

Case History Report

Results Comparison, Softened Makeup Cooling System

Nalco and ProChemTech Chemistry Programs

CHR 06/07

History

A carbon/graphite plant in Northwest Pennsylvania had experienced problems with scale formation in high temperature furnace and gas generator cooling jackets due to insufficient blowdown and hard makeup water. We had advised the plant to soften the makeup water, institute routine blowdown to keep the cycles below (6) six, and utilize a ProChemTech SOFT[™] water treatment chemistry. While the plant decided to soften the cooling tower makeup water, they elected to utilize a chemical treatment program by Nalco Chemical, which was claimed to be equal to, or better than, our SOFT chemistry. Soft water makeup and the Nalco chemistry were started in 2002.

In 2005, we provided a competitive survey of the cooling tower system as the customer was still experiencing plugging of critical heat exchangers.

Survey Results

The following table summarizes some makeup and cooling water results from our 2005 survey.

Parameter	City Water *	Cooling Water
pH	7.50	8.90
total alkalinity mg/l	105	705
conductivity mmhos	400	2790
calcium mg/l	28.4	10.4
magnesium mg/l	9.5	1.92
iron mg/l	0.05	3.9
copper mg/l	<0.02	0.14
zinc mg/l	0.058	0.792
silicon mg/l	3.9	25.1
chloride mg/l	80	430
molybdenum mg/l	-	0.2
total phosphate mg/l	1.41	31.7
ortho phosphate mg/l	0.71	25.9

* Note, city water is cation softened prior to use as makeup, typical makeup hardness is < 5 mg/l as CaCO₃.

A deposit sample obtained from the system cold well analyzed at 42.9 % as iron oxide.

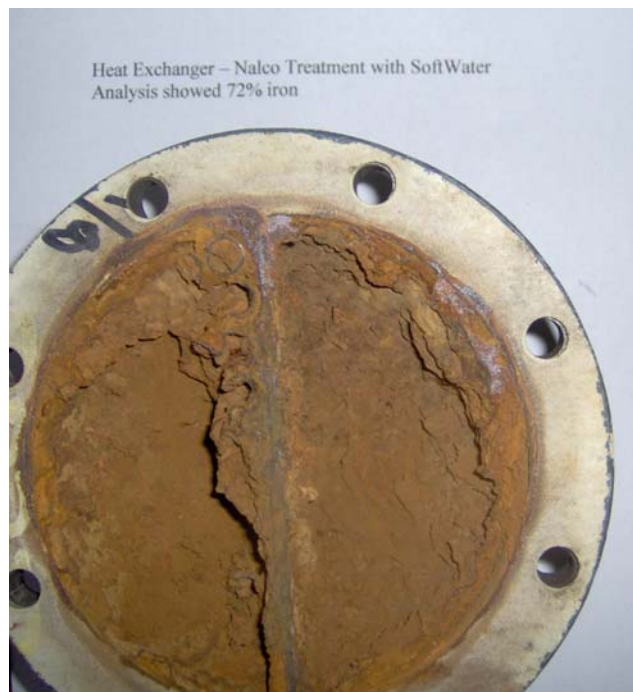
We also ran a set of corrosion coupons for the customer with the following results obtained:

mild steel – 16.28 mil/yr
mild steel – 15.67 mil/yr
copper – 0.06 mils/yr
brass – 0.07 mil/yr

The following is a picture of the corrosion coupons as removed from the rack.



The customer continued to experience plugging problems through 2006 and opened a heat exchanger up for inspection, the end bell is shown in the following picture:



Conclusion

Based on our survey results, corrosion coupon study results, readings from an on-line Nalco corrosion rate monitor showing values averaging over 9 mils/yr, and the evidence of excessive corrosion and deposition in the opened heat exchanger; the conclusion was reached that the plugging problem was the result of excessive corrosion with subsequent deposition of the corrosion products.

Results Comparison

In early 2007 the customer switched to a ProChemTech SOFT chemistry using BlueTrace™ for accurate program control. The first set of corrosion coupons, exposed just 30 days, on the ProChemTech water management gave the following results:

mild steel – 1.76 mil/yr
mild steel – 1.84 mil/yr
copper – 0.11 mils/yr

The results are quite clear; the ProChemTech SOFT chemistry program is far superior to that used by Nalco, 30 day corrosion coupons giving an average mild steel corrosion rate of **1.8 mil/yr**, well below the industry standard of 2 mil/yr for acceptable performance. Forty (40) day mild steel corrosion coupons on the Nalco program averaged **16 mil/yr, eight times higher than the ProChemTech program!**

An environmental “green” side benefit is that the ProChemTech chemistry, using BlueTrace control technology, is molybdate free, thus no potential problems with disposal of the cooling tower blowdown.

The exclusive ProChemTech SOFT™ water chemistry had its beginnings in 1984, when softened makeup water was used to address severe scale problems on recirculating cooling tower systems providing cooling water to large, very high temperature glass melting furnaces. Application of the softened makeup water eliminated the scale problem, but caused a high corrosion rate problem. This corrosion problem lead directly to the development of the advanced corrosion control chemical technology used today in our SOFT makeup water management programs. SOFT water management programs are recommended for consideration when makeup water hardness exceeds 200 mg/l as calcium carbonate and/or high temperature heat exchangers are part of the cooling load.

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