WWTP Uses Process Monitoring & Control Technology for Increased Productivity and Efficiency

The Littleton/Englewood wastewater treatment plant, Colorado, put in place processes to effectively monitor the levels of ammonia in their wastewater treatment. As well as ammonia levels, the plant is now able to effectively conduct pre-chlorination monitoring, monitoring of dissolved air flotation thickeners and the measurement of dissolved oxygen concentration. Accurate measurement of these parameters is imperative to ensure an efficient process in both time and cost.

Wastewater Treatment

The need for efficient wastewater treatment technologies is becoming progressively more important. Ever increasing population, urbanization and industrialization along with a reduction in personnel and pressure to save energy costs is putting a lot of pressure on municipalities to do more with less. For these reasons, many treatment plants are required to ad here to strict regulations regarding their wastewater effluent.

The effective monitoring of various applications including ammonia is vital to the wastewater industry and is essential to ensure that wastewater treatment plants are able to operate efficiently, while protecting the surrounding environment. Ammonia is a wide cause of concern as it can cause severe problems in the disinfection process and in extreme cases can cause drinking water to become hazardous. Ammonia is also fatal to fish and other aquatic life when it is changed to unionized ammonia gas with increased river temperatures. In 1994, ammonia limits were initiated by the Colorado Department of Public Health and Environment (CDPHE).

The CDPHE specifies an individual monthly average and daily limit that treatment plants must adhere to. Wastewater treatment plants must therefore keep their discharge within these limits in order to meet their permit and avoid potential fines. Continuous, realtime ammonia monitoring can be complex and costly, therefore a smart solution is needed to make the process simpler, as well as more cost effective.

Effective Continuous Monitoring

Founded in 1977 as a pure oxygen activated sludge plant, the Littleton/Englewood wastewater treatment plant is the third largest publicly owned treatment works in the state of Colorado. The plant receives sewage from Littleton and Englewood, as well as 21 smaller districts in the service area. In 2009 a $110 million construction project was completed which transformed the plant into a

The IQ Sᴇɴsᴏʀ Nᴇᴛ 2020 XT terminal mounted tank side provides continuous process monitoring and control - even in harsh conditions.

800.000 PE trickle filter/ solids contact facility with post nitrification and post denitrification capabilities. The large advanced treatment plant is required to exceed secondary treatment requirements and remove ammonia from wastewater, working in compliance with local, state and federal regulations applicable to wastewater treatment and discharge. Additionally, the plant also required solutions for a number of other applications including pre-chlorination monitoring, monitoring of dissolved air flotation thickeners and the measurement of dissolved oxygen concentration.

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The South Platte River Basin is a mixed-use basin with mountainous terrain and urban and agricultural uses. Wastewater plants must adhere to ammonia effluent limits throughout the basin and all of Colorado. Photo courtesy USGS.

Multiparameter Solution

In order to ensure accurate measurement of these parameters, the Littleton/Englewood plant set up a procedure to find the new instrumentation it needed to meet multiple requirements. Greg Farmer, process control administrator in the plant's operations department, explains; " The dissolved oxygen models used previously were becoming increasingly outdated and were no longer suitable for use in controlling dissolved oxygen levels in the aeration basins." Various products were assessed for their suitability for monitoring oxygen levels while increasing productivity, with each type was tested side by side.

The IQ Sensor Net 2020 XT system provided the most accurate results and involved the least amount of operator over-sight. The system allows the plant to customize its analytical measurements and enables the facility to incorporate any combination of up to 20 sensors into one sensor network which communicates directly with the plant's internal computerized control system. The plant now utilizes an system-wide solution to manage its multiple sensor network allowing the facility to 'keep on growing', adding more sensors as and when needed. Implementation of the system at the facility has enabled the plant to undertake a wide variety of different applications using a single system, offering highly economical operation, and providing minimal total cost of ownership.

Applications

As a result of the plant's investment in new technology it can now utilize one system for multiple needs, including the following.

Centrate Return Ammonia

By continuously measuring the amount of ammonia in the aeration basin, the team is able to monitor the contribution of ammonia from the return of anaerobic sludge dewatering centrate to the aeration basin. An ammonia concentration target is entered into the SCADA system and the centrate pump output is varied to attain the desired concentration in the aeration basin.

By monitoring and controlling the amount of ammonia present, the ammonia loading to the nitrification process is kept within target ranges, which improves efficiency in the conversion of ammonia into nitrate.

Pre-Chlorination Disinfection

One of the most important advantages of the IQ Sensor Net for the plant are the benefits that arise during disinfection. Chlorination of wastewater provides the disinfection necessary to protect the receiving stream and downstream users. Greg explains, "A certain ratio of ammonia to chlorine must be maintained for this process to work most efficiently."

The ammonia concentration prior to disinfection is monitored using the selected sensor, with the value being fed into the SCADA system and compared to the desired ammonia concentration setpoint.


An IQ Sensor Net dissolved oxygen sensor deployed directly in the aeration basin for continuous monitoring and control of aeration.

The collated information is used to vary the output of pumps that can bypass a flow of ammonia rich secondary effluent around the nitrification process, thereby maintaining the desired ammonia setpoint and maintaining the critical ammonia to chlorine ratio. The technology ensures that the chlorination process works and guarantees that the plant achieves very low fecal coliform levels while also keeping ammonia levels at a minimum.

Dissolved Air Flotation Thickeners

Prior to introducing new instrumentation, the plant used a constant dosage of polymer to keep the subnatant suspended solids at an acceptable level when thickening waste activated sludge (WAS) and primary sludge in dissolved air flotation thickeners. This resulted in periods of under dosage both when suspended solids were higher than desired and when polymer was being wasted. The suspended solids in the subnatant are returned to the treatment process adding to the loading on those processes. Therefore it is vital to use a reliable online measuring instrument to ensure an efficient and energy saving control of the process. The subnatant suspended solids are measured and the values are fed into the SCADA system. The values are compared to the setpoint and polymer adjustments are made.
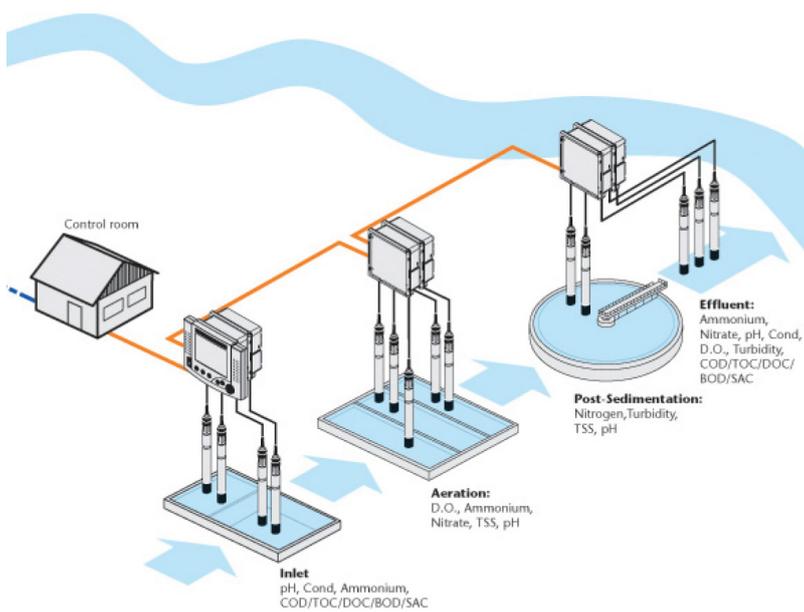
An example of a typical IQ SENSOR NET installation monitoring influent, aeration, post-sedimentation and plant effluent. In this example, 14 sensors are deployed with the ability to deploy up to 20 available.

Key Benefits

The versatility of the IQ SENSOR NET allows Littleton/Englewood to solve several problems using a single system, contributing not only significant cost savings but also enabling multiple probes to be used in a variety of locations throughout the plant. The facility has also been able to automate sections of its treatment procedures based on the information that has been collated by the system, significantly accelerating processes. Due to the location's weather conditions, the plant was previously unable to use probes that required water to be pumped from an outdoor location to an indoor analyzer as it was highly likely it would freeze in the winter. The robust IQ SENSOR NET, can be continuously operated outdoors even in freezing conditions.

Smart Solution

Successful monitoring of various applications by wastewater treatment plants is now a necessity. Continuous and accurate monitoring ensures that wastewater treatment plants remain safe for humans and the environment as well as staying within the specified legal regulations. This meant that the Littleton/Englewood wastewater plant needed a system that would allow it to accurately measure multiple parameters and meet the ammonia limitations that were put in place in 1994 by the CDPHE.

Prior to their use of the IQ SENSOR NET, the plant used equipment that required a lot of personnel hours to ensure its correct running and operation. Since the introduction of the new technology the plant has benefited from the instruments working with less assistance from staff once installed. Whereas data used to be manually retrieved from the field, it is now automated with the continuous monitoring and control of the IQ SENSOR NET. The information that is collected from the various probes can then be analyzed for trends and patterns. This can be used to learn more about the finer details of the operation and further increase long term productivity and efficiency.

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