

PALISADES PLANT  
NPDES PERMIT MODIFICATION REQUEST  
WATER TREATMENT ADDITIVES FOR ZEBRA MUSSEL CONTROL  
DISCUSSION

INTRODUCTION

Consumers Power Company is seeking approval and NPDES permit modification for the routine use of Betz ClamTrol CT-1 and Nalco Acti-Brom (1338) at the Palisades Plant. Nalco Acti-Brom, a chlorination treatment supplement, will be used as an on-going, preventive treatment to control the larvae and veligers of these mollusks and, where possible, to reduce the chlorine feed required for microbiofouling control in plant raw water systems. The Betz ClamTrol CT-1, a molluscicide, will be used, if needed, to periodically control adult zebra mussels and/or adult Asiatic clams in raw water systems.

MACROFOULING CONTROL NEEDS

The Company has previously documented the need to control macrofouling of power plant raw water systems by zebra mussels and Asiatic clams. (Refer to information in letters from R L Fobes of November 6, 1989 to Mr R Schramek and September 9, 1988 to Mr F Eyer). Currently, the zebra mussel poses the greatest threat to operation of our raw water systems.

Populations of zebra mussels are present in the vicinity of the Palisades Plant. In late 1990, the plant staff identified adult zebra mussels on monitoring blocks in the plant raw water intake system. As the populations of zebra mussels in the lake environment grow exponentially during the first few years, the fouling in the plant's raw water system will similarly increase exponentially.

To date, at our J R Whiting Plant on Lake Erie where zebra mussel fouling has affected plant operations, the Company has attempted to control fouling with a combination of periodic applications of ClamTrol CT-1 and periodic mechanical cleaning where the biocide does not fully contact the system. The periodic remedial treatment with CT-1 biocide, however, results in shell debris that restricts flow in small diameter tubing or piping. To avoid or minimize problems created in some systems by dead organisms, the Company would like to use a preventive treatment program consisting of an oxidizing biocide using either daily intermittent chlorine/bromine based chemistry with Nalco Acti-Brom or continuous chlorine based chemistry. The Company perceives the use of chlorine/bromine chemistry for zebra mussel control as having an environmental advantage over continuous chlorine or higher level intermittent chlorine because lower amounts of halogens will be used. Consequently, the chlorine/bromine chemistry will result in the formation of fewer chloro-organic compounds in the environment. The bromamines formed by bromine are less persistent than the chloramines formed with chlorination. The chlorine/bromine chemistry is also advantageous to the Company because it is less corrosive to system metals and is more economical than continuous chlorination.

Some systems, due to design features, will not warrant or need daily or continuous treatment to avoid problems from macrofouling. For these systems the Company may wish to treat periodically or once a year with Betz ClamTrol CT-1 to kill adults. System treatment with CT-1 may also be needed to kill adult mussels prior to using daily intermittent treatments with chlorine/bromine to control veliger mussel attachment. Likewise, if the routine of daily, intermittent chlorine/bromine feed is interrupted due to equipment problems, it may be necessary to treat with Betz CT-1.

The Company believes that the use of Betz CT-1 and the chlorine/bromine chemistry with Nalco Acti-Brom will provide two essential tools for controlling zebra mussel fouling of cooling water systems. In the event that the approval of Nalco Acti-Brom for chlorine/bromine chemistry is delayed, however the Company also requests permit modification to allow continuous chlorination as a mussel control option.

This request identifies and discusses the application, monitoring and control of these products individually. Each product should be considered as a separate request for review and approval. The intended outcome of the review, as previously mentioned, is a modified NPDES permit for the Palisades Plant that will allow routine use of either product with specified discharge limits and monitoring requirements as necessary.

#### CONTINUOUS CHLORINATION

The Company requests that the NPDES Permit for this plant be modified to provide for continuous chlorination as was done with the NPDES Permits reissued in 1990 for the Company's J H Campbell and D E Karn-J C Weadock Plant Sites. The Company is not providing any aquatic toxicity data for chlorine because it is our understanding that Staff have developed sufficient background data on this chemical to establish effluent limits and monitoring requirements. It is my understanding that permit modification for continuous chlorination is relatively straightforward. Based on the Campbell and Karn-Weadock Permits, the Company assumes that the Discharge Limitations and Monitoring Requirements for continuous chlorination would be a Daily Maximum of 0.036 mg/L TRC monitored by Grab sample 5 X Weekly. The Company also requests that the provision that the permittee may use dechlorination techniques to achieve the applicable limitations be included in the permit modification.

#### BETZ CLAMTROL CT-1

ClamTrol CT-1 is marketed by Betz Industrial (a division of Betz Laboratories, Inc., 4636 Somerton Road, Treose, PA 19047). The product is registered as a molluscicide with the US-EPA.

ClamTrol CT-1 is a blend of cationic surfactants (dodecylguanidine hydrochloride and alkyl dimethylbenzyl ammonium chloride) in a alcohol/glycol carrier. Consumers Power Company has developed extensive experience with the use of this product at the J H Campbell Plant for Asiatic clam control and the J R Whiting Plant for zebra mussel control. The product use at these two plant sites had previously been reviewed and approved by MDNR.

Discharge of CT-1 to receiving waters can be controlled at or below the 0.08 mg/L CT-1 level through comingling of treated systems with untreated systems or by detoxification with bentonite clay (Betz DT-1). In previous CT-1 applications, Consumers Power Company has used dry clay as the detoxicant when necessary. Because of potential plugging problems with dry feeder equipment used near water, the Company requests to include Betz DT-S as an alternative source of clay. The DT-S is a clay slurry stabilized by the addition of a polymer.

Manufacturer product bulletins and Material Safety Data Sheets for ClamTrol CT-1 and DT-S are attached for reference. Attached separately are aquatic toxicity information for CT-1 and DT-S. The aquatic toxicity data for CT-1 includes 96 hr LD50 for rainbow trout, fathead minnow and bluegill sunfish and 48 hr LD50 for Daphnia magna.

The Company anticipates using Betz CT-1 to periodically control adult zebra mussels in systems where continuous or routine treatment for veliger mussel control is not physically or economically practical. Alternatively, the CT-1 may also be used as a system pretreatment, if mechanical removal is not practical, prior to implementing a continuous/routine treatment program.

#### Application

The CT-1 treatments would be performed as necessary but the Company does not expect that more than six series of treatments would be performed per year. A series of treatments would be the sequential treatment within a one to two week period of individual systems fouled with adult zebra mussels (e.g., condenser cooling water, house service water, fire protection system, auxiliary cooling water).

The CT-1 treatment program for controlling zebra mussels recommended by the manufacturer is a 6 hour application maintaining a 15 mg/L CT-1 residual in the system discharge when water temperature is above 50°F. Below 50°F, the recommended application time is extended to 12 hours with the same 15 mg/L CT-1 residual in the system discharge.

#### Detoxification/Discharge Control

The final discharge concentration of CT-1 entering receiving waters can be controlled at  $\leq 0.08$  mg/L. Sequential treatment of systems and comingling of treated water with untreated water will detoxify and lower product residuals due to the CT-1 demand of the untreated water streams. ClamTrol CT-1 can be neutralized by a variety of natural materials including silts, clay, humic acid and microfouled surfaces of cooling water systems. If needed, controlled amounts of bentonite clay slurry (Betz DT-1 or DT-S) can be injected into the discharge stream to provide additional detoxification of the CT-1. Approximately a one-to-one ratio of bentonite clay to CT-1 is recommended by Betz for controlling discharge concentrations.

The final discharge concentration can be tested by an analytical field method with a 0.2 mg/L CT-1 lower level of detection. Calculations using the CT-1 demand (at time of treatment) and volume of mixing streams can be used to determine if the final discharge concentrations are  $\leq 0.08$  mg/L CT-1 without detoxification. If detoxification is required, an average applied concentration of clay at least equal to the average CT-1 residual (one-to-one mass ratio) would assure detoxification of CT-1.

### Monitoring

The Company proposes to monitor the discharge of treated streams by the field analytical method to indicate  $\leq 0.2$  mg/L CT-1 and demonstrate by calculation that detoxification to  $\leq 0.08$  mg/L occurs by the CT-1 demand in untreated mixing streams or by the ratio of bentonite clay mass concentration to CT-1 mass concentration in the system discharge (prior to clay addition).

The proposed monitoring program would consist of the following. Prior to feeding CT-1 to a system, the inlet water would be sampled to determine the CT-1 demand in the inlet raw water. This information will be used to establish initial chemical feed rates and expected final discharge (outfall) concentrations after comingling with untreated systems. The expected final discharge concentration would determine the need to use detoxification (either DT-1 or DT-S). During the treatment of a house service water system or circulating water system, the system discharge and final effluent to receiving waters will be tested for CT-1 residuals hourly during the first four hours of treatment while feed rates are being established. After four hours, samples will be tested once every two hours for the remainder of the treatment (6 or 12 hours).

### NALCO ACTI-BROM

Nalco Acti-Brom (also designated Nalco 1338) is a water based solution of sodium bromide and a biodispersant (surfactant). Nalco 1338 is marketed by Nalco Chemical Company (One Nalco Center, Naperville, IL 60566). The product is registered with the US-EPA for use as a molluscicide.

Nalco 1338 is used in conjunction with sodium hypochlorite to form hypobromous acid. The sodium bromide in Nalco 1338 may be fed at up to a 1:1 molar ratio of bromine to chlorine to produce hypobromous acid and bromamines as the oxidizing biocide in lieu of hypochlorous acid and chloramines from sodium hypochlorite alone. The attached article, "Chlorine Minimization with a Chlorine-Bromine-Biodispersant Mixture", discusses the chemistry of bromine in more detail. Copies of the Nalco 1338 product bulletin and Material Safety Data Sheet (with available aquatic toxicity data) are attached for reference. The existing aquatic toxicity data on hypobromous acid generated from sodium bromide includes 96 hr LC50 static acute to rainbow trout, 96 hr LC50 flow through acute and no observed effect to sheepshead minnow and 48 hr LC50 static acute and no observed effect to Daphnia magna, and 96 hr LC50 and no observed effect to bluegill sunfish. It is our understanding that additional aquatic toxicity data is being developed. When the results of this additional testing are available, we will forward copies to the MDNR.

### Application

Per vendor recommendation, control of zebra mussel veliger attachment with Nalco 1338 requires daily feed at up to 2 hr/day with a system discharge target concentration level up to 0.5 mg/L TRO (total residual oxidant). The final discharge concentration to receiving waters will be controlled at less than 0.2 mg/L TRO via comingling of the discharge from treated systems with the discharge of untreated systems or by dehalogenation with sodium sulfite ( $\text{Na}_2\text{SO}_3$ ), sodium meta bisulfite ( $\text{Na}_2\text{S}_2\text{O}_5$ ) or sodium thiosulfate ( $\text{Na}_2\text{S}_2\text{O}_3$ ) as needed. The current NPDES permit authorizes the use of dechlorination reagents at up to 1.5 times the stoichiometric amount needed for dechlorination.

Nalco 1338, described as a chlorine enhancer, will supplement existing chlorine feed. As such, the treatments will be seven days a week for up to the currently permitted chlorination discharge time instead of the current five days per week. The daily treatments may be divided up into two or three equally spaced treatments.

Currently, sodium hypochlorite is used to chlorinate the circulating water (condenser cooling) system, house service water and other auxiliary cooling water systems. These same systems will receive treatments with Nalco 1338 and sodium hypochlorite under the schedule previously described.

While using Nalco 1338, Consumers Power Company requests continuation of the permit specified chlorination time limit to allow for sequential rather than simultaneous treatment of systems. Sequential treatment will help reduce or avoid use of dehalogenation chemicals. Field experience to date with Nalco 1338 in Ohio suggests that the treatment time and TRO concentration in the system discharge can be reduced from that developed in laboratory testing. At the J R Whiting Plant on Lake Erie, Consumers Power Company plans, with MDNR approval of Nalco 1338, to evaluate alternative feed rates and treatment times aimed at reducing chlorine and bromine use. The information from the Whiting evaluation, where mussel fouling is an existing problem, will be of benefit to industry and our other facilities on Lake Michigan and Lake Huron where mussel colonies are just developing.

The amount of Nalco 1338 used per year will be a function of chlorine use and hence, chlorine demand. Similarly, the applied dosage will vary day-to-day dependent upon the chlorine feed needed to meet the system demand and provide the desired residual.

### Monitoring

Monitoring of the plant discharge streams for total residual oxidants will continue to be by existing amperometric techniques or other US-EPA accepted analytical methods. Because Nalco 1338 is a chlorine supplement we propose that sampling, testing and reporting requirements be the same as the current permit monitoring requirements for chlorination.