FOCUS ON

By Jeffrey M. Conway, ClearWater Enviro Technologies, Inc.

C&I
A commercial & industrial article

Electronic Scale Treatment

Electronic water conditioning cleans up scale and softens water for various applications

Scale is a coating or precipitate deposited on surfaces that are in contact with hard water. Water that contains carbonates or bicarbonates of calcium or magnesium especially is likely to cause scale. When water is heated or evaporation takes place or if there is a change in water pressure, scale minerals precipitate layers of rock-like deposits inside pipes, water heaters, equipment, fixtures and glassware. While most common scale is a result of calcium carbonate, other combinations of ions commonly found in water offer a variety of scale. These substances include calcium bicarbonate, calcium sulfate, calcium chloride, magnesium carbonate, magnesium bicarbonate, magnesium sulfate and magnesium chloride.

Scale is most visually evident as white to off-white deposits that buildup inside faucets, water pipes, equipment, fixtures and heating elements. Scale formation usually is hard and very difficult to clean. Scale formation can occur on virtually any surface in contact with water, provided the water has some content of scale-forming chemistry. With more than 85 percent of U.S. water considered hard, the problem is widespread. Many billions of dollars are lost in business and industry each year due to scale buildup. Scale formation will cause corrosion in pipes and equipment, downtime and high maintenance expenses. Just a quarter inch of scale buildup will increase heating costs by as much as 40 percent.

How is Scale Formed?

Principally, scale forms from calcium carbonate. Its structure consists of tiny crystals. The most common form of crystalline calcium carbonate is called calcite. Calcite begins formation when a dynamic called supersaturation occurs. Supersaturation can be illustrated by visualizing sugar in a glass of water. If someone filled a glass full of water and began to spoon sugar into the glass, the sugar would dissolve. However, sugar will dissolve only up to a point where the water reached a maximum saturation—at this stage, sugar then will remain in its solid form.

The point where a solid will no longer dissolve is called the point of supersaturation. When calcium carbonate reaches the point of supersaturation it begins to change from its dissolved form to a solid form. This can occur even in total submersion.

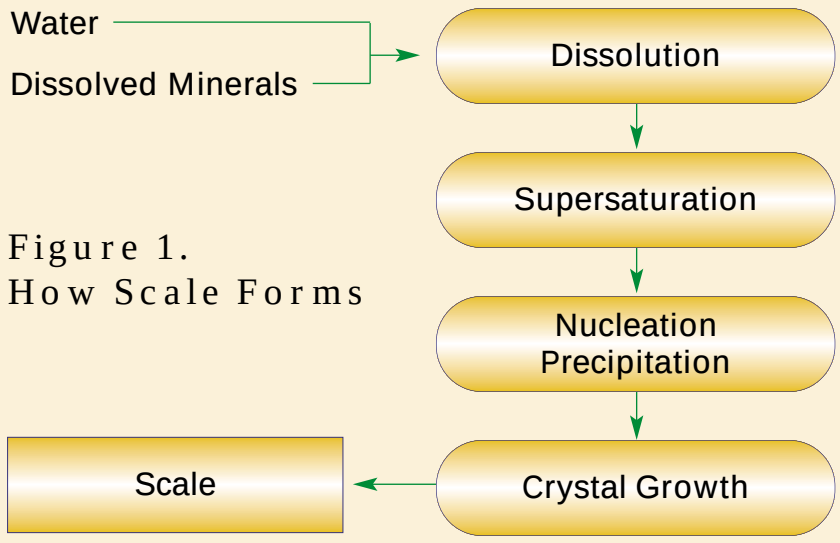


Figure 1.
How Scale Forms

The rate of formation of calcite is influenced by many factors such as temperature and evaporation. These two factors certainly account for accelerated scale formation in hot water pipes, water heaters and on surfaces such as sinks, countertops and dishes.

Treatment Technologies

Several technologies have been used successfully over the past several decades to combat the effects from hard water and scale formation.

- **Water softening** by ion exchange removes water hardness cations (positively charged) of calcium and magnesium ions and replaces them, usually with sodium chloride (common salt).
- **Reverse osmosis** will remove approximately 95 percent of dissolved solids in the water. Water pressure against a reverse osmosis membrane forces the water molecules through the semipermeable membrane, but the larger contaminant molecules and bacteria are kept behind and flushed to the sewer.
- **Polyphosphates** are used as a sequestering agent to control iron and hardness and as coating agents to control corrosion by formation of a thin passivating film on metal surfaces. In essence, they bind calcium and magnesium in solution where they are less likely to precipitate and form calcite.
- **Water jetting and sand and plastic-bead blasting** can be used to remove excess scale buildup.

Though effective, these technologies have been scrutinized by environmentalists over the past decade or so. A new technology has emerged that can solve scale problems without the need of salts, chemicals or maintenance.

Electronic Water Conditioning

Electronic water conditioning is a relatively new technology that evolved from the use of magnetic fields in water treatment. Historically, the performances of permanent magnets have been ultimately reliant on controlled conditions such as flow rate. However, their energy levels and fields are fixed. The advent of electronic systems introduced both variable energy and frequency.

Electronic treatment is based on the principal of creating an oscillating field of energy

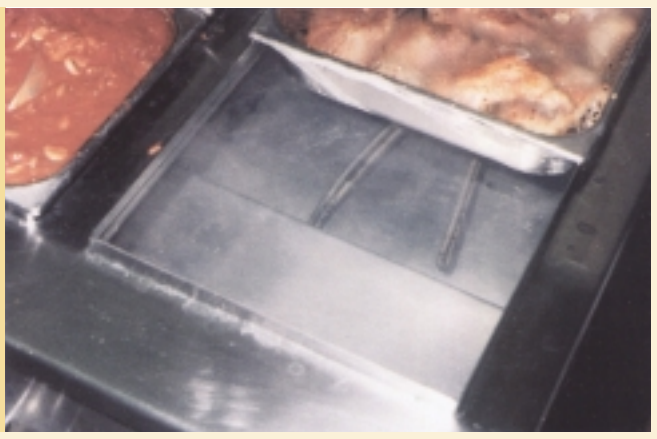
Harvest Buffet Reaps Rewards of Electronic Water Conditioning

The Harvest Buffet Restaurant, the largest independently owned buffet/banquet facility in the state of Oklahoma, solved its hard water problems by installing an electronic descaler. ClearWater Enviro Technologies, Inc.'s Scale Blaster was selected to treat this restaurant's hard water problems.

The buffet-style restaurant and convention facility, located in Tulsa, seats 550 people and uses more than 360,000 gallons of water a month. Imagine the hard water problems with this high volume of water use. The equipment constantly was clogging with calcium buildup.

The commercial dishwashers at the Harvest Buffet would clog with scale on the water jets and surrounding areas. Heating elements that heat the water for food trays were seeing scale buildup. In addition, there was buildup in the two main boilers and coffee urns.

The blue curtain on the commercial dishwashers normally would be covered with scale buildup. Today, they are virtually free of scale buildup, as is the interior of the dishwasher.



The heating elements that heat the water for food trays now are totally scale-free.

Within two weeks of installation, the affected areas began cleaning themselves and by the sixth week, virtually all the scale in the interior was gone including the rubber curtains on the dishwashers. The water jets were scale free without any trace of buildup.

The heating elements on the food lines went from heavy scale buildup to almost spotless in six weeks. These heating elements, which are under all of the water heated food trays, have turned from heavily corroded to almost squeaky clean. A year and a half later, the elements are still spotless without any maintenance required.

The owners, Phil and Jill Dietz, are saving thousands of dollars annually on maintenance costs due to scale deposits. Jill reported, "Best of all, when Economic-Labs tested our water after six weeks, it indicated to me that our water reacted like soft water, which allows us to use less vigorous detergents and saved us even more money."

with the use of low frequency radio waves. As water passes through a pipe delivering variable frequencies and energy levels, a physical change in the preferred crystal structure of calcium and magnesium occurs, tending to form the crystalline structure of aragonite rather than the random crystalline structure of calcite. Aragonite is a form of calcite crystallizing in the orthorhombic system and prefers remaining in solution and not adhering to surfaces. Through this physical mechanism, electronic conditioning alters the effects of calcium and magnesium carbonates with regard to scale formation and reaction with soap to form curd. Precipitated aragonite has a fine powder-like consistency that is not hard and does not intrinsically adhere to surfaces.

There are several electronic descalers available on the market today. Many use radio wave while others use square wave technology.

Another electronic descaler is one that creates a rapidly alternating current in a frequency range that exceeds the best estimate of the internal natural frequency of water. The natural frequency of water varies with temperature, pressure, minerals present, pH and other factors. The current generates an oscillating magnetic field within the pipe. The rapid oscillation of the magnetic field creates a molecular agitation in the water passing through the field. It is this agitation that alters the effects of calcium and magnesium carbonates with regard to limescale formation.

LearnMore!
For more information related to this article, go to ww.waterinfocenter.com/lm.cfm/wq040200

Results

Scale either is eliminated completely or is reduced to a fine powder that easily is wiped away. Soap curds or scum are no longer a major contributor to bathtub soap scum buildup, dingy looking laundry or a variety of other undesirable effects. Savings in industrial equipment such as cooling towers and boilers are substantial. Basically, existing scale is removed and never formed again.

Depending on the application and water hardness levels, the benefits include savings in chemicals, maintenance, downtime, energy and extended life of capital equipment.

Controversy

The use of catalytic and magnetic devices in the treatment of water is controversial. Failures of equipment performance in this industry are not uncommon. Unfortunately, as with any new and relatively inexpensive technology, there are those who ride the profit wagon. These entities often make false product claims and never cease to amaze the industry with their creativity and devotion to generate sales. No industry or product is insulate from this phenomenon. Throughout its history, the water improvement industry certainly has fallen prey to wild marketing tactics and false promises including the manufacturing, marketing and sales of water treatment devices.

To date, there are no standards on the technology with the Water Quality Association or NSF. Perhaps someday there will be a standard from an accredited association from which manufacturers, dealers and customers alike can work from. WQP

About the Author
Jeffrey M. Conway is the president of ClearWater Enviro Technologies, Inc., Clearwater, Fla. ClearWater Enviro is the manufacturer of ScaleBlaster, an electronic descaler that eliminates hard water and limescale problems. For further information, visit www.scaleblaster.com.

For more information on this subject, write in 1010 on the reader service card.