

# Soo~Soft Digital Technology

## The Lime Scale Story

**Naturally Occurring calcium** is a large part of all water. Calcium has been dissolved into all the water sources in the world through the accumulation of countless land and sea animals over hundreds of millions of years. It is the principle element that makes water “hard” and forms into lime scale. Crystals of hard calcium will form on everything that hard water touches.

Just as rain precipitates from the air, calcium precipitates from water. Heat, pressure changes and evaporation cause calcium to precipitate. In addition, these particles of calcium contain an electrical charge causing them to be attracted to metallic surfaces. The insides of pipes, water heaters, boilers, coffee makers, icemakers and dishwashers provide the perfect surfaces to build lime scale.

Lime scale does not limit itself to sinks, tubs, and toilet bowls alone. It also forms on clothes, skin, hair, and teeth. These crystals of calcium take up space in the water preventing soap and detergents from making suds. Hard calcium crystals can also be a skin irritant. Showering and shaving with hard water often creates skin irritation. In time, calcium forms deposits in every plumbing system and appliance.

## Costs of Lime Scale

The economic costs are both direct and indirect. Radiators clogged with scale do not transfer heat well and require more energy for operation. Energy costs for appliances, hot water heaters, boilers and pumping equipment are significantly increased. The amount of cleaners, soaps, and chemicals used for cleaning scale from drains adds to the costs. Other costs of lime scale are more deductive and often taken for granted. These include the cost of maintenance and replacement of all appliances that use water. From coffee makers, ice machines, water heaters, dishwashers, to hot water boilers used for heating, the costs for lime scale deposits are very high.

Studies of water heaters indicate that ¼ inch of scale can increase fuel consumption by as much as 40%. In cases where the scale builds up to 1 inch, there is a 95% reduction in heat transfer. In water heaters the cost of operation will exceed the cost of the unit itself. Because the effects of lime scale are so pervasive, it is difficult to accurately gage the costs of the problems created. Estimates are often in excess of 100 billion dollars per year in the U.S. alone. This is probably a very conservative estimate.

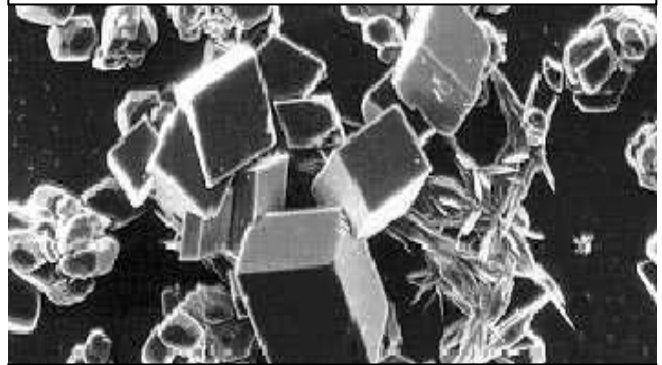
## Maintenance

Calcium, in its natural hard form, is abrasive. It collects inside of pumps, causing their premature failure. Electric solenoid valves also collect hard calcium deposits, causing them to seize. Sprinkler heads can become clogged with calcium as well. In addition, sprinkler heads can wear out prematurely from the abrasion caused by hard calcium crystals.

Calcium deposits are also a major factor in corrosion. The corrosive contaminants become trapped by calcium deposits, allowing them to corrode pipes, tanks, valves and water jackets. This corrosion reduces the life expectancy of all components using water.



**Large Lime Scale Formation**



**Hard Calcium Crystals**

Water filters of all types collect calcium deposits on their surfaces. This forces filter replacement long before the filter itself is fully utilized.

Calcium is also a thermal insulator. It inhibits the flame of a water heater from heating the water inside the tank. The heat is concentrated on the calcium deposit at the bottom of the tank and the calcium must then heat the water. This is why water heaters will most often leak at the bottom when they fail. When heated, the calcium and steel “sandwich” causes steel fatigue at the bottom of the tank.

In an electrical heating element, calcium builds up on the outside of the element and traps heat. The element is then forced to work at a much higher temperature than its design parameters. It then fails long before its time. In some areas, heating elements in coffee makers build an inch of scale in just a few months.

Temperature sensors with calcium deposits add to the problem. The sensor is thermally insulated from the water, masking the actual water temperature. This causes the control system to demand more heat from the element. In addition many sensors have their own heating element built in. Calcium deposits causes these elements to fail prematurely due to trapped heat.

As lime scale builds up inside the plumbing system, it obstructs the flow of water. In time it can stop the flow of water through the pipes. The plumbing will then require replacement. This is common in older facilities or in areas with high mineral concentrations in the water.

## **Energy Efficiency**

Energy ratings listed on water heaters, boilers, dishwashers, etc. are misleading. They demonstrate the energy costs for one year. The dollar amounts referred to are for brand new unit that has no calcium deposits. Depending on the calcium content in the water these numbers can often be doubled in as little as six months.

In industrial and commercial applications the cost benefits of the Soo-Soft system are proportional to the amount of energy that is being consumed in heating, cooling or plumbing of water. The cost benefits can be profound and add greatly to the bottom line of any business.

## **Labor Costs**

Calcium deposits require strong chemicals and considerable labor to keep them in check. This extends from additional scrubbing to keep surfaces clean, additional detergents for cleaning and washing, and labor required to remove scale from expensive equipment and appliances. The costs of calcium fouling estimates for the United States are in the range of 100 billion dollars annually.

## **Chemically Softened Water**

Salt-based ion exchange systems operate by removing a portion of calcium from the water. Water passes through a container filled with resin beads. (Zeolite) These beads collect calcium on their surface, removing a portion of the calcium from the water. When the beads become coated, they need to be cleaned of calcium deposits. This is accomplished by washing them in a salt brine solution, a process referred to as regeneration.

These beads can be contaminated by other elements in the water such as ferric iron, which is a bacterium. The ferric iron creates a slime preventing the calcium from sticking to the resin beads. In these instances the resin beads must be replaced in order to maintain their effectiveness.

A salt-based system removes up to 75% of calcium from the water when new. As the beads age and become contaminated, their ability to remove calcium from water is reduced. This is a natural effect of time and contamination for ion exchange systems. The end result can be as little as 25% of the calcium being removed from the water. The remainder is released into the plumbing system forming scale on pipes and appliances. Water feels “Slimy” or “Slick” and is a skin irritant with salts and left over hard calcium crystals. In any case, the balance of hard calcium will make its way into the plumbing system and form lime scale. Ordinary water softeners only slow the process down. Lime scale will still form it just takes longer.

The greater the amount of calcium removed from the water, the larger the amounts of salt introduced into the water. This can create an objectionable taste if the water is used for drinking, cooking, making coffee, Ice, etc.

**Salt in water aggravates existing high blood pressure conditions. Coronary hypertension is now a problem that 9 out of 10 people will develop during their middle years.** In Japan, where salt is a common preservative, the

incidence of hypertension is high. **By comparison, hypertension is rare in cultures that use little salt in their diet. Chemical salt-type softening systems add salt to water.**

In a salt-type softener, calcium and magnesium are removed from the water. Studies by the World Health Organization have shown increased mortality from cardiovascular disease, stroke, and cancer in areas where drinking water is naturally low in calcium and magnesium content.

Aside from a constant diet of large amounts of salt required for operation, Salt-type softeners are doomed to failure from the corrosive nature of the salt they consume. They typically require regular maintenance and frequent replacement.

The "test" for hardness that is the basis of salt-based softening systems is misleading. The test demonstrates amounts of calcium left in the water measured as total dissolved solids. (TDS) However the 25-75% of calcium crystals left in the water are still very hard and will still form lime scale.

## **Environmental**

Conventional methods of softening water use salt in order to remove calcium from the water. These systems require regular flushing with salt and dump salt brine into sewage systems. The salt brine discharged from these units is dumped into rivers, lakes and streams without treatment by municipal waste facilities. One family with a salt-based softener can dump 600 pounds of brine per year into the ecosystem. The end result for America is that billions of pounds of salt are dumped into the ecosystem every year.

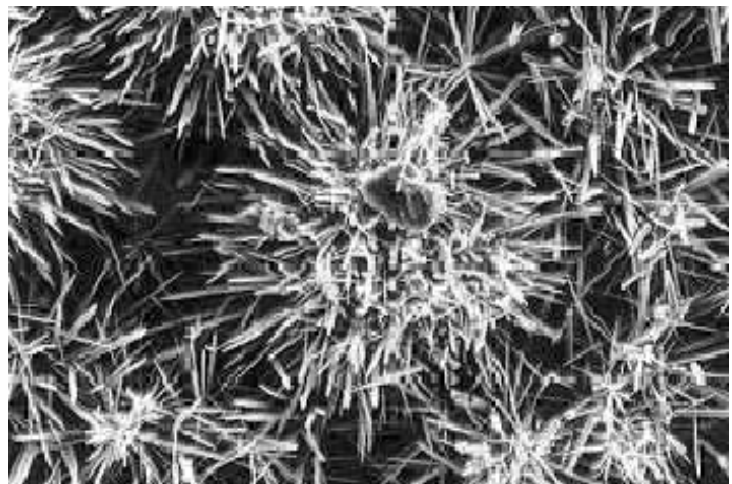
Salt is harmful to all plant life. Salt significantly reduces all aspects of plant growth. Root and shoot growth are reduced and tip burn is increased. Crops such as strawberries, lettuce, and avocados are especially sensitive to salt content in their irrigation water.

Salt accumulation is rapidly increasing in freshwater of lakes, rivers, and streams. These make it though the food chain and eventually arrive in our food and drinking water. Much of today's drinking water has twice the EPA limit of sodium content. In the end, Americans consume from two to ten times the amount of salt required for good health.

Many areas around the country are at the limits of salt content in both potable and wastewater. There is no practical way to remove salt during waste treatment. The county of Los Angeles estimates that it would cost 300 million dollars to remove salt in the process of treating their wastewater.

## **Physical Water Softening**

Millions times a second the Soo~Soft system varies a complex group of electrical signals that alter the physical chemistry of water. A cascading chain reaction reduces the long chains of hard calcium into a fine calcium aragonite powder. With a particle size of only 4 microns, (156 millionths of an inch) the soft calcium in water groups itself into soft snowflake-like shapes. Spaces appear between these groups and allow the water to become an improved carrier for minerals, nutrients and for the formation of suds from detergents. This calcium powder is so fine that it becomes six times more dissolvable into the water itself. The extremely small size of the calcium particle creates another advantage. Heat, pressure changes, and evaporation will not cause the particle to revert, and form hard lime scale. The temperature required for re-conversion to a hard crystal state is 700 degrees Fahrenheit, well out of the range of any heating or plumbing system. Since the Soo~Soft system is always processing the water, new lime scale formation is always being prevented from forming.



**Calcium Aragonite Clusters**

The surface tension of the water is also reduced by this conversion to a soft form. This increases the solubility of the water making it an even better solvent. In addition, the electrical charge of the water and minerals suspended in it are altered so calcium will not adhere to surfaces

The end result of all these physical water modifications is that all pipes, filters, pumps, appliances, etc. will discharge their existing calcium deposits over the initial period of 90 days and cease to return.

The affects “downstream” of the Soo~Soft unit are profound. After an initial 90-day period of de-scaling, ice machines, coffee makers, steam tables, steam ovens and other appliances no longer clog with deposits. The grief of calcium deposits in equipment is over. Lime scale no longer forms in sinks, toilets, and bathtubs. The effectiveness of soaps, detergents and other chemical agents used for cleaning increases as much as 60%. Housekeeping labor is then reduced with the absence of lime scale deposits.

## A “Soup” Analogy

Imagine for a moment that you have a bowl of soup loaded with large croutons that are old, dry, and hard. If you try to get them to dissolve into the liquid soup it is very difficult. Stirring the soup does little good, as does removing a portion of them. It makes it easier to get at the liquid, but great portions of the hard croutons are still there.

If you however crush the hard croutons into the soup, they become powder. The warm soup dissolves the breadcrumbs quickly and the soup now has an even consistency with the breadcrumbs dissolved into it. The soup is now more liquid, tastes smooth, has a uniform consistency, and is easy to consume.

What the Soo~Soft system does for water is very similar. The large hardened forms of calcium are broken down into a fine powder. This powder is so fine that the calcium particles dissolve into the water, the makes the water “Wetter” and even more transparent. Because of the lack of hard calcium particles, the water is a better solvent, which makes more suds from less detergent. It penetrates skin, hair, and even clothes as they are being washed far more effectively. The wetness of the water (reduced surface tension) is what makes it possible for the Soo~Soft System to dissolve the existing calcium deposits in the plumbing system and keep them from returning. It has the added benefit of improving the wash and rinse water in every application that uses water.

## 100% Effective

Residential Soo~Soft systems can soften 30 gallons per minute through a 1-inch copper pipe or a Commercial system can soften 150 gallons per minute through a 2-inch pipe or 300 gallons per minute through a 3-inch plastic pipe. These flow rates are similar to a broken pipe spewing all it can. At all flow rates Soo-Soft systems are highly effective in breaking down the hardest water into a form that is soft and silky-smooth. **As they use no salt or chemicals, they are completely environmentally friendly.** In saving money through more effective water and lime scale removal, they pay for themselves instantly.

## Health Benefits

Water is the universal solvent for all of life. It is the solvent used for the bodies waste disposal systems. Water removes the toxic waste products produced by countless cellular functions. Water fills the capillaries, which act to remove impurities. It follows that the better a solvent the water is, the more it will act in a positive way to influence health and well-being.

The Soo~Soft system reduces the surface tension of the water. This is a natural result of reducing the minerals in water to a 4-micron size. Water becomes “wetter” and a better solvent to remove toxins. Its ability to dissolve and carry away bodily waste products is improved.

In addition the reduced surface tension of the water helps the cells absorb water. Water with a reduced surface tension can penetrate the cell wall easier, facilitating the growth and division of cells in the body.

Water is also the primary carrier for nutrients delivered to the cells. The ability of water to dissolve these nutrients and deliver them to the cells is also influenced by the wetness and solubility of the water.

One of the most important cellular nutrients is calcium. It is the primary constituent of the cell wall. It has been shown to tighten and strengthen cellular membranes. Low levels of calcium create weak cell walls and

increase the ability of the cell wall to be penetrated. This weaker cell wall increases susceptibility to invasion by bacteria and toxic elements

Outside of the body, bacteria in physically treated water starve. Algae and bacteria must obtain nourishment through their cell walls. Water can easily penetrate, but cells are prevented from absorbing mineral nourishment. The altered form of crystallized mineral shapes created by the Soo-Soft system cannot easily penetrate cell walls of bacteria.

## **How To Know the Soo-Soft Unit Is Working**

You can perform several observations to demonstrate that your plumbing, equipment and appliances are de-scaling and that you are achieving permanent total lime scale removal and benefiting from the attributes of soft water.

Before installation, perform a visual inspection of the inside of your toilet's water tanks and your dishwasher's heating element. Generally, even with a salt based softening system, you will see evidence of lime scale formation on toilet tank metal parts and a white coating on dishwasher heating elements. These deposits will be re-absorbed and will disappear within the first 90 days of your Soo-Soft installation. You can verify the recovery time for your hot water heater before installation by filling a bathtub with hot water to the bottom of your overflow valve. Make note of the time you started filling the tub until the time the hot water heater recovers and stops heating the water. Perform this test again at the 90-day point after installing your Soo-Soft unit. Recovery time should be shorter, indicating that the hot water heater-heating element and tank have de-scaled, and indicating that you are now saving energy in the improved recovery process. Many of our customers report having to reduce the temperature of their hot water heater, as the water heater is now more effective. Also make note of areas where you have observed lime scale build up around fixtures and on surfaces. Once your Soo-Soft unit is installed and these are cleared away, they should not reform.

At this point, you can make the same subjective observations about soft water that you would with any water softening system. Your laundry should require much less detergent to achieve the same level of suds. Your dishwasher should require much less detergent to clean your dishes. Your glassware should rinse much cleaner and be much more spot-free. Cloudy glassware will begin to come clear again. Your clothes will become softer as the same de-scaling process in your plumbing system actually de-scales the cloth fibers. Your hair and skin will become softer as they de-scale and retain more moisture.

At this point, you can note added benefits that cannot be gained using salt based softening systems. Soo-Soft treated water is very beneficial to plants and landscaping and can be used to wash cars, RVs and boats without harm. Pets actually prefer the new taste of your Soo-Soft water just like you will without the taste of added salt or the harshness of untreated calcium. Compare the taste of your treated water to your neighbor's untreated water to demonstrate the improvement.

## **Commercial Applications**

As the Soo-Soft system begins to work, it will begin to dissolve all the existing scale build up in the plumbing system. This can be removed by draining a few gallons from the bottom of the hot water heater, which is typically the lowest point of the plumbing system. Water from the water heater will be cloudy and often milky. Equipment such as steam ovens, boilers, high-temperature equipment will require separate flushing, as they tend to contain large amount of scale within them. This flushing of components and the water heater should be done on a regular basis to remove the excess calcium from the system.

You will observe a large-scale change that occurs in the character of the calcium that is removed. It is now soft and will flush away easily. In a period of 90-days the plumbing system and appliances that are connected to it will have all of its calcium converted to this soft state and can be flushed from the system. The Soo-Soft system will now concentrate its power on the incoming water alone and continue to keep the system free from new lime scale formation.

# **Applications for Use**

## **Home Models**

**Homes, Individual Apartments, Individual Condominiums**

## **Commercial Models**

**Apartment Buildings, Condominium Buildings**

**Hotels, Motels, Bed & Breakfasts, Lodges**

**Restaurants, Banquet Facilities, Bars, Pubs,**

**Commercial/Institutional Kitchens**

**Resorts & Water Parks**

**Businesses (Office Buildings, Shopping Centers)**

**Laundromats & Laundry Facilities**

**Car Washes**

**Animal Husbandry**

**Landscape Management**

**Golf Courses,**

**Nurseries**

**Fountains,**

**Waterfalls**

## **Recreational Vehicle Models**

**RVs, Mobile Homes, Campers**

## **Marine Models**

**Yachts, High Humidity Environments**

**Swimming Pools, Spas**

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