UGA Warnell School of Forest Resources builds mobile laboratory for wastewater analyses and management

MATTHEW J. COLEMAN

Michael Bruce Beck, University of Georgia Eminent Scholar, focuses research on wastewater treatment using a mobile laboratory to study waste stream flows.

Wastewater treatment is an important subject in the paper dustry and is a major concern for environmental compliance in many other industries. Typical models for wastewater treatment assume a steady state for contaminant levels and bio-reaction processes, but this is not always the case. Michael Bruce Beck of the University of Georgia has spent years studying wastewater treatment using the latest in process sensors and data analysis software. He has found that wastewater streams are anything but steady state. Treatment using that assumption can therefore lead to downstream problems and lack of compliance with regulations.

A major problem is that wastewater is not pleasant to be around. The nature of the waste stream makes it hostile to measuring devices. It is far from the laboratory instruments necessary to analyze its components. Beck's solution was to create a mobile laboratory that would have the sensors and recording instrumentation in it. This mobile laboratory can be taken to a waste stream and left there with sensors in place to analyze variations with a degree of accuracy and "granularity" not possible with dip samples analyzed remotely. The laboratory will also give "real-time" data to allow researchers and process operators to see the effects of process variations on the waste stream.

Michael Bruce Beck (left) and Demetrius Cox, graduate student Assistant (right), inside the monitoring laboratory trailer. Sampling equipment and monitors are on the bench in front.

Most waste stream data models use very few data points. Due to the hostile environment and the difficulty of taking samples, a true data shortage has existed in this field of study. Beck and the Warnell School of Forest Resources addressed these shortcomings with an innovative approach to applying complex and sensitive instrumentation.

This article is a current report on the work being

Pond monitoring probes are in the center of this photograph. The intake and outflow lines are the two pipes running diagonally into the water.

The two mobile monitoring laboratory trailers showing the intake and outflow lines.

done by Beck, who is a University of Georgia Eminent Scholar, in wastewater treatment and bio-sensor control of waste treatment processes.

FIELD OF STUDY

Waste treatment systems have large volume flows; high variability in the flow rate; high variability in the content, mixture, and chemical composition of the flow; and much debris and material in the flow that can clog sensors. This environment is almost universally hostile. In addition, process upsets often occur at night or other times that are not typically monitored. These can cause dramatic variations in the wastewater flow composition that have very short duration. Standard monitoring methods may miss them entirely.

For paper mills, external agencies mandate and manage the effluent monitoring and control. Failure to comply with the standards enforced by these agencies can result in fines, penalties, and even shutdowns. Total compliance is important, but process "spikes" that cause upsets in the treatment can be a major problem.

EQUIPMENT

In the field of wastewater flows, Beck has become a renowned expert on their monitoring. Under his guidance, a special mobile testing lab was constructed that allows continuous and automated monitoring of wastewater streams. The Warnell School of Forest Resources acquired and commissioned an Environmental Process Control Laboratory (EPCL) from Capital Controls. The laboratory consists of two mobile trailers that house all the components necessary to have a sample pumped from a given field location and analyzed for various characteristics. Resulting observations can be communicated over a telephone line to a remote host location. The purpose of the EPCL is to help develop process models and decision support and automatic control of systems.

The system can handle samples pumped continuously from three to six locations. Within each trailer, sample-switching devices are available such that each sensor can be presented in turn with a sample from each of the three streams. This provides a much clearer picture of the changes in the wastewater stream. Each trailer also

WARNELL SCHOOL OF FORESTRY RESOURCES CENTER FOR FOREST BUSINESS

The University of Georgia has created the Center for Forest Business as part of the Warnell School of Forestry Resources. It provides support for the forestry operations of the paper and forest product industries in the Southeastern United States. The center is a specialized area for education, information, and technical help to companies whose business is forestry related.

The principal activities of the center focus on a graduate program for the future leadership of the forest-based industries, research to improve planning and provide financial analyses to forest industry and private landowners, and service programs to educate professionals and organizations about the financial, biological, and social components of intensive forest production.

The future of the forest and the future of forest management are moving toward more intense sylvaculture. Simultaneously, the public exposure of forestry is increasing daily. This center is a major step forward for a state institution especially since it does not fall into one of the current "glamour" industries.

contains an automatically operated respirometer that can operate in many ways to meet the data collection needs. The respirometer measures the dissolved oxygen (DO) concentration in the water body being observed.

Besides DO, the instrumentation in the trailers can measure microbial oxygen uptake rate (OUR), total organic carbon (TOC), suspended solids (SS), nitrite and total oxidized nitrogen (TON), orthophosphate-P, and ammonium-N. Four other devices that can be deployed remotely at short distances from either of the trailers are also integral parts of the laboratory monitoring system. These are two automatic DO probes, one mixed liquor suspended solids (MLSS) probe, and an optical sludge blanket detector for secondary clarifiers. A capacity also exists for interfacing with permanent in-plant measuring devices such as flow monitors to the data logging and communications systems for the laboratory.

RESULTS

The EPCL was first deployed in 1997 at the Athens, Georgia, Water Pollution Control Facility No. 2. The system operated at this site for more than three months and provided a look into the process that had never been available. While more data on this are available directly from Beck's office, the summary is that the additional data from this laboratory allowed the managers of the facility to close one carrousel reactor for a substantial power savings while maintaining treatment quality at the same level.

Plans for the facility include active use by several industries in the state to provide the in-depth analysis that would normally be impossible without an automated process. The school is actively seeking other potential users to broaden the base of experience for the laboratory operators and provide a unique insight into waste treatment processes for industries that rely on these operations. **TJ**

Coleman is publisher of TAPPI JOURNAL, email: mcoleman @tappi.org.