By Andy Harris

Remote Water Treatment Process System Benefits

Conventional water treatment control systems often lack the ability to communicate all process parameters from a centralized location to the point of operation. Thus, standardized control of all the facilities within a water district is difficult. Process adjustments performed onsite may not conform to federal, state or municipal regulations for water quality control.

In a conventional water treatment program, river and lake water travels from a pump station to a raw water reservoir, where the unpurified water is stored temporarily. The water undergoes sedimentation and flocculation procedures before filtration and additional purification at the water purification plant. Each step has the potential for error.

Remote control of all process parameters enables complete, automated monitoring by experts at a central location as well as manual adjustments to process steps at specific sites by local service companies as required. Such a system allows operators to speed up, slow down or otherwise change a specific aspect of the process as detected by sophisticated central monitoring.

Sand Filtration Purification

For example, a critical component of the purification process is the sand filter system. In a sand filter system, an exact and defined flow rate of the contaminated water is required to assure that debris, sediment and impurities remain in the filters while the water flows through the sand. A mechanism is needed to monitor the pH value of the water to maintain the proper balance of lye and metallic salt used in the filter's batteries.

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Sand filters, used for continuous water treatment, pass water slowly through a bed of sand to remove pathogens and turbidity by natural attrition, biological action and filtering. The outlet of a sand filter must be above the sand level and below the water level. The water must be maintained at a constant level to ensure an even flow rate throughout the filter. In order to increase the flow rate, the controller can lower the outlet pipe or increase the water level. The turbidity level for water must be kept as low as possible.

The optimum treatment time for pathogens in the sand filter may be a week or even more. During this time, the water should be chlorinated or purified with iodine if at all possible. After the filter has stabilized, the water should be safe to drink, but chlorinating or other purification of the output is still a good idea, particularly to prevent recontamination. As the flow rate slows down, the filter will have to be cleaned by draining and removing the top few inches of sand. As the filter is refilled, it will take a few days for the biological processes to reestablish themselves.

Easy Flow, Level and Analysis Control

Process control systems that remotely manage the conversion of water from rivers and lakes into safe drinking water can address the need for standardized, centralized control while enabling changes to be made on the premises. These systems can manage multiple parameters and signal the need for adjustments.

Using specialized sensors to measure the quality of the water, these systems can be programmed to trigger alarms when the water or the system exhibits out-of-range measurements. Manual adjustments can be made to properly adjust amounts of chemicals or other control parameters at any point in the water purification process, should the system detect problems.

A control system with a flow sensor controls the continuous flow of unpurified water to the sand filter. A programmable logic controller (PLC) establishes the external setpoint.

Meanwhile, a pH transmitter controls the dosing pump for the metallic salt. This pH value is used to adjust the dosing pump for the lye addition through the PLC. A two-level transmitter measures the level of the chemical tanks and transmits the values to the central PLC to ensure chemical delivery and sufficient chemical inventory.

The entire water treatment plant is remote controlled by the central PLC and a data modem. The refilling of the chemical tanks can be ordered according to the remotely accessed level value.

Convenient Control Mechanism

The controller compares the actual process value measured by the sensor with an internal setpoint. After using a predetermined method to calculate a setpoint, the controller uses it to adjust the actuator or valve until the process value equals the setpoint.

The setpoint is the ideal process value for operating the production process. This value varies according to the application, and therefore differs for every production process.

In addition, the setpoint may vary in the process in order to adapt the process to the particular production batch. For example, lower constant temperature or higher constant pressure may be required for different products. Often the operator enters the setpoint manually into the controller during the process. The controller then settles to the new process value.

Controllers have a special communication interface (typically 4–20 mA or field bus) to enable the automation of this intervention. This interface enables the transmission of the new setpoint from a process master computer to the control loop.

Obviously, the smallest process control loop (e.g., flow rate, temperature, pressure, analysis or filling level) is the most important basic cell in automation. The cell's configuration influences the technical behavior and system costs of the entire automation system.

Decentralized intelligence assures the flexibility of the connecting technology and integrates it into the controllers.

In order to simplify the design of the control loop, the controller can be recombined with the sensor or valve. The sensor and actuator (valve) can be connected with a direct link using industry standard communication protocols (4–20mA, 0–10V, pT100, frequency, etc.). This recombination, along with decentralized intelligence, enables the use of a direct link with most of the familiar and proven technologies. The control method used (on/off, continuous solenoid control, continuous pneumatic control) determines the choice of technology.

Decentralized intelligence assures the flexibility of the connecting technology and integrates it into the controllers. Appropriate valve technologies for on/off control systems, continuous solenoid and continuous pneumatic control systems ensure precise matching to the liquids or gases to be controlled, whether pure, pasty, oily or particle-loaded fluids.

Process accuracy requirements, old habits and accepted wisdom usually determine the control technique used. When designing a control loop, start with the configuration of an easy on/off control.

Conclusion

By installing a centralized water treatment system that monitors flow, level and analysis control, a water treatment processing plant can achieve constant and improved quality of the drinking water production process. The payback period after installing the system is approximately three months.

In water quality applications for manufacturing plants, the system reduces operating costs while enabling fast configuration and installation. It provides centralized control to monitor the entire plant from one location, putting the local process into the main control system at the point of operation. The result is cost-effective, centrally managed and consistent water quality control.

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