

## Application Brief

# COOLING SYSTEMS

Cooling systems are employed to keep the temperature of a process from exceeding the limits dictated by the needs of comfort, safety, and efficiency. Commonly encountered problems in cooling systems include corrosion, deposition, fouling, and biological growth, which can all disrupt operational functioning and lead to increased costs, equipment failure, and emergency shutdowns.

Cooling water systems remove heat from various industrial processes, including power generation, refining, and mission-critical operations such as data center cooling. The three most common cooling water systems are once-through, open-recirculating, and closed-recirculating.

## Once Through

Once-through cooling water systems employ cool water that circulates once only through the entire system before being discharged. This type of system is common alongside rivers or coastlines where abundant water is available. The system design contains heat exchangers and transfer piping, as shown in Figure 1. Power utility services often operate this type of system.



Figure 1: Open-Recirculating Cooling Tower at a Data Center Facility

## Open-Recirculating

Open-recirculating cooling water systems are open to the atmosphere and continuously recycle and reuse their cooling water. These systems comprise an evaporator unit, a cooling tower, or an evaporative condenser. The units mix air and water and allow some of the water to evaporate, cooling

the balance of the water volume. The cooled water is then circulated to heat exchangers or chillers to extract heat from the process flow stream. The warmed cooling water flows back to the cooling tower, repeating the cycle. Water loss from the system is primarily through evaporation; however, a portion of the cooling water must be discharged as waste (i.e., blowdown) to maintain a suitable water quality within the system. Makeup water must be added to replace the lost water. Recirculating cooling water systems are found in most air conditioning chiller operations and many heat exchange operations.

## Closed-Recirculating

Water circulates in a closed loop in a closed-recirculating system with little to zero evaporation. These systems are not atmospherically exposed; thus, the circulating water's chemistry is unaffected. These systems are ideal for critical cooling applications such as continuous casters in metal industries where greater water purity is required since even trace contamination can lead to equipment failure. Process heat is extracted via heat transfer plates in the closed cooling water system, and the accumulated heat in the closed-system cooling water heat is eliminated through a separate heat exchanger in an open evaporative, once-through, or air-cooling system.

## Your Pain Points

Undesirable foulants accumulate in each of these standard processes. These can derive from the reduced presence of oxygen, or as water heats and cools. A robust cooling water treatment program's primary objective is to minimize the formation and accumulation of these foulants, thereby ensuring the operating efficiency of the cooling water system and protecting the equipment surfaces that directly contact the cooling water. Fouling is limited by controlling or minimizing scaling, deposition, corrosion, and microbiological growth within the cooling processes. Treatment programs must also address requirements for environmental compliance, safety, water conservation, and fiscal control of chemical costs.

All of the problems associated with a cooling system - scaling, corrosion, and microbiological fouling - are interconnected. One contributes to another and vice versa, so a successful treatment program must address each issue.

# Our Comprehensive Solution

Gradiant offers a comprehensive approach to address these challenges, integrating advanced chemical treatment with sophisticated feed, monitoring, and control systems. Our tailored programs treat entirely all the issues found in cooling systems to ensure safe, reliable, and efficient cooling operations.

By combining our application expertise and suite of high-performance CURE chemicals, we can tailor the optimal combination to your plant's unique operating needs, which include but are not limited to:

- Scale Inhibitors
- Corrosion Inhibitors
- Biocides and biodispersants

Gradiant technologies allow the operation of the cooling tower systems at optimum chemical concentration and treatment levels to produce savings in water, and treatment costs and promote health and environmental compliance.

## Bespoke Service Programs

Gradiant designs customized service programs aligned with each facility's needs. These include routine water chemistry analyses, chemical inventory checks, system performance monitoring, training, technical support, and on-site response. Chemical dosing systems are integrated into the comprehensive chemical and service program.

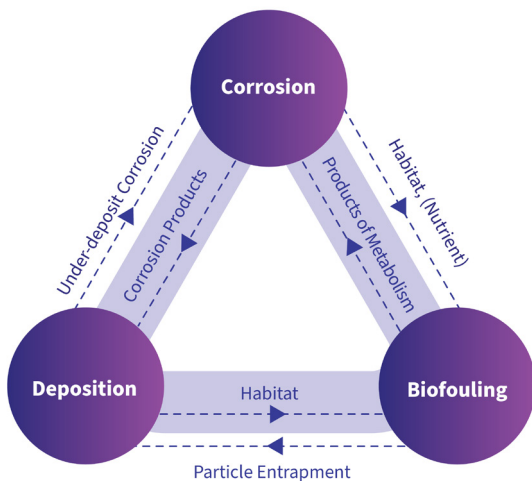


Figure 2: CURE Chemicals Solve Cooling System Problems

Have a question? Contact us at: [gradiant.com/contact](https://www.gradiant.com/contact)

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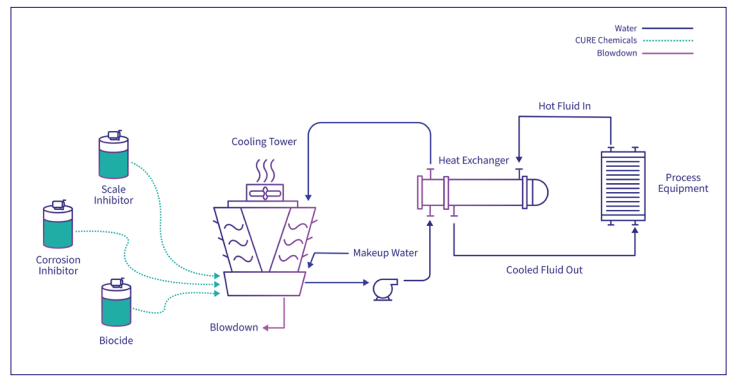


Figure 3: CURE Chemicals in an Open-Recirculating Cooling Cycle

## Benefits

Boost energy efficiency, reduce water usage, and enhance the longevity of your equipment —Gradiant's tailored solutions redefine the potential of your cooling systems.



### Energy Efficiency

Improved heat exchange efficiency, achieved by preventing scale deposits, reduces the energy required for cooling processes. Compared to non-optimized systems, expect energy efficiency improvement of up to 20%.



### Reduced Water Usage

Properly managed cooling systems have increased cycles of concentration, reducing the consumption of fresh makeup water, and with a multifunctional chemistry program, these systems can utilize alternative water sources for makeup, such as treated wastewater, to reduce freshwater consumption by up to 30%.



### Extended Asset Life

An optimized chemical program will extend the lifespan of cooling system assets, increasing equipment longevity by up to 300%.

Learn more about Gradiant's water treatment expertise across your facility:

- [Technologies](#)
- [Solutions & Industries](#)
- [CURE Chemicals:](#)
  - Water Clarification Systems
  - Membrane Systems
  - Wastewater Treatment
  - Cooling Systems
  - Process Treatment
  - Boiler Systems