The world's largest gas to liquids facility runs on Thermo Fisher SampleManager LIMS Software

Established by Shell and Qatar Petroleum in 2006, Pearl GTL is the largest gas to liquids facility on the planet. Gas to liquids (GTL) is the conversion of natural gas to liquid fuels and other products, including gasoil, naphtha, kerosene, normal-paraffin and lubricants. Pearl GTL has a capacity of 140,000 barrels per day of these products and 120,000 barrels per day of liquefied petroleum gas, and the data produced by its quality control program is tremendous: More than 30,000 content, volume, emissions and equipment measurements are transmitted at any given time. With the integrity of its brand, the safety of its workers and the profitability of its enterprise on the line, Pearl GTL turned to Thermo Fisher™ SampleManager™ LIMS software, to manage, analyze and integrate the data that keeps this facility functioning securely and efficiently.

The facility
Pearl GTL has no shortage of world records: The facility, located 80 kilometers north of Doha, Qatar, includes the largest GTL plant and one of the largest instrumentation and control systems anywhere on earth. GTL technology enables Qatar – in partnership with Shell – to open up new opportunities in new markets, monetizing its enormous natural gas resources through the creation of high-quality, easy-to-export liquid fuels.

The facility, which became fully operational in 2012, processes 1.6 billion cubic feet of wellhead gas per day to remove contaminants and refine natural gas liquids. Using the proprietary Shell Middle Distillate Synthesis process, Pearl GTL converts output from the world's largest non-associated gas field into fuels, lubricants and other high-quality products that Shell ships to markets around the world. Pearl GTL is unique as an integrated upstream/downstream facility that entails the full value chain of gas extraction and processing from offshore development through onshore refining.

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The challenge

The scale and diversity of Pearl GTL makes it an incredibly complex operation. The building phase alone required Shell to create a private off-loading quay in Ras Laffan City so it could import two million freight tons of necessary materials and equipment. More than 100,000 visas were issued to bring in workers who installed enough steel over five years of construction to build 40 Eiffel Towers.

It was clear from the beginning that Pearl GTL would need a highly sophisticated software solution to manage the data coming out of a quality control system that receives a constant stream of 34,000 transmitted measurements. These tests gauge well content, volume, emissions, equipment condition and hundreds of other issues integral to the plant's operation. In addition to collection and storage, the data also needed to be organized, integrated and analyzed to ensure product quality, plant and customer safety, environmental protection and production efficiency.

"A project of Pearl GTL's magnitude hasn't been attempted before," said Ajith Kumar, senior business analyst for Qatar Shell GTL. "With billions of investor dollars and tens of thousands of jobs at stake, data management was a major priority. To maximize production with quick decisions, we needed condensed, accurate information at our fingertips at all times."

Additionally, Shell and Qatar needed a solution that would ensure that Pearl GTL's labs remained in compliance with standards such as ISO 17025. The ISO standard sets an international benchmark for running a testing laboratory, laying out qualifications for suppliers, training, record-keeping, equipment calibration and much more. Pearl GTL required the ability to comply with ISO 17025 and other standards at all times and retrieve data that demonstrated compliance in the event of an audit.

LIMS to the rescue

With so many prerequisites for success, Pearl GTL needed a proven solution. That solution turned out to be a Laboratory Information Management System (LIMS). The right LIMS would allow Pearl GTL's sampling program to meet its designers' sophisticated ambitions. It would present accurate, unbiased information that enabled Shell to maintain the highest standards of safety, regulatory compliance and environmental commitment without sacrificing financial performance. In fact, a LIMS would enhance Pearl GTL's bottom line by collating testing data, which allows managers to make impactful business decisions quickly.

Given the operation's complexity, not just any LIMS solution would do. In addition to organizing sample results, Pearl GTL's LIMS would be need to be fully integrated and communicate with a variety of other systems, including operations management, batch tracking and ERP systems. Without full integration of the LIMS to existing enterprise systems, making a venture the size and scale of Pearl GTL successful would be nearly impossible.

Shell chose SampleManager LIMS software for its state-of-the art testing laboratories, standardizing on the solution across all laboratory equipment and production systems. The LIMS offered unparalleled support for each of the Pearl GTL facility's stringent requirements, and its implementation helped drive success from the very beginning.

"In spite of complex quality, regulatory and interface requirements, rolling out SampleManager LIMS software in Pearl GTL was a no-hassle implementation," said Kumar. "Some of the LIMS interfaces we implemented are first of their kind in any Shell facility. The LIMS is a very flexible system that is easy to customize for the various requirements of any enterprise."

Automation and error elimination

One of Shell's principal reasons for choosing SampleManager LIMS software was its ability to work with other systems. At Pearl GTL, the LIMS is integrated with an operations management system (known as OTTER), process historian (PI), the oil movement and batch tracking system, laboratory instruments and other production systems.

"Integration between the LIMS, OTTER, PI, lab instruments and other systems is completely seamless and bi-directional," said Mansoor Al-Shamri, laboratory manager for Qatar Shell GTL. "SampleManager LIMS software makes my life a lot easier, because it ensures that working with data from each of the systems requires no manual transition whatsoever, which alleviates errors, automates our operations and allows us to make faster, more pragmatic decisions. All the information we need to manage complex sample scheduling, and stringent safety, quality and regulatory requirements is readily accessible."

The way the LIMS integrates with PI is a particular source of efficiency for Shell and Qatar Petroleum at Pearl GTL. Where some labs manually send test results to operations, technologists and process engineers, among other users, at Pearl GTL results become available to all relevant parties within the PI system as soon as they are authorized in the LIMS. This means that the many employees whose work hinges on quality sampling are receiving the information they need in real time.

Faster production and reporting

Another critical consumer of lab data is Pearl GTL's oil movement and batch tracking system. Again, the LIMS creates efficiencies by eliminating wait times. When panel operators need to move oil to new tanks in preparation for shipping, for example, they do not have to wait to be notified of test results, minimizing demurrage charges for loading delays that can cost as much as $35,000 per day. As soon as the results have been issued in the lab, the LIMS notifies operators through the oil movement system, with which it is seamlessly integrated. Since Pearl GTL opened, the facility has incurred no demurrage charges, an incredible feat for an operation so large.

The LIMS has also enabled a paperless environment that eliminates many human errors inherent in traditional laboratories. Human beings make an average of 3-6 mistakes for every 1,000 lab readings transcribed. In a sampling program the size of Pearl GTL's, this would amount to dozens of errors–if not hundreds–every day. SampleManager LIMS software solves this problem by integrating with lab instruments that automatically transmit data to the LIMS as soon as final results are produced.

The LIMS aggregates all this data and combines it with information collected from other sampling systems, and even technicians in the field, enabling the vast array of data to be collated and presented in a logical format for managers to analyze, which makes for fast, effective decision making.

Integrating the field with the lab

SampleManager LIMS software also helps Pearl GTL operators more efficiently collect data from the field for analysis in the lab. Using the OTTER system, all sample points in the field are marked with radio frequency identification tags. When field operators perform sample rounds, a handheld computer guides them to each sample point and then automatically records the required information, whether the sampling task is routine or non-routine.

"It's amazing how much overhead we were able to eliminate with the OTTER system," said Al-Shamri. "Field operators can do their jobs faster and also more accurately, since they're not recording readings by hand. And ultimately, it's SampleManager LIMS software that enables the real-time aspect of the OTTER system to be possible."

The LIMS is fully integrated with OTTER, so the data collected in this system are instantly transferred to SampleManager LIMS software from the field for analysis by managers or technicians back in the lab, saving Pearl GTL an estimated 2,400 hours worked per year.

Enhanced compliance and safety

Finally, the LIMS makes it possible for Pearl GTL to meet an increasingly crucial requirement of oil and gas laboratories: regulatory compliance. ISO 17025 established an international standard for how sampling labs manage data collection, security, instrumentation, traceability, personnel and more. By collecting complete data records, SampleManager LIMS software ensures that Pearl GTL is always in compliance with ISO 17025 and other standards. The solution also guarantees that compliance can be easily proven in the case of an audit.

The LIMS even helps Shell go beyond ISO 17025 requirements in instilling a culture of safety at Pearl GTL. By tracking equipment condition, well content and many other issues that could become safety concerns at any GTL facility, SampleManager LIMS software allows managers to make real-time decisions that protect workers and the surrounding environment. Shell's and Qatar Oil's dedication, coupled with the holistic solution from Thermo Fisher Scientific, have led to an impressive safety record at Pearl GTL. Despite its enormous size, in 2010 the facility hit 77 million hours worked without a single lost-time injury.

Conclusion

From the moment it broke ground in 2006, the ambitious Pearl GTL project needed to be grounded in proven, dynamic technologies. Shell and Qatar Petroleum chose SampleManager LIMS software to help their ambitious vision excel by managing a highly sophisticated sample program. The LIMS fully integrated multiple systems within the testing laboratory, including operations management, batch tracking and laboratory instruments. SampleManager LIMS software also brought that integration into the field where the LIMS automates data transmission via handheld devices. Finally, the LIMS software ensures that the facility constantly adheres to the highest standards of safety and quality. Pearl GTL's testing program enables the world's largest gas to liquids facility to operate efficiently and safely while adhering to regulations and maintaining profitability, and a LIMS is the lynchpin that makes it all possible.

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