

LABWORKS LIMS Solutions

Environmental



Environmental Laboratory Cuts Turnaround Time 50% with PC-Based LIMS

When the Mississippi Department of Environmental Quality's management first made the decision to implement a Laboratory Information Management System (LIMS), they selected a system other than the one they are using now. They had so many problems during implementation that they decided to revisit the selection process. The second time around they chose LABWORKS™ from PerkinElmer Instruments. LABWORKS was one of the first PC-based LIMS and continues to consistently rank at the top of industry surveys. The software package supports Windows 95, 98, NT, 2000 and XP operating systems and Microsoft Access, SQL Server, SyBase,

DB2, Oracle and a native database with the same user interface and add-on applications.

PerkinElmer's LABWORKS ES includes expanded data fields to improve flexibility and readability, a Quick Help feature that displays help screens with current program information and enhanced security features that help laboratories meet 21 CFR Part 11 compliance. Another important feature is the ability to integrate a hand-held computer with the Process Scheduler. Results may be entered into the hand-held computer off-site and seamlessly downloaded to the LIMS, virtually eliminating transcription errors and reducing data entry time.

Key Features

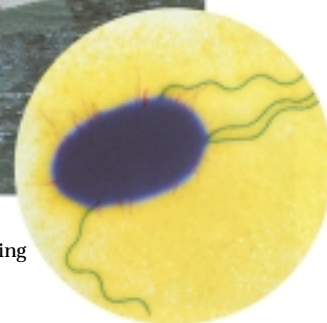
- ▶ LW Process Scheduler
- ▶ Instrument Interfaces
- ▶ LW Explorer
- ▶ Barcoding
- ▶ SQC
- ▶ QA/QC
- ▶ Report Designer

The Mississippi Department of Environment Quality (MSDEQ) has cut analysis turnaround time from receipt of samples to issuance of final report by 50% by implementing a personal computer based LIMS. When a paper based system was used, delays were common due to login errors, delays in moving paper forms from one person to another and the fact that it was difficult to track due dates of projects. The LIMS detects login errors so they can be corrected on the spot. It automates the process of moving information to the proper chemist and through the laboratory's four- or five-level review process. Major time savings come from the fact that the new LIMS tracks due dates so that chemists and reviewers can prioritize their work and complete the most urgent jobs first. "When we used a paper-based system our turnaround time ranged from between 50 and 90 days," said Heather Smith, programmer-analyst for the Mississippi Department of Environmental Quality in Jackson. "Now we are easily able to meet management's mandate that our final reports be completed within 30 days of sample receipt."

The mission of MSDEQ is to safeguard the health, safety, and welfare of present and future generations of Mississippians by conserving and improving the environment and fostering wise economic growth through focused research and responsible regulation. The Office of Pollution Control (OPC) Laboratory is a full service environmental laboratory, providing the agency with accurate and timely analyses of pollutants. The staff solves analytical problems, provides expert witnesses in environmental litigation, and offers technical support and information to the state's programs, the regulated community, and the public. Annually more than 3,000 samples from specific sources are analyzed and as many as 250 different determinations are made on one sample. Skilled and highly trained chemists and biologists use mass spectrometry, gas chromatography, atomic absorption spectrophotometry, fish pathology, toxicity testing and



Fig 1. The MSDEQ Office of Pollution Control (OPC) Laboratory is a full service environmental laboratory, providing the agency with accurate and timely analyses of pollutants.



routine quantitative and qualitative wet chemistry procedures to produce accurate results. A quality assurance program is used to continually evaluate and improve the efficiency and reliability of the laboratory.

Previous paper-based system

Prior to implementing the new LIMS, paper forms were used to track samples from the time they were received until the final report was issued. Technicians logged in each sample by recording pertinent information in laboratory notebooks and prepared hand-written labels. Then, the technicians tested the samples on laboratory instruments and recorded the results by hand. When the technicians were finished, they would pass the form on to a supervisor who reviewed their procedures and calculations. The supervisor reviewed the results and in turn passed the form onto the next person who needed to review it. This process was tedious because of the amount of manual data entry and calculations and was prone to errors such as transposing numbers when entering the reading from a laboratory instrument into the notebook. Another problem is that paperwork could easily be lost or simply set aside until well after the deadline for performing the analysis had past.

New automated process

Smith spearheaded the three-month implementation process. "The software itself was straightforward and required relatively minor customization to suit our application," Smith said. "The most challenging part of the job was training our staff and developing new business processes that take advantage of the LIMS' capabilities. Nearly everyone on our staff recognized the benefits and did their best to expedite the implementation process." The new process begins when the sample collector brings samples to the technician that handles login. During the login process, the technician enters the type of sample and the system automatically checks that the sample has been provided in the right bottle and has the right preservation method. "The checks that are performed during the login process help avoid the possibility that the test will be invalidated because of an error," Smith said. The software automatically begins the chain of custody at the time the sample is logged in.

Once the sample is logged in, it is automatically assigned to a chemist in the appropriate department for analysis. A major advantage of the software is that it organizes each

chemist's work so that they can easily see all of the projects that are assigned to them along with the due dates for each job. "The computer provides a continuous reminder that has played a major role in the turnaround time reductions that we have achieved," Smith said. At the present time, chemists enter their results manually. But Smith has nearly completed implementation of LABWORKS modules that will automate the results entry process for most analyses performed at the laboratory. "We are planning to have the interfaces for our gas chromatographs and our inductively coupled plasma spectrometers," Smith said. "They will be followed soon by an interface for our ion chromatographs." The interfaces will automate many aspects of sample logging, data entry and validation, saving considerable amounts of time.

Improved visibility and control

The analysis results are automatically routed for approval, first to another technician in the same department, next to the supervisor of the department, then the overall chemistry supervisor, and depending on the type of sample, often to one or two other managers as well. This process saves time previously spent delivering paper documents and avoids the risk that documents could be lost or damaged. Each person in the approval process can call up a list of test results that are waiting for their approval along with the due dates for each one. A manager can also easily check the status of individual tests or obtain a summary of tests for a particular department or the entire laboratory. "The advantage of providing complete visibility is that it has become almost impossible for a job to fall through the cracks," Smith said. "Managers can see almost immediately when work in a particular area is beginning to fall behind and take corrective action."

The LIMS also automates the majority of the reporting process. The previous generation of reports were multipage carbonless forms that had to be typed by hand. LABWORKS LIMS on the other hand, generates reports automatically by drawing on information that has been entered into the database throughout the analysis cycle. Smith said that some modifications to standard reports were required to meet MSDEQ's requirements. The result is that a job that required two and a half people can now be handled by one person with time left over to help in other areas. "The software also provides a chain of custody functionality that provides an audit trail to assure that our results will stand up in court if they ever need to," Smith said.

Improved productivity and quality

Smith concluded that the LIMS implementation has substantially improved both the productivity and quality of the laboratory. "The LIMS implementation has made it possible

to accomplish management's directive that we reduce our turnaround time by 50% without adding staff or working overtime," Smith said. "Just as important is the fact that the manager of the laboratory has said that the consistency of our database quality has significantly improved. In fact, he is so pleased with what we have accomplished that he has set a goal of becoming completely paperless at some point in the future. LABWORKS LIMS provides an excellent platform to achieve that goal, although we have a considerable amount of work ahead of us. Finally, I'd like to mention that the quality of technical support from the PerkinElmer Instruments group has been fantastic. We have many older computers that present unusual compatibility issues and they have provided us with a world of help to overcome them."

Special thanks to Heather Smith and the Mississippi Department of Environmental Quality for their assistance in writing this article.

Sample	Sample Description	Loc. Code	Anal Code	Anal Name	Anal Date	Sample Date	Print Date
111	AA00126	Outfall #2	OUTFALL2	PREP#0350	EPR 820 Prep ANALYSIS	09/11/02	09/11/02
112	AA00115	Outfall #2	OUTFALL2	PREP#0350	EPR 820 Prep ANALYSIS	09/11/02	09/11/02
113	AA00129	Outfall #1	OUTFALL1	PREP#0350	EPR 820 Prep ANALYSIS	09/11/02	09/11/02
114	AA00114	Outfall #1	OUTFALL1	PREP#0350	EPR 820 Prep ANALYSIS	09/11/02	09/11/02
117	AA00121	Outfall #2	OUTFALL2	PREP#0350	EPR 820 Prep ANALYSIS	09/11/02	09/11/02
116	AA00215	Outfall #2	OUTFALL2	#001	Halogenated Volatiles	09/25/02	09/18/02
117	AA00216	Outfall #1	OUTFALL1	#001	Halogenated Volatiles	09/25/02	09/18/02
118	AA00214	Outfall #2	OUTFALL2	#001	Halogenated Volatiles	09/25/02	09/18/02
119	AA00214	Outfall #2	OUTFALL2	PREP#001	Halogenated Volatiles Prep Analysis	09/25/02	09/18/02
120	AA00215	Outfall #2	OUTFALL2	PREP#001	Halogenated Volatiles Prep Analysis	09/25/02	09/18/02
121	AA00214	Outfall #2	OUTFALL2	PREP#001	Halogenated Volatiles Prep Analysis	09/25/02	09/18/02
122	AA00226	Outfall #1	OUTFALL1	#001	Halogenated Volatiles	09/24/02	09/24/02
122	AA00225	Outfall #1	OUTFALL1	PREP#001	Halogenated Volatiles Prep Analysis	09/24/02	09/24/02
124	AA00214	Outfall #1	OUTFALL1	#024	EPR 824 ANALYSIS	09/25/02	09/25/02
125	AA00216	Outfall #1	OUTFALL1	#024	EPR 824 ANALYSIS	09/25/02	09/25/02
126	AA00215	Outfall #2	OUTFALL2	#024	EPR 824 ANALYSIS	09/25/02	09/25/02

Fig. 2. The color-coded Backlog feature allows analyst to visually check which tests are overdue or approaching due date making it "almost impossible for jobs to fall through the cracks."

**PerkinElmer Life
and Analytical Science**
710 Bridgeport Avenue
Shelton, CT 06484-4794 USA
Phone: 800-762-4060 or
(+1) 203-925-4620
Fax: (+1) 203-944-2513
www.perkinelmer.com



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