QA/QC In Action:
Strengthening Data Integrity from a Laboratory Quality Perspective

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Land Acknowledgement

Greetings and acknowledgement as we are on Treaty 6 Territory and the Homeland of the Métis where SRC's headquarters are located.

We pay our respects to the First Nations, Inuit and Métis ancestors of this land and reaffirm our relationship with one another. We understand the importance of acknowledging the past and embracing a future where Indigenous Peoples and their traditions are valued and supported.

Together, we strive for a more inclusive and equitable business environment that benefits all.

A Bit of Background

- BSc. Chemistry-University of Saskatchewan
- MSc. Geology –University of Saskatchewan
  - Geochemical Controls on Arsenic, Uranium, and Molybdenum Mobility in a Low-Level Radioactive Waste Management Area in Ontario, Canada
- Canadian Light Source
  - Associate Scientist, Industrial Services
- SRC Geoanalytical Laboratories
  - Quality Supervisor

Outline

- Introduction
- Why Quality Matters
- Quality System Components
- Data Integrity
- Continuous Improvement
- Getting Buy In
- Key Takeaways
- Q&A

Introduction

SRC Geoanalytical Laboratories

- ISO/IEC 17025:2017 accredited laboratory
- Provides geoanalytical testing and automated mineralogy
- Serves the mining and mineral exploration industry
- Nearly 70 years of innovation in analytical methods and systems
- Analytical packages available for:
    - Uranium
    - Potash
    - Base metals
    - Precious metals
    - Rare earth elements
    - Specialty commodities (e.g., lithium)

Introduction

SRC Sorting and Separation

- Offers customizable preconcentration testing and piloting services
- Minerals Liberation Sorting Centre provides testing for:
  - Sensor-based sorting (amenability to pilot-scale)
  - Crushing and sizing
  - Heavy liquid separation
  - Magnetic separation
  - Dense media separation (5-tonne-per-hour plant)
- Operates the world's largest commercial diamond laboratory
  - Macro and micro diamond recovery
  - Secure, specialized services for the diamond industry
- Additional services:
  - Heavy mineral processing
  - Indicator mineral recovery and analysis

Introduction

SRC Environmental Analytical Laboratories

- One of Canada's most complete suites of analytical services in a single facility
- ISO/IEC 17025:2017 accredited by the Canadian Association for Laboratory Accreditation
- Licensed by the Canadian Nuclear Safety Commission to handle radioactive samples
- Services include testing of water, soils, vegetation and biota for:
    - Environmental monitoring and assessment
    - Site remediation samples
    - Industrial hygiene samples
    - Radon in indoor air
- Includes petroleum analytical testing of:
    - Biofuels
    - Transformer oils

Why Quality Matters

- **Ensures Accuracy and Reliability**
  - Prevents incorrect results
  - Builds trust with clients, regulators, and stakeholders
- **Supports Regulatory Compliance**
  - Meets ISO/IEC 17025:2017 and CNSC standards
  - Facilitates audit readiness and traceability
- **Drives Operational Efficiency**
  - Reduces manual errors and rework
  - Enables automation and streamlined workflows (e.g., eQMS)
- **Promotes Continuous Improvement**
  - Encourages data-driven decisions and corrective actions
  - Enhances team collaboration and training
- **Protects Environmental and Public Health**
  - Supports sustainable practices in mining, agriculture, and municipal services

Quality System Components

Data Integrity

How do we keep things going right?

What do we do when things go wrong?

How do we keep things going right?

- Proficiency Testing
- Standards
    - QC charts
- Blanks
- Sample Split Repeats
- Reagent Blanks
- Internal Audits
- External Audits

How do we keep things going right?

What Are Proficiency Testing Programs (PTPs)?

Structured assessments that compare a lab's test results against predefined standards or peer results to evaluate performance.

Why They Matter:

- Validate testing capabilities and regulatory compliance
- Enhance quality assurance and result accuracy
- Identify areas for improvement and foster continuous development

Key Benefits:

✅ **Performance benchmarking**
✅ **Reliable feedback loops**
✅ **Evidence of effective quality controls**

How do we keep things going right?

Standards and Quality Control (QC) Samples

Standards used are Certified Reference Materials

Highly characterized substances used to validate analytical methods, calibrate instruments, and ensure quality control in laboratory testing. They come with a ***certificate of analysis*** *that provides the exact composition and uncertainty values.*

- **Strategic Placement:**
  QC samples are placed at regular intervals to monitor the response and stability of the analytical process over time.
- **Limit Tracking in LIMS:**
  System-defined limits help flag deviations and ensure consistent performance.
- **Standard Checks:**
  Automatically highlight potential issues or anomalies in the process.
- **QC Charts:**
  Visualize performance trends and detect shifts or drifts over time.

How do we keep things going right?

Limits in LIMS

SRC GEOANALYTICAL LABORATORIES

2901 Cleveland Avenue
Saskatoon, Saskatchewan, Canada
S7K 8A9
(306) 933-8118
Fax: (306) 933-5656

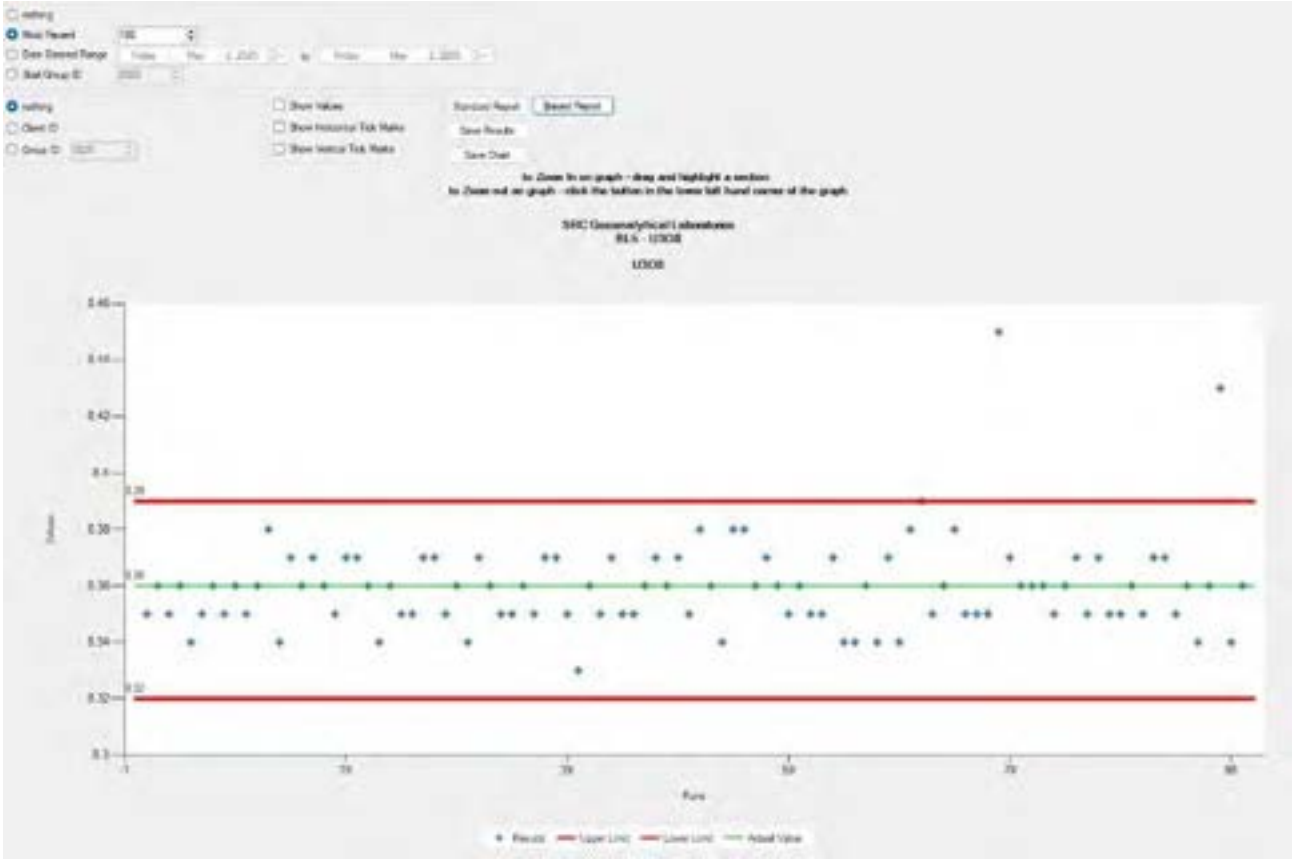
DCB01 - ICP Total (MS PKG) + S

Jan 09, 2023

Analyte Name	Value	Range
Al2O3	11.1	10.9 - 11.4
Ba	387	373 - 401
CaO	1.5	1.4 - 1.6
Ce	128	123 - 132
Cr	270	225 - 316
Fe2O3	3.36	3.19 - 3.53
K2O	2.46	2.06 - 2.86
La	66	60 - 73
Li	43	30 - 55
MgO	1.7	1.56 - 1.84
MnO	0.03	0.02 - 0.04
Na2O	0.58	0.5 - 0.65
P2O5	0.21	0.19 - 0.23
Sr	401	350 - 451
TiO2	0.79	0.69 - 0.89
V	101	98 - 104
Zr	419	383 - 454
S	3849	3641 - 4057

How do we keep things going right?

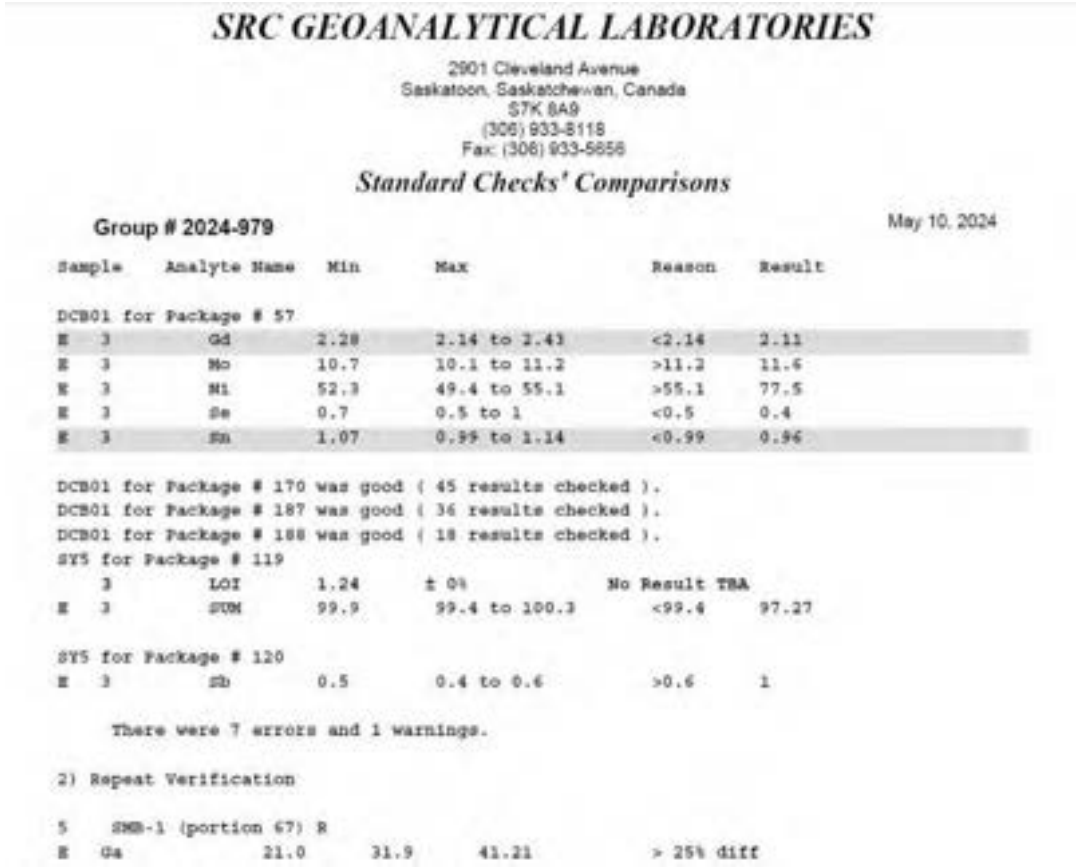
Control Charts



- Limits 3SDs above and below mean.
- Warning limit 2SDs above and below mean.
- Bias warning-3 points above or below warning consecutively.
- Trend warning- 10 points trending upward or downward.

How do we keep things going right?

QC Checks



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Standard Checks' Comparisons

Group # 2024-979 — May 10, 2024

Sample	Analyte Name	Min	Max	Reason	Result
DCB01 for Package # 57					
E 3	Gd	2.28	2.14 to 2.43	<2.14	2.11
E 3	Mo	10.7	10.1 to 11.2	>11.2	11.6
E 3	Ni	52.3	49.4 to 55.1	>55.1	77.5
E 3	Se	0.7	0.5 to 1	<0.5	0.4
E 3	Sn	1.07	0.99 to 1.14	<0.99	0.96
DCB01 for Package # 170 was good (45 results checked).					
DCB01 for Package # 187 was good (36 results checked).					
DCB01 for Package # 188 was good (18 results checked).					
SY5 for Package # 119					
3	LOI	1.24	± 0%	No Result TBA	
E 3	SUM	99.9	99.4 to 100.3	<99.4	97.27
SY5 for Package # 120					
E 3	Sb	0.5	0.4 to 0.6	>0.6	1
There were 7 errors and 1 warnings.					
2) Repeat Verification					
5 SNB-1 (portion 67) R					
E Ga	21.0	31.9	41.21	> 25% diff	

- Every group, goes to scientist for investigation prior to data release.

How do we keep things going right?

Blank Samples

- **Purpose of Blanks:**
  Ensure accurate analyte concentrations by identifying background signals not related to the analyte.
- **QQ (Quintus Quartz) Blank/Method Blank:**
  A full-process blank — used from sample preparation to final analysis — to detect contamination throughout the entire workflow.
- **Reagent Blank:**
  Contains only reagents, no sample matrix — used to check for contamination introduced by instrumentation or reagents.

How do we keep things going right?

SSR & Replicate Analysis

- **SSR (Sample Split Repeat):**
  Conducted during sample preparation to assess the **homogeneity** of the sample. Ensures consistent distribution of analyte across subsamples.
- **Repeat/Replicate Analysis:**
  Involves reanalyzing one sample from a batch to evaluate the **precision** of the analytical process.
    - Can be placed **adjacent** to the original or **randomly** within the batch.
    - Helps detect variability and confirm method reliability.

Data Integrity

How do we keep things going right?

What do we do when things go wrong?

When Things Go Wrong

🔍 **What Can Go Wrong?**

- ⚠ **Alerts from Clients**

  Clients may report failing results or anomalies in QC data, prompting urgent investigation and corrective action. Results outside of expected range.

- 📉 **PTP (Proficiency Testing Program) Failures**

  Poor performance in blind sample testing can indicate systemic issues in method accuracy or analyst technique.

- 📊 **Bias Issues in Standards**

  Shifts in recovery rates or consistent low/high results may signal bias in sample prep, instrumentation, or reagent lots.

- 📈 **Outliers in QC Charts**

  Data points outside control limits (e.g., beyond 3σ) or trending patterns (e.g., 2 of 3 points beyond 2σ) require review and may trigger formal reporting and method revision.

When things go wrong

🛠 Non-Conformity Report (NCR) Process Overview

Purpose:
To document and resolve deviations from expected standards, whether identified internally or by clients.

Step-by-Step Process

Initiation

- Supervisor or designate completes initial assessment of situation
- NCR assigned to Section/BU Quality personnel

Root Cause Analysis

- Conducted by supervisor or assigned personnel

Corrective & Preventive Actions

- Define actions, assign responsibilities, and set target dates

Follow-Up & Effectiveness Check

- Supervisor reviews all actions
- Confirm effectiveness

Closure

PTP Failure:

Initiation: Quality personnel start the NCR process by documenting the issue and sharing the information with relevant personnel.

Root Cause Analysis: Performed by the relevant personnel

Actions: Rerun all groups run with the PTP and the PTP in the same conditions as the initial run to determine the issue

Follow-Up: Document the issue and findings.

Closure: Discuss with all relevant personnel and quality.

Continuous Improvement

🔍 **Internal Audit Process Overview**

Purpose:
To ensure ongoing compliance with ISO/IEC 17025 and internal SOPs, while driving continuous improvement across all lab operations.

Key Steps in the Audit Cycle

- **Planning & Scheduling**
  - Audits are scheduled annually or as needed
  - Scope and objectives are defined in advance
- **Audit Execution**
  - Conducted by trained internal auditors independent of the audited process
  - Includes interviews, observations, and document reviews
- **Checklist & Evidence Collection**
  - Standardized checklist used to assess conformance
  - Observations recorded and linked to ISO clauses
- **Closing Meeting**
  - Findings are reviewed with the auditee and supervisor
  - Opportunity to clarify or contest observations
- **Reporting & Follow-Up**
  - Audit report issued with corrective actions (CARs)
  - Effectiveness of actions verified before closure

Benefits of Internal Audits

- Reinforces adherence to SOPs and ISO standards
- Identifies gaps and areas for improvement
- Supports staff training and process transparency
- Enhances readiness for external audits

Continuous Improvement

🔍 **External Audit Process – ISO/IEC 17025:2017**

Audit Frequency & Scope

- **Annual Surveillance Activity**
  One formal on site audit every two years to verify compliance with ISO/IEC 17025: 2017
- **Comprehensive Review**
  Includes:
  - PTP Performance
  - NCRs and Corrective Actions
  - Internal Audit Records
  - Training and Competency Logs

Audit Components

- **Pre-Audit Questionnaire**
  Tracks lab performance and readiness
- **Site Visit**
  In-depth inspection of facilities, procedures, and documentation
- **SOP Review**
  Every Standard Operating Procedure is examined for compliance
- **Staff Interviews**
  Auditors engage with personnel to assess understanding and implementation

Outcome

- Identification of strengths and areas for improvement
- Issuance of findings and required corrective actions
- Verification of resolution in follow-up assessments

Getting Buy-In

Changing the culture

- Encourage reporting of NCs with positive and efficient responses
- Quality tidbit seminars
- Preparation for audits
- Including quality in all meetings
- Show continuous improvement within the QMS

Key Takeaways

Importance of Quality: Quality ensures accuracy, reliability, regulatory compliance, operational efficiency, continuous improvement, and protection of environmental and public health

Data Integrity: Maintaining data integrity involves proficiency testing, standards, QC charts, blanks, sample split repeats, reagent blanks, internal audits, and external audits

Handling Issues: When things go wrong, the NCR (Nonconformity Reporting) process steps are followed to document, analyze, and resolve deviations

Continuous Improvement: Continuous improvement is driven by internal and external audits, which help identify gaps, reinforce adherence to standards, and support staff training and process transparency

Upcoming Events

Event	Location	Dates
Canadian Ecotoxicity Workshop	Victoria, BC	October 5-8
6th Biennial SMA Environmental Forum	Saskatoon, SK	October 28-30
Central Canada Mineral Exploration Convention	Winnipeg, MB	November 3&4
Saskatchewan Geological Open House	Saskatoon, SK	December 1-3

Questions?

Thank you!

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