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Upgrading From Gas Chlorine to On-Site Hypochlorite Generation (OSHG) – How Nashville Metro Water Used Next Generation Microclor® Technology to Improve Safety and System Resilience



The City of Nashville is widely known as the “Heart of Country Music” and is the capital of the state of Tennessee. The city has its roots in a history that stretches back over two centuries. In recent years, the population of the Nashville Metropolitan area has surged to over 1.8 million people. Growth in the downtown area is approaching 25% per year. Amid this dense population and rapid growth, how does a municipal water agency tackle the challenge

of upgrading an aging water treatment plant utilizing chlorine gas while continuing to provide safe, reliable water service to its customers?

Metro Water Services, a department of the Metropolitan Government of Nashville and Davidson County, provides drinking water to over 190,000 customers in Davidson, Rutherford, and Williamson Counties through a distribution system consisting of more than 3,000 miles of water main, some five feet in diameter. Two water treatment plants with a combined capacity of 180 million gallons of water per day (MGD) serve the city of Nashville: the K.R. Harrington and the Omohundro Water Treatment Plants, both located in North Nashville along the Cumberland River and a little more than two miles from the historic Ryman Auditorium and the Country Music Hall of Fame. Once built on the outskirts of town, the water treatment plants - like thousands across the country – are now located in the heart of a major metropolitan area. Both water treatment plants utilized gas chlorine for disinfection of the drinking water. Omohundro, the older plant, commissioned in 1889 and listed in the National Registry of Historic Places, relied on 90 ton railcars for chlorine gas delivery and storage while the newer K.R. Harrington Plant received truckloads of 2,000 pound gas cylinders.

Both of Nashville’s water treatment plants are increasingly vulnerable to major floods, having experienced a “five hundred year flood” as recently as 2010. In an effort to reduce the risk associated with gas chlorine and improve

overall operations, Nashville Metro Water embarked on a complete overhaul of their treatment system to move from gas chlorine to on-site hypochlorite generation (OSHG) in 2013. OSHG systems utilize electricity, salt brine and softened water to electrolytically generate ~ 0.8% (8,000 ppm) sodium hypochlorite. At 0.8% the OSHG generated sodium hypochlorite is non-hazardous, unlike industrial strength bulk-delivered sodium hypochlorite which is roughly 12.5% concentration and very corrosive.

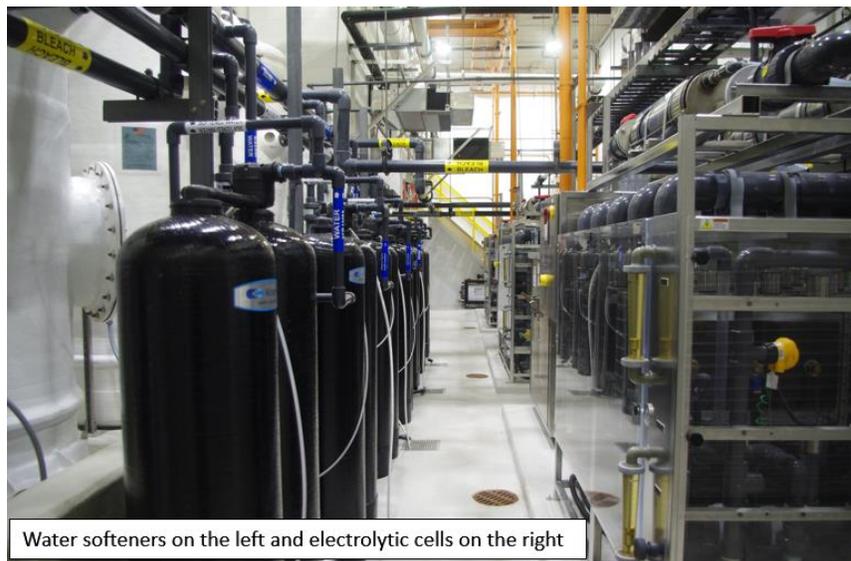


The primary goals for the project were; improve public safety by eliminating the risk of exposure from transporting gas chlorine by railcars through a densely populated area, improve system resilience and enhance overall treatment operations. Additionally, conversion of the disinfection system had to be done without shutting down operations of either plant. After a detailed review of OSHG alternatives that included site visits, engineering reviews and other operational due diligence, three Microclor® MC-2400 OSHG skids were ultimately selected for each facility. The Microclor® MC-2400 manufactured by Process Solutions, Inc. (PSI) is designed to produce the equivalent of 2,400 pounds per day (PPD) of chlorine gas equivalents each for a total of 7,200 PPD of free available chlorine

(FAC) per Nashville site.

Both plants faced two primary challenges: constructing a temporary disinfection system to continue daily water production as well as overhauling the dated gas chlorine system inside a limited footprint with no room for expansion. The complexity and scope of the project required the work of numerous engineering firms with the project being constructed in multiple phases over two years. PSI was an integral member of the design team and provided expertise in the design, construction and operation of a temporary disinfection system which at the core was a set of bulk hypochlorite dilution panels, negating the need for a plant shutdown. By designing a system that automatically diluted 12% liquid bulk hypochlorite to 0.8% hypochlorite, PSI was able to utilize the same storage tanks and metering pumps in both the first and final phases of the project. Following the construction and implementation of the temporary system at each site, the gas chlorine systems were decommissioned and removed.

By utilizing the latest generation of OSHG technology, Nashville Metro Water has enhanced not only their internal water plant safety, but the



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safety of neighboring residents in multiple ways. The Microclor® OSHG systems themselves include numerous safety features such as a vertical cell configuration which immediately and passively vents by-product hydrogen coupled with the inherent resiliency of a multi-cell design which allows a system to operate if an individual cell fails. Together, these design features result in reduced operator maintenance, system resiliency and enhanced safety. Furthermore, the elimination of the extremely hazardous gas chlorine and subsequent conversion to OSHG enabled them to delist from the Federal Risk Management

Plan (RMP) Rule.

By replacing gas chlorine with on-site hypochlorite generation, Nashville was able to improve the safety and longevity of its water plants to accommodate the growth of the “Heart of Country Music” far into the future. At a recent water conference, Glen Doss, Treatment Plant Manager stated, “In 2016, the last gas chlorine railcar left to large applause.”

“The conversion from gas chlorine to the Microclor® on-site generated hypochlorite went smoothly with the added benefit of the operations staff becoming enthusiastic supporters of the systems after over 40 years of gas chlorine operation.”

Glen Doss, Metro Water Services Treatment Plant Manager, Nashville, TN