



Eliminating Zebra Mussels from a Power Plant's Service Water System with Oxamine®

Background

A power plant in the U.S. Midwest region started a new combined cycle gas unit with the capability to produce 495 megawatts (MW) of electricity. The plant was using industrial grade 12.5% bleach for microbiological control. This strategy proved no match for zebra mussels, once dubbed “public enemy number one” on the United States Fish and Wildlife Service aquatic nuisance species list (Figure 1).

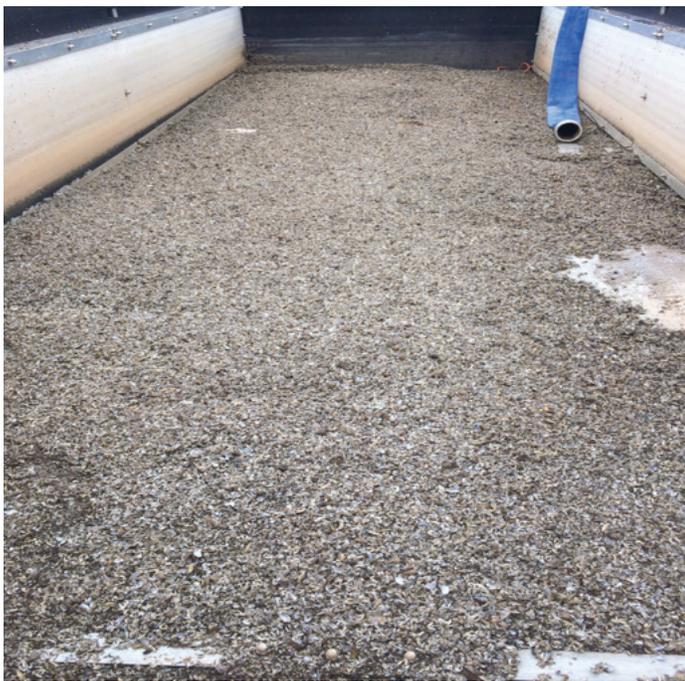


Figure 1: Zebra mussels collected from the open recirculating cooling water system via strainers located upstream of the CCW and LRVP Plate and Frame Heat Exchangers while on the 12.5% bleach program. The program was supposed to prevent these mussels from even getting into the system in the first place.

About 1.5" to 2" in length with threadlike filaments that enable them to attach to water intake structures and plant piping, zebra mussels began causing serious blockage in the system, including the vacuum pump heat exchanger filters (Figure 2). With fast reproduction rates and no known predators, these mussels proved difficult to control.



Figure 2: The vacuum pump heat exchangers filters were plugged with Zebra mussels.

Action

The power plant turned to Buckman for help. Buckman technicians implemented a customized 24-hour Oxamine program to eliminate existing mussels in the service water system. Live zebra mussels were collected from the raw water make up pond and were positioned in a “clam condo.” The clam condo housing the zebra mussels received a slip stream off the cooling tower recirculating water pumps (condenser supply) which discharged back into the basin. The live zebra mussels received the same level of Oxamine treatment as the rest of the cooling water system and a kill study was performed following the 24-hour Oxamine feed cycle.

Results

The 24-hour Oxamine treatment killed all the zebra mussels that were added in the clam condo. Kill study data showed a significant reduction in both total and bacterial ATP counts throughout system. Samples were collected from the condenser supply, condenser hot return, and the plate & frame heat exchangers. Data collected from condenser hot return also showed a significant reduction in ATP counts during Oxamine® treatment.

Benefits

Oxamine treatment was effective at 1.2 ppm for 24 hours. Observations following Oxamine treatment of 2 hours per day showed no more growth of zebra mussels. The plant saw full cleanup of microbiological deposits at the condensers.

Condenser Cooling Tower – Oxamine Startup Data

Time	Sample Location	MCA (ppm)	Total ATP (RLU)	Free ATP (RLU)	Bacterial ATP (RLU)
7:30:00 AM	Condenser Supply		9404	377	9027
9:00:00 AM	Hot Return		10580	155	10425
10:20:00 AM	Condenser Supply	0.8	8432	298	8134
10:30:00 AM	Hot Return	0.52	6899	272	6627
10:30:00 AM	Service Water PFX	0.54	6834	162	6672
10:50:00 AM	Hot Return	0.82	3626	646	2980
11:25:00 AM	Hot Return	1.03	1448	560	888
1:50:00 PM	Hot Return	1.42	606	480	126
2:30:00 PM	Hot Return	1.32	216	315	0
4:15:00 PM	Hot Return	1.4	320	233	87
5:00:00 PM	Hot Return	1.3	124	76	48

ROI

Customer-estimated savings of \$2,000,000 per year:

- All feed equipment was supplied by Buckman—no capital cost was incurred.
- Delays necessary for shocking and treating cooling tower and closed cycle cooling systems were

avoided, as was the corrosion potential from excess chlorides and oxidizers.

- Reduced chemical usage:
 - 170 gal/day of bleach before Oxamine, 34 gal/day bleach with Oxamine.
 - Complete elimination of continuous sodium bisulfite feed to neutralize free chlorine in blowdown stream

ROE

- Significant reduction in chemical shipping volumes (5x reduction in bleach volume, elimination of sodium bisulfite), associated transport emissions, and packaging expenses
- Reduction of safety risks associated with the shipping and receiving of bleach
- Lower AOX generation (Absorbable Organically Bound Halogens). AOX are toxic to fish and aquatic organisms and have a tendency to accumulate in the environment. AOX concentrate up the food chain, leading to a potential exposure of humans to dangerous levels.

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