Speaker Name: Chris Schulz and Jeremy O'Neil

Affiliation: CDM Smith

Coauthors: Jeremy O'Neil

Coauthor Affiliations: CDM Smith

Abstract Title: PILOT TO FULL SCALE OZONE TREATMENT FOR OXIDATION OF HYDROGEN SULFIDE FOR JEA'S GREENLAND WATER TREATMENT PLANT

Abstract: JEA's Greenland Water Treatment Plant (WTP) in Jacksonville, Florida treats groundwater from two production wells with elevated hydrogen sulfide levels up to 3 mg/L. The existing process train includes tray aeration (located above a groundwater storage tank) for hydrogen sulfide stripping, followed by sodium hypochlorite addition for primary disinfection and oxidation of any remaining sulfide. This treatment process has required increased levels of chemical addition to meet sulfide removal requirements and there are concerns about increasing disinfection by-products (DBPs) in the distribution system. For these reasons, JEA initiated a pilot study, design and construction project to add ozone to the plant process train upstream of tray aeration to achieve complete sulfide removal and potentially reduce DBPs in the distribution system.

The pilot study was conducted to develop ozone demand and decay characteristics, ozone dose requirements, and potential effects of ozone on DBP formation. It was performed over a 30-day period using an ozone pilot unit rated at 2 ppd with a sidestream injection (SSI) dissolution system and degasifier. The raw water sulfide levels during piloting (95th percentile value of 2.45 mg/L, n=22) required an ozone to total sulfide ratio of 4:1 to satisfy the sulfide demand and achieve an initial ozone residual of 0.1 mg/L. It was also determined that DBPs were not a concern due to the low levels of bromate, and insignificant impact of ozone dose on the DBP formation potential. Ozone decay results were used to assess the potential for ozone as a primary disinfectant, however, it was determined that sodium hypochlorite was the more cost-effective alternative. Based on pilot study results, it was decided to design the ozone system for hydrogen sulfide oxidation at a design dose of 10 mg/L, followed by tray aeration (as a potential polishing treatment step), and sodium hypochlorite for primary disinfection.

The ozone system design for the Greenland WTP includes the following major components: one liquid oxygen (LOX) storage tank and two ambient air vaporizers; two ozone generators, each rated at 570 ppd (1 duty/1 standby); outdoor, concrete pad mounted SSI system with two venturi injectors, two SSI pumps, and one flash mixing reactor; nitrogen boost system; closed loop cooling water system; and ozone destruct system. Unique features of this design include: (1) an automated flow-paced ozone dose control system with trim feedback control using an oxidation-reduction potential (ORP) meter to maintain an ozone residual target of 0.1 mg/L, (2) horizontal flash reactor and piping layout that relies on the static pressure of the groundwater storage tank (20-25 psi) to improve ozone utilization and mass transfer efficiency in the flash reactor, (3) pressurized off-gas release system using an offgas release valve manifold, pressurized nuisance tank (for offgas moisture condensation and removal) and two ozone destruct units (duty/standby), and (4) optimization of the ozone process in conjunction with the existing tray aerator to achieve complete removal of hydrogen sulfide at lower ozone doses.

This paper will present the main findings of the pilot study, the unique design features of the ozone oxidation system, and results of startup and commissioning of the ozone system at the Greenfield WTP.