



Case Study: Liquid Sodium Aluminate Replaces Alum in Phosphorus Removal Application and Solves Long-Term Problems at Ohio Wastewater Plant

The Challenge

For many years, the Lakewood Ohio Wastewater Treatment Plant experienced phosphorus compliance issues and increased chemical costs during the dry summer months. Aluminum Sulfate was effective 9 to 10 months of the year; however, performance diminished drastically, and dosages increased when influent flow dropped and caused corresponding changes in water quality. Theories were examined to determine why the facility struggled with meeting its 1.0 mg/l permit limit under these conditions. The only course of action was continually increasing alum dosage, to which the phosphorus concentrations became unresponsive. The plant's Alum supplier confirmed that the chemical can be subject to limited performance outside a certain pH range but provided no solution to remedy the problem. Facility personnel were frustrated and concerned about the impact of phosphorus violations and chemical costs.

The Solution

USALCO worked with plant personnel to analyze data over three years, explicitly examining phosphorus removal efficacy, Alum administration, flow, and concentrations of various wastewater constituents. Most of each year, the average aluminum to phosphorus (Al: P) ratio was calculated at 0.7 to 1.0, demonstrating efficient phosphorus removal with Alum. The data showed that during the troublesome months, the Al to P ratio dramatically increased to levels over 2 to 1, with a significant increase in Alum consumption as facility personnel struggled to control effluent

phosphorus. A trend was identified where diminished performance was usually seen when the average influent wastewater alkalinity exceeded 190 mg/l. USALCO recommended investigating Sodium Aluminate as a solution because its range of effectiveness had no defined limitations like Alum. Additionally, Sodium Aluminate has greater aluminum content when compared to Alum. Lakewood WWTP personnel agreed to allow USALCO to conduct bench testing, where Sodium Aluminate was subsequently demonstrated to remove phosphorus in their wastewater effectively.

The Results

A three-week plant trial was commenced towards the end of Summer under ideal conditions (low flow, higher alkalinity) that tested sodium aluminate's capabilities. The trial results showed consistent phosphorus removal below 1.0 mg/l (with no violations) at a dosage 58% less than Alum. Lakewood WWTP converted to Sodium Aluminate in the Spring of the following year. After a full year of utilization, the following results and benefits were confirmed:

- Consistent phosphorus removal, which averaged below 0.7 mg/l independent of influent conditions. Greater flexibility in phosphorus control and immediate response to any influent P change.
- Improved water quality - less algae growth and perceived improvement in UV operation.
- Sodium Aluminate consumption is 67% less than Alum on a gallon-per-day basis.