Tech Brief

A NATIONAL DRINKING WATER CLEARINGHOUSE FACT SHEET

System Control and Data Acquisition (SCADA)

by **Zacharia M. Lahlou**, Ph.D., Technical Assistance Consultant

Summary

As small water systems continue to struggle to become more efficient, technology provides good ways to improve operations. Nowhere is this more apparent than in the application of control and communications systems—namely SCADA [System Control and Data Acquisition]—and their ability to provide system and information management that can help utilities meet regulatory requirements, reduce operating costs, and improve customer service. A water distribution system transports water from the treatment facility to the user. The distribtion system should supply water, without impairing its quality, in adequate quantities and at sufficient pressures to meet system requirements.

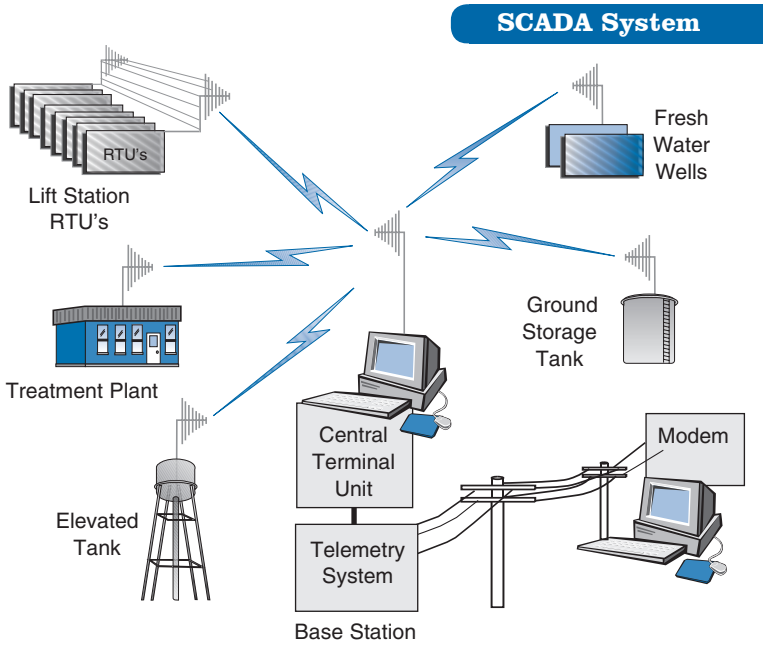
What is SCADA?

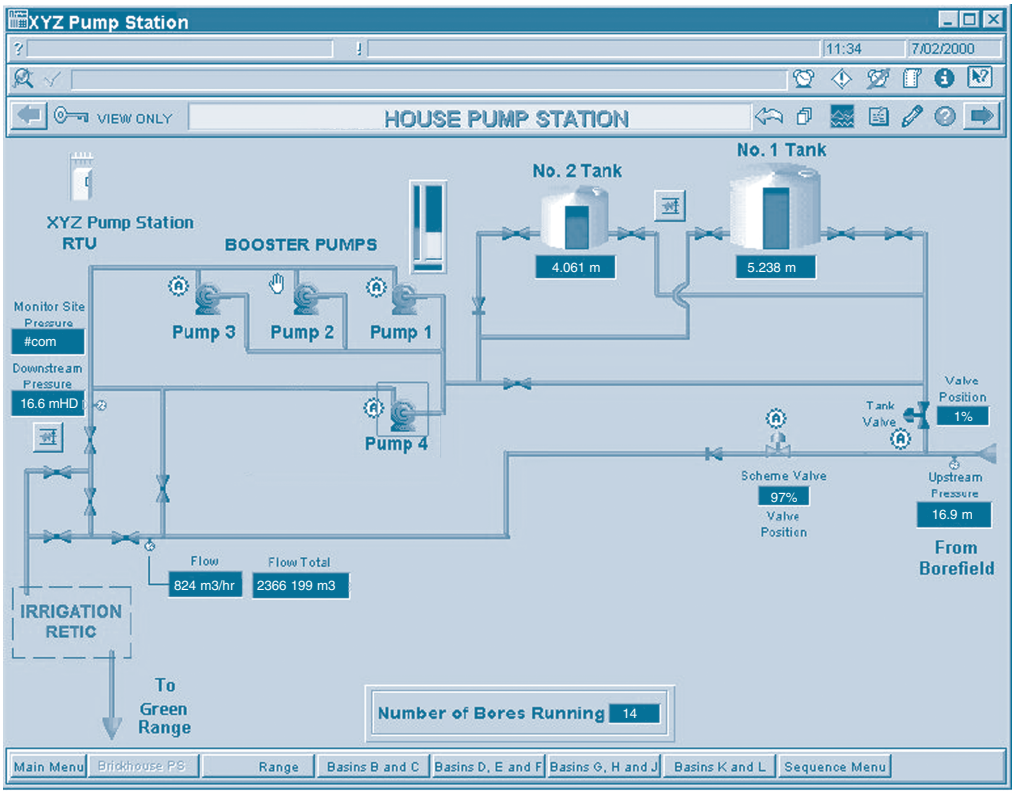
A SCADA system consists of a computer placed at a central location, communications equipment, programmable logic controllers, sensors, and other devices that when put together, will monitor and control equipment and processes in a utility, such as a water system. Remote sites, equipped with remote telemetry units (RTUs), can be located as close as within the same building or as far away as across the country. RTUs measure a variety of conditions and parameters, including tank levels, temperature, voltage, current, volumes, and flow rates, and report back to a central processing unit (CPU). This technology is widely accepted in the water and wastewater industries as a reliable and efficient control system.

SCADA Equipment Enhances Water Operations

Functions that the SCADA system can perform include: remote monitoring of well levels and control of their pumps, and monitoring flows, tank levels, or pressures in storage tanks. A SCADA system can also monitor water quality characteristics, such as pH, turbidity, and chlorine residual, and control the addition of chemicals. In the distribution system, SCADA can supervise and control the water pressure of networks, assure water pressure is uniformly distributed, lower the leakage rate, and store data for future analysis.

SCADA is not a new technology by any means, but significant innovations and improvements have been achieved since its introduction. By automating many routine tasks, a SCADA system frees the





plant operator to perform other duties, such as addressing state and federal reporting requirements. In fact, SCADA can assist in mandated reporting because it can store various activities and information on the computer. Graphs and reports can be generated automatically using the data collected remotely from the field. These reports are important in inferring production and consumption patterns, data that help manage the water resources more efficiently. Stored information also proves invaluable when producing the annual Consumer Confidence Reports required under the 1996 Safe Drinking Water Act (SDWA) Amendments.

SCADA is useful in an emergency situation. Immediately following an incident, an operator can be notified via personal pager and increase response capability dramatically. SCADA provides multipurpose utility management, operating flexibility and more complex system control. SCADA keeps an eye on the entire system from one place.

SCADA Provides Cost-Effective Control and Monitoring for Small Water Systems

Because of its cost, smaller systems often viewed SCADA as a luxury item. But water system management has become complex and SCADA has become more advanced yet, paradoxically less expensive, making SCADA a viable option. Initial installation costs, which are often high, typically pay for themselves in a short time through direct labor and vehicle cost savings, as well as increased efficiency.

Due to a low tax base, many small communities have limited financial resources for drinking water system management and operation. Thus, it is difficult for operators to maintain extensive manual monitoring to ensure the system complies with complex regulations. These small systems, therefore, frequently violate (monitoring/reporting violations) the SDWA and its amendments, according to the National Research Council.

One solution to keeping up with ever more stringent requirements is for several small communities to pool their resources. The U.S. Environmental Protection Agency is evaluating the option of using remote telemetry, called an "electronic circuit-rider," that allows one qualified operator to monitor and control the operation of several small treatment systems from a centrally located computer. Using such a system can optimize the time spent taking daily readings out in the field. For onsite inspection and maintenance efforts, the RTS allows the operator to visit only the problematic systems. The results expected from an appropriately designed and successfully deployed remote monitoring and control system include enhanced water quality, compliance with existing water quality regulations, and reduced operating and maintenance costs for small communities.

Security Measures Are a Concern

Experienced computer hackers can access SCADA systems that operate over the Internet and deactivate process alarms, change chemical parameters, start and stop equipment, and so on. The results of such an intrusion can be devastating to the general public and to

SCADA Components and Terminology

Distributed Control System (DCS): An integrated system made up of many subsystems that are remotely located. Each subsystem can operate independently.

Modem (MOdulator DEModulator): Used to convert signals in one form to another. This is generally used for communication between computers and other devices over telephone lines or radio.

Programmable Logic Controller (PLC): A microprocessor-based controller, usually with multiple inputs and outputs and a program to perform control functions

Remote Telemetry Unit or Remote Terminal Unit (RTU): A microprocessor device with multiple inputs and outputs connected to field instruments and devices. The RTUs translate these signals to digital form and transmit the same to central location by radio or telephone lines.

plant employees.

Many system managers installed protection as part of their "Y2K" contingency plans. The likelihood of a terrorist cyber attack is less likely than a cyber attack from a disgruntled employee. Fortunately, there are steps a system can take to minimize a security breech.

The National Infrastructure Protection Center (NIPC), located in the Federal Bureau of Investigations headquarters in Washington, D.C., shares information with public and private sector owners and operators of critical infrastructures. The NIPC monitors, warns, and investigates unlawful acts involving computer and information technologies. The agency manages computer intrusion investigations and supports law enforcement related to cyber crimes.

Best practices regarding the security of SCADA operation include:

- Internal threats are usually the main security challenge. The key to managing internal threats is understanding who might do what and why.
- Log-ins should be traceable and a strong password authentication process used.
- Suggest that a utility consider fiber optics to each of its remote facilities. This is the best solution in terms of bandwidth and security.
- Suggest taking a look at commercially available tools for monitoring computers and having a security team review activity weekly to verify that only authorized users are accessing the system.

What should be considered when buying a SCADA system?

Selecting the appropriate SCADA system software is all-important. The software program should be capable of performing every task needed to operate and maintain water treatment and the distribution system. Its use in many similar applications should prove its reliability. Make sure the hardware supplier and the software developer can guarantee prompt, efficient, and cost effective support. The manufacturer should have experience in the water and wastewater industry and be able to provide service, replacement parts, and support for the system when needed.

To expedite the selection of specific devices/components for an RTS that monitors and controls a small drinking water facility, prepare a list of features associated with the particular water treatment facility. Identify the water quality parameters and types of monitoring that are key to the specific operation. For example, monitor residual chlorine to verify disinfection operations. Next, review the regulatory compliance requirements and consider them when reviewing manufacturers' specifications and discussing the applicability of their device or system. Finally, select the monitoring device.

It is important to document the pump characteristics, operational functions, and the physical dimensions of the treatment system

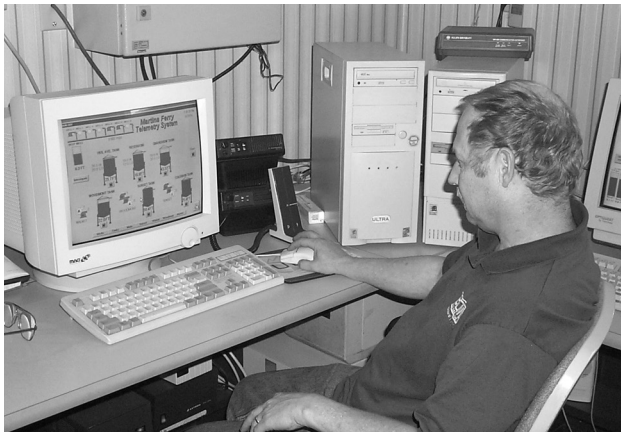


Photo by Kathy Jesperson

John Barkey, plant operator for Martin's Ferry, Ohio, inspects the water levels of the system's storage tanks from his desk.

before selecting components to monitor flow rates, pressure, electrical usage, or other process functions. Know facility specifications when contacting technical representatives of process monitoring/control devices. Component selection must be based on the plant's operational characteristics.

Data acquisition and telemetry components can be purchased as package items, but again, identify an inventory of what devices will be used on line and what options exist for transmitting data in the locality of the treatment plant before contacting suppliers.

For More Information

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To learn more about the National Infrastructure Protection Center (NIPC), write to the NIPC, 935 Pennsylvania Avenue, NW, Washington, D.C. 20535-0001, call toll free (888) 585-9078, or e-mail nipc.watch@fbi.gov. *Information is also available on the NIPC Web site at* www.nipc.gov.

Zacharia M. Lahlou holds a doctorate in Environmental and Natural Resource Economics, as well as an MBA and a master's degree in Civil and Environmental Engineering from West Virginia University. Now a consultant, he formerly served as technical assistance coordinator for the National Drinking Water Clearinghouse.

National Environmental Services Center

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