Case History Report

The “Zeta Rod” Nonchemical Device

0209

Device Evaluated

"Zeta Rod tm", by Zeta Corporation, 4565 South Palo Verde Road, Suite 213, Tucson, AZ 85714, ph: 520-747-4454.

System Data

A "Zeta Rod tm" system was installed to control corrosion and scale on a cooling tower used for "free cooling", at the Fort McDowell Casino, Fort McDowell, AZ 85245 (Fort). The Zeta Rod tm system consisted of a non-chemical device (NCD), an "electrostatic" capacitor type unit, installed in the basin of cooling tower #3. The Fort is a large Indian operated gaming establishment, which has three cooling tower systems installed to provide recirculated water for chiller and free cooling of the building HVAC system.

Claims Made

Zeta literature reviewed claims "superior anti-fouling performance - maintains heat transfer surfaces at near perfect condition", "reduced corrosion potential results from clean surfaces", "water conservation through reduced bleed", "control of scale and biofilm is accomplished without need for storage and handling of toxic chemicals", "foul odors associated with cooling water disappear", and "help eliminate biofilm". **The Fort was cited in the literature as a** successful **installation.**

History

The NCD was installed in mid-1994 on cooling tower #3 at the Fort. Makeup was untreated Fort well water with the cooling tower system operated at 3 to 6 cycles. In 1995, we began chemical treatment programs on the other cooling towers and observed, sampled, and documented the performance of the NCD on cooling tower #3 until its use was discontinued in 1996.

Analytical Data

The following are typical of analytical results obtained on samples from cooling tower #3 during use of the NCD on June 27, 1995 and July 17, 1995.

Parameter	Well	Cooling Tower	Well	Cooling Tower
pH	7.66	8.84	7.80	9.20
conductivity mmhos	514	3130	460	2600
total alkalinity mg/l	190	420	173	1133
calcium mg/l	43.5	117	40.5	30
magnesium mg/l	22.2	156	19.6	175
Ca:Mg ratio	1.96	0.75	2.06	0.17
saturation index 100 F	+0.37	+2.26	+0.43	+2.44
conductivity cycles		6.1		5.7

A sample of deposited material was obtained from the cooling tower basin and analyzed. The laboratory reported that the foulant was 39.2% calcium oxide, 3.02 % magnesium oxide, and 44% loss on ignition; a typical calcium carbonate based hard water scale.

Discussion

Zeta literature claims that their NCD minimizes scale "by elevating the surface charge of particles in the water", thus preventing them "from sticking to each other or to the surfaces of pipes, vessels, and other wetted areas." The NCD "operates by forming an electrostatic field between the Zeta Rod tm and a grounded metal surface" "that elevates the natural surface charge of particles in water systems" and "particles with elevated surface potential repel each other".

The analytical data clearly shows that the makeup water, as well as the cycled cooling water, are both very scaling with positive saturation index values. We thus would expect the cooling tower to experience severe scaling. This is exactly what has been observed at the Fort, severe scaling occurred in the time between installation of the NCD and resumption of chemical treatment. In fact, the scale formation was severe enough to require extensive acid cleaning for its removal.

As with many other NCD installations examined, a substantial buildup of precipitated hardness material was noted in the cooling tower basin. This results from the well known "soda- lime" softening and "carbonate cycle" reactions where hardness ions are precipitated from solution in bulk waters due to high pH and alkalinities obtained by operation at high cycles. It is of interest to note that operations personnel at the Fort initially claimed that the NCD was working well based upon their finding of little scale in the free cooling heat exchanger in the first year of operation.
This opinion changed as scale gradually became evident in the heat exchanger and the precipitation products in the cooling tower basin had to be removed on a frequent basis.

Note should also be made that the Ca:Mg ratio of the makeup and cooling tower water showed significant differences in each sampling event. The large decrease in this ratio, from makeup to tower water, found is a very good indicator of calcium, scale, precipitation within the system.

Conclusion

Installation of the Zeta Corporation NCD at the Fort has shown that this particular unit **cannot control calcium based scale formation** in a light load standard open cooling tower with scaling makeup water. This conclusion is based on the observed serious scale problems and analytical results.

The other claimed abilities of this NCD are also open to question based upon generally accepted knowledge of water chemistry. It is impossible to establish an electrostatic field across a conductive water due to the ability of the water to immediately transport an electrical charge. Thus, it is impossible to change the charge of any particles in the water by means of such a field.

In addition, ions are primarily responsible for formation of mineral scales from water solution via formation of crystalline solids. Ions in solution, which have no charge, are not particles and thus cannot be "charged" by any device to prevent formation of solids.

Reporter
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