EST
RECOVERING THE IRRECOVERABLE

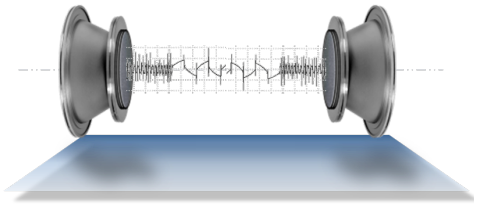
Ecoscience Technologies Sdn Bhd (810058-V)

www.ecosciencetechnologies.com

Non-Chemical
Ultra Low Frequency (ULF) Water Treatment for Boilers & Cooling towers

Subsidiary of Ecoscience Manufacturing & Engineering Sdn. Bhd. EME

OUR TECHNOLOGY
ULTRA LOW FREQUENCY (ULF) WAVE TREATMENT



Our system is built on a revolutionary concept of water treatment using Ultra Low Frequency (ULF) electromagnetic wave technology. The time varying ULF electromagnetic wave (10^2 -10^4 Hz) generated by the emitters energize the vibrational and rotational energy of water and other constituents. This promotes many desirable treatment effects which are not achievable by conventional chemical treatment methods.

The ULF wave treatment excites water and elevates its internal energy. Resonated with the appropriate applied frequencies, scaling and corrosion control is achieved through the formation of non-adhering, powdery calcium carbonate scales in bulk water and protective magnetite layer on steel surfaces. The unique ionic current pulsates in water providing effective biological disinfection properties in controlling bacteria and algae simultaneously.

Our system operates without chemical, consumables and contains no moving parts which allows for minimal maintenance requirements. It also consumes relatively low power and has been made to require minimal to no human attendance or monitoring. This translates to low operating and maintenance cost.

OUR SERVICES

ULF electromagnetic wave is generated by an advanced electronic microprocessor controlled system. Our system has provided effective water treatment and protection to thousands of cooling water systems, chilled water systems and other process cooling water systems worldwide. In the aspect of non-chemical water treatment, we offer the following solutions to our clients by:

- Promoting sustainable physical water treatment solutions
- Identifying operational cost saving opportunities
- Offering complete technical project assessment
- Installation and commissioning
- Technical assistance during the period of implementation
- Post-warranty services

BENEFITS OF NON-CHEMICAL WATER TREATMENT FOR BOILER & COOLING TOWERS

Water Savings

Higher cycle of concentration (COC) is achieved
Less bleeding or blowdown of water required
Water discharge is fully reusable & recyclable
Rain water harvesting

Energy Savings

Promote heat impeding energy savings
Improved heat transfer efficiency of chillers & boilers
Maintaining mass water flowrate by controlling algae and biofilm
Lower chiller condenser approach temperature

Chemical Savings

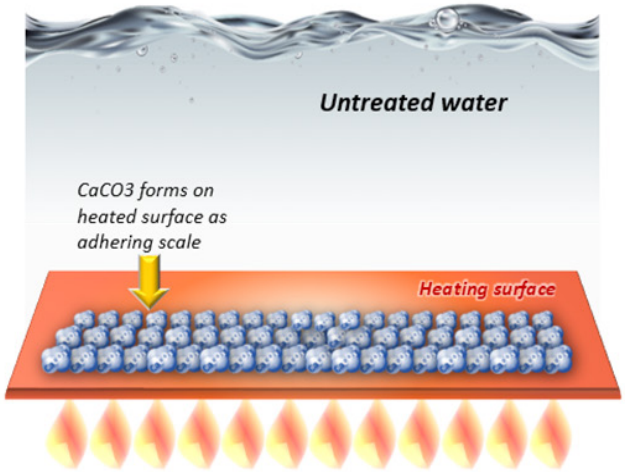
Eliminate monthly chemical cost commitments
No secondary pollution is produced
Water can be discharged to surface drain
Monitoring of chemical dosing no longer required
One solution for solving all problems related to water treatment

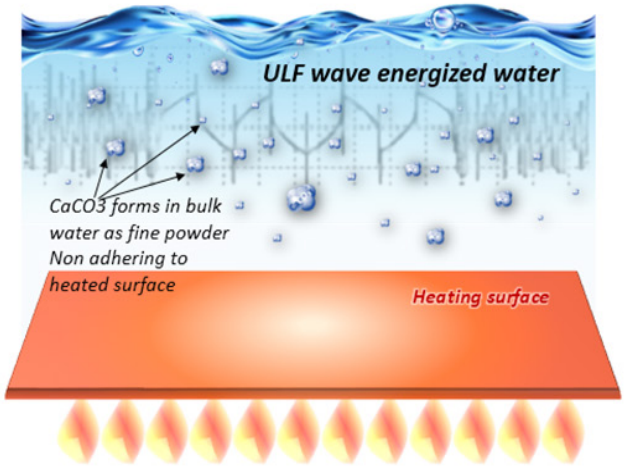
Corporate Social Responsibility

Improved workplace safety environment
Minimal to no human interference or monitoring required
User friendly operations as technical expertise not required

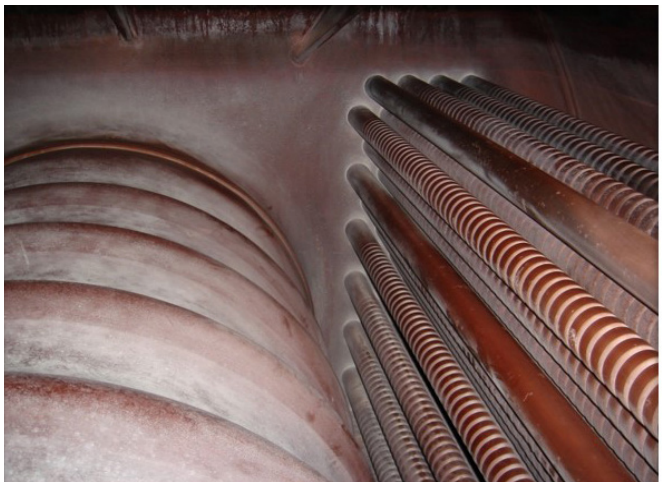
SCALING CONTROL

Calcium hardness solubility in water reduces when the temperature is increased. Without ULF excitation, the reduced solubility causes the calcium ions to precipitate and form hard adhering calcium carbonate (calcite) scale on surfaces of heat exchangers. This leads to impeding of heat transfer efficiency and results in higher energy consumption. Furthermore, adhering calcite densely solidifies on heat exchange surfaces which can only be dissolved and removed by acid chemical wash. Hence, shortening the equipment lifespan and incurring maintenance costs.





The ULF treatment prevents the formation of adhering hard scale by means of force precipitating the higher energy state, powdery calcium carbonate in bulk water known as aragonite. Fine aragonite particles suspend in bulk water instead of adhering to heat exchanger surface and is easily removed during the bleed off process. This protects the chiller condenser and heat exchanger surfaces from scaling and eliminates the need for chemical cleaning, while providing significant energy savings in return.



Formation of Powdery Aragonite

ULF treatment prevents the formation of adhering hard scale by force precipitating the high energy state, powdery calcium carbonate ($CaCO_3$) in bulk water, also known as aragonite.

CORROSION CONTROL

Corrosion control is achieved via the patented ULF excitation technology which promotes the magnetite formation beneath the coating or existing rust of submerged steel surfaces. The energy generated excites the steel in contact with the cooling water. This forms high energy state oxide, Fe_3O_4 (magnetite) instead of low energy state, Fe_2O_3 (hematite). Magnetite acts as a corrosion protection coating and inhibits steel from further corrosion.

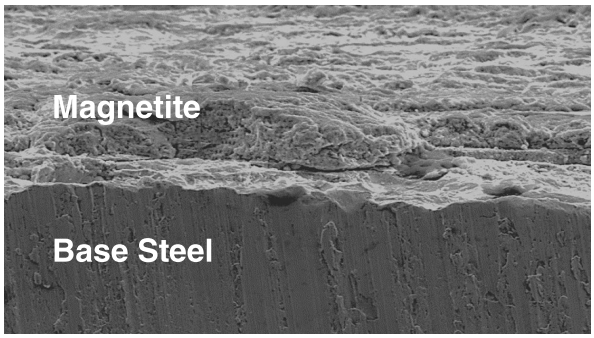
It is non-porous, adheres strongly to the steel surface and is an active self generating, self-repairing substance under the ULF treatment. Magnetite is conductive and does not corrode when interference corrosion current leaves the magnetite coated steel surfaces.

The ULF corrosion protection enhances the equipment service life and therefore reduces maintenance cost. Furthermore, the ULF treatment eliminates the use of any chemical corrosion inhibitors that typically provide nutrients to bacteria and trigger algae bloom formation in cooling towers. As chemical dosing is no longer required, this allows complete recycling of ULF treated cooling water to be possible.

> ***ULF treated cooling water system has been proven to achieve "Excellent to Good" (1-5 mpy) corrosion rate for submerged steel based on CTI, ASTM and other certified international standards.***

Formation of Magnetite layer

Serves as a protective coating layer against corrosion.



Corrosion control properties

It is non-porous, self regenerating & conductively inert.

ALGAE CONTROL

Algae bloom happens in cooling water systems when there are sufficient nutrients and direct exposure to sunlight conditions. Chloroplast in the algae cell captures sunlight and undergoes photosynthesis. Typically phosphates and nitrites (which are commonly used in chemical treatment) serve as food source for algae.

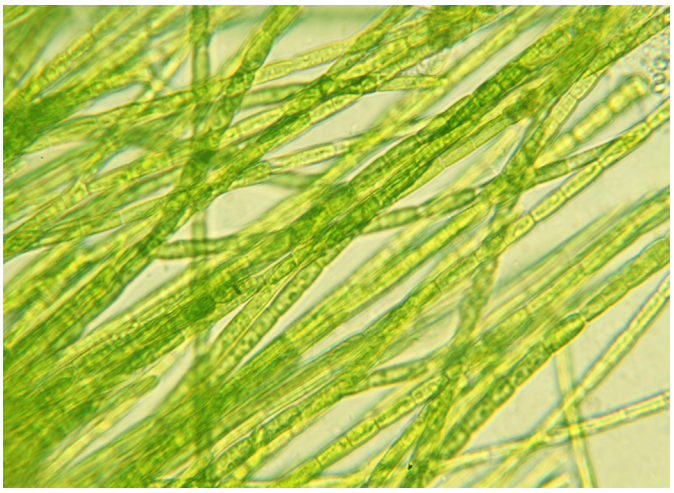
While algae do not grow in chiller condenser as it is not exposed to sunlight, excessive algae growth in cooling tower basins, infills and exposed water passages are common. This will obstruct water flow and affect cooling tower performance. Algae formation also facilitates unwanted bacterial growth and proliferation, especially the *Legionella* bacteria which are commonly found in cooling towers.

Our ULF system effectively controls algae growth without the need for chemical algaecide. The ULF treatment controls algae growth by bursting chloroplasts in algae cells and disrupting the metabolic activities of algae. ULF wave treatment also controls both the cell metabolism and multiplication process hence resulting in an effective algae control mechanism without using chemical treatment (algaecide).

Most chemical algaecides are strong oxidising agents thus inducing severe corrosion in the cooling water system. With ULF treatment, no oxidizing chemical is used hence no secondary corrosion issue is created and the bleed off water from the cooling water is safe to be recycled or discharged to surface drain without polluting the environment.

> ***ULF treatment controls algae formation by disrupting the metabolism and multiplication process by bursting the chloroplasts within algae cells.***

Algae growth in cooling towers
It will affect both mass water flowrate & heat transfer efficiency.



Chloroplast found in Algae cell
It functions to carry out photosynthesis & metabolism in algae.

BACTERIA CONTROL

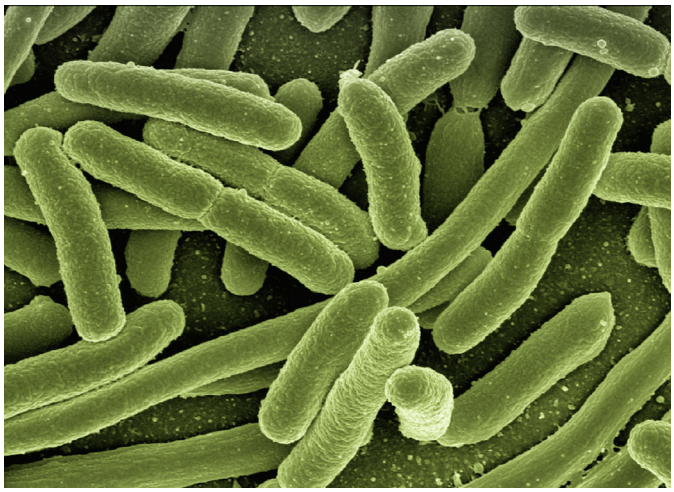
The operating temperature of cooling tower (30-45°C) is an ideal habitat for bacteria growth especially *Legionella*. This undesirable condition is further exacerbated by the formation of biofilm, algae growth and sedimentation in cooling towers. Biofilm functions as both shelter and defense mechanism against external chemical attacks. When bacteria population excalates, the biofilm thickness increases. This inadvertently leads to the presence of *Legionella pneumophila*.

Formation of biofilm will impede heat transfer efficiency 4-5 times more than calcium carbonate hard scales which causes huge increase in energy consumption and wastage hence bacteria control must not be neglected in cooling tower water treatment.

Bacteria consist of water which has hydrogen bonds. Their DNA structure are also held together by hydrogen bonds which are susceptible to ULF treatment resulting in disruption of bacterial cell division, inhibiting the multiplication process. Bacteria metabolism consists of an electron transport chain process, which is disrupted when water conditions they live in is treated with ULF.

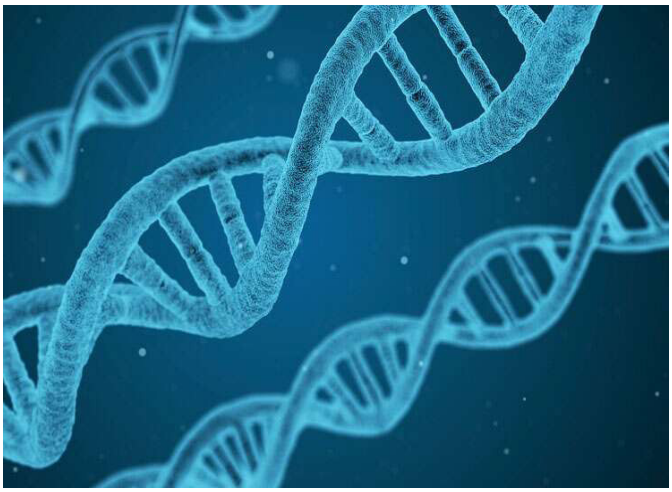
The total bacteria count including those colonized in biofilm will decline drastically after ULF treatment. The biofilm in the cooling water system will also deteriorate significantly with the decline in bacteria population providing a healthier environment and achieving potential energy savings.

> ***ULF treatment effectively controls bacterial cell division by inhibiting the multiplication process and also disrupting the metabolism process of bacteria.***



Bacterial growth & metabolism control

ULF treatment is able to inhibit cell division and multiplication.



DNA hydrogen bonds are entangled

Bacteria is unable to multiply as splitting process is impeded.

COOLING TOWER TREATMENT

ULF treatment has been implemented successfully for thousands of cooling water, chilled water and other process water systems worldwide. It is an advanced electronic microprocessor control system with no moving parts. It is reliable, robustly built and designed for both indoor or outdoor installations.

No dosing of chemicals or consumable materials is required, coupled with very low power consumption and minimal human intervention, the operating and maintenance costs for the system are kept to a minimum.

Smaller cooling tower basins are typically made of fibre glass or steel materials. For non-metallic fibre glass basin, the emitter pairs are installed and immersed under water in the basin. The ULF wave signal cables of both emitters are routed back to the ULF wave generator/power unit.

For metallic basin, emitters are placed either in the basin or water channel but the return signal cable to the wave generator/power unit is connected to the metallic basin.

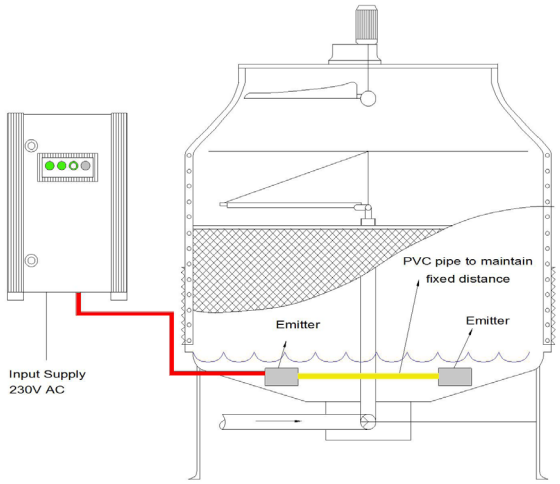
Power unit is installed externally from the cooling tower, preferably in shaded locations such as beneath the cooling tower itself.

The ULF wave signal cables between emitters and the ULF wave generator shall be separated from any power cable to avoid interference between power cable and the ULF wave signal cable.

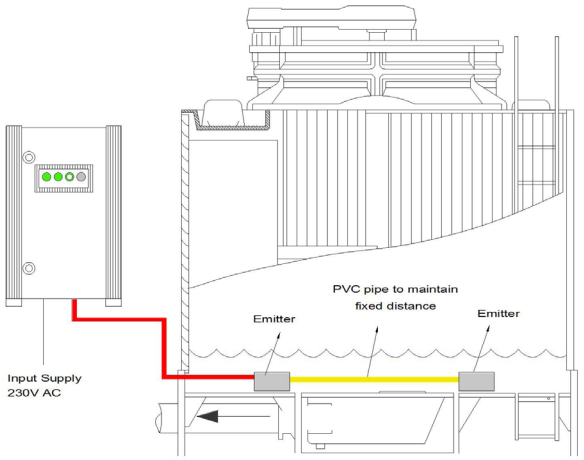
The ULF wave generator/power unit only requires single phase power supply of 110/230V, 50/60Hz.

CW / CX Series Installation Layout

Emitter pairs are installed and immersed in water, either in non-metallic fibre glass or metallic basins.



Bell Shape Cooling Tower



Box Type Cooling Tower

BOILER WATER TREATMENT

The simplicity and relatively portable design footprint of the BW / BM series allows for ease of installation for both retrofit and brand new installations.

It can be installed on all sizes of boilers ranging from large water tube boilers with operating capacities of more than 100 ton/hour to smaller fire tube boilers of less than 1 ton/hour.

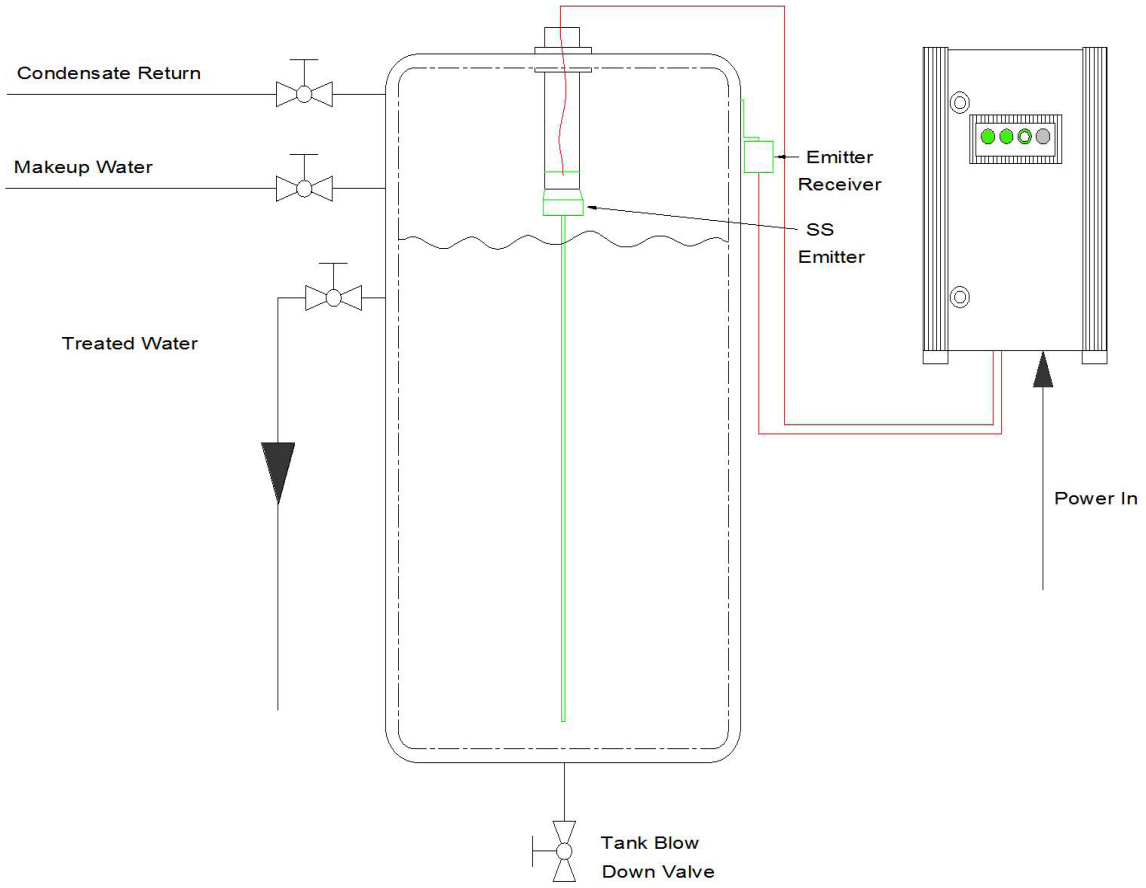
EME-BW series is also applicable for both closed and open loop steam systems.

In most smaller boiler installations, the feedwater may be ULF treated, side stream in a separate loop to the feedwater tank or inline treated in the feed water pipe entering the boiler. A separate feed water pump will be required for the side stream system.

For larger boiler installations, makeup water, hot well and some of the condensate at the return lines may also be ULF treated depending on the steam and condensate system layout.

BW / BM Series Installation Layout

Rod emitters are installed and submerged under boiler feedwater and receiver is welded onto external surface of feedwater tank.



COOLING TOWER PRODUCT SPECIFICATIONS

CW / CX Series

Cooling Capacity (HRT)	Model (Single Cell)	Model (Multiple Cells)
50-250	CW-i	CX-i
300	CW-j	CX-j
400	CW-k	CX-k
500	CW-s	CX-s
800	CW-t	CX-t
1000	CW-u	CX-u
1500	CW-v	CX-v
2000	CW-x	CX-y
3000 & Above	CW-z	CX-z

BOILER SYSTEMS

BW / BM Series

Boiler Capacity (ton/hour)	Model (Packaged boilers)	Model (Biomass boilers)
2 to 5	BW-i	BM-i
10	BW-j	BM-j
15	BW-k	BM-k
20	BW-s	BM-s
25	BW-t	BM-t
30	BW-u	BM-u
35	BW-v	BM-v
40 & Above	BW-x	BM-x

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