BlueTrak tm and MiniBrom tm
Improving Cooling System Operation

Background CHR 0511

Based on a history of poor chemical feed control due to load changes, leaks, and changing makeup water conductivity, a patented* BlueTrak tm chemical inhibitor feed controller, with a patented* MiniBrom tm electrolytic bromine biocide feed unit, were installed at a sintered metal parts manufacturing plant in April, 2007. The makeup water to this plant has a variable conductivity with very low hardness and alkalinity, making it quite corrosive. A BAC FXT 115 cross flow cooling tower with a 5,000 gallon volume hot well – cold well design cooling system supplied by ProChemTech is used to cool several metal part sintering furnaces operating at over 2200 F, air compressors, and hydraulic presses. System metallurgy is mostly steel with some copper heat exchangers. We have found that sintered metal parts plants present a severe cooling water treatment challenge as water temperatures in the carbon steel sinter furnace cooling jackets can range from 95 to 195 F, with very low water flow velocities.

The equipment installed consisted of a panel mounted BlueTrak Model 2EZ-D1L with a MiniBrom Model MB 2.5 mounted on the precursor mix drum. System blowdown is controlled by a makeup proportional control while the MiniBrom is controlled by a standard timer for three doses per week.

Water Analysis Data

The following table summarizes the analytical results from makeup and cooling water samples taken February 1, 2008, which are typical for the cooling system when the city water conductivity is low.

Parameter	Makeup Water	Cooling Water
pH	6.6	7.6
total alkalinity mg/l	6	55
conductivity mmhos	37	223
total hardness mg/l	9.0	14.2
chloride mg/l	7	17
sulfate mg/l	< 5	< 5
total phosphate mg/l	0.92	30.2
suspended solids mg/l	-	< 2
cycles on conductivity	-	6
saturation index	-3.4	-1.4

Results

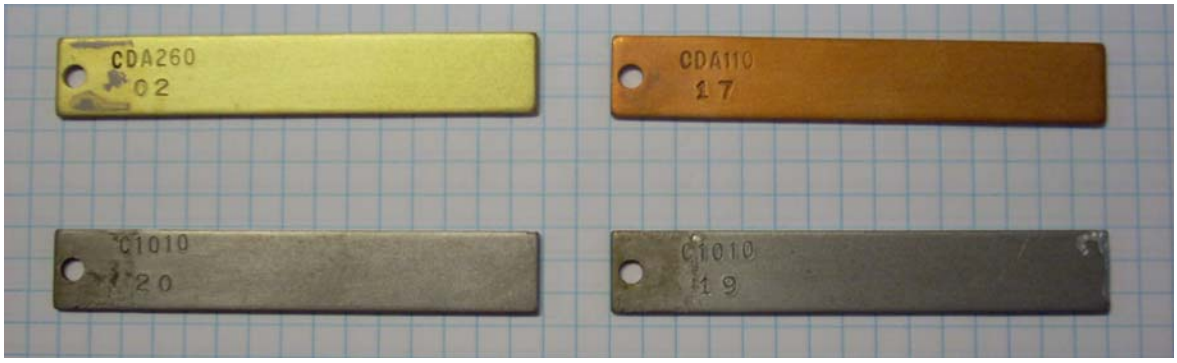
The following service report data was collected during the course of the corrosion coupon study by our field service technicians using field test equipment and plant makeup water meter readings.

Date	Makeup gpd	BlueTrace abs	Makeup Conductivity mmhos	cycles	ATP - rlu
01/25/08	2,255	0.10	30	7.3	92
12/18/07	1.291	0.11	32	10.6	127
12/21/07	2,010	0.11	32	11.3	-
12/13/07	2.058	0.09	42	11.0	126
12/07/07	1,560	0.12	46	16	182
11/27/07	1,137	0.11	150	5.5	211
11/16/07	1,966	0.11	140	4.7	203
11/09/07	1.717	0.12	160	4.9	157
11/02/07	1,703	0.09	150	3.5	98
Control Limits		0.08/0.11		5/6	<2000

Cycles on conductivity, readings in mmhos

The corrosion coupon study run between 11/09/07 and 01/25/08 provided the following results:

Mild Steel C1010, coupon #19 – 0.50 mil/yr
Mild Steel C1010, coupon #20 – 0.45 mil/yr
Copper CDA110, coupon #17 – 0.08 mil/yr
Brass CDA 260, coupon #02 – 0.06 mil/yr



Cleaned coupons from the corrosion coupon study.

Corrosion coupons rates for a one year period prior to installation of the BlueTrak and MiniBrom units averaged 1.72 mil/yr on mild steel and 0.03 mil/yr on copper and brass. Note that the inhibitor used, a specialized product formulated for use in soft, corrosive waters, was chemically the same as in the recent study while PCT 3026, a “stabilized bromine” (n,n,dibromosulfamate), was used as the sole biocide.

Discussion

Looking first at the service report data, we see that the makeup water had a considerable change in conductivity during the course of the corrosion coupon study, going from a high of 160 mmhos to as low as 30 mmhos, more than a five fold change. This, coupled with changing thermal loads and some system leakage, caused substantial swings in the cycles obtained, from 3.5 to 16, in the system during the course of the study. **The BlueTrak unit, however, maintained the level of chemical inhibitor within set control limits throughout the entire study time period, regardless of cycles.**

Review of field service reports for the three month period prior to installation of the BlueTrak unit shows that the chemical inhibitor level was outside, either higher or lower, than control limits for the entire period. From this data, it is clear that installation and operation of the BlueTrak unit substantially improved chemical inhibitor control.

Biological control of the system, using only the electrolytic bromine provided by the MiniBrom unit set to three doses a week, was excellent with the highest ATP rlu reading observed being just 211 on a maximum control limit of 2000 rlu.

Some concern has been expressed about the potential for increased corrosion rates when using electrolytic bromine as the sole biocide. The steel corrosion rate, average 0.50 mil/yr, is much better than the 3 mil/yr generally considered to be acceptable and was substantially lower than the average 1.72 mil/yr rate from five previous corrosion coupon studies. With bromine being a halogen, yellow metal corrosion is also an area of concern. The corrosion rates for copper and brass, 0.08 and 0.06 mil/yr, while being higher than the average of 0.03 mil/yr found for both metals in the previous studies, is still well below the levels generally accepted as excellent corrosion control, 0.2 mil/yr, for yellow metals.

Conclusions

Installation of a BlueTrak unit substantially improved the chemical inhibitor control in a cooling system with wide swings in cycles due to load changes, leaks, and changing makeup water quality. For a three month period 100% control was maintained in contrast to the previous three months where the system was continuously out of control. Steel corrosion control was improved while copper and brass corrosion levels remained at acceptable levels.

The MiniBrom electrolytic bromine unit provided very good control of microbiological growth with no supplemental hazardous biocide addition, a lower steel corrosion rate, and with only a small increase in copper and brass corrosion rates found.

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* BlueTrace patent #7,932,470; MiniBrom patent #7,927,470