CASE STUDY

BACTERIAL REMOVAL AND SCALE INHIBITION IN AN INDUSTRIAL COOLING TOWER USING CLEARITAS®

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INTRODUCTION

Blue Earth Products® is the leader in innovative approaches to improve water quality in both commercial process and drinking water applications. Our products work in conjunction with existing primary disinfectants to eliminate organic and inorganic scale from any water surface in a cooling, process, or potable water system.

Mineral scale and organic film in cooling towers, chillers, and system piping are a common challenge for most chiller plants and cooling towers. Often, the makeup water that enters these systems is "scaling" in nature, causing buildup of both organic and inorganic material. Left unchecked or inadequately treated, this buildup impedes performance, shortens infrastructure lifetime, and increases the consumption of both water and energy. Replacement of chiller plants can cost up to $500/ton of cooling capacity, not to mention the inconvenience of such a replacement.

Blue Earth Products worked with Mid America Agri-Products Wheatland LLC to improve their existing, multi-component cooling tower treatment plan with a straightforward, nonhazardous solution comprised of Clearitas 201 and bleach. These treatment programs are designed to simultaneously control scale formation, control bio-slime buildup without increasing corrosion. This particular system is approximately three years old, but is located in a compromising location (next to a large corn farm and dirt road). As is typical in this situation, dirt is periodically sucked into the tower from the road and insect parts are often found in the circulating water.

The primary objective in making the change to Clearitas 201 was to simplify the overall water treatment package by reducing the number of treatment chemicals required, as well as to reduce damage to employee vehicles parked near the towers. The drift from the tower was carrying minerals that were bound with organic matrices, which would bond to the surface of the vehicles when evaporated. The tower was reported to be in good operating condition at the beginning of the trial. Prior to the treatment change, periodic spikes in colony forming unit (CFU) counts were being reported, which is typically caused by the presence of biofilm in the system.

All previous chemical treatments were terminated. Initially, Clearitas was added at a maintenance dose of 1:20,000 and approximately 1 ppm of bleach was applied as free chlorine.

After one month, an on-site assessment was performed; it was determined that the amount of HOCl being added by the customer was reacting with the natural ammonia in the well water, producing monochloramines. There was very little, if any, free chlorine in the system, but approximately 1 ppm of total chlorine. Large amounts of dirty foam were noticed in the drain-off basin of the system from the removal of both dirt and bacteria. Visual inspection of the tower confirmed that some slimy deposits were noticeable.

The dosing of Clearitas was increased to a cleaning amount of 1:10,000. The presence of a free-chlorine residual was required in this system for the proper function of the Clearitas 201 product. Therefore, bleach was dosed and monitored to push the system past breakpoint and achieve a free chlorine residual of 0.5 to 1.0 ppm in the system. During the cleaning period, the chlorine values, both free and total, did vary somewhat while the remaining bacteria were being removed.

RESULTS

After the dosing of both Clearitas and bleach were increased, the system continued to fluctuate but stabilized after approximately two weeks. A second on-site inspection revealed that all of the slime/algae noted at the one-month visit of the trial were completely gone, as was the dirty foam located in the basin. Additionally, the employees reported a dramatic improvement in the ease of which the drift minerals were washed off their vehicles.

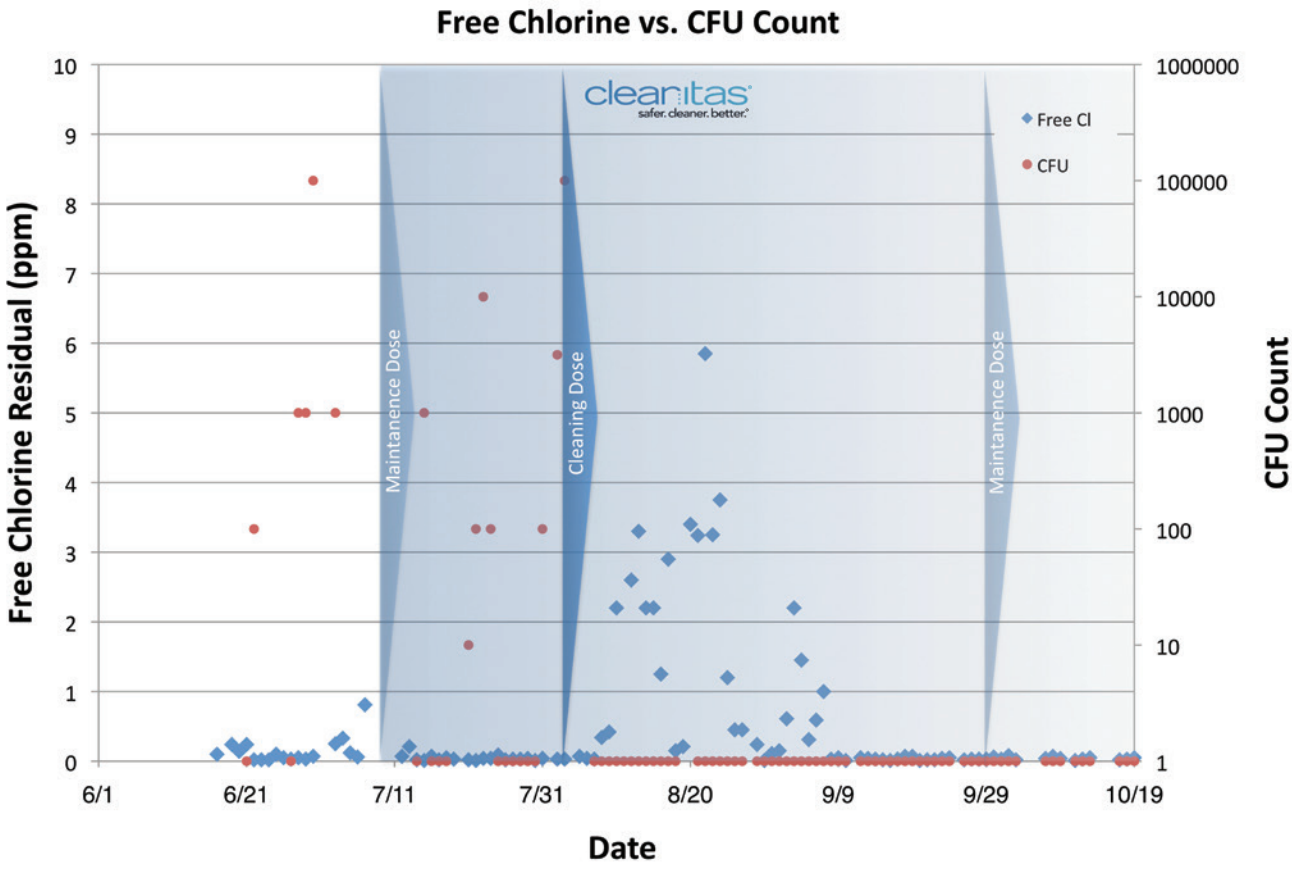

Figure 1 - Free chlorine residual vs. CFU count before, during, and after the Clearitas cleaning dose.

Figure 1 plots the CFUs measured within the cooling tower as well as the free chlorine residual. NOTE: The chlorine values are recorded daily and the CFU values are measured 2-3 times per week. As noted, the CFUs were not well controlled while on the prior chemical treatment. Additionally, very little free chlorine was in the system. Additional chemical analysis of both the source water and treated water confirmed that a large portion of the

chlorine was converted to chloramines.

During the initial Clearitas period, CFU counts did go down somewhat, but values did persist. Table 1 shows the average value of all the measurements taken. After the chemical changes to achieve free chlorine were made, the system quickly stabilized (starting around 8/8/2010). The free chlorine quickly rose and the CFU measurement went to zero and stayed at zero. Based on recommendations by Blue Earth Labs, the amount of HOCl added was brought back and maintained at a maintenance residual of 0.2–0.5 ppm.

In November of 2010, water samples were collected immediately before the entrance and exiting of one of the major plate and frame heat transfer units within the system. These samples were analyzed by ICP using Pace Analytical Services of Lenexa, KS, to determine if any scaling was occurring in the chiller. For calcium and silica, the values before and after the chiller were identical within the variance of the measuring technique, indicating that no mineral scale formation was occurring in the chillers, the most likely place within the entire system for scale to occur. Additionally, the presence of zero copper and almost non-detectable iron indicates that little or no corrosion is occurring throughout the system being treated.

	Before	July 12 - Aug 7	Aug 8 - Oct 19
pH	8.04	8.47	8.96
Conductivity	1349 µS	1378 µS	1254 µS
Silica	156 mg/L	166 mg/L	179 mg/L
TDS	1004 mg/L	985 mg/L	866 mg/L
Free Chlorine	0.09 mg/L	0.04 mg/L	0.76 mg/L
ORP	351 mV	152 mV	353 mV
CFU 10^x	2.17	1.18	0

Table 1 - Average values before Clearitas, during cleaning and post cleaning.

DISCUSSION

In this particularly challenging system, due to the influx of debris from the local environment, the customer was encumbered with the challenge of managing five different water treatment chemicals. In addition, the drift from the existing chemical treatment program caused damage to both employee and company vehicles. Once the chemical treatment was changed to a cleaning dose of the Clearitas-HOCl combination, immediate results were noted. This cleaning period was required to completely eliminate the visible biological slime and produce zero CFU counts.

Additionally, scale forming analysis was completed after approximately five months on the new treatment. No scale formation was detected nor was any significant corrosion.

In this system, we have converted the customer's cooling tower from several hazardous water treatment materials to a simple, two-step process that has shown better bacteria count reduction as well as secondary benefits from the elimination of drift damage.