

# Minera San Cristobal integrates and automates labs using LIMS

Minera San Cristobal S.A. is the largest mining company in Bolivia and is considered to be one of the world's largest silver-zinc-lead development projects. Its key challenges illustrate the significant trends in the mining industry today, including the need to not only automate the laboratory, but to provide for rapid data capture and analysis of sample data through the integration of analytical instruments with laboratory software. This paper discusses the process used to select a Laboratory Information Management System (LIMS) at Minera San Cristobal.

## Building a modern mining operation

San Cristobal is located in the Potosi district of southwestern Bolivia and hosts approximately 443 million ounces of silver and 8.4 billion pounds of zinc and 2.9 billion pounds of lead contained in 250 million tonnes of open-pittable proven and probable reserves. The San Cristobal mine consists of an open pit mine and concentrator with a designed capacity of 40,000 tonnes per day. A contract miner extracts ore from the open pit by conventional truck and shovel operation and transports mined ore by truck from the pit to the primary crusher. The crushed ore is then transported by a 1.7 kilometer overland conveyor to an ore stockpile. A reclaim system moves crushed ore from the stockpile for grinding in a semi-autogenous (SAG) and ball mill circuit. The ore is then processed by a selective flotation process in which lead is first floated and zinc is suppressed to produce a lead-silver concentrate, and then zinc is floated and lead is suppressed to produce a zinc-silver concentrate.



Concentrates are then filtered, loaded into containers and transported by rail to the port in Mejillones, Chile, and then by ocean vessel to smelters and refineries around the world.



A long-term agreement is in place for the transportation of the concentrates by rail to the port in Mejillones, Chile. As transportation of the mined ore is a key component of the necessary infrastructure at Minera San Cristobal, construction of the 65 kilometer rail spur from the mine site to the main rail line was an essential element.

Concentrates will be unloaded from the rail cars at a facility at the port in Mejillones and then loaded into ships for export. Once the concentrates have arrived in Mejillones, they will be shipped by bulk carriers to smelters around the world.

### **The Informatics project team and vendor selection**

As the leading mine in Bolivia, Minera San Cristobal seeks continuous growth and a competitive advantage in the industry to keep its profits in line with shareholder expectations. To keep the company strong from a technology perspective, Minera San Cristobal began an investigation into the ways it could reduce its reliance on manual processes throughout the laboratories, and automate those processes so that data capture was more timely and more accurate.

By automating its laboratory processes, Minera San Cristobal sought to ensure real time access to accurate data, avoid manual errors, produce the highest quality in the control process of samples, methods and results, and save personnel time and costs as a result.

The Manager for the Chemical Laboratory (D. Raúl Castro) issued a call for RFPs from the leading technology companies to assess the possibilities for automating the mining operations at Minera San Cristobal. After a period of due diligence and involvement with laboratory and IT personnel, Thermo Scientific™ SampleManager™ LIMS software was selected to automate processes and improve quality and methods in the chemicals laboratory located next to the plant.

Phase 1 of the project involved a close coordination between the laboratory personnel and Thermo Fisher support team to begin the integration of analytical instruments and configuring the LIMS to meet the needs of the chemicals laboratory. The goal of Phase 1 was to fully integrate the lab, from sample registration to sample report.

### **Phase 1 benefits achieved**

Since completion of Phase 1, complete installation of SampleManager LIMS software, and full laboratory instrument integration, management at Minera San Cristobal is taking advantage of some of the benefits brought by their investment in the LIMS.

- The chemical laboratory has certified five test methods, as well as other tests of impurities, to the Bolivian Accreditation Organization (IBMETRO).
- The volume of paper records and other physical documentation has been dramatically reduced and it is expected that by Phase 2, all paper records will be completely replaced by electronic records produced and stored within the LIMS database.

## Next steps – Phase 2

At the end of Phase 1, SampleManager LIMS software was fully operational within the chemicals laboratory. Management at the mine and laboratory personnel are now exploring new options and configurations that may be provided by the LIMS, opening new opportunities for improvement in the daily operations of the San Cristobal mine.

For example, in an effort to reinforce the analytical services provided by the chemicals laboratory, it is critical that new instrumentation is integrated across the laboratory, and SampleManager LIMS software has demonstrated this capacity already. Laboratory personnel will begin building on this capacity with new equipment as it is required and installed.

Another key component of the production process at Minera San Cristobal is the testing of minerals deployed by the chemicals laboratory, including the exploration and production of minerals and the exportation of products from concentrated minerals. The testing services provided by the chemicals laboratory will be extended to other mining units and internal clients whose focus is environmental control, occupational health and maintenance of equipment.



Phase 2 will also include configuring the LIMS so that it becomes a fully integrated system to support production planning and control. It is expected that the LIMS will automate all operations by its integration with ERPs, PIMS and existing instruments and software running in other operations centers of the company.

## SampleManager LIMS Software helps Minera San Cristobal meet ISO 17025 requirements

The ISO 17025 standard, General Requirements for the Competence of Testing and Calibration Laboratories, covers laboratories using standard, non-standard and laboratory-developed methods. This international standard is the accepted standard for analytical laboratories developing their data management system for quality, administrative and technical operations.

There are several critical areas of compliance for any mining operation, including security, instrumentation calibration, maintenance of electronic records, traceability of procedures, personnel, environmental and equipment monitoring. The ability of laboratory managers at Minera San Cristobal to have control of this vital information is an important aspect of the mining operation and ensures that production can continue uninterrupted by changes related to environment, personnel, instrumentation or equipment that falls out of calibration or becomes damaged in the production process. Laboratory managers at Minera San Cristobal will be maximizing their use of the LIMS' full capabilities regarding ISO 17025 throughout Phase 2.



SampleManager LIMS software offers a centralized system to access data and extract information, enabling effective management of laboratory operations. The LIMS provides evidence and documentation to support laboratory compliance with ISO 17025.

The LIMS addresses the security required for laboratories conducting testing in their “permanent facilities, at sites away from permanent facilities, or in associated temporary or mobile facilities,” by providing full security controls, including “group security,” which can be used to segregate work from different clients or in different laboratory areas. The LIMS’ enhanced functionality covers a broad range of requirements, including validation of methods, instrument calibration, sampling, control of non-conformance testing and reporting of results.

To meet ISO 17025 requirements regarding the “control of non-conforming testing and/or calibration work,” SampleManager LIMS software has built-in functionality for incident management and statistical analysis of both calibration standards and sample results. The LIMS also automatically maintains all electronic records and makes them available for either reviewing or reporting, and has built-in archiving, which allows for the removal of older records once their retention period has expired. Full audit trail facilities are standard for SampleManager LIMS software, allowing full traceability of the personnel and the procedures that were entered. These built-in capabilities allow laboratories to more easily review their quality system by having ready access to all incidents, corrective actions, non-conforming results and other events.

To address the technical requirements of the standard, SampleManager LIMS software has built-in functionality to handle environmental monitoring, a critical component of laboratory compliance with ISO 17025. Within the LIMS, environmental monitoring of key areas of the laboratory can be scheduled on a routine basis. Certain instrumentation can be connected via the Instrument Manager function, and data can be collected and logged at periodic intervals. Validation of methods is a critical ISO 17025 requirement, for which SampleManager LIMS software has built-in functionality to allow lab managers to be in continuous compliance. Batch Management functionality provides analytical QA/QC support, including automatic and interactive sample assignment according to pre-defined templates.



Equipment and instrument calibration, also an important part of ISO 17025, is managed by the LIMS through Instrument Calibration Scheduling, allowing the LIMS to prevent the use of any instrument that is past its calibration due date. SampleManager LIMS software provides reporting that indicates which instruments are out of compliance or need calibration. Finally, to comply with ISO 17025 reporting requirements, the LIMS’ existing functionality includes powerful and flexible report writing, making it possible to create any report format required by the laboratory, and including any data stored within the LIMS database.

### Why SampleManager LIMS Software

In undertaking this process of fully automating the chemical laboratory processes, mining operations managers at Minera San Cristobal were eager to work with an industry leader that could provide continuity of service, the highest level of training and support, and a proven LIMS that was time and industry tested.

### Industry leadership/proven experience

SampleManager LIMS software is the industry leader in quality control and automation of laboratories in the mining industry, with a broad range of key references from all of the major mining centers and proven experience in critical analytical business environments.

## Enterprise integration

The ability of SampleManager LIMS software to interface with enterprise systems such as ERP and PIMS, as well as analytical instrumentation was a key factor in the decision to work with Thermo Fisher Scientific. The speed of processing reports and managing large amounts of laboratory data is now dramatically increased and allows all laboratory managers and mining personnel to have the information they need when they need it.

## Standardized laboratory practices and reporting

During the implementation of SampleManager LIMS software, a team consisting of laboratory managers, IT personnel, and Thermo Fisher Scientific support personnel worked together to develop a standardized list of commonly used reports within the lab and mining operations. The objective of this was to standardize on formats and minimize the number of different reports being used so that all laboratory personnel, across the operation, had an increased level of understanding of the data being generated and how to utilize that data. In addition, the use of a single system to administrate and operate all the activities in the laboratory has dramatically simplified lab operations, and ensured the consistent quality of all processes and reports.

## Global presence, regional strengths

An important consideration in selecting SampleManager LIMS software was the fact that Thermo Fisher Scientific has the ability to provide fast, effective and local response to any administrative or operational situation that could arise at Minera San Cristobal. Because of its global presence, Thermo Fisher can support customers around the world, and provides local and regional Customer Support through offices in Chile, Brazil, Argentina and Mexico. Localized training of the laboratory personnel at Minera San Cristobal ensured that the LIMS could be easily configured by all users, regardless of their level of expertise. Because of LIMS' easy-to-understand system architecture, laboratory users can easily create new methods, reports or define new processes without seeking time consuming and costly assistance from either the IT personnel at the mine or the software provider.

## Partnering with Thermo Fisher Scientific

Thermo Fisher Scientific is the worldwide leader in laboratory software and services, providing enterprise-wide, multi-laboratory solutions that are relied on at other minerals and mining companies, such as The Corporacion Nacional del Cobre de Chile (Codelco) the largest copper producer in the world, CVRD (Brazil), Doña Inés de collahuasi (Chile), Yamana Gold (Brazil) or CIMM (Chile). To support our installations, we provide implementation, validation, training, maintenance and support from the industry's largest worldwide informatics services network.

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