



**SORA GREEN**

TECHNOLOGIES (S) PTE LTD

# Revolutionary Non-Chemical Water Treatment System for Cooling Towers

“From Chemical to Natural”

Technology  
that provides  
reassurance  
of safety to  
humans and  
protects Mother  
Earth in a  
natural way

Successful implementation of Sora water treatment technology in Japan, has now allowed Sora Green Technologies Singapore to leverage these innovative success stories to deliver a revolutionary water treatment system to Singapore. This revolutionary technology provides reassurances of safety to humans and protects Mother Earth in a natural way and reduced costs of ownership for Property Owners and Facility Managers. Sora patented design is able to utilize each unique function of the major components to achieve synergistic effect and deliver the best performances and results to address the issues of cooling tower pollutants in a natural way

This innovative technology is explained below in terms of its applications to Cooling Towers in Singapore market. Data has been drawn from live monitoring of operational systems in Japan with independent laboratories performing parallel testing for verification.

## Current Issues in Cooling Towers



Microorganisms and Bacteria in water



Scaling



Corrosion



Tower Infill Fouling



Foaming, dirt and sludge

**Bacteria and Legionella growth.** Cooling tower systems are a warm and damp environment providing favorable conditions for Legionella and other bacteria to grow. Biofilm is formed and it coats the interior of piping, heat exchanger and cooling tower infill. Biofilm will trap particulate matter such as scale, corrosion and rust tubercule which together provide both ideal habitat and food supply source for bacteria. Biofilm will also act as an insulator and compromise heat transfer efficiency and lead to higher energy wastage.

**Managing chemical use.** To minimize bacterial growth, scaling and corrosion issues, a vast range of chemicals like biocides, inhibitors, dispersants and flocculants are added to the cooling tower water.

Chemical-based biocide has a very short span of effectiveness as their function deteriorates very rapidly after dosing. Biocides are also incapable of penetrating deep into the biofilm to carry out its biocidal effect. Bacteria or viruses will develop immunity to chemical biocide after some time and new biocide or stronger dosage is needed,.

Chemicals like scale inhibitors are acid-based and can cause corrosion when overfed into the water circuit. Phosphate or nitrate corrosion inhibitors are nutrients for microorganisms and encourage high bacterial growth rate.

# Message from

President of

Sora Total Research Laboratory

**Mr. Kazuhira Mishima**

# Harmony With Mother Nature

There is a strong need today to recognize that our environment will never be recovered once destroyed, no matter how advanced and excellent our technology may be or will become. Only through harmony with nature shall we have comfortable lives for ourselves and future generations. Sora Total Research Laboratory believes that all our technologies and associated products shall conform to this principle.

From the outcome of our study on the pollution issues of domestic environments, industrial plants and hospitals, a nonpolluting device using natural catalysts was conceived and developed, resulting in the Sora Metal-Ion Water Sterilization System. The product aims to promote both physical and biological phenomena through synergistic interaction of natural media and returns the subject water to a condition closer to the clean natural state. Sora Green Technologies in Singapore plays an important role with our products in the process of bringing about our ultimate goal of restoring the global harmony with Mother Nature.

The effectiveness of these chemicals gets reduced by fresh makeup water. Consequently, additional chemicals need to be added to make up for the shortfall and result in higher chemical replenishment costs and possible higher disposal costs. Chemical cocktails are likely to be formed from multiple chemical mixtures and may lead to other undesired consequences.

**Environment and Water Use.** Cooling Tower water circuits must blow down an amount of the system's water to reduce the mineral concentration level of the system's water to reduce the mineral concentration level of the water circuit via TDS auto-monitoring and control. Fresh makeup water is used to make up for the water loss. This process requires tens of thousands of liters of makeup water per day. Similarly, tens of thousands of liters of chemical waste laden water is discharged into the public sewer.

**SORA** revolutionary chemical-and-pollution free water treatment system provides reassurance and safety to humans and returns the subject water to a condition closer to the clean natural state and will not cause any pollution to the environment.

**Metal Ions, Ag<sup>+</sup> Cu<sup>2+</sup>**



**Sora Natural Ceramics**



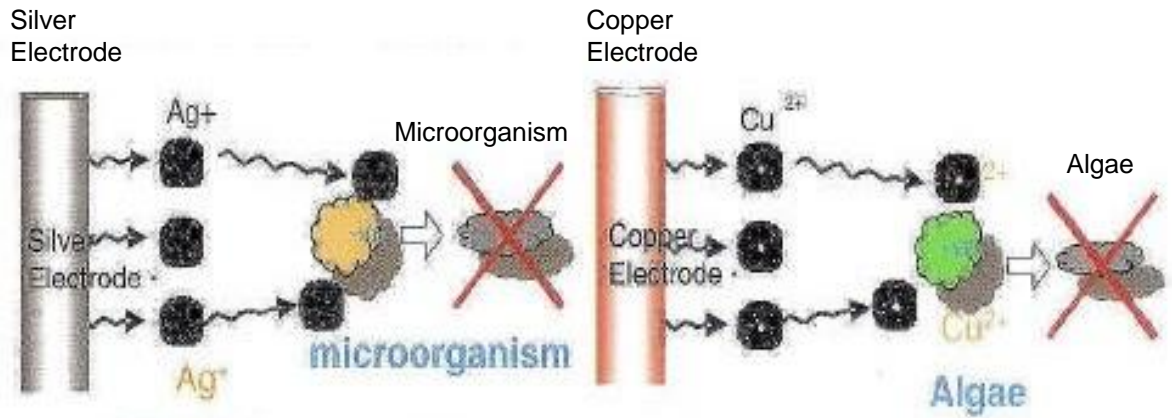
**Repulsive Ferrite Magnet**

Ag<sup>+</sup> and Cu<sup>2+</sup> ions are generated through precise release and monitoring. Ag<sup>+</sup> has excellent biocidal effect on bacteria and Cu<sup>2+</sup> has excellent algicidal effect on algae.

It is a non-volatile system and is able to maintain its biocidal and algicidal effects for a long time. It is harmless, odorless and safe to humans and animals.

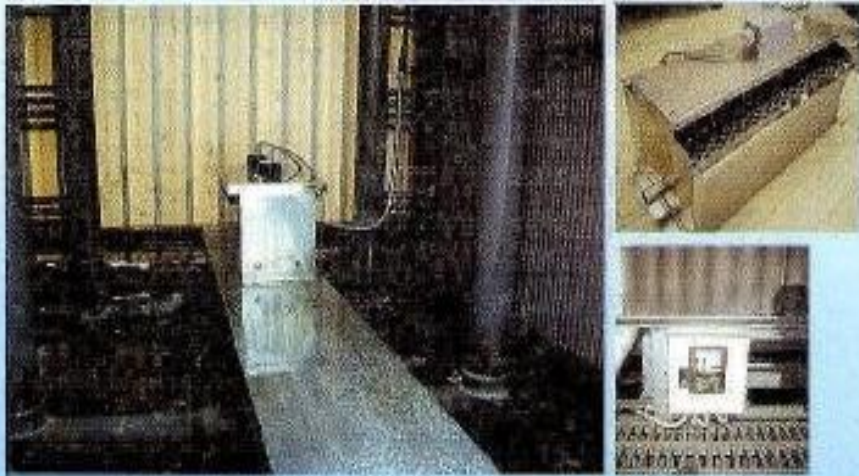
Sora revolutionary system utilizes the synergistic effects of metal ions + Sora Natural Ceramics + repulsive neodymium magnets to deliver excellent biocidal and algicidal effects and cleans the circulating system without affecting humans and the environment.

Sora pollution-free water treatment system complies with ISO 14001 and meets Singapore's BCA Green Mark in Water Efficiency and Innovation.

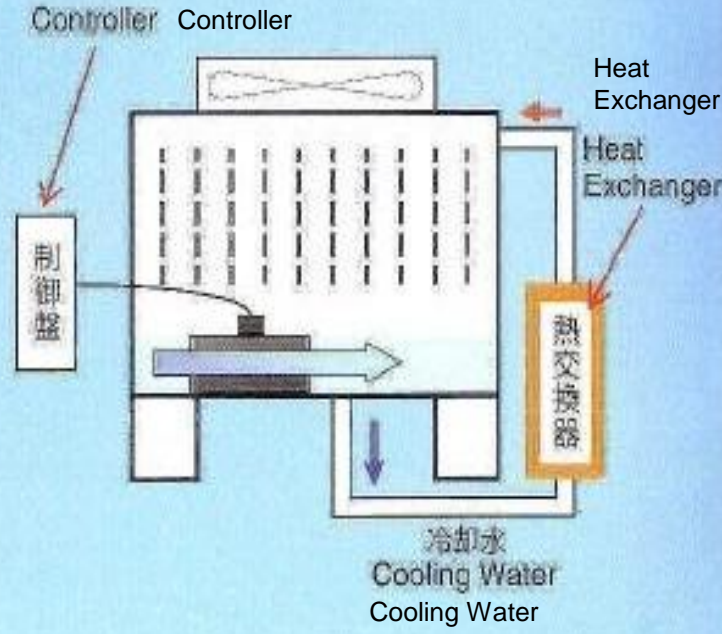
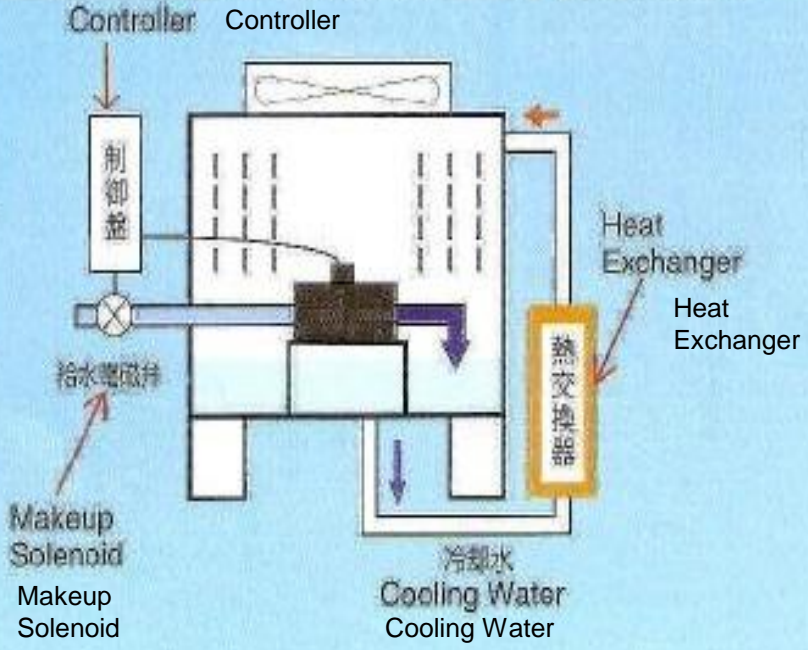


# Product Exhibits and Result Demonstrations

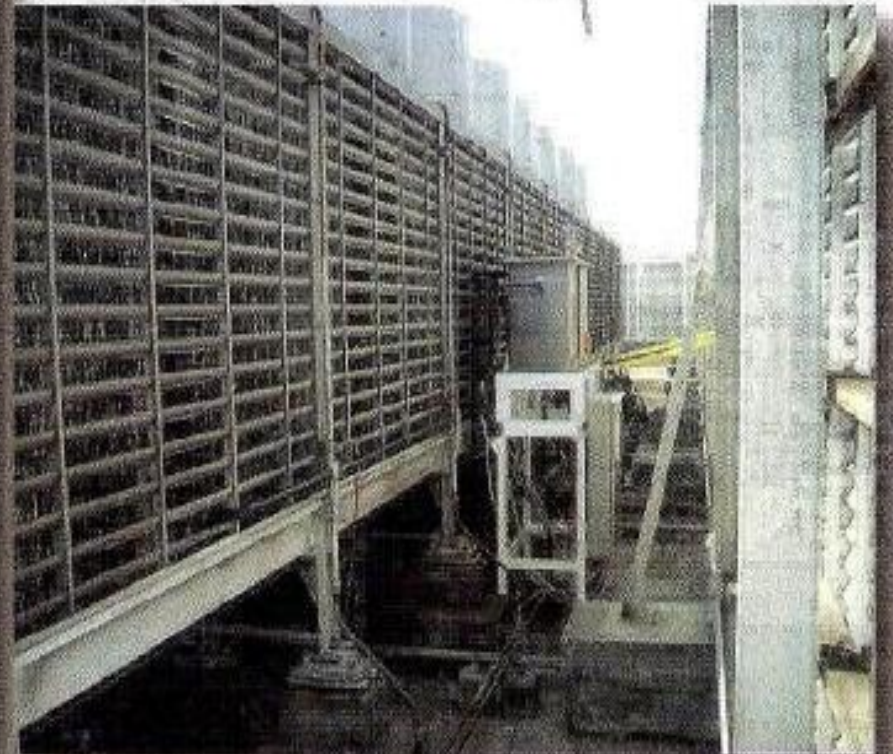
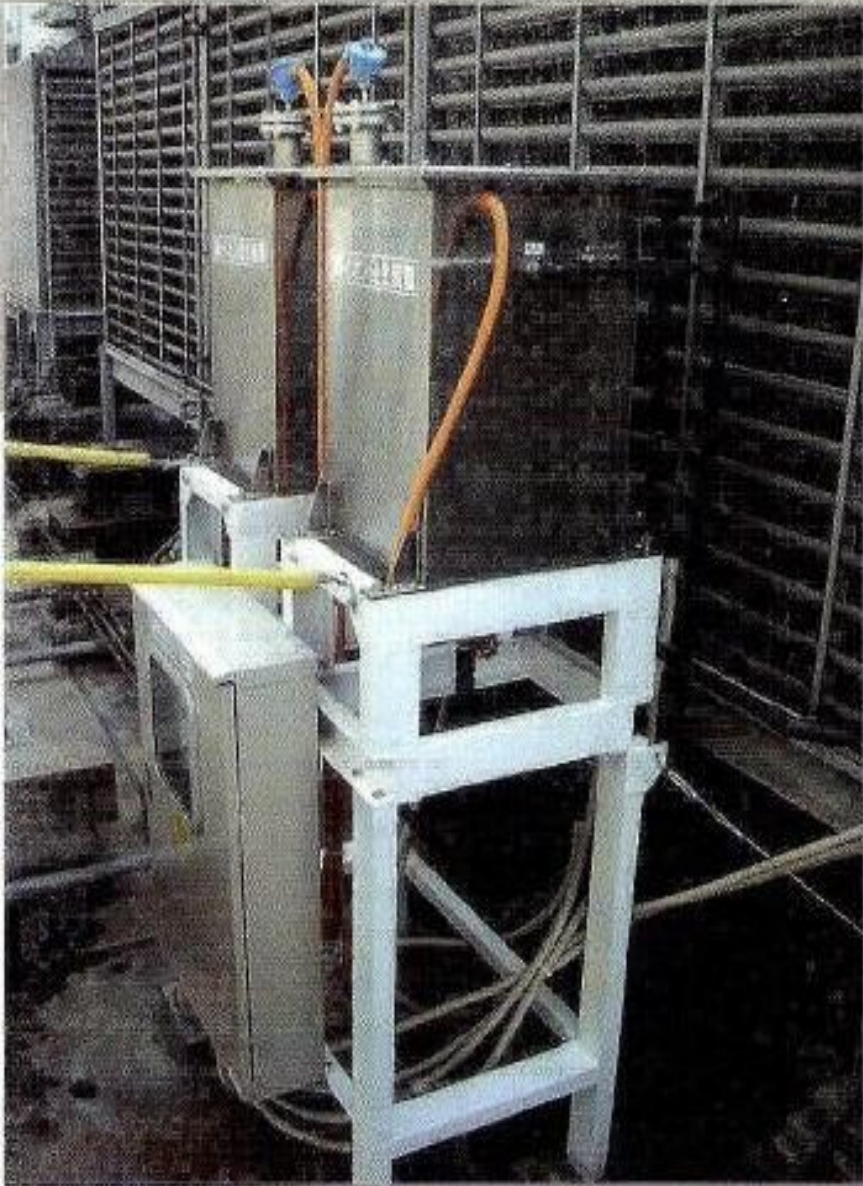
## Detached Model

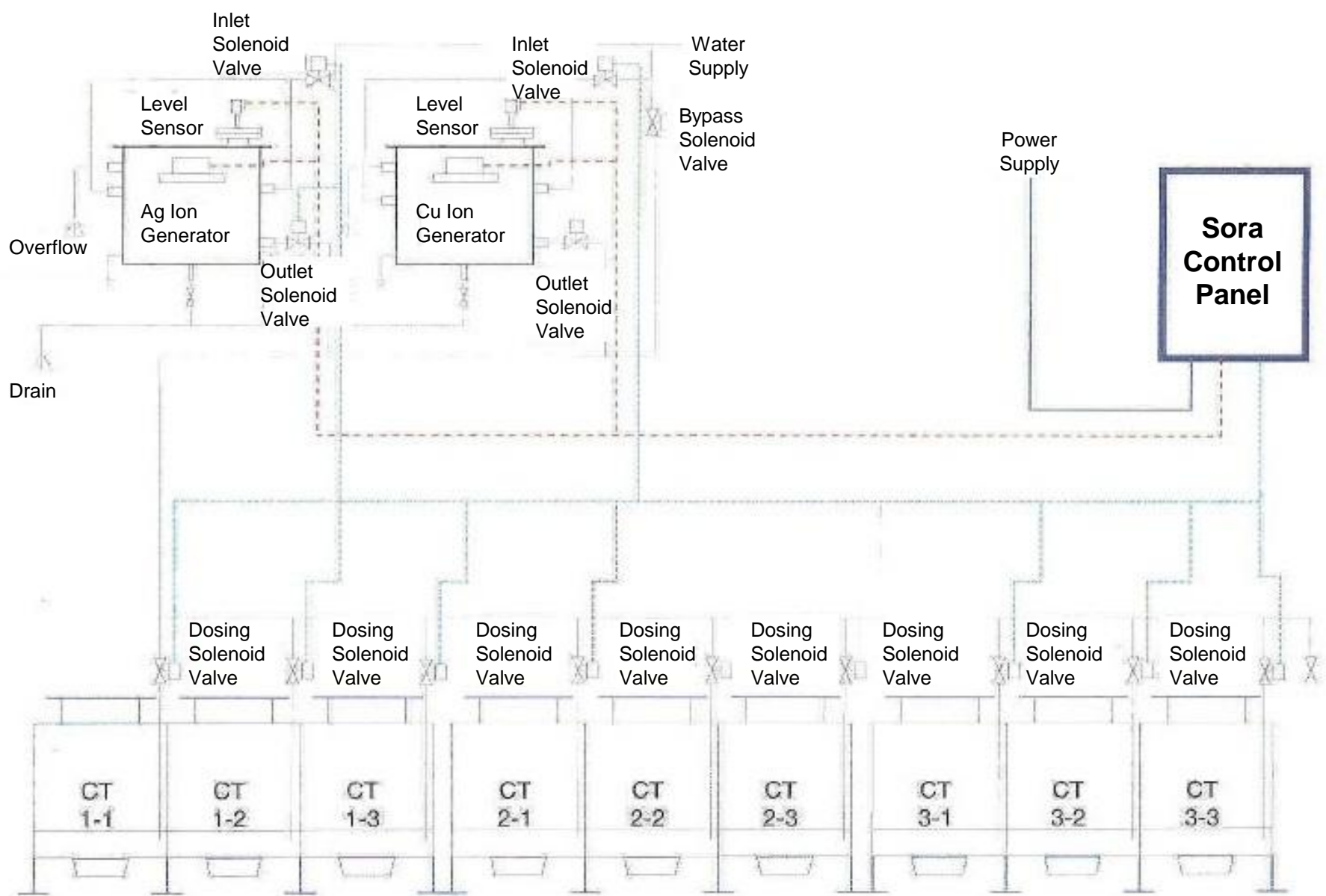


## Submerged Model



# Detached Model Serving Multiple Cooling Towers





**Typical Detached Type Sora Piping Schematic**

# Water Saving by Sora System

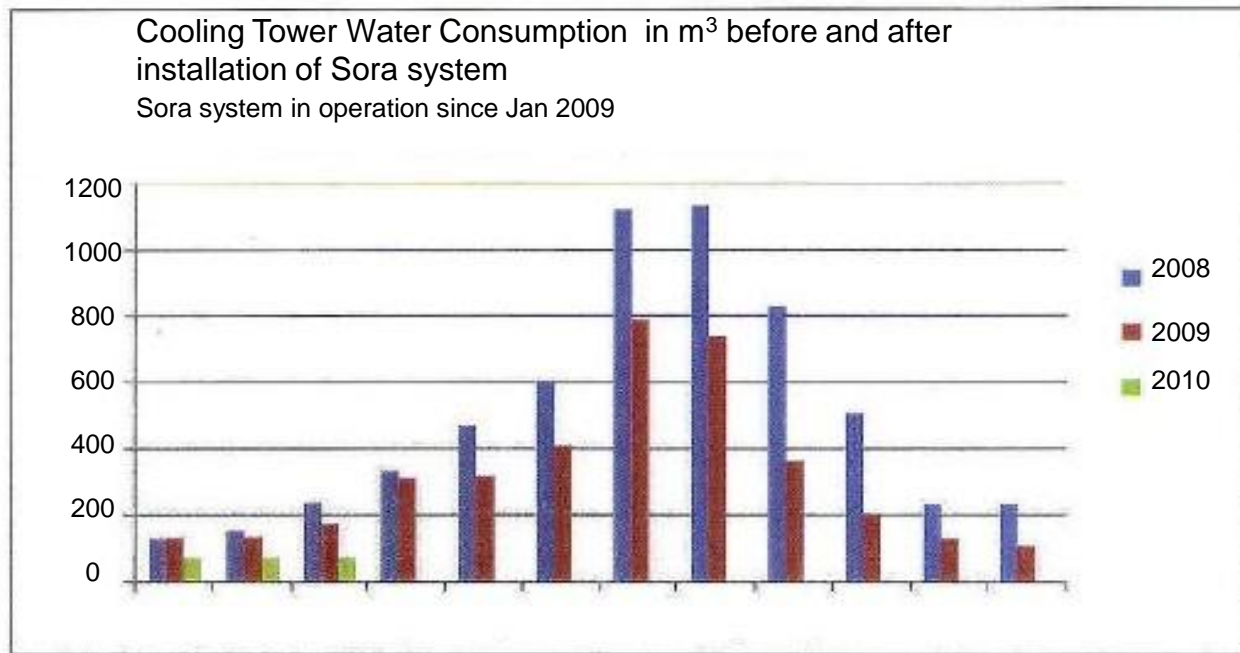
*(For reference only, because site conditions affect savings rate)*

## Site A water consumption (m<sup>3</sup>) before and after installation of Sora non-chemical system

*(For reference only, result may vary from site to site)*

## Cooling Towers (400+250 Evaporative Tonnage)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly Cumulative
2008	132.4	156.4	241.9	336.3	473.1	607.9	1122.91	153.3	830.5	505.7	235.3	237.8	6015.5
2009	132.2	133.8	173.9	311.4	319	409.3	787	736.7	367.4	205.4	127.6	108.1	3811.8
2010	74.7	76.7	77.1										



## Test Result of Bacteria Killing Effect by Sora system

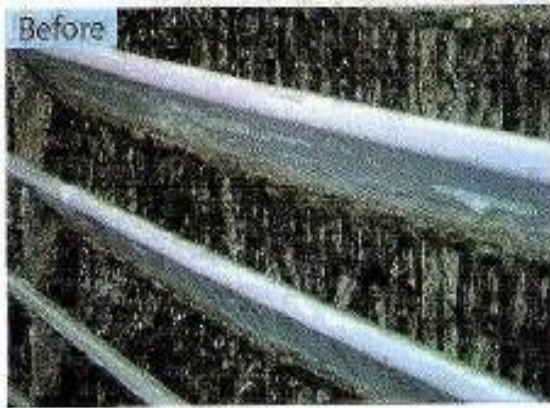
(For reference purpose only. Other factors like weather, field installation conditions may affect the test result)

Specimen	Analyte	Initial Bacterial Counts	After 3 hours	After 6 hours	After 48 hours	After 72 hours	After 12 days
Legionella	SORA Water Sample	1100000	<100	<100	<100	<100	<100
	Control Test Sample	1100000		400000	280000	180000	
Salmonella	SORA Water Sample	50000	<10	<10	<10	<10	<10
	Control Test Sample	50000	350000	180000	60000	25000	
Pseudomonas Aeruginosa	SORA Water Sample	60000	<10	<10	<10	<10	<10
	Control Test Sample	60000	550000	350000	60000	4500	
Bacillus Coli	SORA Water Sample	45000	<10	<10	<10	<10	<10
	Control Test Sample	45000	500000	550000	49000		
Stphylococcus Aureus	SORA Water Sample	30000	<10	<10	<10	<10	<10
	Control Test Sample	30000	240000	160000	48000		

Test carried out by Japan Food Research Laboratory

<10, <100 means that it is below the detection limit

## Sora Natural Ceramic / Catalyst



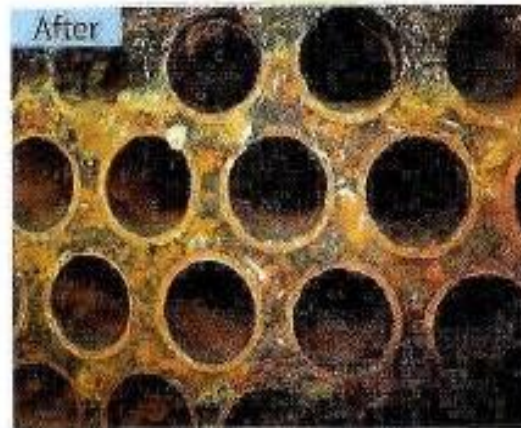
Cooling tower infill fouling & algal growth



Algae completely removed from tower infill after 1 month installation of Sora Treatment System



Slime and fouling at heat exchanger



No evidence of slime after installation of Sora System

1. Sora catalyst raises water solubility and improves water permeability. As a result, existing scale will break off gradually and separate from the pipe wall and heat exchanger – **Sora Scaling prevention and Descaling**

(Scale is very porous and therefore allows the activated water to move freely in an expanded area. Scale separation with Sora system occurs in a large surface area and the effect is neither concentrated at any one spot, nor does it penetrate deep enough to reach the metal surface)

2. Sora catalyst absorption characteristics will spread extensively to all corners of the cooling water circuit. This combination of Sora natural ceramic particles with Silver and Copper ions exhibit maximum **bactericidal and algicidal effect**.

(Sora catalyst is of porous structure and its surface has numerous nano pores. These pores are negatively-charged and will attract positively-charged Cations like Silver and Copper. Furthermore, the excellent absorptive power of Sora catalyst also absorbs and captures unwanted metal ions and trihalomethanes in water)

3. Sora catalyst provides deoxidizing effect and deters corrosion – **Sora Scaling prevention and Descaling**

## With Sora treatment

## Without Sora treatment



## Repulsive Neodymium Magnet

1. The repulsive magnetic force of repulsive neodymium magnet acts on dissolved metal ions and induce higher dispersibility to the metal ions. As a result, water molecules gather around the metal ions and form smaller water clusters which have high solubility and permeability. This will enhance cleaning effect.
2. The strong magnetic force will act to prevent crystallization on the surface of the electrode rods overwhelmingly.
3. The strong magnetic force will create high dispersibility of silver and copper ions such that they can be readily absorbed into Sora catalyst nano pores. Thus synergy between magnet and Sora catalyst enhances the **slime / scale prevention and removal actions**

For Enquiries, please contact:

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