HALOX Case History #5

Microbiological Control In Small To Intermediate Cooling Towers

Application: Cooling towers ranging in size from 500 tons to 10,000 tons (750,000 units in the U. S alone).

Problem: Cooling towers are prone to bacterial contamination and a slimy biofilm[1] and are a recognized source of Legionnaire's Disease

Solution: Halox electrochemical chlorine dioxide (ClO_2) generator

A bulk-mail handling center in a Dallas suburb has almost 800 thousand square feet (74,300 square meters) of mail processing area. Air conditioning for this facility utilizes a cooling tower rated at 2500 tons. A Halox distributor provides water treatment at this site. The cooling system is 'open loop'. Water, evaporating over a cooling tower, expels heat that is collected in chillers within the building.

The Problem

The cooling tower is at ground level and adjacent to an active crop field. Dust and debris blow in from the field. This provided a constant source of nutrients for bacterial and algae growth and created an unreasonable chlorine/bromine demand that caused corrosion problems. Excessive biofilm was an additional problem. Traditionally, this cooling tower has been treated with two different non-oxidizing biocides that are expensive and extremely hazardous to humans and the environment. Besides constant additions of the biocides, it was also necessary to 'shock' the system with huge doses of the biocides every few weeks to control bacterial growth.

The Approach

Halox recommended replacing the highly toxic non-oxidizing biocides with chlorine dioxide (ClO_2). The goal was to increase microbiological control, eliminate the frequent 'shock' treatments, save money on chemicals and clean up the heat exchange surfaces so they would perform more efficiently. Two Halox electrochemical chlorine dioxide generators with four cassettes each were installed. Each unit fed continuously into the tower's sump.

The Results

Within a few days, a ClO_2 residual of 0.2 mg/L was established throughout the cooling system. This was accompanied by a dramatic decline in water turbidity as contaminating micro-organisms were destroyed. The desired level of microbiological control was met ($<10^3$ cfu/mL) and the toxin-based control system was eliminated. The cooling tower system operated at maximum efficiency, as the ClO_2 effectively removed the insulating biofilm layer from the heat exchange surfaces in the chillers. The water recirculation rate in the system was minimized resulting in significant savings in electrical power consumption for the large recirculation pumps. Corrosion rates throughout the system decreased dramatically.

The Savings

Savings on biocides alone were~$600 per month. This did not include the savings from increased cooling efficiency and the water savings from increasing the cycles of concentration. The total was significant, estimated to be about $18,000/year.

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Another major advantage of using ClO_2 in cooling towers was revealed. The Dallas, Texas area experienced record heat and drought during the summer of 2000. Water was scarce and rationing was imminent. Normally, the cooling system consumed upwards of 75,000 gallons (~f284,000 liters) of water per day through evaporation and dumping of mineral-ladened water. If wastewater dumping were reduced, water cost savings as well as chemical cost savings could be achieved. Halox worked with the mail center to institute this change.

Background

Cooling Towers

Cooling systems control temperatures and pressures by transferring heat (BTUs) from where it is generated to where it can be dissipated or reused. The open recirculating system is the most widely used industrial cooling design. It consists of pumps, heat exchangers, and cooling towers. The pumps keep water recirculating through heat exchangers where the water picks up heat and continues on to the cooling tower where heat is released from the water through evaporation. Cooling towers are used in refineries, steel mills, petrochemical manufacturing, chemical processing, and electric utilities. Other applications include apartment houses, office buildings, healthcare facilities, shopping centers, universities, and post offices.

Chlorine dioxide (ClO_2)

Chlorine dioxide has long been recognized as a very effective biocide, sterilizer and bleaching agent. Its unique properties have made it the water treatment chemical of choice for such large-scale applications as industrial process water, food and beverage processing, and pulp and paper production. It has all of the required regulatory approvals for these applications. It is also approved and recommended by the U. S. Environmental Protection Agency as an environmentally friendly drinking water additive to replace chlorine (which forms carcinogenic byproducts).

However, Federal law prohibits the transportation of ClO_2; it must be produced where it is used. Most traditional generation techniques are unacceptable to small and intermediate size users. These methods produce excessive quantities of ClO_2 (solutions containing 10 to 50 thousand ppm ClO_2). They also involve the use of multiple hazardous reactant chemicals and are difficult and dangerous to operate. The Halox System is a self-contained generator that provides for the safe, continuous production of chlorine dioxide. The Halox System brings economical ClO_2 to a large group of new users for whom the high cost and complexity of generating equipment has been prohibitive.

The Halox System uses an electrolytic method that makes one to 5 ½ pounds (2.4 Kg/day) of ClO_2 per day using a single precursor, sodium chlorite. The heart of the Halox system is a patented electrochemical cassette that directly converts sodium chlorite to chlorine dioxide. When operated according to Halox guidelines, this Halox equipment generates a safe, dilute solution at a controlled, measurable rate that contains up to 550 ppm of chlorine dioxide. For specific sizing concentrations, please contact Halox Technical Service.

This simple-to-operate system is the perfect solution for small to intermediate sized operations. The patented Halox System is a ClO_2 generating process that requires NO added acid, NO chlorine gas, NO bleach. Because of its unique ability to perform controlled oxidation, the Halox System generates a very pure product and is cost-effective

[1] When certain microbes land on surfaces, they attach themselves by producing polysaccharide films that are similar to a spider web in design. This film is sticky and very difficult to remove. Channels are formed in this film, through which water flows. This sticky web catches nutrients and other microbes that pass by, providing food and a quick growth mechanism for microorganisms. This sticky web is called biofilm.