

New Process Control System Encodes Unique Elements Of Process Engineers' Knowledge

By John Sheridan



Often, plant controls are nothing more than a controller connected to a dissolved oxygen (DO) probe, programmed by an installer that may know little about the actual process. Sometimes a control system is nothing more than some clever animation, pretty graphics, and switches on a computer screen.

The challenge is to design automation that provides real value to the user. Process knowledge and understanding of its control should be encoded into the software. The control system should enable the operator to get better performance than with a manual system. It should also bring knowledge otherwise unavailable to the operation of the plant.

USFilter's Envirex Products provides a control system designed by process engineers. The proprietary software in the controller encodes unique elements of knowledge of process. It is the result of many decades of work in developing process expertise as well as many years of research in understanding the process.

The principle features of the SmartBNR™ process control system are: precise control of simultaneous nutrient removal in the aerated-anoxic reactor; predictive aerator response to reactor conditions and oxygen demand; integrated control strategy using both oxidation-reduction potential (ORP) and DO in reactors in series; automated sludge wasting to control to an optimum sludge age; automated response to stormflow conditions.

The principle benefits are:

- *Extremely high process reliability.* Absolute minimum power cost.
- *Hands-free operation.* The operator need not perform process control actions daily.
- *Unattended plant operation.* Plants that are not attended nights and weekends still perform control functions.

The main function of the system is to optimize oxygen delivery to a process using an aerated-anoxic reactor. It

maintains precise reactor conditions to reliably remove both nitrogen and phosphorus as well as provide selection of microorganisms to minimize the chance of bulking and other process problems.

An extensive program of research has enabled USFilter's process engineers to understand reactor conditions based upon ORP and DO. They have also learned of trends that signal process changes and potential degradation before it occurs. With this knowledge, they have developed a responsive system that predicts reactor behavior and changes conditions in advance.

Aerated-anoxic processes, while only recently entering the mainstream literature, have been the mainstay of Envirex aeration processes for more than two decades. Aerated-anoxic allows for simultaneous removal of nitrogen in a single reactor. It also allows for enhanced biological phosphorus removal without the use of expensive and inefficient anaerobic tanks.

In one sense, the main function of activated sludge is to turn soluble waste into biosolids. Control of the solids inventory in a process is the key to running a plant well. The SmartBNR system measures the solids inventory in the process and wastes sludge to maintain a constant target sludge age. The operator selects the sludge age, and the system does the rest.

It constantly evaluates the sludge inventory and updates wasting requirements. Wasting is automatically controlled to meet other process requirements in the plant. For instance, the system can waste to maintain a level solids loading (constant mass flow rate) to get the best performance out of dewatering equipment and allow

dewatering with little or no operator attention.

The constant nightmare for the duty operator is the stormflow situation. A rainstorm in the middle of the night often means a call from an automatic dialer. The operator must run out to the plant and try to keep his solids from washing out of the plant.

The SmartBNR system automates the stormflow mode of operation. This ensures that no solids are lost over the clarifier weirs and that the duty operator can get a good night's sleep (or at least can focus his attention elsewhere).

This system can run any number and variety of control functions and programs in the plant. An example: in a plant with an equalization basin, the controller can measure the level in the basin and adjust pump speed to meet process goals.

The SmartBNR system uses a panel PC running PlantScape® Vista software, offered through a strategic partnership between USFilter and Honeywell for the human/machine interface (HMI). Through proprietary software design, the PlantScape Vista automatically shares all graphics and control points with PlantScape SCADA. This significantly reduces the cost of the SCADA system. In plants with other SCADA systems, the SmartBNR system can communicate on any standard communication protocol.

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