CASE STUDY

VA POULTRY-PROCESSOR MEETS STRINGENT NITROGEN LIMITS WITH EOSI'S MICROC® 2000 & NITRACK® AUTOMATION

A large Virginia poultry-processing plant coping with highly variable wastewater flows and loadings turns to EOSi's MicroC® carbon sources and Nitrack® Program dosing automation to achieve consistent BNR performance for permit compliance — and avoiding costly and disruptive capital upgrades.

Client: Poultry Processing Facility

Location: Virginia, Chesapeake Bay Watershed

Flow Design/Actual: 2.0 MGD/1.3 MGD

Treatment Technology:
Four-Stage Bardenpho Activated Sludge with Tertiary Filtration

Total Nitrogen Discharge Limit:
6 mg/L annual average; 22,824 lbs annually

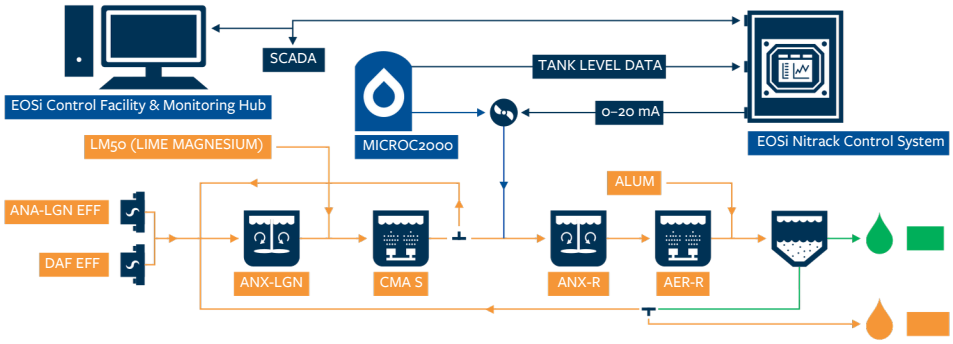
Total Phosphorus Discharge Limit:
0.3 mg/L annual average; 1,142 lbs annually

Background: Stricter BNR Requirements

The Virginia poultry-processing plant packaging up to 200,000 chickens per day requires vast quantities of water sourced from its onsite wastewater treatment plant (WWTP) for processing and rendering offal, blood, and fats. A 2010 plant upgrade enabled the WWTP to treat 2 million gallons per day (MGD), but the plant struggled to meet stricter standards for biological nutrient removal (BNR) to protect the Chesapeake Bay Watershed.

The Virginia Department of Environmental Quality (VADEQ) mandates total mass daily limits (TMDLs) and effluent concentration limits for nitrogen and phosphorus in the treated wastewater. The poultry-processing plant's WWTP must achieve annual effluent loadings of less than 22,824 pounds of total nitrogen (TN), less than 1,142 pounds of total phosphorus (TP), and must also achieve effluent concentration limits of 6 mg/L of TN and 0.3 mg/L of TP. The plant's WWTP needed help to achieve VADEQ's strict BNR standards, and turned to EOSi's MicroC® 2000 carbon sources and Nitrack® Program automated dosing optimization expertise.

FIGURE 1



Costly Upgrades vs Affordable Optimization

Wastewater flows and incoming loadings from the poultry plant are highly variable, changing daily, weekly, and seasonally according to process modifications and production levels, such as when influent to the WWTP averages 1.3 MGD during the week, but only 0.9 MGD on weekends. Influent total-nitrogen concentrations range from 150 mg/L to 350 mg/L, a broad variability creating difficulties with achieving consistent BNR performance.

Historically, the WWTP operators manually adjusted the supplemental carbon feed rate based on laboratory data and periodic instrument observations. The WWTP in 2012 began adding more supplemental carbon and increasing operator oversight of their BNR processes, resulting in improved but still unacceptably inconsistent nutrient removal. The upshot: the plant needed automated supplemental carbon optimization to achieve consistent nutrient removal.

MicroC® Premium Carbon Sources

FIGURE 2

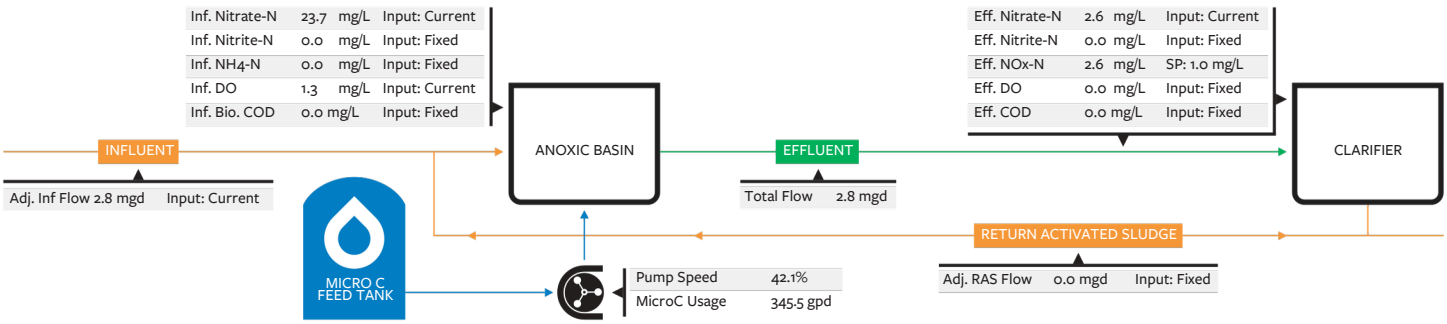
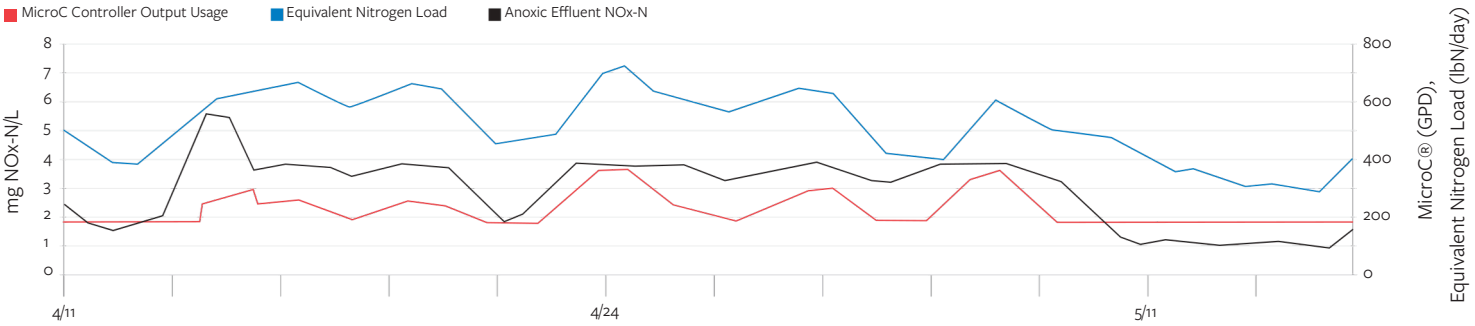


FIGURE 3



EOSi's Process Analysis & Performance Monitoring

EOSi's objectives with improving the plant's nutrient-removal processes:

- Achieve consistent effluent quality
- Meet regulatory discharge limits on nitrogen and phosphorus loadings
- Minimize operator oversight of the BNR processes
- Optimize supplemental carbon usage and cut unnecessary cost

After reviewing plant's operational data history, EOSi installed inline analyzers with remote monitoring capability to evaluate real-time variability with flows and nutrient loadings. EOSi quickly determined from the real-time plant data that supplemental carbon was often being over-fed during low-load conditions, and underfed during peak load conditions. EOSi recommended implementing their Nitrack® Program system to optimize and automate the plant's supplemental carbon usage.

The Nitrack Program monitors process parameters to achieve optimized feed set-points, and controls automatically the feed rate of MicroC® carbon source products. Nitrack's cloud-based communications integrate with plant operator's treatment control systems, providing ongoing remote monitoring of the nitrification and denitrification processes, and delivering real-time recommendations to improve process performance and monthly reports on MicroC usage and treatment effectiveness. The combination of process monitoring, control hardware, and remote technical expertise enables dynamic adjustment of the carbon feed to consistently achieve compliance and reduce unnecessary chemical usage cost.

Implementing the Nitrack Program at the poultry-processing WWTP required developing a dynamic model of the nutrient removal processes, including:

- Determining the quality and placement of real-time data analyzers
- Optimizing the MicroC 2000 injection point and control strategy
- Interfacing with the plant's SCADA controller

Also recommended was installing EOSi's MicroC-IM chemical inventory management program, adding another layer of quality control and performance monitoring by enabling EOSi and plant staff to track MicroC 2000 usage and conduct trend analysis.

Remotely monitoring MicroC 2000 inventory levels, MicroC IM notifies EOSi and plant staff by text/email when chemical stock is depleting and resupply delivery should be scheduled.

Figure 1 shows how the Nitrack Program and MicroC-IM are integrated with the poultry plant's wastewater treatment system. Figure 2 shows a sample of data displayed by the Nitrack controller.

Nutrient Removal Enhanced, Cost Reduction & Compliance Achieved

Implementing EOSi's Nitrack® Program system enabled the WWTP serving the poultry-processing plant to continuously adjust the supplemental carbon feed based on influent flows and loadings, and Figure 3 shows how the Nitrack system increases or decreases the MicroC® 2000 feed rate as needed. The result: the WWTP achieved the effluent concentration limit for nitrogen of 6 mg/L while the effluent nitrogen loading varied from 300 to 700 pounds per day.

Real-time data exchange between the Nitrack system, WWTP operators, and EOSi technical staff enables rapid and decisive responses to process upsets or varying conditions to maintain optimal nutrient removal. Further, optimizing and automating the carbon feed has minimized supplemental carbon costs while freeing operators to focus on other duties. With EOSi's Nitrack Program, the WWTP has improved nutrient removal performance, achieved a more consistent effluent quality, optimized and automated to minimize chemical costs — and continuously met VADEQ's strict BNR permit compliance standards.