Executive Summary

WERF

Advantages of real-time monitoring and automated process control for nitrogen removal processes using online analyzers

BNR Process Monitoring and Control with Online Nitrogen Analyzers for Nitrogen Credit Exchange Program in Connecticut (NUTR1R06y)

Automated carbon dose control at the Stratford, CT water pollution control facility resulted in a significant cost savings. To fully recognize the benefit of the automated control, the plant operator worked on the optimization and tuning of the carbon dose controls, which further reduced the carbon dosing requirement, while continuing to achieve targeted denitrification performance.

The Central Issue

More and more treatment facilities are using automated process control and online analyzers as part of their biological nutrient removal (BNR) process control strategy to reduce nitrogen loading into waterways. Before the introduction of online analyzers, many facilities relied on nutrient data from composite samples which were analyzed once or twice per week by outside laboratories. As a result, process decisions were based on data that were at least a week old.

Context and Background

As part of Connecticut's Nutrient Credit Exchange program, the Connecticut Nutrient Credit Advisory Board (NCAB) offered funding for plants in the state to purchase online or portable analyzers for dissolved oxygen (DO) and nitrogen to improve BNR process control. This project evaluated the performance and reliability of online analyzers and the process control scheme used to optimize BNR performance. The research team conducted a survey of treatment plants in Connecticut which either participated in the NCAB program or were already using online instrumentation at the plant. The collected information included the type of online monitoring instrument, location(s) and frequency of monitoring, maintenance record, online analyzer performance, factors affecting the usability of the online analyzers, and conditions affecting nitrogen removal performance. The team held a workshop to encourage plant operators to contribute to the survey and to encourage implementation of automated process control. Two treatment plants were chosen for a more in-depth interview.

Findings and Conclusions

The research revealed there is an increasing interest and understanding of online nitrogen analyzers. However, the use of the analyzers for automated process control is not common. Many plants use the data from the analyzers for manual process control and for monitoring purposes only. The implementation of automated process control is easier when the treatment facility undergoes an upgrade, but it very much depends on the condition of the facility's existing processes. The cost of implementing automated process control can be recovered from the cost savings of energy and chemical use.

Management and Policy Implications

This research will help decision makers understand the importance and advantage of real-time monitoring and automated process control. The report includes recommendations that operators can consider should they choose to implement online analyzers and automated process control. It also updated a list of nitrogen analyzers (from WERF Project No. 03CTS8) which lists the manufacturer, model, technology, nitrogen compound measured, measurement method (in-situ or ex-situ), and maintenance requirements. This information regarding what is available in the market will be useful for utilities considering installing online analyzers at their facility.

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Related WERF Research

Project Title	Research Focus
Nitrogen Credit Trading in the Long Island Sound Watershed (97IRM5B)	Tracks a watershed-based trading program in the Long Island Sound in Connecticut to help other municipalities develop and implement trading programs of their own. Nitrogen effluent credit trading offers an equitable and cost-saving approach for major point sources to meet nitrogen reduction requirements and total maximum daily load (TMDL) limits.
On-Line Nitrogen Monitoring and Control Strategies (03CTS8)	Presents a cost-effective approach to comparing control strategies. Documents available nitrogen instrumentation technologies by categorizing nitrogen instrument specifications in a matrix for comparison, conducting site surveys of installed nitrogen instruments at treatment facilities, and assesses both "successful" and "limited" nitrogen control strategy applications used in conjunction with nitrogen instruments in case study investigations.
Evaluating the Impacts of Cold and Wet Weather Events on Biological Nutrient Removal in Water Resource Recovery Facilities (NUTR1R06s)	Evaluates strategies employed by BNR facilities in response to cold, wet, and cold-wet weather events, also known as adverse weather events (AWEs). Such conditions pose a challenge for many treatment facilities in meeting nutrient limits during the event, as well as returning to effective and consistent performance after the event.
Reference Guide of Proposed Terminology for Nutrient Management (WERF Nutrient Compendium)	Provides definitions and clarification on commonly used nutrient management terms for practitioners working in wastewater treatment, nutrient removal, or nutrient recovery areas.
Operation and Control of BNR Facilities (WERF Nutrient Compendium)	Summarizes current understanding, gaps of knowledge, and research needs in the operations and control of nutrient removal processes. Discusses BNR, biological phosphorus removal, and physical/chemical phosphorus removal processes.
Carbon Augmentation for Biological Nitrogen Removal (WERF Nutrient Compendium)	Q&A document provides a background on using carbon augmentation to achieve nitrogen removal and discusses fundamental process and design issues and operational considerations, as well as the advantages and disadvantages of using methanol and what other sources are suitable for carbon augmentation.

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