



**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  
protect Mother  
Earth in a  
natural way**

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

## Message from President of Sora Total Research Laboratory

### Mr Kazuhira Mishima



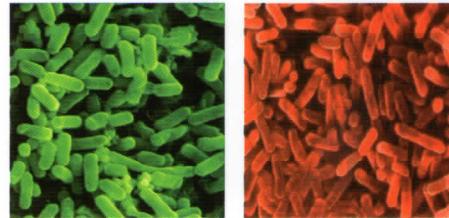
## Harmony With Mother Nature

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 a comfortable life for ourselves and for the future generation. Sora Total Research Laboratory believes that all our technology and associated products shall conform to this principle.

From the outcome of our study on the pollution issues of domestic environment, 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.

This innovative technology is explained below in terms of its application 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



Microorganism 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 favourable 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 tubercle 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 bacteria 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 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 sometime and new biocide or stronger dosage is needed.

Chemical like scale inhibitors are acidic based and can cause corrosion when overfed into the water circuit. Phosphate or nitrate corrosion inhibitors are nutrient to microorganism and encourage high bacteria growth rate.

The effectiveness of these chemical get thinned down by fresh makeup water. Consequently, additional chemical need to be added to make up for the short fall and result in higher chemical replenishment cost and possible higher disposal cost. Chemical cocktail likely to form from multiple chemicals mixtures and lead to other undesired consequences.

**Environment & Water Use.** Cooling Towers water circuit must blow down an amount 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 makeup for the water loss. This process requires tens of thousands of liters of makeup water per day. Similarly, tens of thousands of chemical waste laden water is discharged to the public sewer.

**SORA** revolutionary chemical-and-pollution free water treatment system provide reassurance and safety to humans and return 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>



Ag<sup>+</sup> and Cu<sup>2+</sup> ions are generated thru 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 able to maintain its biocidal and algicidal effect for a long time. It is harmless, odorless and safe to humans and animal

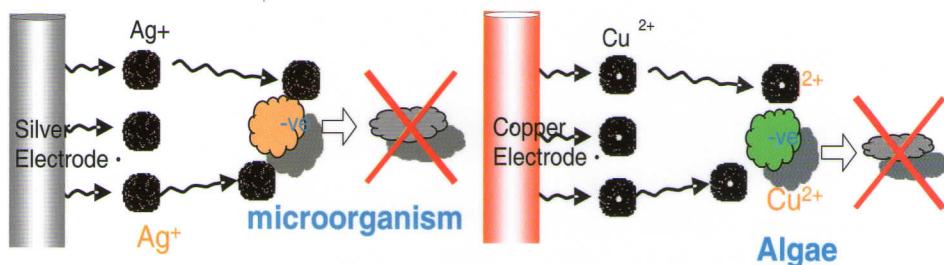
### Sora Natural Ceramics



Sora revolutionary system utilizing the synergistic effect of "metal ions + Sora Natural Ceramic + repulsive ferrite magnet" to perform excellent biocidal and algicidal effect and cleans the circulating system without affecting human and environment.

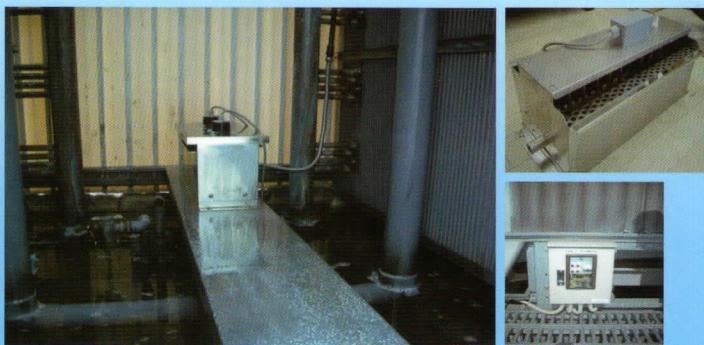
Sora pollution free water treatment system is complying to ISO14001 and meeting Singapore BCA Green Mark in Water Efficiency and Innovation.

### Repulsive Ferrite Magnet

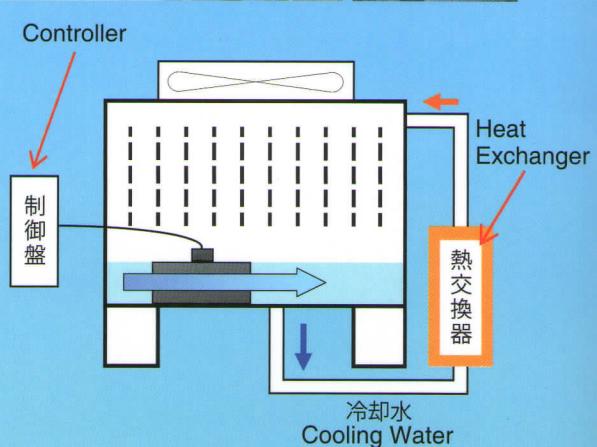
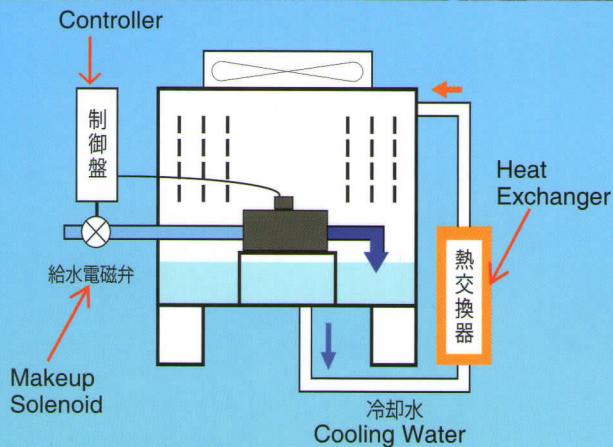


## Product Exhibits and Result Demonstrations

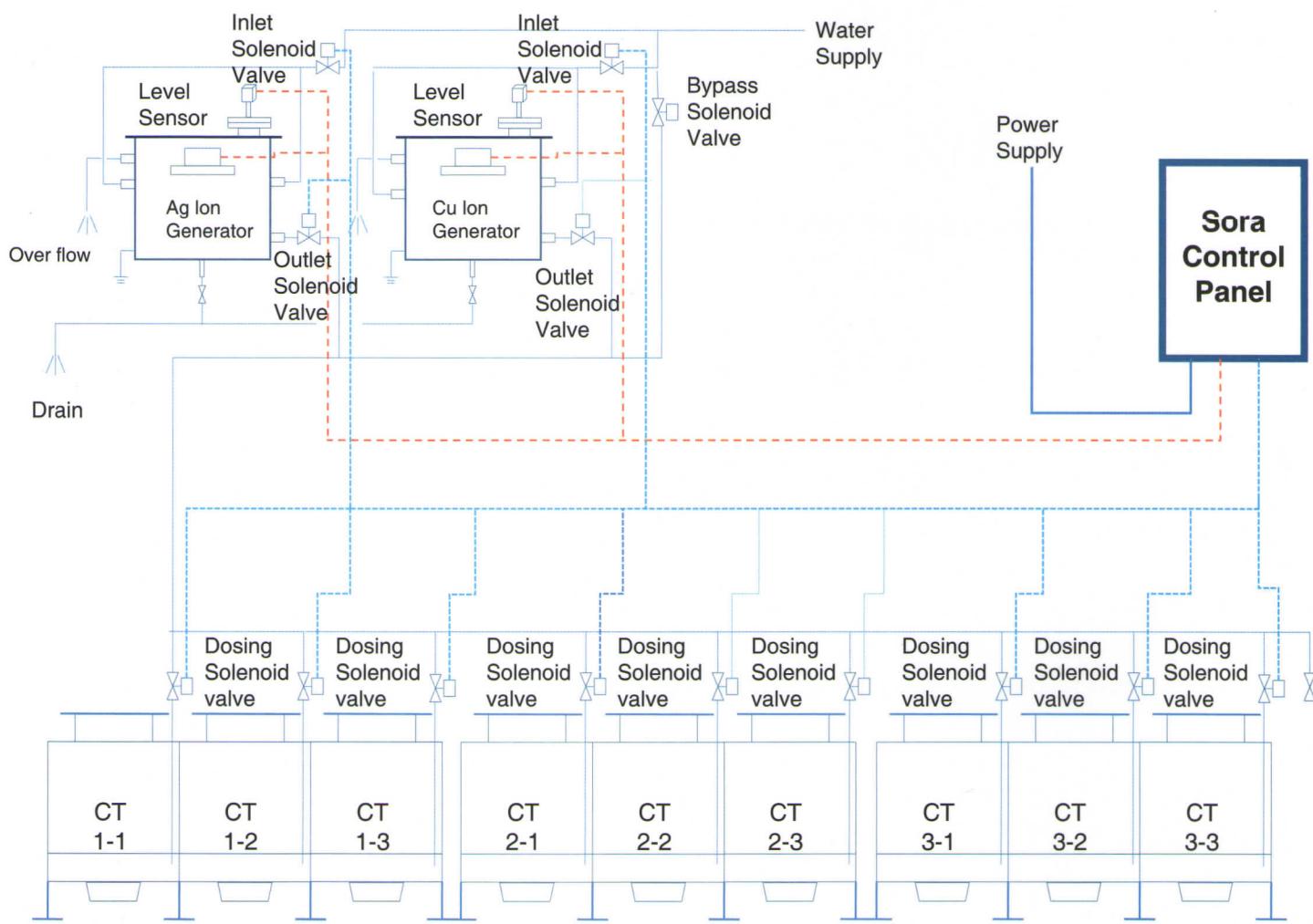
### Out of Water Model



### Submerged Model



# Detached Model Serving Multiple Cooling Towers



Typical Detached Type Sora Piping Schematic

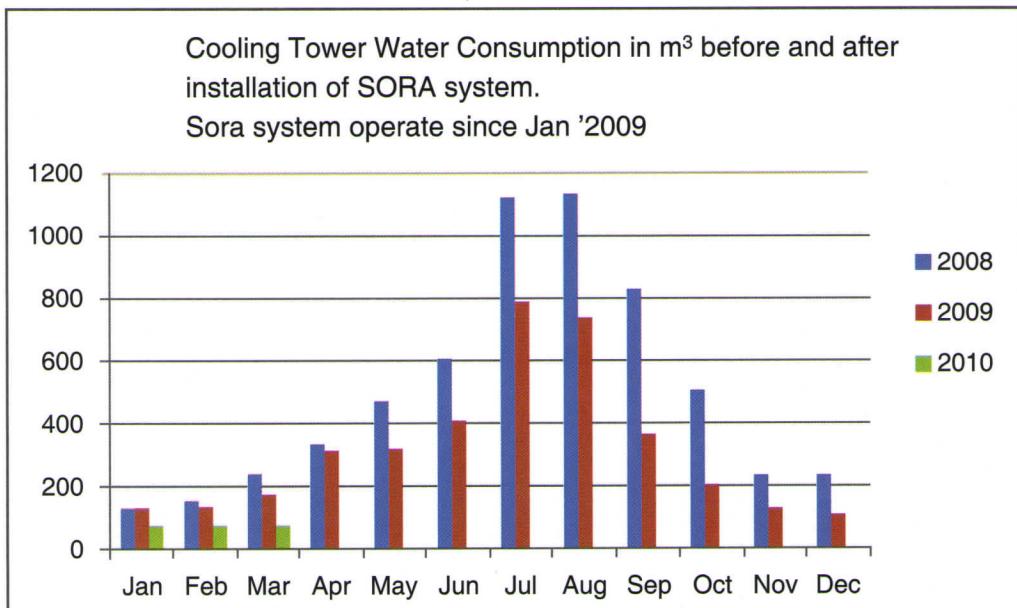
# Water Saving by Sora System

(For reference only, because site conditions affect saving rate)

**Site A water consumption (m<sup>3</sup>) before and after installation of Sora non-chemical system**  
(for reference only, result may varies from site to site)

## Cooling Towers (400+250 Evaporative Tonnage)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly Cummulative
2008	132.4	156.4	241.9	336.3	473.1	607.9	1122.91	135.3	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										



Site A makeup water consumption reduced by 37% on an annual comparison

## 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 Bacteria Counts	After 3 hours	After 6 hours	After 48 hours	After 72 hours	After 12 days
Legionella	SORA Water Sample	1,100,000	<100	<100	<100	<100	<100
	Control Test Sample	1,100,000		400,000	280,000	180,000	
Salmonella	SORA Water Sample	50,000	<10	<10	<10	<10	<10
	Control Test Sample	50,000	350,000	180,000	60,000	25,000	
Pseudomonas Aeruginosa	SORA Water Sample	60,000	<10	<10	<10	<10	<10
	Control Test Sample	60,000	550,000	350,000	60,000	4,500	
Bacillus Coli	SORA Water Sample	45,000	<10	<10	<10	<10	<10
	Control Test Sample	45,000	500,000	550,000	49,000		
Stphylococcus Aureus	SORA Water Sample	30,000	<10	<10	<10	<10	<10
	Control Test Sample	30,000	240,000	160,000	48,000		

Test carried out by Japan Food Research Laboratory

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

## Sora Natural Ceramic / Catalyst



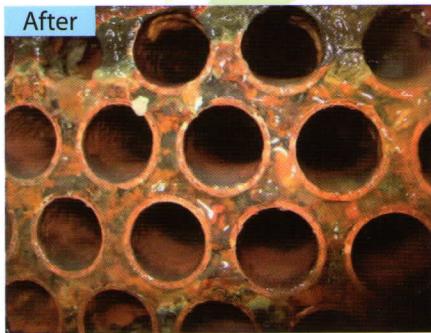
Cooling tower infill fouling & algae growth



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

## Comparison of Turbidity of CT water



For Enquiries, please contact:

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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 De-scaling**

(Scale is very porous and therefore allowing 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 spot or does it penetrate deep enough to reach the metal surface)

2. Sora catalyst absorption characteristic will spread extensively to all corner of the cooling water circuit. This combination of Sora natural ceramic particles with Silver and Copper Ion 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 it attracts and absorbs positively charged Cations like Silver and Copper. Furthermore, the excellent absorptive power of Sora Catalyst also absorbs and captures unwanted metal ions and trihalomethane in water)

3. Sora catalyst provide de-oxidizing effect and deter corrosion. - **Corrosion deterrent**

## Repulsive Ferrite Magnet

1. The repelling magnetic force of repulsive ferrite magnet acts on dissolved metal ions and induced higher dispersibility to the metal ions. As a result, water molecules gathers around the metal ions and form smaller water cluster which has high solubility and permeability. This will enhance cleansing effect.

2. The strong magnetic force will act to prevent crystallization of 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 particles surface nano pores. Thus synergy between magnet and Sora catalyst enhances the **slimes / scale prevention and removal actions**