

PureLine's Skid-Mounted Portable Chlorine Dioxide Generator Keeps Bacteria and Slime at Bay in Major University's Thermal Energy Storage System

GOALS

To reduce unacceptable levels of bacteria, eliminate slime layers and prevent biologically-influenced corrosion in a Thermal Energy Storage System and associated chilled loop in the University's HVAC plant.

SITE

A University in the Southwest.

HISTORY

As part of its HVAC system, the University had a large thermal energy storage system and associated chilled loop. Both had been plagued with biological fouling since the system's start-up. While traditional non-oxidizing biocides had been used for years, they were expensive, showed marginal efficacy and always decomposed over time. In fact, the consistent use of non-oxidizing biocides actually contributed to fouling of the system and biologically-influenced corrosion. Oxidizing biocides—bromine and bleach—were tried in an attempt to remedy the problem, but they could not be fed at lethal dosages due to their adverse effect on the inhibitor formulas and system metallurgy. As a result, mobile bacteria levels consistently exceeded 1,000,000 (10⁶) colonies per milliliter. Elevated bacteria levels threatened the system's integrity, energy efficiency and general hygiene.

PROBLEM

Excessive bacteria in the University's HVAC systems not only increased energy consumption, system waterside corrosion and potential loss of capital equipment—it posed a serious risk that students could be exposed to a dangerous pathogen outbreak. The University tried to solve the problem by using a variety of industry standard non-oxidizing biocides that are readily available to the water treatment service providers. Each non-oxidizer was chosen for system metallurgy and treatment program compatibility. Yet, they all proved ineffective in terms of cost and efficacy. The organic biocides eventually decomposed, not only adding to the organic loading, but serving as a food source for bacteria growth. In addition, the non-oxidizing products did not penetrate the slime layers that formed in the chilled water loop. As a result, bacteria levels recovered rapidly—well above 10⁷ colonies per milliliter—in the circulated water. To combat bacterial growth, higher and higher dosages were applied. Still, efficacy improved very little and the costs soon became prohibitive—more than \$225,000 per year.

Finally, the University applied bromine and bleach as a last resort. Low-dose treatments of both were used to try to

stabilize the bacteria without causing a chemical attack in the high-retention system. While they were able to stabilize the bacteria at 106 to 107 colonies per milliliter, these levels still far exceeded the industry standard control target of less than 1,000 (103) colonies per milliliter. The bromine and chlorine residuals were increased slowly, but the treatment program inhibitors began to degrade and corrosion rates jumped. Very little, if any, slime removal was achieved.

SOLUTION

PureLine Treatment Systems resolved the University's problem with a full-service chlorine dioxide shock feed program that incorporates a pure chlorine dioxide gas generator—the PureClO₂™ Gas Series P-40E. The P-40E produces a pure gas stream using just one precursor—PureCide™ (25% sodium chlorite). PureCide™ is circulated through a patented electrochemical cell where it is converted to a chlorine dioxide solution. The pure chlorine dioxide gas is then stripped from the solution using proprietary stripping column. The pure chlorine dioxide gas is immediately introduced into the water or air stream to be treated.



Together, PureLine's Research & Development and Engineering & Manufacturing groups designed a skid-mounted, high-pressure feed system to work in conjunction with the generator. The portable, skid-mounted unit allows pure chlorine dioxide gas to be introduced into the chilled loop. The innovative system recovers all excess chlorine dioxide gas and air off the day tank. The excess chlorine dioxide and air (resulting from stripping pure chlorine dioxide gas from the anolyte solution) are recovered from the feed tank and drawn back into the stripper columns. Since the system recovers all excess air, there is no need to vent the feed tank.

The generator and feed skid feature simple and easy to locate connections for gas, electrical and plumbing lines. A state-of-the-art programmable logic controller and relay automatically control the on-demand production of chlorine dioxide according to the chilled water ORP. Interdependent controls include 14 different fail-safe alarms.

The system's design provides a mobile generation and high-pressure chlorine dioxide feed system that is safe enough to operate in an HVAC central plant. Flexible connections and easy installation offer a field-friendly solution to a variety of emergency disinfection applications. In the case of the thermal energy storage system at the University, PureLine safely introduced a highly effective oxidizing biocide that is compatible with existing treatment formulas. The injection of pure chlorine dioxide gas has eliminated the addition of solids and liquids without effecting system pH. PureLine's full-service field technicians were able to install, start-up, operate, shutdown and remove all equipment without interrupting the daily activities at the central plant.

RESULTS

For the first time since it began operating, bacteria has successfully been reduced to undetectable levels in the University's thermal energy storage system and chilled water loop. In addition, corrosion is no longer a problem, and the University no longer has to cope with adverse effects on treatment formulas. PureLine's safe and reliable chlorine dioxide generation technology offers the University an effective alternative to traditional biocides without adding unwanted organics, corrosive salts or outside fluids. Pure chlorine dioxide gas is a highly efficient kill agent at low dosages and is completely compatible with existing treatment program formulations. Chlorine dioxide is also able to penetrate and eliminate slime formations without attacking system metallurgy. PureLine's proprietary on-line control system automatically responds to oxidizer demand, ensuring program efficacy without jeopardizing treatment formulation and system integrity.

CONCLUSION

PureLine's patented chlorine dioxide generation technology, fully-automated controls and dedicated professional support services, offer a successful treatment solution that is safe, easy to implement and non-intrusive even under the constraints typically found in large central plant facilities. Plant personnel were finally freed from time-intensive monitoring and maintenance. Routine system monitoring now requires less than 10 minutes per day.

PureLine's packaged solution is offered under a full service agreement with the University's total water treatment service provider. The water treatment service provider is able to offer a turnkey, "hands-off" program at desired margins while reducing the University's treatment costs more than 30% over traditional approaches used in the past. The savings are even more dramatic when other positive outcomes such as increased energy efficiency, treatment efficacy, reduced unscheduled maintenance, ease of implementation and extended life span for capital equipment are all factored into the cost-savings equation. With unparalleled flexibility, the skid-mounted PTS with PureClO₂[™] Gas Series generator is completely portable and allows periodic shock disinfection treatments to be applied where and when they are needed.

PureLine's safe, reliable and highly effective chlorine dioxide gas generators serve as an alternative in applications where potable acceptance may affect the efficacy and application of traditional biocides, as well as applications where there are:

- persistent pathogens
- heavy organic or other contaminant loading
- system conditions that reduce contact time
- extended system retention time with oxidant-sensitive treatment formulations and system metallurgy

As a result, PureLine's chlorine dioxide gas generators offer ideal disinfection solutions for drinking water, chilled water, process waters, industrial and municipal wastewater, reclaimed water, air emissions control, re-used and water conservation applications.