

Beyond the Laboratory: Unique Solutions for the Water/Wastewater Industry

The Littleton/Englewood Wastewater Treatment Plant (L/E WWTP) has been facing increasingly stricter regulations. This is partly because the South Platte River, into which its effluent flows, is being used more and more for recreation and is a major water supply for a large community downstream. The paper-based information process previously used by L/E WWTP's laboratory was prone to occasional transcription errors, because results needed to be manually entered into multiple systems. The utility overcame these problems by implementing a Laboratory Information Management system (LIMS) that integrates with personal digital assistants and laboratory instruments

The utility uses Microsoft® Excel to largely eliminate manual data entry. The LIMS also integrates with other systems used at L/E WWTP to automatically move information into other systems where it is needed. "Our

chemists save one to two hours each per day in data entry and calculation time while the accuracy and quality of reporting have also been substantially improved," said Joan Day, Laboratory Supervisor at L/E WWTP. (A similar reduction in manual data entry by administrative staff has also been realized.)

The Littleton/Englewood Wastewater Treatment Plant is the third-largest publicly owned treatment works (POTW) in Colorado; serving 250,000 residents in the cities of Englewood, Littleton, and 21 other connector districts on the south side of Denver. The L/E WWTP is designed for waste water treatment of 36.3 million gallons per day and is regulated by the United States Environmental Protection Agency (US EPA) and the Colorado Department of Public Health and Environment. The Laboratory Division processes an estimated 40,000 samples and performs 90,000 total analyses per year.

Key Features

- ▶ Improved accuracy and efficiency of reporting
- ▶ FlexSystems PDA Interface with barcoding for sample collection
- ▶ Interfaces to PIMS, EEDMS, SCADA & more
- ▶ Color-coded sample status updates with the Process Scheduler
- ▶ Calculations using MS Excel

L/E WWTP. “For this reason it was necessary to perform a number of one-time tasks such as defining all of the various tests performed by the laboratory, the locations where samples were collected, labeling formats for sample collection bottles, etc.” With this information defined, the implementation team was then able to automate most of the repetitive tasks that used to be performed by the chemists. Laboratory managers have set up a schedule of tests that need to be performed in order to meet regulatory requirements. Work orders for these tests, which are repeated hourly or daily or at other intervals, are automatically generated by the LABWORKS Process Scheduler module. The work orders are initially queued as “not ready to collect” status. When a worker in the plant updates the status to “ready to collect”, the labels are automatically printed for each order. The chemists attach the

labels to bottles and put them on a cart ready for the operators who do the actual sample collection to pick up.

Automating sample collection

The operators performing sample collection use a software package called FlexOps that runs on Symbol PDAs with integrated scanners for capturing the test data. Data entry screens guide the operator through the sample collection process. When they are ready to collect the sample, they scan the bottle and the barcode at the sample collection location. The PDA software then checks to ensure that sample is being collected at the right location and signals the operator if they do not match. It also keeps track of who collected the sample and when.

The operator has the ability to select incidents from a list or enter

freehand notes. The results are uploaded through the Personal Data Entry Terminal (PDET) via the LABWORKS Process Scheduler every morning. At this point the sample status changes to “waiting analysis”. This automated status monitoring process ensures that all necessary samples are collected and analyzed while saving large amounts of time relative to the previous manual process.

Transferring data from instruments to LIMS

Chemists perform tests on these samples using instruments in the lab such as ion chromatography, mass spectroscopy, and atomic absorption, which can be interfaced directly within LIMS. The other instruments such as automated biological oxygen demand (BOD) are interfaced with Excel® spreadsheets that automatically perform various calculations. After the calculations are completed and the chemist checks the results, they simply push a button to upload the results to the LIMS. In some cases, the results of individual samples are stored in the spread sheet while only a composite value, such as an average needs to be stored in the LIMS. The analysis results are not immediately available for reporting but are held in the “waiting analysis” or “waiting validation” status where they are queued for peer review by a different analyst. Each analyst can log into the system and see a list of all the samples that are ready for review. After peer review, the results are then queued for a second review by a supervisor. Only after the second review do the results become available. Batch processes run on a periodic basis, typically every hour, to look for new or updated information. When new



Figure 2. The FlexOps PDA application provides sample collection operators an easy-to-use data entry interface that automatically uploads collection information to LABWORKS.

information is detected, it is automatically converted into the format required by other plant systems. One of the most important plant systems is the OPSSQL plant operation and maintenance program. It is used to store both flow information and test results in order to generate reports incorporating both to meet state regulatory requirements.

Wastewater implementation experience

The LABWORKS implementation and support team along with professionals from Inflection Point Solutions has worked with and implemented all of the major systems used in the water utility environment. These include Performance Information Management Systems (PIMS),

EEDMS, SCADA, and plant operations and maintenance systems. This experience helps them develop interfaces that make LIMS data more accessible to other stakeholders, eliminates redundant data entry transcription and increases laboratory and operational data quality. "The LIMS saves a huge amount of time," Day concluded. "Each of the four chemists in the lab saves 1-2 hours per day, which was previously spent mostly in manual data entry and calculations. The operators experience comparable time savings. I even save time by being able to access information, such as to answer questions on how calculations were performed, much more quickly. Even more importantly, the results are more accurate because most data is entered and transferred into other data systems automatically. The LIMS also automatically performs many data checks that there was scarcely time to do in the past such as using the PDA to ensure that the sample is being collected at the right location at the right time."

The screenshot shows the LABWORKS LIMS Process Scheduler interface. The main window displays a table titled 'PLANT-MONDAY' with columns for Sample, Schedule, Sample ID, Description, Priority, Status, Department, LIMS Sample ID, Analysis, Logon record file, Violation, Comment, Sample Type, Request time, and Logoff time. The table is color-coded: red for 'Ready to Collect', yellow for 'Waiting Validation', and green for 'Completed'. A sidebar on the left lists various departments like BOI/NITRATE, BENEFICIAL LIFE, GRASS MONDAY, etc. The interface includes standard software menus like File, Edit, View, Options, Reports, and Help.

Figure 3. The Process Scheduler allows analyst to easily identify sample status with a color-coded screen.

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