A Water-Saving Brew

By Abby Harris

Texas brewery saves water during drought conditions

After California and Texas announced a state of emergency this past March due to water scarcity, the U.S. industrial sector is focusing on ways to reduce water footprints. In a facility with a cooling tower, the biggest water-users are not the faucets or toilets; it is actually the cooling tower or evaporative condenser.

Chemical companies are traditionally used to treat the problems of scale, corrosion and microbiological growth in water-cooled systems. While the treatment is effective, many customers are requesting a more efficient way to save water and improve their environmental footprint by eliminating chemicals.

Due to more stringent effluent regulations and fluctuating prices of chemicals, the market is looking to nonchemical treatments, such as controlled hydrodynamic cavitation (CHC) treatment service, to solve cooling water issues, save water and eliminate chemicals to improve worker and environmental safety. Because the discharged water from the nonchemical system does not contain chemicals, the water can be reused for nonpotable applications such as landscape irrigation or equipment washing.

VRTX of Schertz, Texas, approaches water treatment from a service perspective rather than an equipment installation. Its full-service agreement allows the operating system and water quality to be monitored on a monthly basis, just as a chemical provider, preventing any upfront capital expense. The agreement includes all necessary equipment, installation, monthly water testing and analysis (bacteria and corrosion coupon), mechanical service, service reports and a mechanical warranty.

Cooling water is drawn from the condenser sump. Velocity, trajectory and rotation are imparted to create opposing water streams as they leave the precision nozzles, and the water collides with tremendous kinetic energy and shear. At the collision of these streams, a region of near total vacuum is created that degasses the flow. Under these conditions, hydrodynamic cavitation occurs with intense, microscopically localized extremes of temperature, pressure and high-energy microjets.

Studies show a typical installation saves an average of nearly 1 million gal of water a year. The CHC technology drops scale particles from solution, and because the system includes filtration, the particles can be filtered out of the system before settling. This process allows an increase in cycles of concentration to save both incoming and discharged water.

A Nonchemical Brew

Texas' oldest brewery, the Spoetzl Brewery located in Shiner, Texas, saw significant calcium carbonate deposits accumulating around their condenser tubes and inside the condensers with their previous chemical treatment service. Cycles of concentration were kept low with repeated bleed-off to ensure water quality. Consequently, the scale build-up prevented efficient heat transfer and required excess electric energy in order to run their ammonia compressors. Under chemical treatment, bacteria counts averaged in excess of 10,000 cfu/mL.

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The brewery operates a refrigeration system with anhydrous ammonia as the primary coolant. The compressed ammonia is being cooled down in three evaporative condensers with a total cooling capacity of 1,500 tons and a water volume of 3,000 gal.

Municipal water is used as makeup for this cooling system. On average, the makeup water contains 130 ppm (as $CaCO_3$) of total hardness, 100 ppm of calcium hardness and 400 ppm of total alkalinity. The pH is around 7.7 with a TDS of approximately 700 ppm. The original chemical water treatment system was designed with a makeup water holding tank into which additives were automatically injected based on water conductivity.

From this holding tank, the cooling water was pumped up to the towers, which are located on the roof.

One 60-gpm VRTX unit, along with a 50-gpm disc filter, were installed to replace the chemical treatment. The brewery installed water meters on both makeup and blowdown lines 47 days prior to the unit's installation. Since the installation, readings from both meters have been regularly recorded. Before the installation, condenser blowdown was 395,600 gal of water and makeup consumption was 901,600 gal. The daily makeup and blowdown rates were 19,115 and 8,387, respectively, before the installation. Cycles of concentration was calculated at 2.3.

The objectives of this case study were to:

- Provide scale, corrosion and microbiological control;
- Improve operating efficiency for the condenser system;
- Conserve water by minimizing makeup discharge;
- Produce condenser bleed without pollution; and
- Implement environmental improvements and worker safety wherever possible.

System Results

Old scale was gradually removed and no new scale has formed. Two weeks after the installation, the hard scale on the condenser tubes started to soften, and in two months' time, most of the scale was removed. Bacteria counts averaged 1,000 CFU/mL over a two-and-a-half year period (normal levels measured by standard pour plate method in cooling water range from 400 to 2,500 CFU/mL). Corrosion rates were less than 2.2 mpy for galvanized steel, 2.5 for carbon steel, and less than 0.3 mpy for copper alloy.

Cycles of concentration were also calculated using the recorded data. After eight years with the VRTX system, the average cycles of concentration are 6.9. It took 311 days to reach the same amount of blowdown reached in just 47 days of chemical treatment. Total makeup water consumption was 7.52 million gal and total discharged water was 1.09 million gal. With the HDC nonchemical treatment the average blowdown rate was reduced to 1,323 gal and 7,624 gal per day.

The installation at the brewery achieved all objectives. Discharge from the cooling system has been reduced, and consequently, the makeup water also decreased. Annual water savings are more than 1.8 million gal. In addition, the discharged water is available for reuse. *wqp*

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