PureLine's PureStrip™ ClO_2 Generator Dramatically Reduces Trihalomethane Levels to Meet New EPA Standards

GOALS

Provide comparable or improved microbial control while minimizing the production of potentially toxic disinfection by-products (DBPs).

SITE

A drinking water treatment plant in Snyder, Oklahoma.

HISTORY

The drinking water treatment plant in Snyder, Oklahoma uses surface water from Tom Steed Lake to process approximately 1.2-1.4 MGD. Since surface water can contain high levels of bacteria and organic material, plant personnel were concerned about microbial control and minimizing disinfection by-products (DBPs). Since it was built in 1976, the Snyder drinking water treatment plant has used chlorine for pre- and post-disinfection. In 1979, the Environmental Protection Agency (EPA) set the Maximum Containment Limit (MCL) for total trihalomethanes (THMs) of 0.10 mg/l as an annual average. In November 1998, the EPA published the final Stage 1 Disinfectants and Disinfection By-Products (D/DBP) Rule. Under the new rule, the MCL was reduced. Effective, January 1, 2004, total THMs can not exceed 0.08 mg/L (80 ppb).

PROBLEM

With the January 1, 2004 compliance date for the Stage 1 D/DBP rule bearing down on surface water systems serving less than 10,000 people, the practice of pre-disinfecting surface water with chlorine is no longer practical. Trihalomethane monitoring began in mid 2001 and has yielded values ranging from 120 to 220 ppb total THMs, with seasonal variations being observed. Two possible scenarios were considered to address the toxic disinfection by-product concern—installation of a microfiltration plant or transition to an oxidant that does not generate THMs (ozone or chlorine dioxide).

An estimate for a microfiltration upgrade proved cost prohibitive—$4.6 MM—and was immediately rejected. Estimated expenses for the installation of an ozone generator were also cost prohibitive. In addition, the potential for bromate formation as a by-product of ozone disinfection made the transition to ozone even less appealing. The drinking water standard for bromate is 10 ppb.

SOLUTION

In order to achieve comparable microbial control while reducing the THM levels to the new US EPA limit, the Snyder plant decided to transition from Cl2 gas to ClO2 gas for pre-disinfection. Cl2 gas would still
be used for post-disinfection. To meet their pre-disinfection needs, they installed PureLine's PureStrip™ P-40 electrochemical ClO2 generator. Not only is PureLine's ClO2 generator a highly effective disinfection system, it sanitizes water without producing halogenated organic disinfection by-products, does not react with bromide to form bromate, and enables chlorite levels to be maintained below the EPA's limit
of 1.0 ppm.

While competitive ClO2 systems have relied on multiple-chemical precursors and been notoriously unreliable and difficult maintain, the P-40's innovative single-precursor design alleviates any concerns Synder personnel had regarding safety and reliability. And because the P-40 generates chlorine dioxide from a single precursor—sodium chlorite—the Snyder facility was able to reduce its on-site storage and handling of chlorine gas.

RESULTS

PureLine's P-40 single-precursor ClO2 electrochemical generator makes and feeds pure ClO2 gas. As a result, THM values at the Synder facility were dramatically reduced 38-59% compared to those obtained using Cl2 gas pre-disinfection. Total THM values ranging from 130 to 220 ppb with Cl2 gas have now been reduced to 80-95 ppb with ClO2. Microbial log reduction values were unchanged after the transition from Cl2 to ClO2. Total and fecal coliform levels were maintained at zero despite a drop in dosage from 2.5-3.5 ppm chlorine to 1.0-1.2 ppm ClO2. Chlorite residuals have remained below 0.75 ppm. The use of chlorine gas has dropped 45% since the initiation of ClO2 feed—a welcome improvement for plant personnel concerned about the serious safety risks that come with the use of chlorine gas.

In addition, since installing PureLine's P-40 generator, there have been other positive benefits at the Snyder plant including improved clarity in the clarifier and improved taste of the final product water. Turbidity values have dropped from an average of 0.35-0.40 to 0.22-0.24 NTU. The significant drop can be attributed to ClO2's ability to oxidize Fe and Mn and create negatively-charged organic species that can form more stable precipitates with coagulant and rapidly settle out in the clarifier. The water tastes better because ClO2 has reduced free chlorine, chloramine, and chlorinated organic disinfection by-products in the final distribution water.

While the PureStrip™ P-40 generator was installed in February of 2002, customer maintenance has not been required to date. PureLine field experts perform standard monthly preventative maintenance as part of the contract, freeing plant personnel to focus on other mechanical and operational projects. The fully-automated P-40 electrochemical generator has simplified the process of transforming sodium chlorite solution into pure ClO2 gas and educting it into the water system without the need for ClO2 storage. The correct dosage of ClO2 is maintained with internal flow-pacing software. Safety interlocks and alarm features ensure safe and simple operation.

CONCLUSION

By using PureLine's PureStrip™ P-40 electrochemical ClO2 generator rather than chlorine gas for pre-disinfection, Snyder now has a safe, reliable and cost-effective system that effectively controls bacteria while reducing THM levels. Because the PureLine system produced 99.5% chlorine-free ClO2, THM values have been dramatically reduced 38-59%. Microbial log reduction and coliform values have been maintained despite using less than half the dosage required for chlorine efficacy. Finally, maintenance of PureLine's fully-automated P-40 single-precursor feed system is much simpler and safer than the previous chlorine gas system or other ClO2 generators that use multiple chemical precursors.