

INCREASING YIELDS

Mounting and diverging pressures in exploration and production are being faced by the oil and gas industry. Organisations are having to maximise the yield from each well, increase throughput and efficiency, and lower costs, all while maintaining regulatory compliance. In order to achieve this, operational processes are controlled by rigorous testing and real time monitoring. Laboratory Information Management Systems (LIMS) play a key role in managing this effort. With the capacity to automatically capture and process sample data, LIMS provides rapid feedback to the

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of better laboratory
information management
systems to help increase
oil and gas yields.



field operations within the fast turnaround time required during oil and gas exploration and production.

Industry trends associated with the analysis of oil and gas

Large oil and gas companies increasingly have to locate their exploration and production processes in harsh and isolated areas because of the ever-growing competition for natural resources. The considerable escalation in difficulty and costs associated with these operations intensify the already complex problems of analysis of oil and gas during exploration and production.

Furthermore, oil and gas companies are monitoring field operations more closely as they strive to increase efficiency in order to remain competitive. As a consequence, there has been a surge in the number of analyses and samples that are run, leading to a need for efficient data management. For example, crude oil data (i.e. salt and water content) is crucial in oil well classification and plays an essential role in planning and maintaining daily oil production rates. Additionally, hydrocarbon gas and condensate composition data ensure that plant processes are monitored and optimised to high standards. As deposits may intrude and plug wells, halting production, it is imperative that the presence of any sub-quality deposits, such as scales, solids and sludge

are identified. While real time laboratory information assists in the design and implementation of corrective procedures for control and removal of these deposits, a comprehensive solution is required in order to manage and interpret the data.

In addition, strict industrial and environmental regulations must be adhered to by oil and gas exploration and production companies. The 2005 release of ISO 17025, *General Requirements for the Competence of Testing and Calibration Laboratories* greatly affected oil and gas analytical laboratories. This international standard is the accepted benchmark for analytical laboratories in developing their management system for quality, administrative and technical operations. Applicable to all organisations performing tests and/or calibrations as well as laboratories where testing and/or calibration forms part of inspection and product certification, the regulation covers laboratories using standard, non-standard and laboratory-developed methods.

A comprehensive LIMS solution provides oil and gas exploration and production companies with a solution that enables them to address the difficult analytical problems as well as comply with the relevant regulations. In order to enable operators and managers to make business-critical decisions such a system must store and analyse data quickly and effectively. As well as capturing and safely storing data in real time the LIMS must distribute data in an effective manner to key operational decision-making personnel. In addition, the solution should be capable of providing smooth integration with multiple other systems, tools and processes.

Integration to improve quality

The integration of LIMS in oil and gas analytical laboratories has revolutionised the way they operate. Previously, analytical results were entered by hand using paper notebooks and transcribed into spreadsheets, a particularly time consuming and error prone procedure considering the multiple analyses carried out on a vast amount of samples on a daily basis. Lengthy rechecks were also required to verify the validity of data. Data was often communicated by telephone, or sometimes fax, again with the potential for introducing errors to the reporting. Integration of LIMS with existing laboratory and business systems, such as Process Information Management Systems (PIMS), Manufacturing Execution Systems (MES) and Enterprise Resource Planning (ERP) systems, has replaced these protracted and risky procedures with sophisticated, automatic data transfer that eliminates error caused by manual procedures and allows more data to be utilised by more decision makers for more efficient operations.

The laboratory and operational productivity benefits of a LIMS include elimination of human error and data duplication, better data quality, considerable time savings and earlier generation of result reports. In addition, immediate data flow between the laboratory and the rest of the operations facilitates faster, data-driven business decision making. By centralising and consolidating IT and technical support personnel, enterprise-wide LIMS

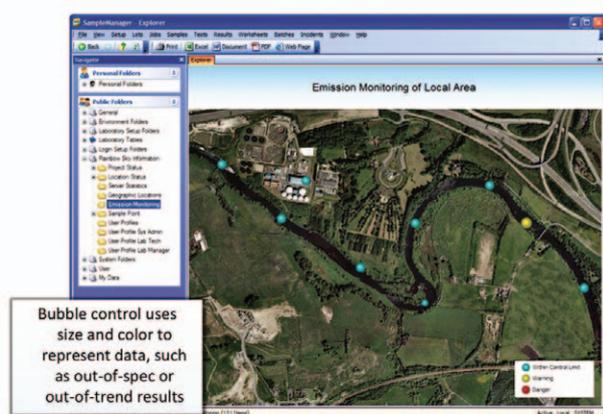


Figure 1. Emissions monitoring view.

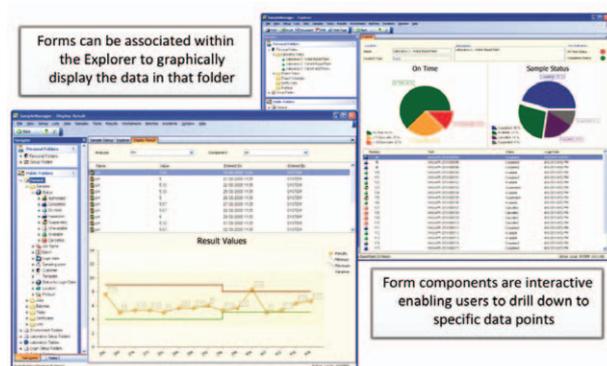


Figure 2. Explorer forms.

integration lowers the total cost of ownership significantly. Standardising on a central LIMS allows organisations to store SOPs, specification limits and have immediate alerts sent out when a sample tests out of specification. An integrated LIMS approach helps companies identify trends and monitor product quality more rapidly with greater ease, dramatically improving their overall quality control process and maintaining the highest quality standards.

A comprehensive LIMS solution such as SampleManager LIMS also facilitates compliance with ISO 17025 regulations. The LIMS covers a broad range of requirements, including validation of methods, instrument calibration, sampling, control of nonconformance testing and reporting of results. Full security controls segregate work from different facilities and laboratory areas. In addition, the laboratory's quality system procedures are stored in the LIMS for reference at any time by relevant personnel, including a documentation of the scope of activities, all policies and procedures, as well as results. The laboratory's quality system can be easily reviewed by having ready access to all incidents, corrective actions, nonconforming results and other events.

Conclusion

Oil and gas companies undertaking exploration and production activities are facing increasing pressure to improve oil and gas field yields and overall productivity while adhering to stringent product quality and environmental regulations and minimising their operational costs. Conducting accurate, frequent monitoring to monitor the quality and effectiveness of their products as well as processes in order to remain competitive against their clients and within regulatory guidelines are proving time-consuming and labour intensive.

With the introduction of LIMS, global oil and gas companies can achieve reduced costs and increased productivity, while ensuring optimum product quality and regulatory compliance. With the elimination of human error and redundant data, overall laboratory efficiency is enhanced and regulatory requirements are met. Enterprise-wide deployment of LIMS can help achieve real time dissemination of information to the enterprise's decision makers.

Case study: the Sakhalin II project

As the largest integrated oil and gas development project in the world, the Sakhalin II project, located in Russia's far east in the Sea of Oshotsk, has extensive requirements for sampling and testing. Environmental and Health and Safety compliance have been important drivers in the development of Sakhalin II, both to monitor the field operations and plant processes and to measure product specification and quality test the products. The function of the laboratories on Sakhalin Island include quality

testing of both onshore and offshore feeds, environmental monitoring across the site, water quality control and water analysis.

In order to provide a real time round the clock analytical regime, an ultra modern laboratory was commissioned to be located at the LNG plant/OET terminal. This new central laboratory is also supported by upstream satellite laboratories. In 2007, the state-of-the-art LNG/OET laboratory successfully passed certification tests to the requirements of Gosstandart and the international ISO 17025 standard.

The decision to invest in a new LIMS to manage the sampling process from upstream through to sample report was imperative for Sakhalin Energy's new laboratory.

Samples for environmental and water analysis are analysed onsite and primary analysis for composition of gases is undertaken to quantify content of nitrogen, methane, ethane, propane and butane and pentane isomers as well as quantification of hydrogen sulphide, CO₂, mercaptans, carbonyl sulphide (COS) and total sulfur content. The daily sampling schedule is managed from within SampleManager LIMS. Sakhalin Energy also carries out water monitoring and takes water samples to measure the presence of suspended solids and their grain size. Water is analysed in a separate water laboratory in the LNG plant and the samples are managed within SampleManager.

The LNG/OET laboratory handles all the samples coming from upstream, through the LPG plant and the final products. The analyses of final products are performed when the LPG storage tanks are prepared and isolated or during the ship's loading. Multiple samples are taken with the sampling time recorded and entered into the LIMS. When sufficient reproducible results are obtained, the mean and weight average composition are both calculated. The mean composition of each cargo is used to calculate density and gross heating value and all values are included on the Certificate of Quality. The Certificates of Quality are issued from within the LIMS.

Any data required by the business is automatically available from the LIMS with sophisticated automatic data transfer. The LIMS is used to interface with critical systems including Sakhalin Energy's corporate ERP package and process information system for efficient reporting and documentation support.

Sakhalin Energy is Russia's largest project in the oil and gas industry and its ultra-modern laboratory has been designed to provide the scientific background to ensure LNG production is maintained year-round. With both a commercial and a scientific driving rationale, Sakhalin Energy has equipped its laboratories with the technologies and infrastructure that allow it to deliver consistent support to the production and shipping cycle of finished product. To deliver this reliability of service while demonstrating regulatory compliance, Sakhalin Energy has standardised on SampleManager LIMS in its new state-of-the-art LNG/OET Laboratory. **LNG**