

## What's in Your Water, by Carla L. Romita

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When it comes to your building's heating and cooling systems, the answer to this question is vitally important.

Water in its natural state contains many impurities that precipitate when the water is heated. This leaves behind deposits that interfere with efficient boiler and cooling system performance by inhibiting heat transfer and water flow. Water has these impurities because it dissolves gases from air, from organic matter, and from minerals in the earth. The primary minerals found in water are calcium carbonate, calcium sulfate, magnesium carbonate, magnesium sulfate, silica (sand), sodium chloride (table salt), sodium sulfate as well as iron, manganese, fluoride, and aluminum.

Water that has a high percentage of calcium and magnesium compounds is called "hard" water. These compounds tend to precipitate when heated and cause scaling. Scaling insulates the tubes or heating surfaces in a boiler, interferes with heat transfer, and ultimately results in overheating. If the overheating is sufficiently severe or long lasting, the metal parts can fail. Corrosion can easily occur under scale deposits and create leaks in the tubes.

Water also contains oxygen and carbon dioxide, both of which oxidize metals. Oxidation causes metal to corrode or weaken, and ultimately to fail. Corrosion byproducts further add to the boiler tube deposits. The single most significant factor leading to premature deterioration of HVAC equipment and piping is corrosion. Corrosion damage can be catastrophic, involving costly downtime for repairs and equipment replacement, discomfort of building residents, and even total equipment shutdown.

Untreated water not only physically damages your boiler, but also reduces its efficiency by producing scale. A mere 1/9<sup>th</sup> inch scale deposit increases fuel consumption by 16%. A 1/8<sup>th</sup> inch scale deposit increases fuel consumption by 20%! It does not take long to build up this scale layer. If a boiler is left untreated or is poorly treated, a 1/9<sup>th</sup> inch deposit can happen in a matter of months. In today's volatile fuel market, this is a result no one can afford to ignore.

In a cooling system, scale progressively impedes water flow by narrowing the internal diameter of pipes and roughening tube surfaces. In compression refrigeration systems, scale leads to higher head pressures with a corresponding increase in power requirements and costs. A 1/8<sup>th</sup> inch scale deposit in a 100 ton refrigeration unit can increase energy consumption by 22% compared to the same size unit free of scale. In absorption systems, scale increases energy consumption by creating higher back pressure on the concentrator.

Aside from scale, biological growth has a well known role in promoting corrosion in cooling water systems. Acid metabolic byproducts cause corrosion. Bacteria, algae, and fungi form slime on heat exchange surfaces and impair heat transfer efficiency. In fact, slime has greater insulating properties than mineral scale and lowers efficiency more than the equivalent thickness of mineral scale. Some of these organisms eat cellulose and lignin and, left unchecked, can cause eventual collapse of wooden tanks or towers. Untreated or improperly treated microbial growth can have negative health consequences as well as degrade equipment and system. This microbiologically induced corrosion is often difficult to combat and detect.

Every cooling tower system experiences some water loss through evaporation, leaks, overflow of the cooling tower sump, and "bleed" – the intentional draining of a certain amount of water to decrease the amount of solids in the system. Dirt, mud, sand, silt, clay, and scale salts can enter the cooling system with the water that is added to replace it. These solids remain in the system and cause sludge buildup. Sludge deposits can damage pump seals and promote corrosion.

The answer to problems created by scale, corrosion, biological contamination, and sludge is to engage a qualified company to provide engineering-based water treatment. A properly administered water treatment program includes scale and corrosion inhibitors, microbiocides and dispersants, and an adequate "bleed" schedule as well as recommendations on the optimal chemical feed system for your facility. This keeps the heat transfer surfaces of the boiler free of scale and allows the boiler to run more efficiently. Fuel consumption and energy costs will be reduced. Chemical water treatment for cooling towers and their associated loops produces the same benefit as for boilers: extended life and improved efficiency.

The treatment company you engage should perform a survey to determine the current condition of your boiler and cooling system and provide a detailed analysis and proposal for water treatment services. Annual contracts for these services are available. Treatments should be performed on a regular basis and should be based on the size and type of your systems. The program should include periodic sampling and testing to determine if and how well the chemical treatment program is working to provide maximum possible benefit.

If your building does not currently receive chemical water treatment, ask your fuel dealer to recommend a reputable treatment company. It's a sound investment that can extend equipment life and improve energy efficiency.