SECURING AMMONIUM COMPLIANCE AND ENERGY SAVINGS USING REAL TIME CONTROL

Wessex Water is continuously seeking new opportunities to improve wastewater treatment plant efficiency and environmental performance.

At Holdenhurst WRC, near Bournemouth (180,000 pe), the company originally operated the activated sludge plant (ASPs) by feeding dissolved oxygen data to the PLC, which controlled the blowers to maintain DO at specific levels (approximately 2.5 mg/l but with variations across treatment zones). The site had a good record for maintaining a low ammonium discharge, but had a high power & aeration requirement, particularly after storm events, with valves manually opened to 100% as the fixed setpoint was often not high enough.

In 2010, a Hach Nitrification Real Time Controller (N-RTC) was installed to optimise the aeration system. The critical input parameters for the N-RTC are the influent NH4-N load and the NH4-N concentration at the outlet of the aeration lanes. Based on these parameters, the N-RTC continuously calculates set points for dissolved oxygen (DO) required to meet treatment objectives, determining the most efficient level of aeration intensity and continuously feeding DO set points to the PLC in order to control the blowers. This means that DO set points are no longer fixed, but instead vary according to the load.

The N-RTC control module combines the advantages of feed forward and feedback control. An online simulation model based on IWA activated sludge models is integrated into the controller, using open loop control to calculate the DO concentrations necessary to achieve the desired ammonium outlet concentration. However, to further improve control of the process, the NH4-N concentration at the outlet of the aeration lanes is also recorded, creating a feedback or closed control loop. This ensures that the DO concentration is increased or decreased, if the ammonium concentration deviates from the desired NH4-N set point.

Over the past 10 years several optimisation steps have been delivered, including:

- Upgrading from ammonium ISE probe to more accurate Hach Amtax analysers.
- Extending the RTC's control to enable the plant to respond to peak loads by diverting settled sewage through the Stabilisation zones of 2 of the 3 ASP's, increasing the aerated volume.
- Upgrading the RTC software to enable the RTC to track a load peak as it passes along a lane of the ASP, targeting the air to where the air is needed. New software enables on screen evaluation of the last 24 hours of values from any input or RTC calculated value. The system also has powerful, user friendly plotting software for on-screen comparison of trends.
- Tuning the RTC to target areas of the plant which have a greater path of resistance to air flow. The site has one common air main that feeds 21 separate control zones that differ in size, static head, and proximity to the blower house. As each of the 21 RTC control zones work as their own entity, it has been possible to fine tune the plant to overcome this problem, something that would not be possible with fixed setpoints.

The RTC combines both energy saving, by reducing DO concentrations and hence blower power during low loads, but also increasing DO set points to above normal levels during periods of high loading to ensure ammonium compliance. As the load is calculated from inlet flow ammonium the system can dynamically respond to reduced residence times due to high flows.

Site operators have measured a notable reduction in blower power demand since the RTC was installed of circa 25%, while improving the site's ammonium compliance.

The Success of this project is a result of foresight by Wessex Water and making sufficient funds available to enable the modifications to be implemented. Additionally, the partnership approach has allowed the goals to be identified and met.

Authors

Martin Butterfield, Application Development Manager (Hach RTC)
Richard Addison, Municipal Projects Manager (Hach)