



ZETA CORPORATION

Biofouling Solutions for Industrial Fluid Systems

Steel Mill uses Zeta Rod[®] to improve Legionella Control in Cooling Towers

Nervacero is a steel mill located 7.5 miles from the city of Bilbao in the Basque territory of Vizcaya. The mill has an electric furnace with a feeder for the pre-heating of scrap metal with a production capacity of one million tons of liquid steel per year. The mill produces billets of different geometries and corrugated round rods of different diameters for reinforcing concrete in construction¹.

The mill has five independent cooling systems of different capacities:

- Circuit I: The Primary Cooling System. It has a total recirculation flow rate of 18,000 gpm servicing the furnace, and the air purifier. The tower has a 1million gallon hot water sump, and a 1 million gallon cool water sump.
- Circuit II: This system provides cooling to the continuous casting process and has a recirculating flow rate of approximately 4,000 gpm.
- Circuit III: Provides cooling to the rolling mill process. It has a recirculating flow rate of 4,585 gpm.
- Circuit IV: Tempcore system. Provides high-pressure water to cool down the hot round rods with a recirculation flow rate of 4,850 gpm.
- Circuit V: The newest of the cooling systems was commissioned in the summer of 2001. It is an expansion of the Circuit I and provides cooling to the continuous casting process with a recirculation flow rate of 5,731 gpm.

Make up water for the cooling towers come from a river nearby and it is of excellent quality.

The Problem

Given the high quality of the make up water, the mill has never encountered scaling problems in their systems; instead, biofouling control has been their main challenge. Local authorities make routine inspections to industrial cooling towers in the region looking for legionella bacteria. Companies can receive warnings, high penalties or even forced shut downs if legionella bacteria is found and not controlled.

Attempting to meet strict standards, Nervacero was treating their cooling water systems with a combination of a chemical biocidal and sodium hypochlorite.

Chronology

Dec. 1999

By the end of 1999 in spite of the chemical treatment, Nervacero was still getting random positive readings for legionella in their cooling systems. The chemical supplier recommended doubling the dosage of the products to solve the problem. At that point plant engineers at Nervacero decided to try the Zeta Rod System.

¹ Data obtained from Nervacero's website: www.Nervacero.com

Jan 2000

Circuit IV was chosen for a trial. A Zeta Rod system consisted of eight Zeta Rod electrodes model ZR24S and two power supplies model ZRPGM. Four of the electrodes were installed in the hot water basin and the other four in the cool water basin, each set of four electrodes was charged by one power supply.

April 2000

Zeta equipment was installed in April 25-27 of 2000.

July 2000

During the annual shut down and while doing some repair work to the structure of the cooling tower in circuit IV, the fill of the tower caught on fire. Nervacero installed temporary spray bars to remove some of the heat from the system, and combined the water from circuit IV with the water of circuit III.

December 2000

Until the event in July Nervacero recognized the Zeta Rod as having a positive effect on bacteria control in circuit IV. Nervacero also recognized that the water in circuit IV was being diluted and mixed with that of circuit III and thus preventing the Zeta Rod from doing its job, so on December 2000 a Zeta Rod system consisting of eight ZR24S electrodes and two ZRPGM power supplies is installed in circuit III (four electrodes in the cold water basin and four in the warm water basin).

April 2001

Based on results from circuits III & IV Nervacero decided to install Zeta Rod systems in circuits I & II. Installation took place during April 3 & 4, 2001. Zeta Rod Systems were eight ZR24S electrodes and two ZRPGM power supplies for circuit II and sixteen ZR36S electrodes and two ZRPGM power supplies for circuit I. Electrodes were divided evenly between the cold water and warm water basins in each circuit.

June 2001

A new cooling system (circuit V) is commissioned at Nervacero and a Zeta Rod system consisting of six ZR24S electrodes and two ZR36S electrodes powered by one ZRPGM power supply was installed prior to the start up date.



Zeta Rod Electrodes installed in Tempcore cooling tower at Nervacero.

Conclusion

Nervacero was able to totally eliminate the addition of the chemical biodispersant, the consumption of Sodium Hypochlorite was reduced by approximately 50%. The mill has not had a positive test for Legionella bacteria since the implementation of the Zeta Rod systems.

Bacteria Counts Data

The following is the general bacteria data that was collected throughout the trial period. There are several sources of this data:

1. Data obtained on site using a HMB IV tester produced by Biotech International Inc. This instrument produces two numbers: a Biomass Readout (BMR) based on the oxygen generated from the reaction of any biomass (living and dead) with the reagents used by the instrument; and approximate bacteria count (cfu/ml) extrapolated from the BMR readout.
2. HACH total aerobic bacteria paddle testers
3. Plate counts done by a third party microbiology laboratory chosen by Nervacero.

DATE	HMB IV				HACH		LAB		Circuit
	BMR ²	Cfu/ml ²	BMR ³	Cfu/ml ³	TAB	Y&M	Y&M	TAB	
03-08-00 ^a								2x10 ⁶	IV
04-25-00 ^b							0	0	IV
05-15-00							0	0	IV
05-18-00							6	5.3x10 ⁴	IV
06-01-00 ^c							0	58	IV
06-07-00	0.12	1.1x10 ⁴	.025	2.2x10 ³	0	0			IV
06-09-00	.13	1.5x10 ⁴	.025	3.0x10 ³					IV
06-10-00	.13	1.5x10 ⁴	.025	3.0x10 ³					IV
06-12-00 ^d	.13	1.5x10 ⁴	.025	3.0x10 ³	0	0			IV
06-13-00	.31	4.35x10 ⁴	.062	8.7x10 ³					IV
06-14-00	.28	3.6x10 ⁴	.056	7.2x10 ³					IV
06-16-00	.26	4.37x10 ⁴	.052	8.7x10 ³					IV
06-19-00	.27	3.3x10 ⁴	.054	6.6x10 ³					IV
06-21-00							0	320	IV
	.27	3.5x10 ⁴	.054	7.0x10 ³			0	0	IV

² BMR & cfu's calculated before adjusting for Sodium Hypochlorite content in the water.

³ Adjusted for hypochlorite content

DATE	HMB IV				HACH		LAB		Circuit
	BMR ⁴	Cfu/ml ²	BMR ⁵	Cfu/ml ³	TAB	Y&M	Y&M	TAB	
06-26-00 ^e							0	1x10 ³	IV
07-07-00 ^f								12000	III
07-14-00								512	III
09-01-00								140	III
09-07-00	.28	3.3x10 ⁴	.06	3x10 ³					IV
09-14-01 ^g								37000	III

Notes:

- a. Performed biocide shock to the system
- b. On 05-08-00 hypochlorite feed was reduced by 50%
- c. On 05-23-00 hypochlorite was reduced to 20% of original rate
- d. Biodispersant reduced to 25% of original rate
- e. Test for legionella on circuit IV gave 0 cfu/ml. Biodispersant at this point had been completely removed.
- f. During July 2000 circuit IV was down for maintenance, and it is when the fill burned down.
- g. Biocide and biodispersant pumps failed on circuit III

⁴ BMR & cfu's calculated before adjusting for Sodium Hypochlorite content in the water.

⁵ Adjusted for hypochlorite content