Water sampling has been required by the U.S. Environmental Protection Agency (EPA) since the 1980s. Every water and wastewater utility or business holding a National Pollutant Discharge Elimination System (NPDES) permit employs some kind of technique or equipment to acquire water samples and a method to analyze the samples according to EPA guidelines. While some plants still take manual samples in many cases, automatic water samplers also are used.

The vast majority of existing stationary automatic water samplers are used mainly to meet EPA NPDES permit requirements. These samplers are designed to minimize effects on the chemical and physical integrity of the sample, and to ensure adequate storage conditions until they can be analyzed in a laboratory.

Most of the stationary units on the market today use peristaltic pumps as the sample transport method. These units periodically take samples and combine them into a single bottle stored in the sampler at 4°C. Lab technicians remove the sample bottles and take them to the laboratory for analysis and subsequent reporting to EPA.

In recent years, automatic samplers have improved to the point that they can be used for more than just meeting EPA regulations. Today, several robust water and wastewater utilities are using automatic samplers for process control and management.

Sampling stations satisfy EPA regulations while increasing process efficiency.

By Tracy Doane-Weideman

How to Use a Liquid Monitoring & Sampling Station
automatic sampling transfer methods and systems are available to meet a variety of matrix and sample compositions. Advanced features provide data that can be used for increasing the process efficiency of water and wastewater treatment plants.

**Sampling the Samplers**

Automatic sampling systems offer various means of obtaining water samples from basins, closed tanks and pipe. This typically involves the installation of a line from the basin, pipe or vessel made of Teflon or C-flex pump tubing from the pipe to the sampling pump. Three types of sample transfer configurations are available:

- **Peristaltic pumps.** These pumps meet the EPA-recommended line velocity of at least 2 ft per second at head heights up to 26 ft. Peristaltic pumps are the most common method used for sampling, and are suited for toxic applications.

- **Vacuum pumps.** These pumps also meet EPA requirements, and have no internal tubing that must be cleaned and maintained. Vacuum pumps can transport samples faster, reducing the time particles have to settle. The lack of compression from tubing avoids particle shearing. This is especially important when determining the dewatering of sludge, the permeation rate of water through membranes, or the head loss in granular media filters. These pumps work well in industrial applications where particle size and shape are important quality parameters.

- **Closed-pipe systems.** These are used on high-pressure pipe or vessels, and no sample pump is required. A pneumatic probe protrudes through the wall of the pipe or vessel and extends a plunger into the stream to collect a sample. The sampler can be used on pipe or vessels at pressures up to 87 psi. Some closed-pipe samplers are available with automatic cleaning systems to reduce maintenance of the sample probe.

**Monitoring Water Quality**

While the EPA-required analysis of the samples is done in a lab, modern sampling systems may have their own sensors to provide event-driven online monitoring. These online and real-time measurements can be fed to automation systems to improve process control.

For example, the Liquistation sampler can accept inputs from up to four industrial-grade sensors, including pH/ORP, conductivity, total suspended solids/turbidity, dissolved oxygen, SAC and nitrate, ammonium/nitrate and free chlorine, in addition to analog inputs from flow or level devices. With the ability to combine sequential sample collection with composite sampling in one system, it is possible to provide the obligatory EPA sample and collect samples based on events.

Data from the sensors can be stored internally in logbooks or on an industrial SD card, displayed locally on an LCD, and transmitted in real time via standard industrial networks, including EtherNet/IP, HART, Profinet DP, Modbus RS485 and Modbus TCP. Data collected typically include measured values with date/time stamps and information regarding calibration, configuration and diagnostics. Some systems come with built-in Web server capability, allowing access to the data from any Web browser. With such access, an operator or engineer can check sampler status, read measurement values or change sampling programs remotely from a smartphone, tablet or PC.

While most automatic sampling systems are used to meet EPA regulations, and therefore are installed on the output side of a water or wastewater treatment plant, samplers can be installed anywhere in the process as required to control, monitor and improve operations.

**Controlling Processes**

When sent to a plant’s automation system in real time, water quality data from the sampling system can be used to monitor and control various treatment processes, such as chemical dosing, aeration, sludge activation, carbon load entering the plant, nitrogen in wastewater, load spikes, denitrification, recirculation, carbon in the biological treatment and dosing of precipitants.

Water from different sources carries different loads. For example, water from springs and wells may contain particles, surface water may contain biologically active elements, and water from industrial processes may contain chemicals. Using an automated sampler with analyzers helps determine the quality of the untreated raw water, which allows the automation system to adjust processes accordingly.

Event monitoring at the inlet of a treatment plant identifies excursions of effluent entering the plant such as a large influx of total organic carbon or a large shift in pH or turbidity, each of which can occur...
how to: sampling & analyzing

due to accidental discharges by industrial entities upstream of the plant.
Continuous monitoring of the discharge values ensures safety.
Complete documentation can be used as proof of wastewater treatment
performance to authorities and for internal monitoring purposes. For
example, if the sludge profile is monitored, changes caused by a heavy
downpour can be detected quickly and countermeasures can be taken.
Automated samplers, therefore, can do more than just satisfy
EPA reporting requirements. When combined with on-board analyz-
ers, modern industrial networks and supporting software, automated
samplers provide vital data for controlling and optimizing water and
wastewater processes.

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