

Addendum

to original Supermal Karawaci Trial CT Report dated June 15, 2015
that was issued after 15 months of "electronic only" Cooling Tower (CT) water treatment

This Addendum covers extension to 32 months of continuous, daily operation of this
408 TR Kuken CT System that was selected for this trial that started on February 26, 2014.

After the CT system at the Karawaci Supermall located outside Jakarta, Indonesia, had been running without any problems for 32 months, it was decided to do another full Cooling Tower inspection and lab test of this Trial unit in order to show the impact of a further 17 months without any chemical treatment at this fully automatic, electronic system.

Our objective was to report any significant findings (good or bad) subsequent to the issuance of the original field trial report in June 2015 and extending the field trial from the initial 15 months to 32 months.

On October 27, 2016 the water of the Cooling Tower was tested, the Ionization anodes were checked, the 2 controllers and the condition of the impulse bands of the Vulcan S 500 Anti scale system were inspected. As well, the condenser Heat Exchanger's copper tubes were examined and photographed. It was found that the tubes were 'clean as new' with no scale and no film of dust, slime or fungus found.

In November 2016 (25th month) we high pressure sprayed (small pump powered spray gun) directly into the outer edges of the Cooling Tower's vertical evaporation panels that had accumulated some algae due to exposure to direct sunlight.

We are now installing a domestic Swimming Pool filter (900mm diameter, backwash cleaning type) and pump to occasionally filter out any dust and non - soluble solids from the CT sumps, initially not operating the main pumps, then for one hour after with the main pumps operating (approximately six (6) system turnover) - particularly after each high pressure spray gun exercise described above.

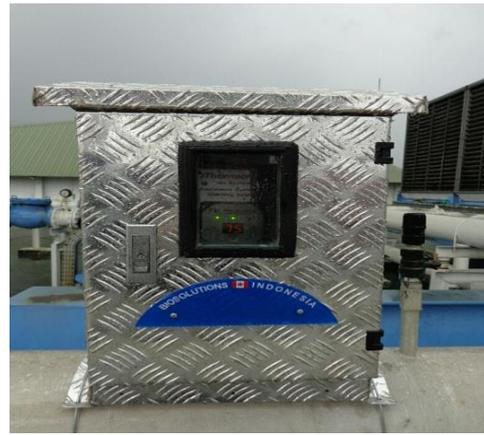
4. A. Roof Top inspection:



Photo: Vulcan impulse bands wrapped on either side of Vulcan Controller (located inside Aluminum box), with similar box housing the Controller of the Silver Copper Ionization system visible at rear (see red circle) near Cooling Tower.



Above: (Large Circle) Ionization System in center of photo (see dark grey PVC piping mounted between two Red handled Isolating Gate Valves.
 Above: (Small Circle) Controller inside Aluminum Box mounted on CT piping and connected to Silver/Copper anodes.



Above: Ionization Controller is visible behind the Glass panel in box.

Cooling Tower: The PVC evaporation media panels and CT Sumps that had been cleaned only once during this test period had remained clean without any treatment or blow downs during the preceding 32 months of continuous daily operation. The entire Cooling Tower system at this busy Mall runs for 15 hours each day of the week, including holidays.

CT Water Test: Samples of the CT water were delivered to an International testing Laboratory on the same day. Speedy delivery of the sample bottles is vital in order to determine if the waters contain any live micro- biological organisms, including Legionella bacteria. (Refer to Test attachment at end of this Addendum).

Silver - Copper Ionization - Electronic Water Treatment (Algaecide & Bactericide) System.
 The anodes were removed and examined. Since this set was renewed at month 24 from start of the Trial, they still have 75% of mass (approximately 16 months) to go, before needing their next replacement.
 The anodes were found to have a bit of copper and calcium carbonate build up that was easily removed with water and rubbing the anodes with a brush or metal object.

B. Condenser Inspection:

As shown in the photos that are part of this Addendum, the results - after 32 months of daily operation - remained very impressive. The condenser tubes were found to be very clean - like new copper pipes. The Mall Senior Building Inspector also drew our attention to the fact that at the last inspection test, the end plate had scale on its inner surface and that during this inspection he noted that the scale had completely disappeared. (see Oct 27 2016 photo of inside of end plate below).



Photo Left: Oct. 27, 2016 photo of ' clean as new ' condenser tubes after 32 months of operation - without any chemicals or blow down or cleaning of these tubes.

Photo Above: Oct 27,2016 inside of Heat Exch. Condenser end plate had lost all scale that was there previously.
(Light spot at bottom is reflected light).

Rust Control: The proponent Graham Gething decided to arrange to open and inspect in the near future a piece of the steel piping in order to check the manufacturer's claims that with this electronic system, any rust that had formed inside the piping will not only be controlled but will disappear over time. The validity of this claim therefore remains to be ascertained after future inspections for rust within these 16 year old steel pipes.

Photos will be provided: a) the first removal with photograph of the pipe internal walls. b) extra photographs every 3 months thereafter.

C. Summary of these latest findings:

- Optimum refrigeration efficiency at ALL times due to the 'as new' copper tubes in the condenser Heat Exchangers. (Absolutely no scale formation).
- No need to stop the equipments to clean out the scale that always forms over time as in conventional chemical treatment plants.

- Total elimination of the harsh chemicals and no need for the technical know-how that it takes to control and monitor the chemicals in conventional CT water treatment systems - all of which are high cost items - needing daily attention or costly, high tech automatic dosing systems which also need maintaining.
- Total elimination of significant blow downs of chemically contaminated water associated with conventional chemical water treatment - thus saving high cost of wasted water.
- We recommend that the Vulcan anti scale controller be monitored continually by a CCTV camera which is focused on the pulsating indicator lights, showing that the electronic impulses from controller into the circulating water in the pipe are functioning as per design. If a building automation system (BAS) is installed, it is in this control room where the CCTV pictures would be monitored.
We also recommend that a CCTV camera be focused on the ionization system controller that can be similarly monitored in the BAS control room, showing proper functioning of the (digital) ionization set point and the polarizing indicator lamps.
- This 'all electronic' water treatment system gives the Cooling Towers a remarkable degree of Eco - friendly operation. The only additional treatment that might be needed would be the Ph control if the local water make up happens to be highly acidic or alkaline in nature, in which case every month or so the PH would have to be adjusted to PH7 - PH8, in order to protect all metals in the system.
- The operating company will save the required personnel to maintain and supervise conventional chemical water treatment systems.
- We recommend each Cooling Tower be fitted with a domestic Swimming Pool pump and backwash type Filter to periodically clean out the sumps after the high pressure spray gun cleaning of the outer edges of the CT evaporation panels that receive constant, direct sunlight.

D. Conclusion:

After more than 32 months of continuous operation of this CT system that was converted from chemical water treatment to "electronic only" water treatment, we can state - judging by any reasonable standard of measurement - that the field trial of replacing all chemicals with these electronic water treatment units definitely improved operating efficiencies in a number of ways, as outlined. The results we experienced during this lengthy trial period have in fact exceeded our expectations - especially with respect to the "ease" and "hassle free" functioning of these fully automatic CT water treatment systems that we found were more efficient and require extremely little human monitoring / maintenance.

Job Number : EV161763
Customer : PT. Biosolutions Indonesia
Project Name : CT Supermal Karawaci
Customer Ref : 1766/IUS-EV/VII/2013

Laboratory Sample I.D :				EV161763-1
Customer Sample I.D :				CT Supermal Neto 100% Electronic Water Treatment
Date Sampled :				27-Oct-16
Sample Matrix :				Water-1
No.	Test Description	Units	Regulatory Limit	Results
Physical Tests				
1	Carbonate Hardness	mg/L	1000	164
2	Conductivity (Lab)	µS/cm	1200	1820
3	pH (Lab)	S.U.	7.0 - 8.3	8.80
4	Total Dissolved Solids, TDS	mg/L	2000	1200
5	Total Hardness as CaCO ₃	mg/L	500	164
6	Total Suspended Solids, TSS	mg/L	50	<1
Anions				
1	Alkalinity Bicarbonate as CaCO ₃	mg/L	80 to 400	284
2	Alkalinity Carbonate as CaCO ₃	mg/L	80 to 400	73
3	Alkalinity Total as CaCO ₃	mg/L	80 to 400	357
4	Chloride, Cl ⁻	mg/L	300	92.0
5	Sulphate, SO ₄ ²⁻	mg/L	500	248
Nutrients				
1	Nitrite, NO ₂ -N	mg/L	200 to 700	<0.001
Total Metals				
1	Copper, Cu	mg/L	-	0.011
2	Iron, Fe	mg/L	0.3	0.012
Microbiology				
1	Legionella pneumophila	CFU/100ml	NA	ND
2	Total Plate Count, TPC	CFU/ml	NA	2100

Note: Refer to QA/QC – Accuracy page for list of analytical methods used
 Regulation Limit based on Superchill Australia

Observation by the proponents related to this (and previous) test reports of Cooling Towers that operate on this automatic, electronic water treatment system:

High levels of Conductivity and Alkalinity do not negatively affect the water of a CT since these factors do not cause formation of scale when the Electronic Water Treatment Systems are installed and operating within the piping system.

Addendum to original Report by Graham Gething and Rudy G. Schouten. Jakarta, Indonesia.

December 06, 2016.