ChemTreat®

CASE HISTORY
#0-14

Zebra Mussel Treatment: Mid-western Nuclear Power Plant Using CL2005

BACKGROUND

The case history is based on the experiences at a Mid-western nuclear plant located on the Mississippi River. Zebra mussels are highly invasive bivalves that, if left unchecked, can significantly foul the cooling and auxiliary water piping that supplies the power plant. Each spring the plant treats for zebra mussel control, and they have had several unsuccessful treatment programs. Fish kills, under feed of chemical, and chemical discharge violations because of chemical overfeed have all occurred at this site. This application for zebra mussel control is extremely complex due to varying river and system demands, tight permit limits, a large system volume, and time constraints. In the past, one of the limitations was the inability to provide timely laboratory information regarding chemical levels in the system because of high system demand. Like many power plants, this plant has the ability to recycle a portion of the main condenser outlet back to the condenser inlet via the recycle canal (see flow diagram). The elevated temperature aids the mussel treatment effectiveness and reduces chemical requirement. However, condenser efficiency is adversely affected by hot water recycling.

APPLICATION

Because of the complexity of the systems involved, any zebra mussel treatment program requires significant planning. We recommend the local representative serve as the application coordinator and assign the laboratory, chemical, and clay feed duties to other personnel. The enclosed flow diagram illustrates the optimum chemical and clay feed points. ChemTreat CL-2005 feed to the recycle canal was chosen to reduce potential overfeeding and permit limit violations. It also provides some mixing energy. We used conservative feed rates to prevent a potential environmental excursion.

Clay feed, for detoxifying CL-2005, was handled by an outside contractor and specialist in the area. This is the most cost effective and efficient way to handle clay feed requirements.

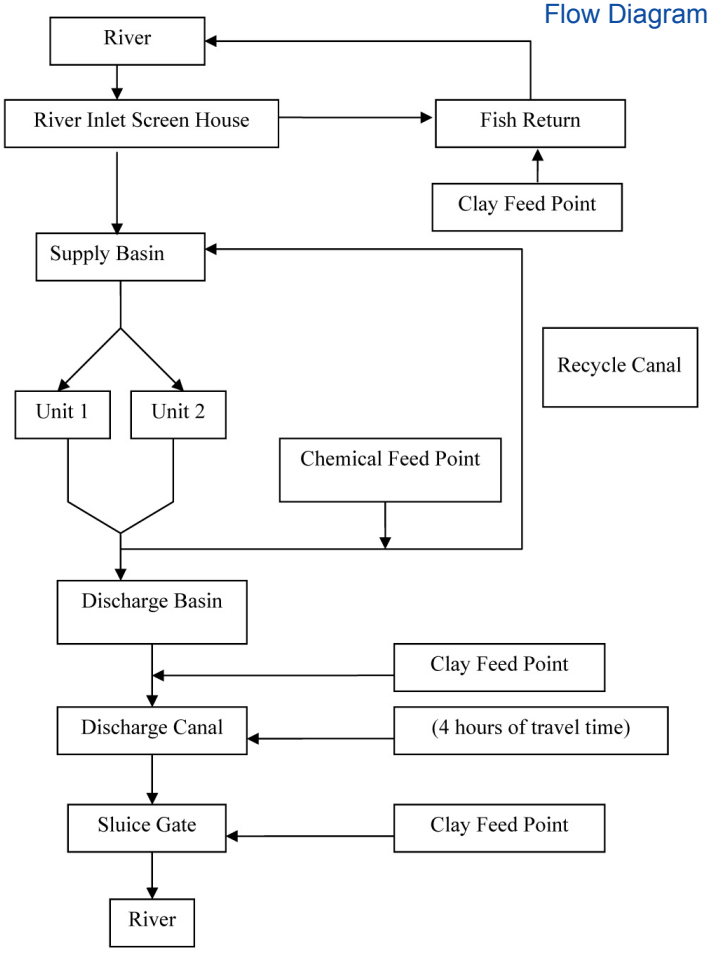
Clay Feed Setup At Discharge Basin

Discharge Basin and Discharge Canal

Chemical Feed Station

System Volume:	33 million gallons
Blowdown Rate:	63,000 gpm
Cooling Tower:	1.25 cycles, 80% of flow
Water Velocity in Recycle Canal:	~30 ft/min
Recycle Flow Rate:	~600,000 gpm
River CL2005 Demand:	1.8 ppm
Target Treatment Level:	4 ppm
Target Treatment Time at 25°C:	6 hours
CL2005 Required for Blowdown:	23 gph
CL2005 Required to Meet Target Treatment Level:	100 gph (first 2 hours)
Clay Target Feed Rate	5 pounds/pound of CL2005

Flow Diagram



RECOMMENDATIONS TO OBSTACLES

- CL2005 biocide is viscous and difficult to pump, so redundant pump capacity is recommended. In addition, use a trim pump to manage the blowdown flow and a separate feed pump to meet product demand.
- Units 1 and 2 consistently showed different treatment levels. Supplemental feed to Unit 2 will improve the kill and shorten the total application time.
- Increase the permit level in the discharge canal from 50 to 500 ppb and use the 50 ppb level to toggle the clay feed at the sluice gate. This allows an increased initial feed rate and reduces the total treatment time with limited fish toxicity in the discharge canal.
- Increase sample frequency to every 30 minutes to monitor the discharge canal (low-level testing) and treatment level for Units 1 and 2 (high-level testing).
- The system demand was higher than expected. Some of this extra demand was created by backflow of water with clay from the discharge basin blending into the recycle canal.
- Additional mixing energy in the discharge basin or discharge canal will improve the detoxification efficiency. This can be accomplished using a pump to create a mixing current in the discharge canal.
- Some system backflow was noted in the screen house because of an eddy created by the wind speed and direction. This was handled by establishing an additional clay feed point and monitoring at the river side.

RESULTS

The treatment was extremely successful. One-hundred percent mussel kill was achieved in the Unit 1 cooling water and circulation water biobox and the Unit 2 cooling water loop. One zebra mussel survived the process in the Unit 2 circulation water biobox out of approximately 200 specimens. Chart 1 documents the chemical feed rates and the residuals in the individual units. Chart 2 illustrates the declining demand in the discharge canal as a residual builds in the discharge basin. At 21:00 hours a breakthrough of CL2005 was noted at the discharge canal and addressed by reducing chemical feed and turning on the clay feed at the sluice gate. The demand information is useful to gauge clay feed and prevent a breakthrough of CL2005 at the river.

Chart 1

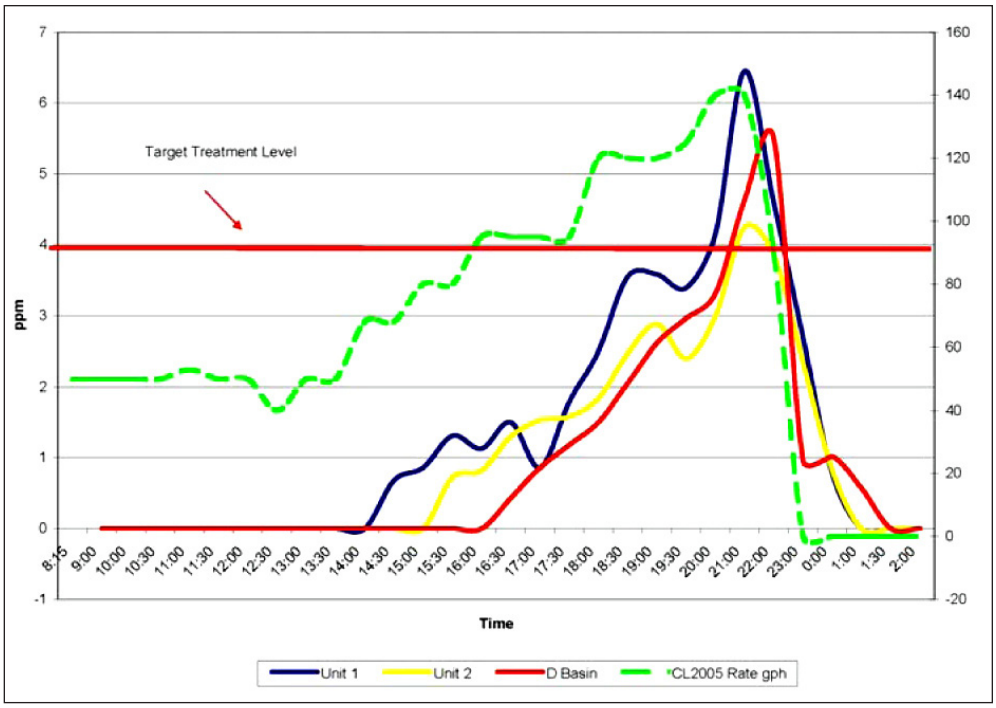
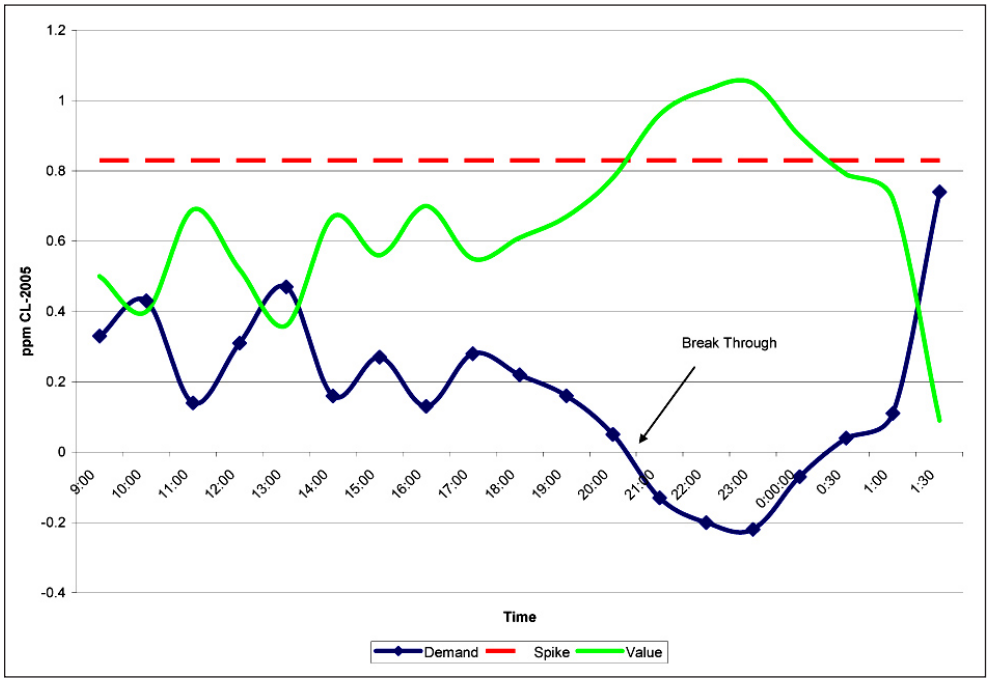


Chart 2



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