

# Trucking in technology

Pennsylvania DEP's wastewater plant performance evaluation program benefits area utilities

Marc Austin Neville



**S**ince early 2009, the Pennsylvania Department of Environmental Protection (DEP) has been conducting performance evaluations at wastewater treatment plants (WWTPs) upstream of drinking water facilities. A part of these evaluations, which are designed to optimize WWTP operations and thereby improve surface water quality at the intakes of those downstream drinking water facilities, includes familiarizing operators with new on-line monitoring equipment and process monitoring and control techniques.

Various factors can affect a WWTP's ability to meet its effluent requirements, including wastewater composition, age and size of the plant, process equipment availability, and water quality monitoring and testing procedures. DEP's performance evaluations are designed to provide an effective means to increase the knowledge base that drives informed decisions to improve treatment performance.

"Our wastewater plant performance evaluations [WPPEs] are designed for educational purposes and to assist municipal



◀ **An ongoing Pennsylvania Department of Environmental Protection program familiarizes operators with new on-line monitoring equipment and process monitoring and control techniques. The program uses trailer-mounted equipment, shown here at the Middleboro Wastewater Treatment Plant.** Marc Austin Neville

## Purpose

DEP began its WPPE program with more than 100 wastewater treatment plants that discharge within 8 km (5 mi) upstream of drinking water plants. The program seeks to improve wastewater plant discharge quality and reduce nutrient and pathogen loading to downstream drinking water plants.

"The evaluations under our program are conducted at each wastewater facility for approximately 2 months, during which time we consult with plant operators and set up a number of on-line monitoring instruments to gather data on plant performance," DiGilarmo said. DiGilarmo and Marc Austin Neville, the author of this article and a water program specialist at DEP, conduct the evaluations. DiGilarmo works with the Northwest, Southwest, and North Central regions, and Neville works with the Northeast, Southeast, and South Central regions.

Operators are closely involved in the evaluation process and are shown the value of the collected data. Based upon analysis of these data, operators are presented with potential options for modifying treatment processes and effectively fine-tuning process control.

"Plant operators may be required to spend more time performing routine tests," DiGilarmo said, "but all the data gathered during the evaluation contributes to an overall picture of the plant's performance, and at all times, operators retain control of the facility."

DiGilarmo added that most participants realize the benefits of participation early on, including exposure to new or different monitoring equipment and process control strategies, the potential for discovering cost-saving modifications, and greater ability in meeting demanding requirements.

Many operators are still working with instrumentation that was there when the treatment plants were built in the 1970s and 1980s. "Our ability to show them modern, digital equipment has really made them aware of the possibilities of deploying SCADA [supervisory control and data acquisition] systems and digital probes, even at smaller facilities with tighter budgets," DiGilarmo noted.

## Instrument trailers provide quick deployment

The evaluations include usage of on-line process control monitoring equipment, portable and lab equipment, and possibly expanding the operator's knowledge of process control strategies and monitoring techniques.

"Operators of smaller wastewater treatment plants often don't have the luxury of using the newest equipment and monitoring all the parameters that our program does," DiGilarmo observed. "Some larger facilities have some of this equipment or different variations of it, but during our evaluation, we can still collect useful data and offer suggestions that may help them operate their plant more efficiently."

The water quality analysis instrumentation used for the program is from Hach Co. (Loveland, Colo.). In some instances, specially

wastewater systems in optimizing their wastewater treatment plant processes as part of the Wastewater Optimization Program," said Robert DiGilarmo, optimization program specialist in DEP's Bureau of Water Standards and Facility Regulation. "During the course of the evaluation, operators gain experience analyzing data gained from new or different instrumentation, analyzing new parameters and translating that data into process improvements," DiGilarmo said. "The end goal is improved efficiency and flexibility for the plant, as well as improved water quality downstream at the drinking water treatment plants."



**John Cowan and Greg Leininger from the Hach Co. (Loveland, Colo.) and Robert DiGilarmo from DEP unload equipment from the trailer on set-up day at the Middleboro (Pa.) Wastewater Treatment Plant.** Marc Austin Neville

designed trailers outfitted with the latest water quality sensors, monitors, and recording equipment are set up at the site. The trailers are hooked into the plant's system and immediately begin generating data.

"Among the parameters monitored are pH, oxidation–reduction potential [ORP], ammonia, nitrates, dissolved oxygen [DO], suspended solids, and phosphorus," DiGilarmo said. "We like using the trailers because they give us the capability of quickly deploying water quality instrumentation from site to site, with everything monitored from inside the trailer."

"We're not going to these plants to sell them equipment," DiGilarmo continued. "We show them new and different ways of monitoring the treatment process. Not only are these evaluations able to potentially help them improve effluent quality, operators become more aware and more involved in the treatment process, so it benefits them a long time after we've packed up and gone down the road."

### Hands-on experience

For example, DEP recently concluded evaluations at the Middleboro Wastewater Treatment Plant and the Ephrata Borough Wastewater Treatment Plant No. 2. At those locations, every 15 minutes, the trailers pulled in a measurement from each of the 19 probes that had been set up, DiGilarmo stated. The evaluations also included the use of hand-held field probes and state-of-the-art laboratory instrumentation.

Often, newer equipment provides more accurate information in a shorter period of time, allowing operators more time to make process control decisions and optimize plant performance while reducing technician workload. "During our evaluations, operators and technicians experience handling more-advanced equipment and learn certain advantages that can be gained from using it," DiGilarmo said.

"For example, a plant using Winkler titration or membrane probes to obtain DO readings is introduced to luminescent technology through the use of luminescent dissolved oxygen [LDO] probes," DiGilarmo said. During the evaluation, plant

personnel get to see firsthand that readings can be achieved from these probes before samples can even be drawn for titration. Also, he said, LDO probes do not require the frequent membrane replacements and calibrations that membrane-based DO probes do. Any equipment that can save time, reduce technician workload, and still produce quality data is well worth demonstrating to personnel during the evaluations.

Also, there are instances where monitoring one additional parameter can promote more efficient operation. For example, Ephrata Borough Wastewater Treatment Plant No. 2, which recently participated in the program, has been commendably running nitrification and denitrification processes using an automated system based on DO measurements.

"But we found through the evaluation program that monitoring ORP in addition to DO should increase the efficiency of the process significantly," DiGilarmo noted. Running the denitrification based on DO probe readings was effective; however, using an ORP probe in tandem can provide detailed data specific to the denitrification process that wouldn't be available from DO measurements alone, he said.

Taking ORP readings in conjunction with DO readings should enable the facility to fine-tune the process even further, delaying aeration until absolutely necessary, DiGilarmo said.



**Kevin Anderson, an environmental group manager for the Pennsylvania Department of Environmental Protection, helps to install a sludge level probe at the McConnellsburg Sewage Authority on the coldest day of the year.** Marc Austin Neville



Pennsylvania. Although Pennsylvania, like most states, has experienced severe budget shortfalls during the recent economic troubles, the WPPE Program has been funded for an additional 18 months. Its scope has been extended to include facilities where public water supply filter plants are up to 16 km (10 mi) downstream, thereby expanding the pool of candidate facilities.

As a result of operator feedback, the program also is focusing more heavily on biological nutrient removal and on energy efficiency, both issues having recently been elevated in importance by increased focus on the health of Chesapeake Bay and the recent deregulation of electricity generators in Pennsylvania.

DiGilaro said he is strongly committed to the educational aspects of this program. "Ultimately, we would like to emulate DEP's filter plant performance

evaluation program, which employs several drinking water specialists at the regional office level, where many more facilities can be evaluated and optimized as part of a mature, securely funded program.

"But the most important part of these evaluations is having operators more involved in the overall treatment process and looking at more parameters than they had in the past in order to continue to optimize their plants' treatment process," DiGilaro said.

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**Companies donate the use of the trailers as well as other lab equipment to the plants for the duration of the wastewater plant performance evaluations.** Marc Austin Neville

### Detecting problems early

The intense scrutiny of plant processes that plays a necessary part in the evaluation program also increases the likelihood of detecting problems before water quality is affected. In one such instance, the Middleboro WWTP was participating in the program and some changes had been recently introduced to the treatment process. In addition to the probes and meters typically utilized in the evaluations, DEP had utilized a software program that enables previously collected and current data to be accessed from anywhere via the Internet.

"During one early morning login, I discovered that DO levels had dropped drastically in one of the plant's aeration tanks," DiGilaro commented. "If levels continued to drop, the process would have lost nitrification, resulting in a plant upset. I called and alerted the operator. Though it was early and he was not yet onsite, he was able to get there quickly and switch on another blower, getting DO back up to proper levels and averting an upset."

### Increasing involvement, building confidence

As on-line technologies and analytical systems have become more advanced, accurate, and reliable, plant operators have become confident in their use. "Our program is helping to further boost that confidence through the implementation of plant evaluations that provide hands-on, real-world experience with new technologies," DiGilaro said.

The hope is that the success of the program will lead to more funding so that the program can be expanded to include additional WWTPs throughout



**Robert DiGilaro, an optimization program specialist in DEP's Bureau of Water Standards and Facility Regulation, removes an ammonia probe at the Middleboro Wastewater Treatment Plant to perform a weekly check and service the equipment.** Marc Austin Neville