



Phoria
Energy Solutions

SRS

Chemical-Free

Water Treatment Systems

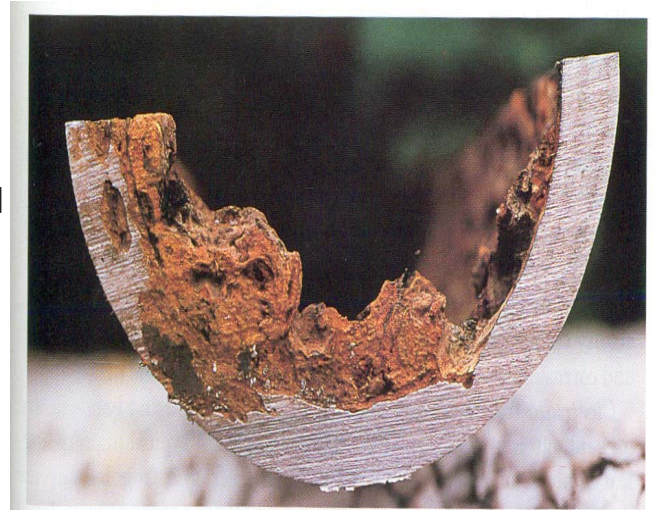
Product Description



Fouling—Its Harmful Effects

The growth of deposits on heat transfer surfaces in cooling towers, heat exchangers, main pipeline systems and control equipment, decreases performance and productivity. It is extremely costly to companies, industry and power plants that are constantly seeking methods to eliminate it.

Sludge that is caused by corrosion and bacterial activity blackens the water and causes sediments, such as scale, silt, algae and others to develop on all parts of the system. The sediments stick to all sections of the cooling system, clogging it and drastically decreasing its energy efficiency. This phenomenon is known in industry circles as fouling.



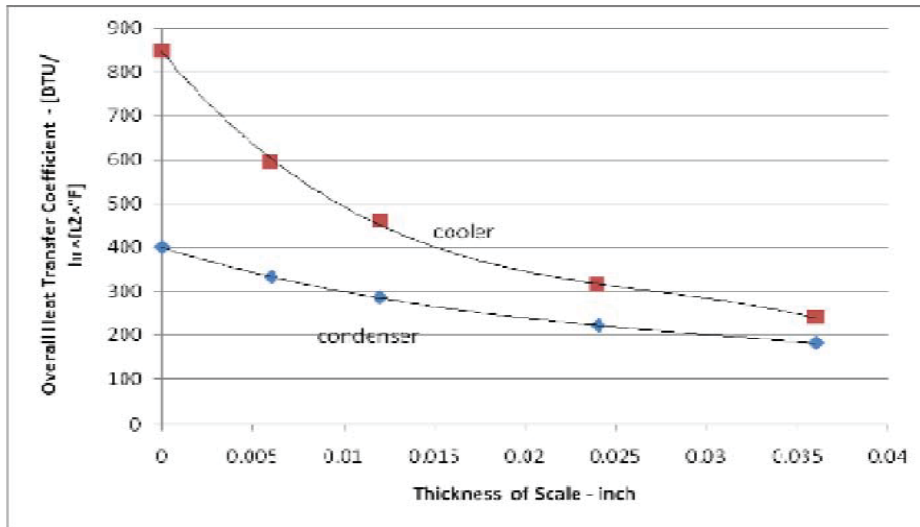
Fouling slows down processes and results in increased operating costs due to:

- * Reduced Flow
- * Increased Pressure
- * Loss of Throughput
- * Equipment Replacement
- * Cleaning and Disposal of Toxic Waste
- * Increased Safety Hazards
- * Ongoing Use of Costly Chemical Additives

Fouling is unstable and it becomes greater over time. Partial cleaning does not solve the problem and simply provides an even better platform for additional sediment and scale to stick to and become thicker.

Fouling is extremely common in both the Cooler (Evaporator) and Condenser of air conditioning systems. It causes a decrease in the heat transfer coefficient. The water contains bacteria and various germs, such as Legionella, that endangers the system operators and maintenance workers who clean the filters and fix cracks and leaks.

The graph below shows the effects of pipe sediment thickness on the unit's heat transfer coefficient.



Several systems exist that combat the problem—offline or online.

Offline Solutions

The offline solution requires shutting down the process for the cleaning. It uses chemicals or mechanical means to do the job. Using chemicals that are harmful to the environment requires extreme safety measures and specialized disposal. Between cleaning treatments, fouling accumulates and hampers performance. These drawbacks make the offline methods of cleaning expensive, cumbersome and inefficient.

The Online Method

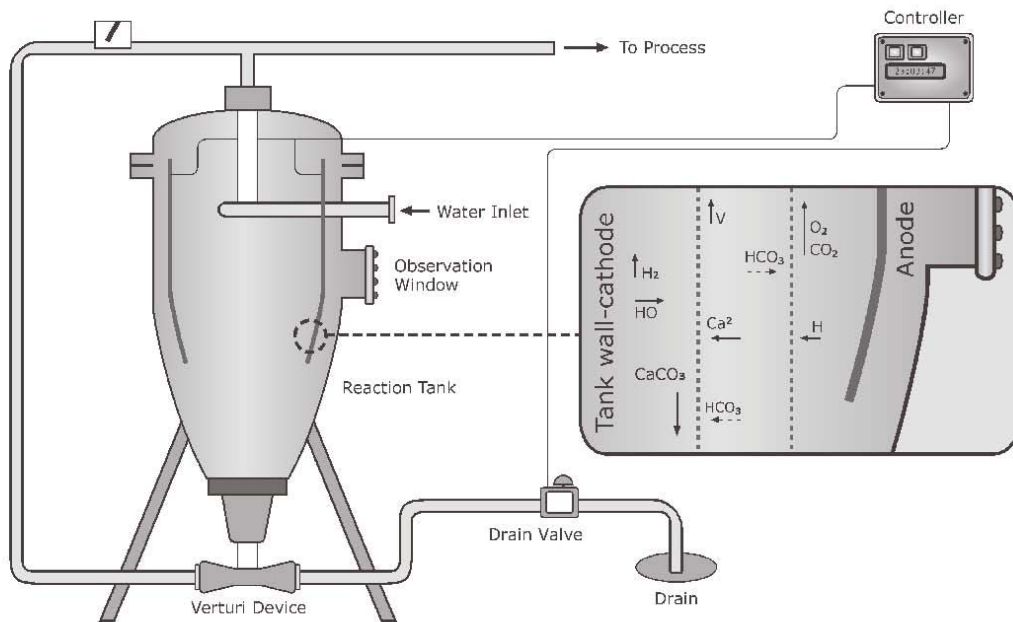
The online method, on the other hand, is both environmentally sound and extremely cost effective. Online cleaning doesn't require shutting down since it is an ongoing process. Fouling doesn't accumulate because the cleaning procedure is constantly taking place. In short, online heat exchanger cleaning is the most resourceful option available today.

PHORIA's SRS provides the robust online water treatment solution that keeps water systems free of fouling and purifies water too!

PHORIA SRS—The Effective Solution

PHORIA has developed an innovative water treatment solution that eliminates fouling in Closed Cycle Systems and Cooling Towers and provides water purification.

PHORIA'S SRS Water Treatment System harness advanced technology to provide a cost effective and resourceful method that cleans and purifies the water.



Chemical Reactions at Work in the SRS

The energy saving, chemical free, low maintenance SRS combats scale, bacteria and corrosion using electrolysis. This process provides a clean, environmentally friendly alternative for keeping systems free from harmful fouling.

The water flows through the electrolytic chamber and functions as a medium that closes the electric cycle enabling the DC current to flow between the anode and cathode of the system. Two disinfecting processes occur on the surface of the anode (+):

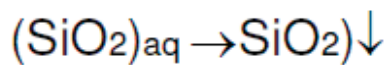
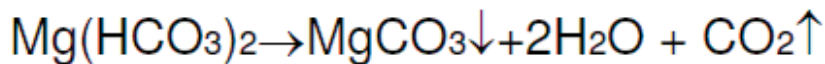
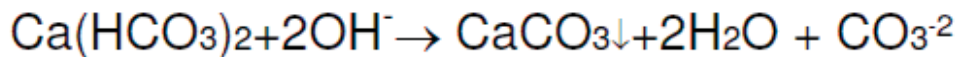
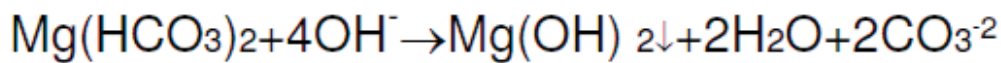
- * Anode oxidation reaction
- * Acidic catalytic reaction

The anode oxidation reaction is a series of reactions that produce gases and free radicals with high oxidation potential that disinfects the water.

Electrolysis works as follows:◦

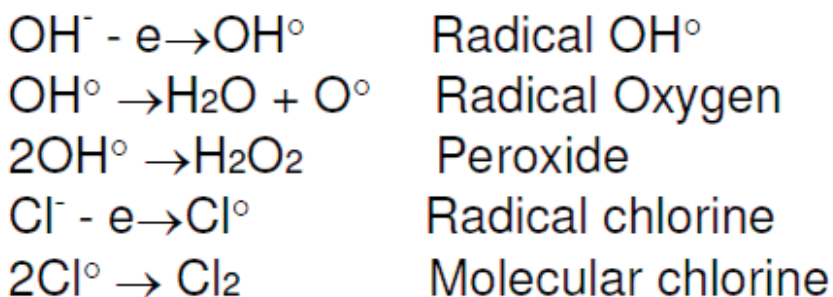
- Water in the cycle is pumped into the electrolysis chamber.
- The water pH level is raised slightly increasing the alkaline environment and preventing corrosive processes.
- Free chlorine is produced which helps to destroy bacteria.
- Higher pH causes corrosion to aggregate into suspended solids that can be removed with a sand filter.

As a result of the basic pH conditions on the cathode surface the following reactions occur:



The main ingredients of scale in water systems (MgCO_3 , CaCO_3 , $\text{Mg}(\text{OH})_2$, SiO_2) are almost completely removed from the water in this process.

The following reactions occur on the face of the anodes:



In addition, this process produces Active Chloride that works to purify the water naturally, without harmful chemical additives.

What is Scale Formation?

In order to understand the inner workings of this system, it is important to understand the chemical reactions of scale formation. Scale is formed when Calcium (Ca) and Magnesium (Mg) mix with Carbonates (HCO_3) in unstable water conditions. These elements are generally stable; however when there is a rise in water temperature, pH or change of element concentration the water equilibrium is disrupted causing the ion surpluses to react. The compound created from this reaction of the free ions is called scale and the action itself is called scaling.



The scale formation theory states that water in its natural state contains a variety of dissolved solids, including the main ones: $\text{Ca}(\text{HCO}_3)_2$ and $\text{Mg}(\text{HCO}_3)_2$.

The Calcium Bi Carbonate is soluble, but it appears in water compounds as an unstable compound as a result of the following reaction: $\text{Ca}(\text{HCO}_3)_2 \rightarrow \text{CaCO}_3 (s) + \text{H}_2\text{O} + \text{CO}_2$.

Ca and Mg Carbonate are not soluble in water. Under pressure the presence of CO_2 makes these compounds dissolve in water causing the reaction to tend to the left.

When the water temperature rises, free CO_2 escapes affecting the concentration of Ca and Mg. The amount of CO_2 decreases and Ca and Mg ions become unsolvable carbonates (scale) in the water system.

In order to eliminate scaling the Ca and Mg Ions must be removed from the water. This is achieved by creating sedimentation that settles directly on the cathode of the SR electrolysis unit.

SRS-Three Water Treatment Applications

PHORIA has developed three applications for this innovative water treatment system. The applications are:

*SR-CT: for Cooling Towers—either removes scale from the make-up water or keeps the basin and downstream equipment clean

*SR-CC: for Closed Cycles—eliminates fouling in closed cycle systems

*SR-CL: for Water Purification—cleans, treats and purifies water

SRS-On going Benefits

Prevents scale build-up

- * Creates water equilibrium that prevents corrosive processes
- * Oxidizes and removes corrosive elements
- * Eliminates the need for corrosion inhibitors by working at a high alkaline pH level
- * Removes suspended solids automatically and continually
- * Purifies water preventing biological growths
- * Destroys microbiological life and prevents development of biofilms
- * Provides automatic hassle-free operation
- * Offers real savings in on-going maintenance

SRS-Scaleable for Added-Value

PHORIA's SRS delivers a solution for a water supply of up to 5 cube per hour. When the water supply is greater, the SRS's scalability enables connecting several systems to work together. This also provides added-value, keeping the system up and running even in the event of system failure in one of the SRS components.



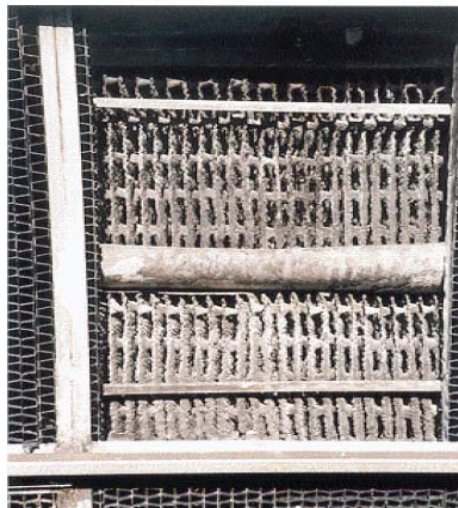
PHORIA customers worldwide that have installed PHORIA SRS's systems enjoy the benefits of clean water and cooling systems without using harmful, environment unfriendly, expensive chemicals. PHORIA systems can be found in South Korea, Turkey, Italy, China, Denmark, Japan and Israel.

SR-CT-The Solution for Cooling Towers

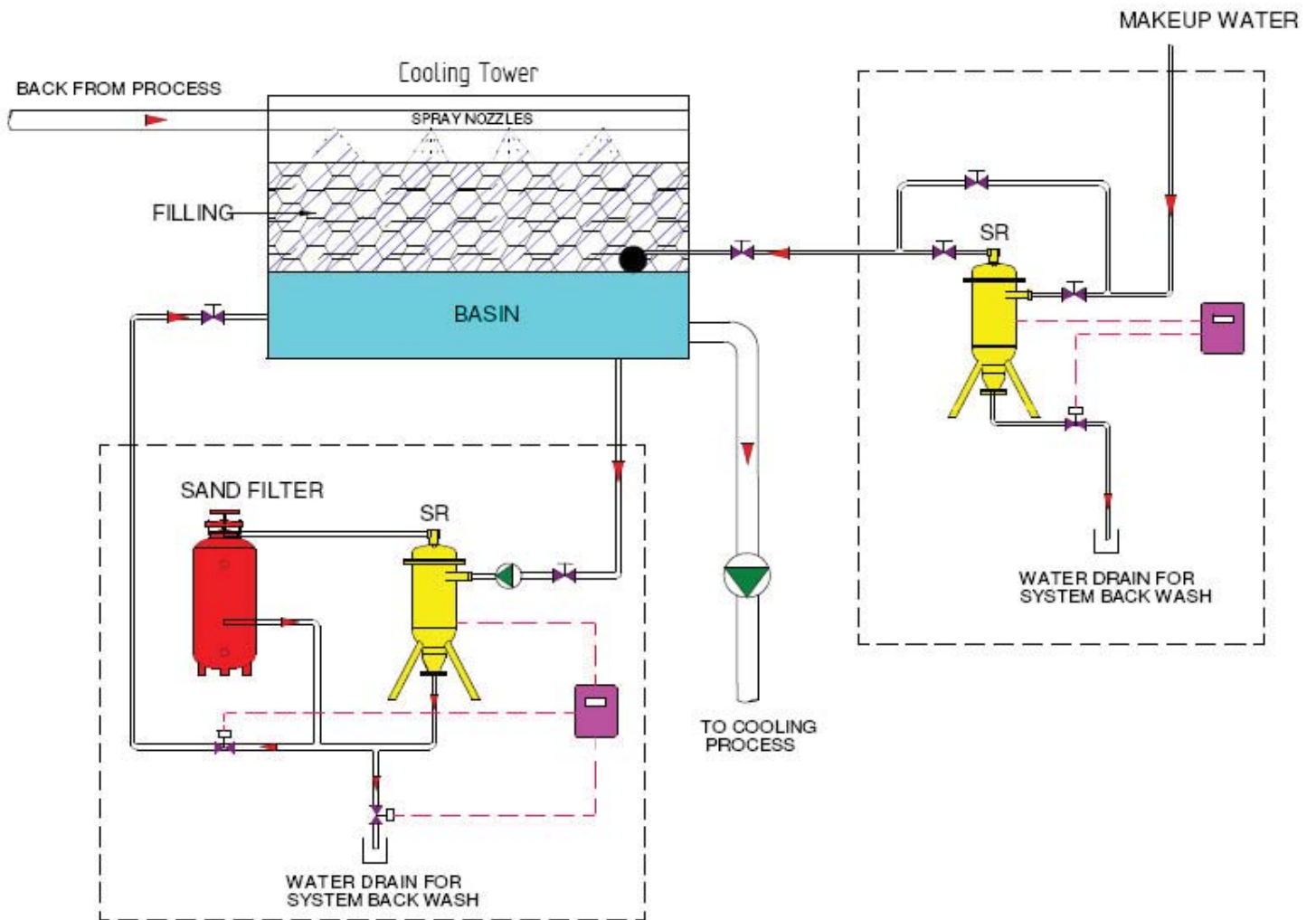
The PHORIA SRS SR application for Cooling Towers cleans the scale in the water before it reaches the tower by treating the make-up water. If this isn't done, the mesh become clogged with scale, and substantially reduces the cooling performance of the tower. The SR keeps the make-up water free of harmful scale build-up and eliminates the need for frequent filling replacement, which is necessary when the scale build-up clogs the filling.

Cooling Tower basins and downstream equipment can also be affected by harmful scale build-up as well as sludge and other bacteria and algae. This results in a decrease in the tower output, increased costs, damage to the Cooling Tower and its Condenser Systems and worse—increased energy consumption! In addition, the man hours and chemical additives to maintain the tower are costly and time-consuming.

PHORIA's SR-CT harnesses leading-edge technology to provide a unique, cost effective and environmentally friendly solution for cleaning, disinfecting and preventing scale build-up in cooling tower water systems. Unlike other costly systems that use chemical processes, SR-CT keeps costs down with low initial investment and maintenance fees, and a streamlined chemical-free process.



The SR-CT uses the electrolytic scale removing process to provide ongoing maintenance that keeps the Cooling Tower clean by keeping the water free of harmful fouling.



SR-CC The Superior System for Closed Cycles

PHORIA's SR-CC scale removal system employ technologies for a cost effective, environmentally friendly solution that eliminates fouling (scale and other sediments) in closed cycle systems. SR-CC differs from other costly systems that use chemicals, by keeping costs down with low initial investment and maintenance fees, and streamlined chemical-free process.

Closed Cycle Challenges

Water in cold water circulation systems comes into continuous contact with iron and various other metals. This results in oxidation which causes corrosion. Since the water is not replaced over long periods, the concentration of dissolved iron in the water builds up beyond saturation point and begins to sink as harmful sludge that clogs pipes and hampers the heat exchange process.



In addition, the corrosion sediments create a bed for bacteria that feed off of the corrosion. These bacteria, found under the sediments, feed off the iron dissolved by the acids that the bacteria produces. The most common solution, adding chemicals, doesn't adequately solve the problem and causes damage to pipes, accessories and auxiliary equipment.

The SR-CC Leading-Edge Solution

PHORIA's S-CCuses integrated multi-task electrolytic technology to 'R combat four common problems inherent in water systems:

- * Scale Build-up
- * Corrosion
- * Bio-growth
- * Suspended Solids

This results in loss of output in the closed cycle water system that occurs in four areas, as follows:

- * Cooler/Evaporator
- * Fan-Coil and Filters
- * The Main Pipeline System and Its Control Equipment
- * Closed Condensing Systems

This robust system simultaneously cleans, disinfects and removes scale and prevents it, combating the harmful effects that cause loss of output. Other purification technologies require a number of separate activities and costly chemicals, which lower water quality and raise costs. PHORIA's multi-purpose solution performs one sophisticated integrated process that is clean, inexpensive and environmentally friendly.

In this process two types of disinfections occur on the surface of the anode in the electrolytic chamber:

- * An anode oxidation reaction
- * An acidic catalytic reaction

The anode oxidation reaction is a series of reactions that produce gases and free radicals with high oxidation properties, which disinfect the water.

Installing this technology means low initial investment, low maintenance and low-cost spare parts. It enables ongoing flow of clean quality water, using relatively little water resource and all in an environmentally friendly manner.



SR-CC Benefits

- * Creates water equilibrium that prevents corrosive processes
- * Purifies water preventing biological growths that cause corrosion
- * Prevents scale build-up
- * Destroys microbiological life and prevents development of biofilms
- * Eliminates the need for corrosion inhibitors by working at a high alkaline pH level
- * Removes suspended solids automatically and continually
- * Provides automatic hassle-free operation
- * Offers real savings in on-going maintenance



PHORIA SR-CL Water Purification No Chemical Additives

Today there is a global effort to keep the environment free of pollution. Therefore, maintaining and providing clean, purified and disinfected water is a top priority. There are several methods available for this process. There are costly processes which add chemicals to the water, and require transporting and handling the chemicals on a regular basis. This is both expensive and dangerous.

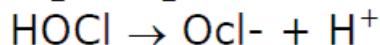
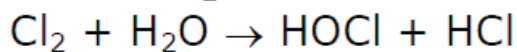
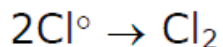
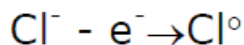
The cost effective natural method currently available is both resourceful and safe. It uses electrolysis to bring out the natural elements inherent in water and produce Active Chlorine. This enables water purification without the need for harmful chemical additives. PHORIA developed this solution to make water purification a natural and relatively simple process.

How Does It Work?

In the electrolytic process, direct electric current (DC) is transferred through the electrolytic medium (water) and the electric voltage of a DC power supplier works between the two electrodes, the anode and cathode.

Chemical reactions take place on the electrode surfaces: In and around the cathode environment, reduction and sedimentary processes occur on a basic pH-level. In and around the anode environment oxidation processes occur on an acidic pH-level. The Active Chlorine is produced in close proximity to the anode in its acidic hypo chlorite form, or alternately, ion hypo chlorite, dependent on the level of the water reaction.

The following are the reactions that produce Active Chloride:



The size of the electrical current in the electrolytic chamber is dependent on several parameters. The main parameters are:

- Electric potential between anode and cathode.
- Electric conductivity of the electrolyte.
- Speed of water flow on the electrode surface.

Using this innovative process guarantees natural chemical-free water purification. The system is both low cost and low maintenance. It offers a viable alternative to the other environmentally harmful solutions available today.

PHORIA Water Purification Benefits

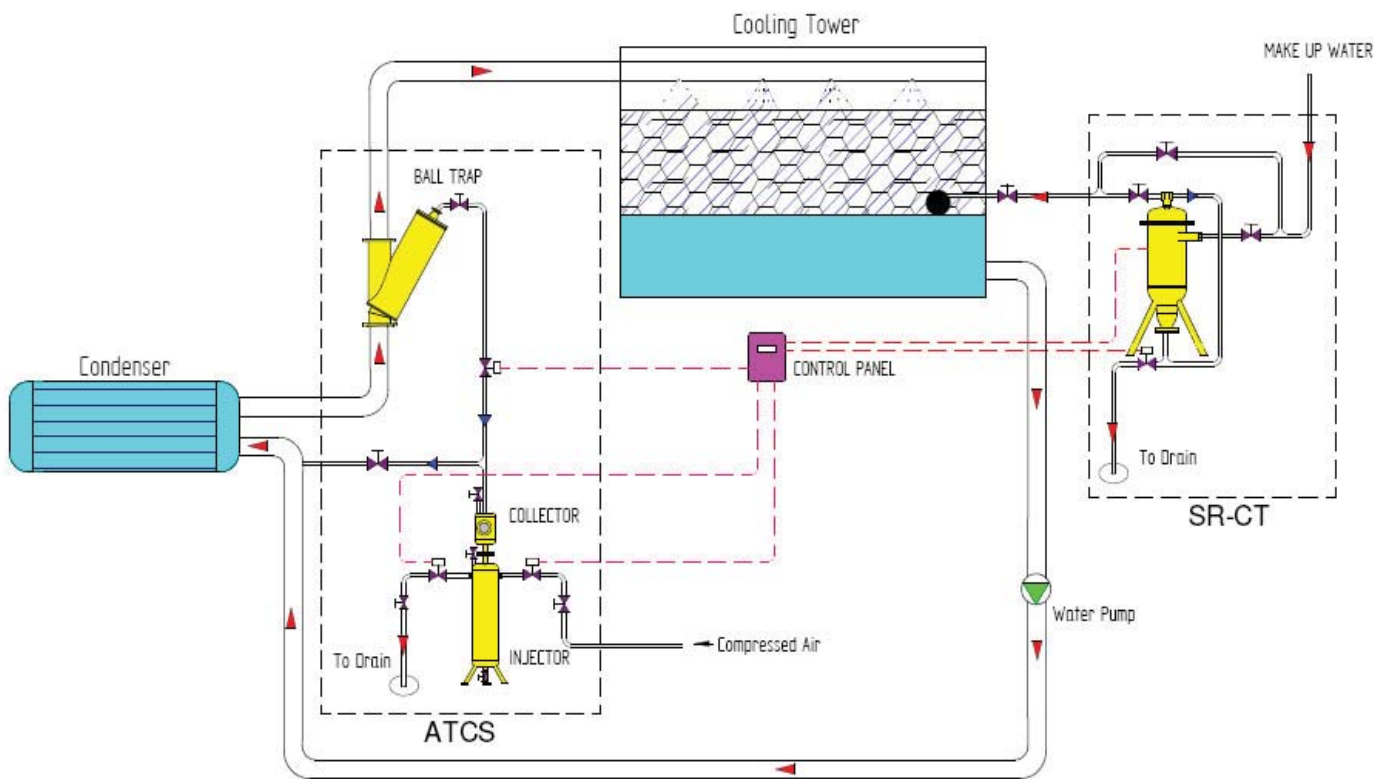
PHORIA's water purification process provides a wide-range of benefits over other methods that are available today. The PHORIA system:

- * Produces Chlorine from Chloride present in water.
- * Produces additional disinfecting substances, such as Ozone and Peroxide.
- * Keeps Chlorine levels in water stable.
- * Decreases in costs as the concentration of Chlorides increases.
- * Has no chemical additives.
- * Produces disinfecting substances instantly.
- * Doesn't require transporting of hazardous substance
- * Has no environmental restrictions – completely natural process.
- * Is environmentally safe and friendly.

PHORIA's ATCS & SRS–The Total Solution

PHORIA's SRS effectively removes scale from cooling towers and closed cycle systems. However, if the SRS is installed on its own the Condenser still forms scale. The PHORIA development team discovered a way to keep the entire cooling system including Heat Exchangers and Condensers scale-free.

*In order to ensure that the entire cooling system remains clean and free of harmful fouling PHORIA developed the ATCS, (Automatic Tube Cleaning System) to complement the SRS for a total chemical free solution for **tube and shell heat exchangers and cooling tower.***



Unlike other solutions available today, the ATCS and SRS combine to provide a low-cost, low-maintenance, quickly installed system. The ATCS keeps Heat Exchangers clean by running sponge balls through the Heat Exchanger tubes on preset time cycles, eliminating foulant and residue deposits and build-up. It also eliminates expensive downtime by keeping processes running. This environment-friendly system is the key to energy-saving cost effective tube cleaning.