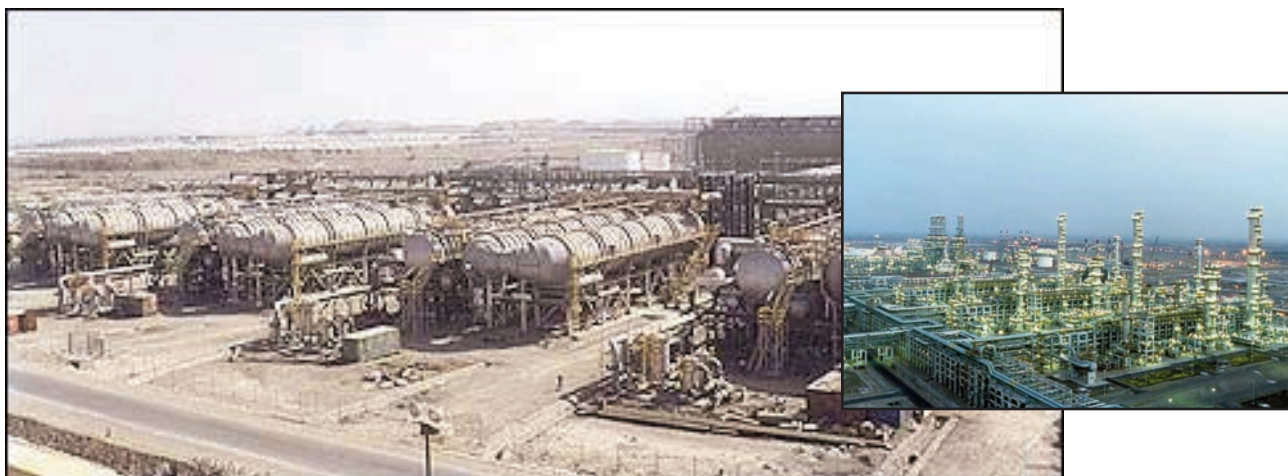


LIMS-PIMS Integration Shows Potential to Save Tens of Millions in Active Ingredients



The integrated LABWORKS LIMS/Aspen PIMS /IP.21 solution enables the refinery to increase capacity, lower cost, and reduce waste by sharing near-real-time information between the laboratory and the plant.

Essar Oil Limited in Jamnagar, India operates one of India's leading petroleum processing refineries and has an upgrade planned that will increase its capacity substantially. The refinery uses the powerful Aspen-1 Manufacturing Suite, which is comprised of various

modules such as MBO, Orion and "Process Industry Modeling System (PIMS) that provide linear programming, blending correlations, automated feedstock and product range analyses to keep this valuable asset running at peak performance. One limitation at most refineries is that the laboratory information needed as input for these analyses is not available until several hours after it is validated. This is because the laboratory information has to be exported from the "Laboratory Information Management System" (LIMS) and manually keyboarded or imported into the Manufacturing Suite.

Key Benefits

- ▶ Integration between LIMS and PIMS helps plant maximize product quality and profitability
- ▶ Process Scheduler automates sample workload
- ▶ Instrument Interfaces automatically send data to LIMS
- ▶ Chemical Inventory helps avoid downtime by tracking purchasing and consumption of chemicals

When the Jamnagar refinery recently purchased the LIMS and Manufacturing Suite software, the ability to provide automated and near-real-time integration between the two systems was high on the list of requirements. A joint proposal consisting of PerkinElmer's LABWORKS LIMS and AspenTech's Manufacturing Suite was selected because it met this requirement while providing leading edge LIMS and plant optimization capabilities. The ability to base analyses that run the plant on near real-time data is expected to provide substantial incremental revenue gains and cost savings. Basing analyses on current data makes it possible to operate substantially closer to the spec while, ensuring that the product meets published specifications. Managers estimate that tens of millions of dollars in active ingredients can be saved each year by operating in this way.

Essar Oil's Refinery has a capacity of 10.5 million tons per annum (MTPA) with an investment of close to Rs.10 Billion (USD 2.2 billion). The refinery is being built with the latest, state of the art technology with technical and project assistance from the world's leading consultants and equipment suppliers in the field. It is designed to handle a diverse range of crude mixes. The refinery is configured to produce Euro II and Euro III grades of Petrol and Diesel. With mid-stream up gradation of processes and technologies, the refinery will have the capability to process the most sour, acidic and heavy crude.

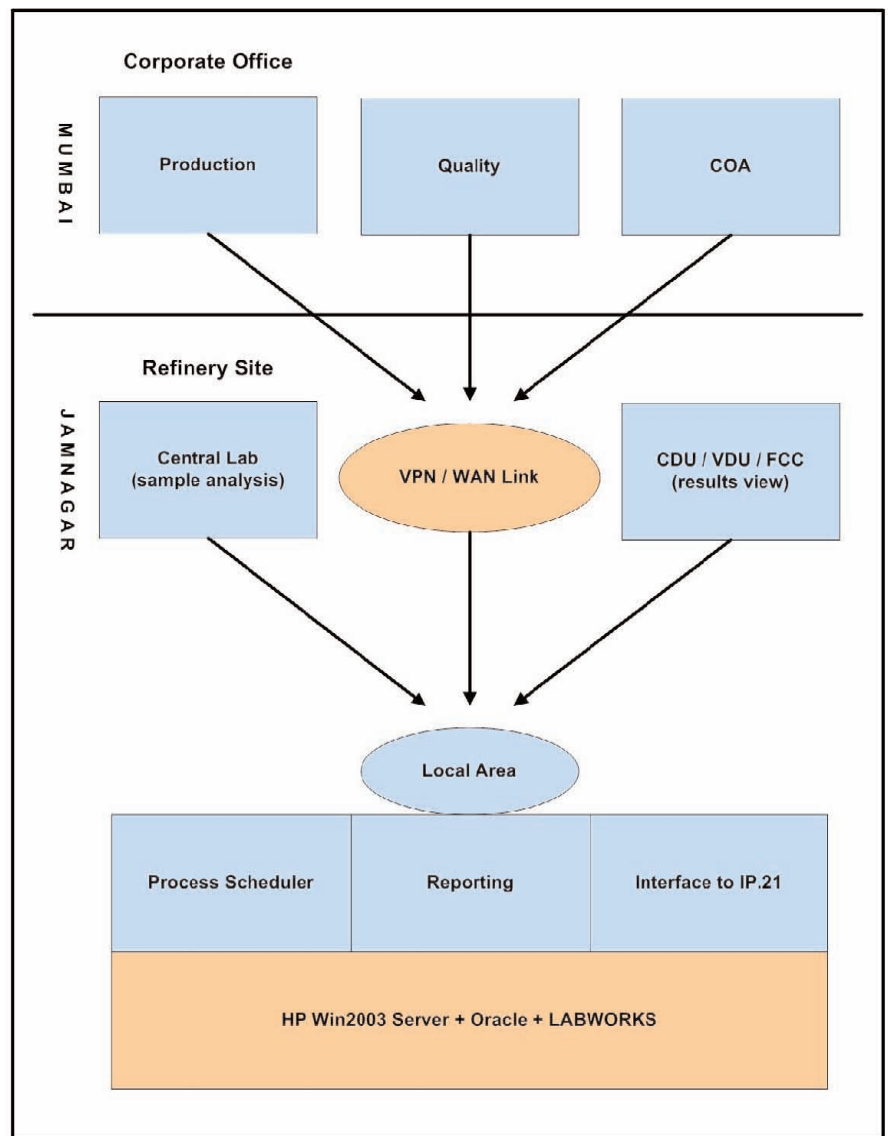


Figure 1: The key components of the system are as per the diagram above. Some important and relevant highlights include:

- More than 300 Location Codes and 500 Analysis Codes and overall 700 parameters.
- Sampling frequency / schedules as varied as 3/day to one/month
- Customized MOR using Word / Excel and Crystal
- Customized Shift-log report
- Customized Certificate of Analysis (COA/COQ)
- Barcode labels / Scanning
- Interfaces to PKI-TotalChrom, Mettler Auto Titrator
- Interface to Aspen IP.21 using OPC server

Critical role of the LIMS and the Manufacturing Suite

Both the Manufacturing Suite and the LIMS play a critical role in the operation of the refinery. The Manufacturing Suite captures online measurements from instruments located throughout the plant that measure pressure, temperature, flow and other parameters. Based on these measurements and other parameters, such as the market price of various products and costs of inputs such as crude oil, the Manufacturing Suite calculates the best way to operate the plant and either automatically implements these decisions or else provides them to plant operators as recommendations for manual implementation. The LIMS, on the other hand, interfaces with much more powerful instruments used by human analysts to measure the quality of raw materials, intermediate products and finished products of the refinery. The final result of the LIMS is a certificate of analysis that demonstrates that a particular batch of product meets the published specifications.

In the vast majority of refineries, the LIMS and the Manufacturing Suite operate as two separate islands of information. The information captured by the Manufacturing Suite is used to operate the plant while the information captured by the LIMS validates product quality, such as by ensuring that each grade of gasoline meets the minimum octane standards. The weakness of this approach is that a considerable portion of the information captured by the LIMS would have enormous value in operating the plant if it was available on a timely basis. For example, the laboratory might determine that the octane rating is

higher than required by the specification. If this information was available immediately, it might demonstrate that the amount of costly active ingredients used to produce the grade could be reduced while still meeting specifications.

Integration critical to project

High on the list of requirements in purchasing a LIMS and the Manufacturing Suite for the Jamnagar refinery was the integration of the two systems. Two leading software providers, PerkinElmer and AspenTech, decided to address this requirement by delivering a joint proposal along with BioAnalytical Technologies, a leading Indian software developer and system integrator. These companies offered to deliver a completely integrated solution built on the foundation of PerkinElmer's industry-leading LABWORKS LIMS solution and AspenTech's industry-leading Aspen-1 Manufacturing Suite solution. Both LABWORKS and the Manufacturing Suite provide an independent solution that is optimized to the requirements of, respectively, the laboratory and manufacturing. The use of two best-of-breed solutions means that the laboratory is not forced to operate as a process plant and vice versa. The three companies promised to implement the software solutions in a two-month time period. Their proposal was accepted by the Jamnagar refinery.

The implementation team began by working with the customer to define the operations of the laboratory. This process defined approximately 300 sample points, 500 analysis codes, and 1000 parameters. Sampling frequency ranged from

once per shift to once every two weeks. These were entered into the LABWORKS process scheduler so that work orders for all of the tests involved in the quality controlled process are generated automatically as needed.

Instrumentation interfaces

The instruments used in the majority of tests are interfaced to the LIMS so that results are automatically entered into the LIMS. The analyst scans the barcode on the sample vial and the instrument determines the analyses that are required, performs them and posts the results to the LIMS database. Instrument interfaces are installed for the PerkinElmer gas chromatography, liquid chromatography and atomic spectroscopy instruments used in the refinery. The implementation team is currently developing interfaces for the Mettler Auto-titrator and Herzog distillation apparatus. Automating the entry of the test results saves time for the highly-skilled analysts and eliminates the possibility of data entry errors. Test results are further processed where calculations are performed and statistical operations carried out and the results are returned to LABWORKS.

The implementation team created several custom reports. For example, the shift log report captures information about the activity of each shift that was previously entered in paper notebooks, making it much easier to archive and retrieve the information. The implementation team also developed "Certificates of Analysis" formats for the many different grades of product produced by the refinery. The reports are available on the company's intranet where

they can be accessed by users who do not have the LIMS installed on their machine.

The implementation team also installed the “LABWORKS Chemical Inventory” module which helps avoid expensive laboratory downtime by tracking purchases and consumption of chemicals and providing notification whenever an item drops below a predetermined level so that new supplies can be ordered. The integration of the chemical inventory module with the LIMS makes it possible to automatically track the items consumed by laboratory tests unlike stand-alone chemical inventory products that require manual data entry.

Development of the LIMS/ Manufacturing Suite interface

A critical part of the implementation was the development of the interface between LABWORKS and AspenTech InfoPlus.21, which

collects and stores information for the AspenTech Manufacturing Suite. PerkinElmer has previously integrated LABWORKS with InfoPlus.21 but each integration project requires some customization in order to account for the specific laboratory results that must be transferred to the Manufacturing Suite. The OPC Gateway in LABWORKS greatly simplifies the process of integrating the LIMS software with the many process control systems that support OPC.

The samples whose test results are needed by the process control systems are identified with a tag. Every time one of these tests is validated in LIMS, the OPC Gateway transfers these results to an OPC server which serves as an intermediate point for the interface. On the AspenTech side, the InfoPlus.21 OPC client picks up the information from the OPC server on a regular basis. The data transfer process can be set to run as

frequently as desired, providing near real-time availability of laboratory information to the Manufacturing Suite.

The primary benefit to the Jamnagar refinery of LIMS integration is the ability to operate more efficiently by using the quality information generated by the laboratory for process control. The goal of the refinery is to maximize profitability by producing a mix of products that will produce the highest possible level of revenues while keeping cost of raw materials and other inputs as low as possible. The integration between the LIMS and the Manufacturing Suite helps the refinery to operate closer to the spec while still meeting published specifications. Having quality information available to the Manufacturing Suite at least one hour faster than in the past can easily help the refinery reduce its usage of active ingredients by thousands of dollars per hour.

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