESTION
SVL 4094	SAMPLE DIGESTION FOR METALS IN SOILS (EPA METHOD 3050B)
SVL 4095	FLASHPOINT PENSKY-MARTENS CLOSED TESTER
SVL 4096	pH DETERMINATION FOR SOILS AND PASTE
SVL 4097	TOTAL SULFUR, TOTAL CARBON
SVL 4099	AMMONIA BY SEMI-AUTOMATED COLORIMETRY
SVL 4101	ANALYSIS OF AVAILABLE CYANIDE BY FLOW INJECTION AND AMPEROMETRY (METHOD 1677)
SVL 4102	ANALYSIS OF METALS BY METHODS 6010B AND 200.7 USING THE PERKIN-ELM OPTIMA ICP
SVL 4102-ILMO5.4	ANALYSIS OF METALS BY ILMO5.4 USING THE PERKIN-ELM OPTIMA ICP
SVL 4105	SELENIUM BY HYDRIDE
SVL 4106	SAMPLE DIGESTION FOR TOTAL RECOVERABLE METALS IN AQUEOUS SAMPLES BY ICP (200.2)
SVL 4107	SAMPLE DIGESTION FOR TOTAL METALS IN AQUEOUS SAMPLES BY ICP AND GFAA (40CFR136 APPENDIX C 9.3)
SVL 4108	SAMPLE PREPARATION FOR ANALYSIS OF DIRECT ANALYSIS, DRINKING WATER, DISSOLVED AND POTENTIALLY DISSOLVED METALS IN AQUAEIOUS SAMPLES
SVL 4111	ANALYSIS OF METALS BY ICPMS (METHOD 200.8)
SVL 4111-ILMO5.4	ANALYSIS OF METALS BY ICPMS (METHOD 200.8) BY ILMO5.4

SVL 4112	ANALYSIS OF METALS BY ICPMS (METHOD 6020)
<b>SOP NUMBER</b>	<b>DESCRIPTION</b>
SVL 4114	TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP)
SVL 4116	TOTAL ORGANIC CARBON
SVL 4118	CALIFORNIA WASTE EXTRACTION TEST (CA-WET)
SVL 4119	PREPARATION OF QC SOLUTIONS FOR METALS ANALYSIS
SVL 4120	TOTAL NITROGEN
SVL 4121	DETERMINATION OF THRESHOLD ODOR NUMBER (TON) SM 2150B
SVL 4122	INORGANIC ANIONS BY CHROMATOGRAPHY USING THE DIONEX DX 100 , ICS-90 AND ICS-900
SVL 4123	ASTM D-2795 AND D-3682-78 SOLID SILICA
SVL 4124	OPERATION OF PERKIN/ELMER GFAA: ANALYSIS OF GOLD BY GRAPHITE FURNACE
SVL 4125	SM 3500 Cr B and D; HEXAVALENT CHROMIUM

### 13.1 Deviations

Occasionally, a deviation from an SOP is required to generate an accurate result for a given test or client. This may occur when a client specifically requires a modification, or when the sample matrix interferes with the analysis. The Laboratory Director or a Department Supervisor may authorize a deviation. The analyst documents details of the deviation from the SOP on the instrument raw data printout or the job bench sheet with a notation in the work order memo in Element.

## 14.0 QUALITY CONTROL

### 14.1 Quality Control Parameters

SVL uses a number of quality control parameters to validate calibration, and to measure contamination, accuracy, and precision. Each SVL SOP defines the parameters required for the method being used.

#### 14.1.1 Blanks

**Method Blank** Is an aliquot of analyte-free water that is put through all the steps of a specific method along with the samples. It is sometimes called a Laboratory Reagent Blank.

**Calibration Blank** The zero-concentration standard analyzed as part of a calibration curve.

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

**Trip Blank** Is a specific type of field blank. A trip blank is not opened in the field. It is a check on sample contamination from the time the container is sealed at the lab or supplier. It is used to verify the container's integrity during sample transport and the container's time on site (it should always be with sampling group).

The acceptance criterion for a blank may be set by the published method, by client Data Quality Objectives (DQOs), or by historical statistics. In the absence of these directives, the acceptance criterion may default to less than the reporting limit.

#### **14.1.2 Matrix Spike**

Is an aliquot of sample to which a known amount of analyte has been added prior to sample preparation or digestion. It is a measure of the effect of the sample matrix on the analytical method. It is sometimes called the "Laboratory Fortified Matrix".

The recovery is calculated by:

$$\% \text{ Recovery} = 100 \times (MS - S) / SA$$

Where the MS = Spiked Sample Result

S = Sample Result

SA = Spike Added

Acceptance criteria for the matrix spike recovery may be determined by the published method, by client DQOs, or set between 70-80 to 120-130%. For those methods without guidelines the QA Manager will set default limits for the acceptance range. Individual SOPs will have the recovery range acceptance requirements. There are no requirements if the concentration of the analyte in the original sample is greater than five times the concentration of the spike.

#### **14.1.3 Analytical Spike or Post-Digestion Spike**

Is an aliquot of sample to which a known amount of analyte has been added after sample preparation. It is a measure of the effect of the matrix on a digestate or extract.

#### **14.1.4 Laboratory Control Sample (LCS)**

Is a solution or material of known concentration that is added to an analyte free matrix and then analyzed to evaluate the recovery and accuracy of a method. It is sometimes called a Laboratory Fortified Blank.

Acceptance criteria for the LCS recovery may be determined by the published method, by the manufacturer of the standard, by client DQOs or the QA Manager will set default limits.

#### **14.1.5 Sample Duplicate**

A second similar aliquot of a sample treated exactly the same through preparation and analysis. The Relative Percent Difference (RPD) between the values of the duplicates is a measure of the precision of the analytical method.

$$RPD = 100 \times | S - D | / [(S + D)/2]$$

The acceptance criterion for the RPD is usually set at 20%, if the concentration in the sample is greater than five times the reporting limit. There is no acceptance criterion if the sample concentration is less than five times the reporting limit.

#### **14.1.6 Matrix Spike Duplicate (MSD)**

A second similar aliquot that is spiked, it is treated exactly the same as the first matrix spike (MS) through preparation and analysis. The RPD between the recovery values is a measure of the precision of the analytical method.

$$RPD = 100 \times | MSD - MS | / [(MSD + MS) / 2]$$

#### **14.1.7 Interference Check Sample (ICS)**

A sample with known concentrations of elements used to determine if the inter-element correction factors are valid.

#### **14.1.8 Initial Calibration Verification (ICV)**

A standard made from a second source from the calibration standards. It is analyzed immediately after the calibration to determine the validity of the calibration standards.

#### **14.1.9 Continuing Calibration Verification (CCV)**

A calibration standard (primary or secondary source) analyzed after every ten samples, and at the end of an analytical sequence to verify that the calibration is still valid.

#### **14.1.10 Reporting Limit Check Sample (RLCS)**

A check standard that is constructed out of either a primary or secondary source made up at same concentration as the reporting limit. An acceptance range of +/- 30% for single analyte methods and +/- 50% for multi-analyte methods was made the default. RLCS results are batched as a Standard Reference Material (SRM) which can be pulled into Element for control charting purposes.

#### **14.1.11 Initial Calibration Blank (ICB)**

A matrix matched deionized water sample ran to prove the system is clean with no carry-over.

#### **14.1.12 Continuing Calibration Blank (CCB)**

A matrix matched deionized water sample ran to prove the system is clean with no carry-over.

#### **14.1.13 Serial Dilution**

**Dilute a sample by a minimum of five fold (1+4). Agreement within 10% between the concentration for the undiluted sample and five times the concentration for the diluted sample indicates the absence of interferences.**

### **14.2 Control Charts**

SVL utilizes Element, to provide its personnel with the up to the minute ability to trend inputted QC results. It is recommended that analysts and technicians regularly consult trending charts to provide themselves with real time information. By trending an analysis, the analyst or technician can look at a current or past snapshot of QC recoveries and possibly determine when prep procedures or QC samples were done incorrectly or used contaminated or expired components. Trending can also be used to show when an instrument's components begin to degrade or fail.

The process is defined in SOP SVL 1033. RLCs, prep blanks, LCSs, duplicates and matrix spikes are tracked. A standard X bar control chart is used to plot 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 fewer than 20 measurements in a 6 month period. Method defaults are used when not enough points are generated during a 6 month period.

### **14.3 Acceptance Limits**

Acceptance limits for quality control parameter recoveries may be set by published analytical methods, DQOs or be default limits set by the QA Manager. Individual SOPs will provide the accepted recoveries for each method. Acceptance limits are also outlined in SOP SVL 1033.

### **14.4 General Frequency of Quality Control Checks**

For those methods that do not have published QC requirements, SVL will use the following QC and frequency if applicable per batch of 20 samples:

Initial Calibration Verification once per calibration.

Initial Calibration Blank once per calibration.

Reporting Limit Check Standards at a frequency of 1 per analytical run.

Method or Instrument Blanks at a frequency of 5%.

Laboratory Fortified Blank or LCS at a frequency of 5%.

Duplicates at a frequency of 10%.

Matrix Fortified Samples at a frequency of 10%.

Continuing Calibration Verification every ten samples.

Continuing Calibration Blank every ten samples.

### **14.5 Uncertainty of Measurement**

SVL uses control charting as a means of determining when selected parameters are out of control. Warning and unacceptable control limits are defined at 2 and 3 sigma, respectively. See 14.2 and SOP SVL 1033.

Almost all approved methods used at SVL contain a section related to precision and bias. Random uncertainties that are systemic cannot be determined statistically and can only be estimated by a trained analyst. Uncertainty represents a bias associated with analytical measurements. The presence and magnitude of bias can be determined by assessment of SVL's control sample results.

SVL reports out data to 3 significant numbers, with the number of decimal places determined by the sensitivity of the method.

## **15.0 CORRECTIVE ACTION**

The SVL Corrective Action Program is defined in SOP SVL 1019.

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 (CAR) to support the quality system. Typical reasons are the need for an SOP revision, overdue MDL study, overdue training, incorrect data reduction or review, improper instrument calibration, or use of an incorrect analytical method.

If there is a non-acceptable result in a Performance Test Sample, the QAM documents the failure as a CAR and works with the analysts and supervisors to discover the root cause. If there are findings from an internal or external audit, the QAM issues a CAR to appropriate staff members so they can prepare a corrective action plan.

### **15.1 Preventative Action**

A "preventative action" is a pro-active process for dealing with a problem before it happens. It is taken to eliminate the cause of an undesirable situation in order to prevent its occurrence rather than a reaction to the identification of a problem or nonconformity. These actions are taken to reduce the probability that a potential problem will occur. They may also include contingencies to reduce the seriousness should a future problem occur. Subjects for "preventative action" may be implemented to address a weakness in the quality system that is not yet causing nonconformities and can be initiated internally or externally

(client complaints). The focus for preventative actions should be to avoid creating nonconformities, but may also lead to improved laboratory efficiencies.

SVL uses the CAR template to document ideas, plans or actions whether developed internally or externally. These reports are audited at a future date to ensure that the changes sought have been implemented and are effective.

## **16.0 COMPLAINTS**

The Client Services Department strives to resolve all complaints from clients regarding analytical reports or service. Client Services contacts the appropriate Director, or Department Supervisor to investigate and resolve issues. Actions may include reanalysis of samples, explanations surrounding technical issues or lab procedures.

**16.1** Reanalysis, whether requested by a client or SVL personnel must have justification. The reasoning behind the justification requirement is to provide a baseline level under which the reanalysis can be compared and to provide a means of tracking quality within the lab. Reanalysis performed in order to “result hunt” is not conducted by SVL, but re-analysis performed to confirm a possible error on the part of SVL or by any of the sample custodians listed on the chain of custody is valid. SVL will report out both values for a re-analysis if the sample results are scientifically indistinguishable and the client requests the new result or another report, such data will be accompanied by a case narrative or data qualifier. SVL will issue a corrected report with only the re-analysis values if it can be determined that an error has occurred on the part of SVL (when this occurs a CAR must be generated). Re-analysis requested on a method that has multiple analytes shall result in the sample being re-analyzed for all of the analytes originally requested (the other analytes may not be re-reported if it is shown that they are scientifically indistinguishable from one another). Work Order memos will be established when a client requests a reanalysis and may be updated throughout the reanalysis. Case narratives will be written up to explain any discrepancies between the original test and any re-analysis conducted. Samples that are re-analyzed in-house will have the reason for the request clearly identified on the re-analysis request form. Whether internal or external, the re-analysis request form must be filled out completely to assist with historical data re-construction and to assist in writing up case narratives or CARs. See SOP SVL 2019.

## **17.0 TRAINING**

SVL conducts annual training in legal and ethical responsibilities for all staff members. SVL provides training sessions that are developed in order to provide staff members with tools in an ever changing environment. New employees will be given various types of training as soon as possible after their hire date.

SVL Management and Supervisors train staff members in laboratory safety. At a minimum this consists of an annual review of the Chemical Hygiene Plan. It also includes seminars on important safety issues throughout the year.

Staff members also receive training in the quality system and QM. At a minimum this consists of an annual review of the QM.

Department Supervisors ensure that staff is adequately trained to perform the analyses assigned to them. The process is defined in SOP SVL 1010. Training includes, as appropriate, quality control requirements, instrument operation, instrument maintenance, software operation, reading the published method, reading the applicable SVL SOPs, successful analysis of a performance evaluation sample, and completion of the Initial Demonstration of Capability (IDOC). When an IDOC is not defined by the analytical method, the QAM will create default criteria outlined in the training summary forms and included in the personnel files.. Upon completion of training, a Demonstration of Capabilities Certificate is placed within their personal file.

SVL Management defines the required elements for training for analytical methods. A Supervisor or a fully trained analyst provides training, when possible. If no fully trained analyst exists, an analyst may learn a new analysis by reading the appropriate method and instrument manual, then performing an IDOC.

During the training period, an analyst may produce data for clients under the supervision of a fully trained analyst. The Department Supervisor or a fully trained analyst must review and sign all trainee work produced.

**17.1** To document continued proficiency, an analyst must perform one of the following tasks annually:

**17.1.1** Successfully analyze a blind performance sample.

**17.1.2** Complete another IDOC.

**17.1.3** Successfully analyze a blank and four separately prepared LCSs.

- 17.2** Analysts and technicians who do not successfully complete a DOC within a year must complete an IDOC before being re-certified for a method.

## **18.0 ETHICS AND CONFIDENTIALITY**

- 18.1** SVL is committed to providing its clients with accurate and defensible data and meeting all client requirements for data quality and integrity. To achieve our commitment, and as a condition for employment with SVL, all employees agree to follow SVL's policy regarding ethics and data integrity characterized but not limited to the items listed below.
- 18.1.1** All reported data, including dates and times, shall represent actual values obtained and are not modified or manipulated in any manner for which allowances have not been made for in the referenced method.
  - 18.1.2** There will be no misrepresentation of another analyst's identity.
  - 18.1.3** Altering the contents of logbooks and/or data sheets to misrepresent data is prohibited.
  - 18.1.4** Altering any operating procedures or QC to make data "fit" is prohibited.
  - 18.1.5** Failing to comply with SOPs without proper documentation and approval from the Laboratory Director and/or QAM is prohibited.
  - 18.1.6** Any attempt to misrepresent data or events as they actually occur in the course of data production, review or reporting is prohibited.
  - 18.1.7** Deleting files, whether electronic or hard copy of raw data that was used in a reported value is prohibited.
  - 18.1.8** Engaging or being a party to any practice that ultimately misrepresents data or narratives in any way is prohibited.
- 18.2** SVL has established a zero-tolerance policy for improper, unethical, or illegal activities. Improper actions are defined as unapproved deviations from contract-specific or method-specific analytical practices. They may be intentional or unintentional. Unethical or illegal actions are defined as the deliberate falsification of analytical or quality assurance results where failed method or contractual requirements are made to appear acceptable. Some examples of improper, unethical, or illegal practices are listed below:
- 18.2.1** Improper use of manual integrations to meet calibration or method quality control criteria.
  - 18.2.2** Intentional misrepresentation of the date or time of analysis.

**18.2.3** Falsification of results to meet method requirements.

**18.2.4** Reporting results without analysis.

**18.2.5** Selective exclusion of data to meet quality control criteria (dropping calibration points).

**18.2.6** Unwarranted manipulation of computer software.

**18.2.7** Improper alteration of analytical conditions (changing voltages or run times).

**18.2.8** Misrepresentation of quality control samples (not preparing them as samples).

**18.2.9** Intentionally reporting results from one sample for those of another.

**18.2.10** Reporting calibration or quality control data not linked to the reported samples.

## **19.0 DATA REVIEW**

SVL uses a three-tier system for data review via the LIMS system. The first level is conducted by the analyst, the second level by a peer or supervisor, the third by a signatory, DCO, Technical Director or the Laboratory Director. Reviews take place upon the review of raw data or within the LIMS system (which uses a system of locks to assure data is secure from accidental corruption). The process is governed by SOP SVL 2009.

In the case that erroneous data does leave the lab, the Laboratory Director or Client Services will contact the affected clients as soon as all of the facts are available. SVL will work with the clients in seeking a new or alternative strategy to meet the client's needs.

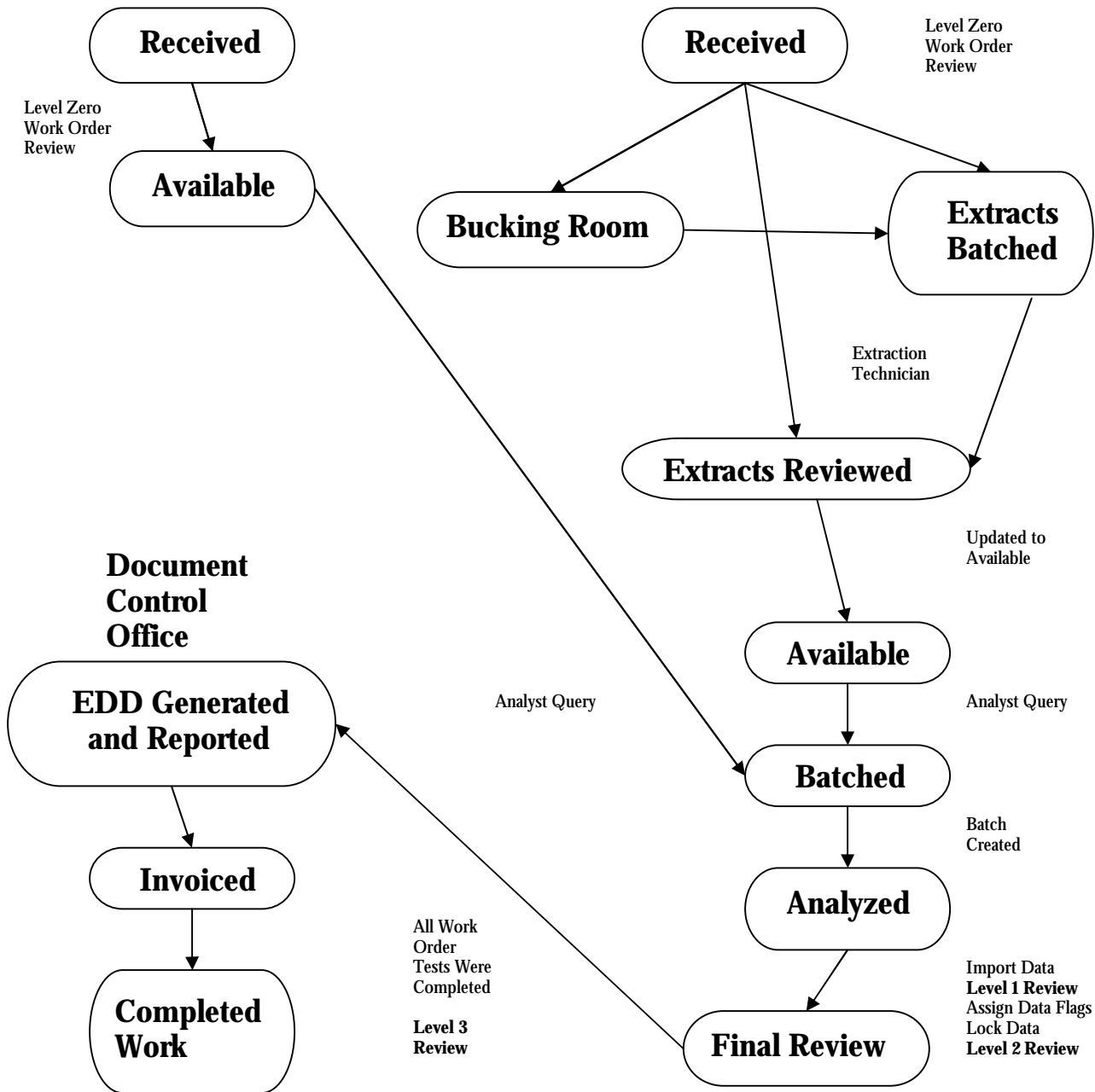
### **19.1 Data Review Flow Chart**

**Work Order Status**

**Analysis Status**

Samples are logged in, tests assigned and updated to "Available"

Samples that need extraction before they can be updated to "Available"



## **20.0 REPORTING**

SVL has a single standard report format for nearly all results (SVL\_Sample) generated by Element. This includes a case narrative, sample report and QC report.

Reports are also available in a number of routine and custom hardcopy formats. Electronic Data Deliverables (EDD) can be provided 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 with their preferred format.

Data that will be used to create EPA CLP-like deliverable packages may be done in Element or can be loaded into a third party data review and reporting system MARRS that will generate the forms required to complete a data package. SVL has the capability of providing a hardcopy and EDD format. EDDs are available in standard EPA CLP formats, as well as popular spreadsheet and database files.

## **21.0 AUDITS**

### **21.1 Performance Testing Program**

SVL participates in two WS, two SOIL, and two WP Performance Testing (PT) Studies each year. SVL uses the second WP Study to meet the DMRQA requirements of our clients. The PT samples are logged in as single-blinds and ran as if they were normal samples in all aspects.

### **21.2 Internal System Audits**

The QAM conducts a minimum of one internal system audit per year. The audit provides an overview of the implementation of procedures and policies set forth in the laboratory's Quality Manual and SOPs; ref, SOP SVL 1005. System audits (that may be limited in scope) may be undertaken at any time in response to external audits, CARs, or at the request of the Laboratory Director.

The QAM prepares an internal audit plan based on information garnered from previous audits both internal and external, CARs, method changes, new instrumentation and requests or complaints from clients. The internal audit plan may define participating auditors, any applicable documents, the audit schedule, and scope of laboratory activities to be

audited. The QAM may use written checklists and/or quizzes to assess the analyst's knowledge of the QM, methods and current SVL SOPs.

The QAM will interview the analyst(s) and conduct reviews of records, logbooks, and data packages.

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

The QAM will deliver the report to the President, Laboratory Director and Technical Director. After review the report will be released to all of the parties involved. The report will contain at a minimum the following parameters: Date and location of the audit, personnel involved in the audit, laboratory operations audited, any minor or major findings that require corrective action (major findings require the issuance of a CAR) and the auditor's summation.

### **21.3 Data Audits**

The QAM performs a data audit of several data packages each year. Data audits can also be triggered by audits, CARs or requests from the Laboratory Director. The purpose behind the data audits is to alert the QAM to any errors, chronic problems or trends that may be developing.

## **22.0 MANAGEMENT REVIEW**

The Management of SVL conducts a review of the adequacy of the quality system and QM annually. The reviews takes into account reports from supervisory personnel, recent internal audits, external audits, the results of PT samples, changes to the volume or type of work undertaken, feedback from clients, and CARs. Conclusions reached are then incorporated into any revisions to the QM and in improvements in laboratory operations.

## **23.0 SUBCONTRACTING AND PURCHASING**

Prior to subcontracting work to another laboratory, the Laboratory Director or Client Services ensures that the subcontracted laboratory is NELAP accredited, or is certified by the appropriate state, for the tests being subcontracted. Management also verifies that the laboratory has an active Quality Assurance Program (QAP) that meets SVL's and the client's DQOs. This may be accomplished by obtaining a copy of the subcontracting laboratory's QAP, or

equivalent document. The Laboratory Director or Client Services advises the client that the work is being subcontracted.

SVL ensures that purchase orders contain the required technical and quality specifications prior to release. If a catalog specifies technical and quality criteria (like the grade or purity), reference to a catalog number is deemed satisfactory.

SVL tests reagents and standards prior to analyzing samples and reporting data. New reagents will be used in Method Blank and LCS preparations; if the QC requirements are met then those reagents are deemed to be acceptable. Standards will be diluted so as to fit into the current linear range of the instrument; they will be accompanied by a Method Blank and LCS to ensure that the standard is of sufficient quality and passes the grade and purity criteria as put forth by the manufacturer (SOP SVL 1015).

## **24.0 TRANSFER OF ANALYTICAL REPORTS, RECORDS and SAMPLES**

In the event that SVL Analytical, Inc. (SVL) goes out of business or there occurs a transfer of ownership, the following plans will apply.

All current clients and past clients going back 5 years, longer if bound by contract, will be contacted by registered mail, return receipt requested, at their current or last known address, and made aware of the permanent closure or transfer of ownership of SVL.

Clients will be requested to respond in writing by return mail, fax or email within 10 business days with the instructions as to the final disposition (in the case of closure) or as to how they wish to proceed with the new ownership concerning their reports, records and/or samples, including work that is in progress.

Options for the client may include complete transfer of all reports, records and samples to their business location, or, complete destruction of all documents and samples. SVL does not take ownership of client samples at any time or under any circumstances, and title to all reports, records and samples resides with the client. SVL will not be responsible for disposal of hazardous materials.

Methods of reports and records transfer may be by hard copy purge file, hard copy reports only, or by electronic data deliverables (EDD) for all data accessible and stored in SVL's database. No customized EDDs will be available.

Should a client decide to stay with the new ownership, any business relationship between the two parties will constitute a new relationship independent of any involvement by SVL. The maintenance of reports and records, and the completion of the work in progress (but not completed by SVL) shall be under the sole control of the new owner. SVL will be relinquished from any and all responsibilities concerning the business relationship between the parties.

## 25.0 GLOSSARY

**Acceptance Criteria:** Specified limits placed upon characteristics of an item, process, or service defined in required documents.

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

**Aliquot:** A portion of a sample.

**Analytical Spike:** An aliquot of sample to which a known amount of analyte has been added after sample preparation. It is a measure of the effect of the matrix of a digest or extract. It is sometimes known as a post-digestion spike.

**Batch:** Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same reagents. For SVL's purposes not to exceed more than 20 samples.

**Bias:** A systematic error inherent in a method or caused by some idiosyncrasy of the measurement system. Temperature effects, extraction efficiencies, contamination, mechanical losses, and calibration errors create bias. Bias may be either positive or negative.

**Blank:** An artificial sample designed to monitor the introduction of contamination into the process. For aqueous samples, reagent water is used as a blank matrix.

**Calibration Blank:** See Section 14.0 Quality Control.

**Contract Laboratory Program (CLP):** EPA program defined by a Statement of Work (SOW). SVL is currently operating under ILMO5.4, all definitions relating to the program can be found in the SOW.

**Method Blank:** See Section 14.0 Quality Control.

**Field Blank:** See Section 14.0 Quality Control.

**Trip Blank:** See Section 14.0 Quality Control.

**Blind Sample:** A sample submitted for analysis whose concentration is unknown to the analyst.

**Calibration:** Comparison of an instrument response with a standard or a certified instrument. Commonly it is performed with a set of known standards plotted versus a response.

**Completeness:** The percentage of measurements that meet quality control acceptance criteria for requested determinations. Percentage completeness is defined by client DQOs.

**Continuing Calibration Verification (CCV):** See Section 14.0 Quality Control.

**Continuing Calibration Blank (CCB):** See Section 14.0 Quality 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.

**Custody Log:** A system for tracking samples from the time they enter the lab until a final report is generated.

**Dissolved Analytes:** An aqueous sample that has been passed through a 45  $\mu\text{m}$  filter. The filtered portion is then run for dissolved analysis.

**Double Blind Sample:** A sample known by the submitter but submitted to an analyst in such a way that its identification as a check sample is unknown.

**Duplicate Sample:** See Section 14.0 Quality Control.

**Homogeneity:** The degree to which a property or substance is evenly distributed throughout a material.

**Initial Calibration Verification (ICV):** See Section 14.0 Quality Control.

**Instrument Detection Limit (IDL):** The smallest concentration detectable on a specific instrument. It is statistically determined by analysis of at least seven replicates of a blank that has not been digested.

**Interference Check Sample (ICS):** A sample with known concentrations of elements used to determine if the inter-element correction factors of the ICP are accurate.

**Internal Standard:** Pure analyte(s) added to a sample, extract, or standard solution in known amount(s) and used to measure the relative responses of other method analytes that are components of the same sample or solution. The internal standard must be an analyte that is not in the sample.

**Initial Calibration Blank (ICB):** See Section 14.0 Quality Control.

**Instrument Performance Check (IPC) Solution:** A solution of method analytes, used to evaluate the performance of the instrument system with respect to a defined set of method criteria. The CCV or LCS may fit this criteria.

**Laboratory Control Sample (LCS):** See Section 14.0 Quality Control.

**Laboratory Fortified Blank (LFB):** Another term for a laboratory control sample.

**Laboratory Fortified Matrix (LFM):** Another term for a matrix spike.

**Laboratory Reagent Blank (LRB):** Another term for a method blank.

**Limit(s) of Detection (LOD):** A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility.

**Limit(s) of Quantitation (LOQ):** The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence.

**Linear Calibration Range (LCR):** The concentration range over which the instrument response to analyte is linear.

**Linear Dynamic Range (LDR):** The concentration range over which the instrument response to analyte is linear.

**Material Safety Data Sheet:** Written information provided by vendors concerning a chemical's toxicity, health hazards, physical properties, fire and reactivity data including storage, spill and handling precautions.

**Matrix:** The substrate of a test sample.

**Matrix Spike (MS):** See Section 14.0 Quality Control.

**Matrix Spike Duplicate (MSD):** See Section 14.0 Quality Control.

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

**Method:** A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order they are to be performed.

**Method of Standard Addition:** Is commonly used to determine the concentration of an analyte that is a complex matrix. The matrix may contain other components that interfere with the analytical signal causing inaccuracy in the determined concentration. Known concentrations are added to a volume of sample to develop a curve based upon the interferences from that sample, so that a reliable concentration can be derived for the sample.

**Method Detection Limit (MDL):** The smallest concentration detectable on an instrument with 99% certainty by a specific method. It is statistically determined by analysis of seven replicates of a low-level standard, prepared in the same way as a sample.

**Performance Test (PT) Sample:** A sample, the composition of which is unknown to the laboratory and is provided to test whether the laboratory can produce analytical results within the specified acceptance criteria.

**Precision:** The degree of agreement of independent measurements under specified conditions.

**Quality Assurance:** A system of activities used to ensure defined standards of quality.

**Quality Control:** A system for verifying and maintaining the desired level of accuracy and precision of an analytical method.

**Quality Control Sample (QCS):** A solution of method analytes of known concentrations which is used to fortify an aliquot of LRB or sample matrix. The QCS is prepared from a secondary source. The ICV fits this criteria.

**Relative Standard Deviation (%RSD):** The Standard Deviation divided by the Mean and multiplied by 100.

**Reporting Limit (RL):** The smallest concentration usually reported for an analyte. It is usually at least three times the Method Detection Limit.

**Reporting Limit Check Standard (RLCS):** See Section 14.0 Quality Control.

**Serial Dilution:** See Section 14.0 Quality Control.

**Standard Operating Procedure (SOP):** A written procedure that defines a laboratory operation or analytical method.

**Sub-sample:** A portion taken from a sample.

**Standard Deviation:** Is the positive square root of the variance. A measure of the average spread around the mean.

**Total Metals:** Follow the digestive method outlined in 40 CFR 136 Appendix C Section 9.3. Results are reported as “total metals”.

**Total Recoverable Metals:** Follow the digestive method outlined in 40 CFR 136 Appendix C Section 9.4. Results are reported as “total metals”. This is SVL’s default total metals method unless both total and total recoverable metals are requested.

**Traceability:** The ability to trace the history, application, or location of an entity (e.g., standard, reagent, sample). SVL tracks the entities from the moment it enters the premises until the time it is disposed of.

**Tuning Solution:** A solution which is used to correct instrument performance prior to calibration and sample analysis.

**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:

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

Ordinarily, only its estimate  $s^2$  can be known.

$$s^2 = \frac{\sum (x_1 - \bar{x})^2}{n - 1}$$

## 25.0 CERTIFICATIONS

**SVL maintains certification for analysis of drinking water in the following states:**

Arizona

California  
Colorado  
Idaho  
Nevada  
Washington  
Wyoming

**SVL maintains certification for analysis of environmental samples in the following states:**

Arizona  
California  
Nevada  
Washington

**NELAC Certification Awarded – Primary Accreditation Florida**

**25.1** Copies of the Scopes of Accreditation can be located at [www.svl.net](http://www.svl.net) .

# WAYNE R. SORENSEN

## PROFESSIONAL EXPERIENCE:

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

President / CEO - Administers company policies and formulates business strategies.

### **SVL Analytical, Inc. - Kellogg, ID 1987-1991**

Laboratory Director: Responsible for all analytical and operational activities of the laboratory; supervised personnel.

### **SVL Analytical, Inc. - Kellogg, ID 1973-1987**

Analytical Chemist: Analyzed soils and water for metals by flame atomic absorption and graphite furnace (7000 methods), for mercury by cold vapor atomic absorption (methods 7470 and 7471); for cyanide (method 9012), fluoride (method 340.2), phosphate (method 365.2), pH (method 150.1), turbidity (method 180.1), and conductivity (120.1); analyzed soils and house dusts for lead, arsenic, cadmium; analyzed hi-vol filters for metals by flame atomic absorption; performed baseline study analyses for permitting mine sites; conducted analysis for Remedial Investigation and Feasibility Study for Bunker Hill Superfund Site..

### **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

John R. Kern

## **PROFESSIONAL EXPERIENCE:**

### **SVL Analytical, Inc. - Kellogg, ID October 2007 - present**

**Laboratory Director:** Manage and direct the activities of the laboratory; establish ethical norms; evaluates personnel performance; conduct QA/QC reviews of incoming work and completed reports; work with the QA Manager to evaluate compliance with SOPs and methods.

### **P3 Scientific - Oakdale, MN September 2005 - April 2007**

**Laboratory Manager – Chemistry:** Management and operation of a laboratory at a cGMP/GLP compliant CRC providing analytical (organic and inorganic analysis) and microbial services to the chemical industry.

### **Arena Pharmaceuticals, - Inc. San Diego, CA January 2003 - August 2005**

**Associate Director, Analytical Chemistry – Pharmaceutical Development:** Direct the analytical chemistry laboratory within the pharmaceutical development unit at a start-up biotech/pharmaceutical company.

### **LC Resources - McMinnville, OR 1991 - 2003**

**Laboratory Director:** Started and built up a contract research laboratory specializing in HPLC and LC/MS/MS services for the pharmaceutical and chemical industries. Oversaw the growth of the lab from 2 to 20 employees, with annual sales of over 3 million. Directly responsible for the day-to-day operation of the lab including project management, experimental design, preparation of proposals, client interface, contracts, budget, oversight of QA and QC departments, SOP and protocol preparation. This position involved extensive interaction with major pharmaceutical companies in negotiating contracts, planned studies, allocating resources, report preparation, and discussing technical issues. Experience was also gained in the direction of projects involving analysis of a wide variety of pharmaceutical products from OTC to complex proteins, and drugs in biological matrices.

### **Syntex USA, Inc. – Palo Alto, CA 1984 - 1991**

**Senior Chemist:** Development of analytical methods for the analysis of active pharmaceutical ingredients (AIP) and determining release specifications. Prepared analytical sections for IND and NDA applications. Supervised laboratory staff and project team membership.

## **EDUCATION:**

### **Montana State University - 1982**

M.S. Chemistry

### **Eastern Michigan University - 1978**

B.S. Biochemistry

## **Professional Memberships:**

American Chemical Society since 1980

American Association of Pharmaceutical Scientist since 1998

## **Professional Honors:**

Syntex Research Fellow, University of Illinois, 1984

Research on chiral separations under the direction of Dr. William Pirkle

## **Publications:**

See attached

# KIRBY L. GRAY

## PROFESSIONAL EXPERIENCE:

### **SVL Analytical, Inc. - Kellogg, ID Dec. 2004-present**

Technical Director - Conducts QA/QC reviews of commercial and EPA (ILMO5.4) incoming work and completed reports; supervises laboratory activities related thereto; primary contact with EPA (SMO); verifies SDGs, and responsible for MARRS (electronic data deliverable system) in coordination with DCO prior to reporting.

### **SVL Analytical, Inc. - Kellogg, ID March 1987-2004**

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

# MICHAEL S. DESMARAIS

## PROFESSIONAL EXPERIENCE:

### **SVL Analytical, Inc. - Kellogg, ID Oct. 2006 - Present**

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

### **SVL Analytical, Inc. - Kellogg, ID June 2004 – Oct. 2006**

Chemist Inorganic Instrument Department – Responsible for analysis of samples for trace metals by EPA methods 200.7 and 6010B. Interprets and reports data.

### **SVL Analytical, Inc. - Kellogg, ID April 2004 – June 2004**

Chemist Organic Chemistry Department – Responsible for analysis of samples for pesticides and PCBs by EPA methods 608, 8081A, and 8082. Interprets and reports data.

### **U.S. Army Engineer District-Alaska – Umiat, AK May 2003 - Sept. 2003**

Alaska Dept. Environmental Conservation approved field chemist. Established field laboratory, developed and implemented QA/QC under USACE and ADEC requirements. Surveyed, sampled and tested soils and waters under a Total Environmental Restoration Contract (TERC).

### **North Creek Analytical Oct. 1997 - Dec. 2002**

Senior Metals Chemist and Health/Safety Officer - Developed, revised and implemented safety and HAZMAT procedures. Developed and documented standard operating procedures. Maintained analytical instrumentation and analyzed samples for trace metals (ICP, AA and GFAA) and BTEX/GRO.

## EDUCATION:

### **Eastern Washington University – Cheney, WA 1996-1997**

Graduate coursework in Hydrology and Fisheries.

### **Washington State University – Pullman, WA August 1993-June 1995**

B.S. in Physical Science (emphasis in Chemistry, Geology, and Environmental Science).

### **Yakima Valley Community College 1991**

A.A.

## PUBLICATIONS:

Desmarais, M.S. and Hills J.W., "A Simple Thermal Pump for In-the-Field Supercritical Fluid Extraction". Analytical Letters, 28 (14), 2575-2583 (1995)

Dunham, D.C., Desmarais, M.S., Breid T., and Hills, J.W. "Carbon Dioxide Supercritical Fluid Extraction with On-line Fluorescence Detection, Analytical Letters, 28 (14), 2561-2574 (1995)

# Daniel K. Gingrich II

## PROFESSIONAL EXPERIENCE:

### SVL Analytical, Inc. - Kellogg, ID March 2010 - Present

Classical Chemistry Department Supervisor -- Supervises the staff and operation of SVL's TDS, Nutrient TKN, cyanide, NOX/NH<sub>4</sub>, Leco, and extraction labs. Ensures that EPA and Standard Method methods are correctly used, including EPA SOW ILMO5.4. Approves lab data prior to entry into Element (LIMS) and submission to DCO for reporting.

### SVL Analytical, Inc. - Kellogg, ID July 2008 – February 2010

Classical Chemistry Analyst – Performs analysis and interpretation of the following methods: SM 4500 PE, SM 4500 S<sup>2</sup> F, SM 5540 C, SM 5310 B, EPA 350.1, EPA 353.2, EPA 410.4 and total cyanide by EPA SOW ILMO5.4. Interprets data and up loads to Element (LIMS).

### University of Idaho - Moscow, ID Aug. 2006 – May 2008

Research — Worked performing DNA analysis. Purified proteins in order to raise antibodies. Conducted presentations in department meetings.

### Coeur d'Alene Cellars – Coeur d'Alene, ID Oct. 2005 – June 2006

Tested wine for pH, total and titratable acidity, sulfur dioxide and ethanol concentration.

## EDUCATION:

### University Of Idaho – Moscow, ID 2008

B.S. Microbiology

### North Idaho College – Coeur d'Alene, ID 2006

A.A. Biology

# **DANNY J. SEVY**

## **PROFESSIONAL EXPERIENCE:**

### **SVL Analytical, Inc. - Kellogg, ID Dec 2004-present**

Instrument Department Supervisor – Supervises staff and operation of SVL's ICP-AES, ICP-MS, CVAA, GFAA, FLAA, and IC labs and their respective sample preparation labs. Ensures that EPA and Standard Method methods are correctly used, including EPA SOW ILMO5.4. Approves lab data in Element (LIMS) prior to submission to DCO for reporting.

### **SVL Analytical, Inc. - Kellogg, ID 1996-2004**

Inorganic Instrument Operator -- Performs metals analysis by ICP and IC.

### **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 April 2008**

Inorganic Workshop Series

### **Perkin Elmer July 2004**

ICP-MS with Elan Software & Elan DRC Accessory Training Course

### **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

# CRYSTAL SEVY

## PROFESSIONAL EXPERIENCE:

**SVL Analytical, Inc. - Kellogg, ID** **2006-Present**

Sample Receiving Department Supervisor— Supervises SVL's sample receiving staff and is Sample Custodian for samples received under EPA SOW ILMO5.4. Responsible for setting up Work Orders within Element (LIMS), case narratives and point of contact with clients and their representatives. Works closely with SVL's Client Services and Technical Director to ensure that projects are setup and priced correctly.

**SVL Analytical, Inc. - Kellogg, ID** **1996-2006**

Sample Receiver—Verifies sample temperature, integrity and security on receipt; creates laboratory jobs; ensures proper sample storage prior to analysis supervises sample disposal; ships sample containers to clients.

# MELBA BENCICH

## PROFESSIONAL EXPERIENCE:

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

Document Control Manager – Supervises data reporting using Element (LIMS) for commercial clients and SDG reporting for EPA's CLP SOW ILMO5.4.

### **Shoshone Insurance – Kellogg, ID, 1984 – 1988**

Duties included accounting, customer service relations and updating manuals

### **Travel People – Coeur d' Alene, ID, 1982 – 1984**

Travel Consultant

### **Farmer's Insurance – Kellogg, ID 1982-1984**

Duties included accounting, customer service relations and updating manuals

### **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