

White Rust Corrosion Control

Comparison of ZincGard[™] and Competitor Program

CHR 0108

History

Due to receipt of a low bid, a school system in Arizona was forced to switch from a proven ProChemTech water treatment chemistry program to a new program provided by a competitor. During the sales process, the competitor had stated that their products could control white rust corrosion of galvanized steel as well as the ProChemTech products they were replacing.

The school system, while being required to go with the low bid, considered control of white rust to be a critical performance parameter due to failure of previous suppliers to make good on their sales claims and the high cost for replacement of cooling towers. In order to evaluate the claim made by the competitor that their product was equal to the ProChemTech product, two schools were selected for continuing water quality evaluations and corrosion coupon studies to ascertain the degree of white rust corrosion with the different water management programs in place. The following are the results from this evaluation. Note that both schools have similar sized HVAC systems with relatively new galvanized cooling towers, black iron piping, and copper condenser tubes.

Water Quality Analysis

The following table summarizes the October, 2007, makeup and cooling water analytical data.

Parameter	Competitor	Competitor	ProChemTech	ProChemTech
	Makeup Water	Cooling Water	Makeup Water	Cooling Water
pH	8.2	8.6	8.2	9.2
total alkalinity mg/l	145	305	203	675
conductivity mmhos	854	1630	672	1894
calcium mg/l	60.5	136.5	50.1	145
magnesium mg/l	24.3	56.0	23.0	82
Ca:Mg ratio	2.5	2.4	2.2	1.8
iron mg/l	ND	ND	ND	ND
copper mg/l	0.07	0.77	0.04	0.04
zinc mg/l	0.033	6.9	ND	ND
silicon mg/l	7.5	20.8	14.1	57.1
chloride mg/l	126	233	66	170
sulfate mg/l	189	480	76	265
total phosphate mg/l	1.2	22.5	2.0	15.9
ortho phosphate mg/l	-	0.46	-	0.77
suspended solids mg/l	-	5	-	4
conductivity cycles	-	1.9	-	2.8
total hardness mg/l	251	572	220	700

Zinc corrosion coupon studies in the two systems gave the following results:

Competitor – **8.2 mil/yr**, 1296 hrs exposure
 ProChemTech – **2.4 mil/yr**, 888 hrs exposure



Discussion

Review of the water analysis results provides the following observations:

1. The Competitor school shows a very high level of zinc in the cooling water, 6.9 mg/l, against a none detected (less than 0.002 mg/l), at the ProChemTech school. Generally, a high level of zinc in the cooling water is a good indication of excessive white rust corrosion with subsequent dissolution of the zinc into the cooling water.

2. A cooling water pH of 8.6 and total alkalinity of 305 mg/l was found at the competitor school, while the ProChemTech school has a cooling water pH of 9.2 and total alkalinity of 675 mg/l. Given that it is generally accepted that white rust corrosion becomes more of a problem the higher the pH and total alkalinity values, the ProChemTech school has a much more aggressive environment than the competitor school as to white rust corrosion.

3. The level of copper in the competitor school cooling water is also somewhat elevated at 0.77 mg/l, as contrasted with the ProChemTech school at just 0.04 mg/l (the same as the makeup water). This is a good indication that the chiller tubes at the competitor school are corroding at a faster rate than those at the ProChemTech school.

4. The competitor school is running at 1.9 cycles against 2.8 for the ProChemTech school, thus substantially increasing water and chemical treatment use and costs.

The zinc corrosion coupon results clearly show that the ProChemTech program with our proprietary white rust inhibitor, ZincGard[™], provides a substantially lower corrosion rate, 2.4 mils/yr, than the Competitor program at 8.2 mil/yr.

Comparison of the zinc corrosion coupons as removed shows a dramatic difference in appearance. The coupon from the Competitor school is almost totally covered with typical white rust corrosion product, while the coupon from the ProChemTech school has very little white rust corrosion product and shows a significant amount of original, undamaged metal surface.

Conclusion

The water quality analysis, corrosion rates, and visual comparison of the zinc corrosion coupons all show that the ProChemTech water treatment program incorporating our proprietary ZincGard inhibitor to control corrosion of zinc (galvanize) is far superior to the Competitor program.

Corrosion rates obtained by the ProChemTech program, operating in more severe service conditions with higher pH, alkalinity, and higher cycles; are just 29.3% of those obtained by the competitor program. The substantial decrease in the corrosion rate of the zinc on galvanized steel obtained will result in the protective coating lasting at least three (3) times as long in service.

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