Process Management Tool Combines Process Knowledge And Online Instrumentation For Proactive Nutrient Removal Optimization

The intelligence-based control system connects the process, equipment, devices, controls, and operational choices to be made.

by Manuel De Los Santos

For proper management of any wastewater treatment plant, the operational staff must create the appropriate environment to achieve the targeted effluent objectives. Accordingly, operators need to take samples, perform analyses, and calculate certain parameters to enhance system performance.

Ready access to key process information allows operators to adjust the operation in accordance with the influent wastewater characteristics and the prevailing reactor conditions. The level of data collection and interpretation grows in complexity as the permit requirements become more stringent. Therefore, municipalities will face increasing demands on their resources to meet the challenges associated with increased environmental restrictions.

Most effluent permits include limits for biochemical oxygen demand, total suspended solids, and ammonia nitrogen. The main operational parameters used to control this type of system include dissolved oxygen and the reactor biomass concentrations. In the last few years, regulatory agencies have been enforcing removal of total nitrogen and phosphorus to unprecedented levels. The high degree of nutrient removal will require some existing facilities to expand or to accommodate the new permit limits.

Meeting Increasing Regulatory Demands

As regulatory pressures increase, the requirement for additional plant information becomes vital, forcing operators to step up qualitative sampling and analyze more parameters. Keeping up with the additional demands may require municipalities to augment their staff to properly manage the information gathered on the system. In this case, the evaluation, interpretation, diagnosis, and response to the data become more critical to optimize process performance.

Adding personnel to the operations group of the treatment plant may not necessarily address the chal-

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lenges associated with this new era of more stringent effluent requirements and nutrient removal. Advancements in instrumentation are only part of the solution, as the data requires evaluation and interpretation. In addition, the mechanical focus of most Supervisory Control and Data Acquisition systems may not identify process or performance issues or aid in the development of corrective actions to adequately assist the operational staff.

To balance recent advancements in technology, combining process knowledge and online instrumentation in a single process management tool seems to be the next logical step. This can be accomplished though an intelligence-based control system that provides a link between the process, equipment, devices, controls, and operational choices that need to be made.

Features Of An Intelligence-Based Control System

Aqua-Aerobic Systems Inc. has developed such a technology. Operators cannot simply rely on a collection of independent parameters to successfully operate a treatment system. To gain a thorough understanding of the system, parameters must be compared and continually evaluated against defined set points to develop a prognosis. This balance of relational parameters is key to proper maintenance of the aerobic, anoxic, and

anaerobic environments desired for advanced nutrient removal.

With the aid of an intelligence-based protocol, the operators maintain 24-hour surveillance of parameters such as mean cell retention times, food-to-mass ratios, dissolved oxygen profiles, oxygen uptake rates, and mixed liquor suspended solids. Having immediate access to these parameters from a central location improves the speed and reliability of decision making by the operator.

To complete a process management system with respect to nutrient removal, combining singular nutrient concentrations with other process variables yields kinetic information, such as specific rates of nitrification and denitrification and phosphorus release and uptake rates. Coupling the results with operator-defined limit points can help the operator characterize and understand the system's performance.

While recording data is implicit to any process control system, the intelligence-based process platform can articulate the data through overlays on timed process sequences creating snapshot images for all operational events. With this information, the operations staff can predict similar events and make necessary adjustments to thwart process upsets before they occur.

To complement the data and process parameter calculations on the process management system, the addition of graphically based calculators to automatically adjust the aeration, system biomass, and chemical addition for nutrient removal makes the system a complete tool to enhance the nutrient removal capacity.

The integration of a complete set of process parameters and calculations into a single management system provides a powerful tool that ensures performance quality and reliability while saving time and money. Most importantly, the online training and decision-making attributes of this system will prove to be an essential tool for those municipalities that wish to do more with less. ∎

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