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TECHNICAL PUBLICATION

INFORMATION & STRATEGY FOR THE FACILITY MANAGER

Closed Loop Water Treatment

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Proper water treatment is essential in preventing problems in your closed loop systems - to avoid corrosion, deposition, and fouling, to avoid disruption of service, and to avoid energy waste. Below is a short summary of the potential problems commonly found in closed loop systems.

Definition of a Closed Loop

A water loop is defined to be "closed", for water treatment purposes, if the make-up rate is less than 10% of the system capacity per year.

In a true closed loop, the chemical treatment is added initially, and is expected to remain in the loop for a long period of time - until the loop is drained either fully or partially - for repair, inspection, and/or expansion purposes - or until the chemical treatment breaks down. All of which require some additional treatment.

One of the most important goals in closed loop management is to minimize make-up. Any make-up is detrimental to the system because it brings in substances that can damage the system quickly.

If a loop has high make-up, it has to be treated differently to overcome the additional problems. The most common cause of high make-up rate is leaks.

Oxygen Induced Corrosion

Raw make-up water contains dissolved gases, among which is oxygen. Left untreated, dissolved oxygen causes pitting corrosion on metal surfaces. Pitting results in holes in your pipes, tubes, and coils which leads to unscheduled shutdowns, disrupting your operation.

Proper water treatment passivates the metal surfaces to withstand against oxygen attack, and/or removes the dissolved oxygen. In a true closed loop, the treatment is filming/passivation. In a high make-up loop, the treatment may include oxygen scavenging.

Deposition

Raw water contains minerals. As the temperature is increased (in hot water applications) or decreased (in chilled water applications), the solubility of the minerals are changed. As such, certain minerals will become insoluble, precipitating and depositing on the heat transfer surfaces.

Deposition reduces your heat transfer efficiency. A mere eggshell thickness can increase you energy cost by 10%.

Severe deposition can lead to high head pressure, and/or tube/coil rupture, forcing unscheduled shutdowns, and disrupting your operation.

Proper water treatment modifies the crystal structures of the minerals, and/or conditions the precipitate to minimize its adhesion on heat transfer surfaces.

Acid-Induced Corrosion

Some closed loops are protected against freezing by the addition of glycol based anti-freeze. Over time, glycol breaks down to form glycolic acids. In turn, the acid attacks your pipes, tubes, and coils, resulting in unscheduled shutdowns and disruption to your operation.

Proper water treatment is necessary to neutralize any acidity in the closed loops.

Microbio Induced Fouling and Corrosion

Because microorganisms are ubiquitous, a closed loop is susceptible to bacterial contamination, especially if it is not a tight system.

Closed loops provide all the necessary ingredients, i.e., water nutrients, to support microorganisms growth. Bacteria have been found to exist even in hot water boiler applications. Over time, the microorganisms grow and cause various problems depending on the species.

Denitrifying bacteria can consume the chemical inhibitor, reducing the protection on the systems.

Slime producing bacteria can accelerate fouling and deposition, increasing head pressure.

Sulfate reducing bacteria (SRB) and iron reducing bacteria (IRB) produce acids, which can eat holes through your pipes, tubes, and coils. The presence of a rotten egg odor is a good indication that SRB is present.

Proper water treatment is essential in keeping the microorganism growth under control, to prevent system failure.