Agriculture
Canada

Canada

Food Production
and Inspection Branch

Direction générale,
Production et inspection des aliments

Pesticides Directorate

Direction des pesticides

Note to CAPCO C92-03

ZEBRA MUSSEL

BACKGROUND

Scientists believe that the European freshwater zebra mussel, Dreissena polymorpha, first appeared in North America in late 1985 or early 1986. It is assumed that a ship from Europe discharged fresh water ballast, containing free-floating zebra mussel larvae into Lake St. Clair. During the summer of 1988, these free-floating larvae were carried with the current, or on interlake shipping, through the Detroit River into Lake Erie. Their presence has now been confirmed in isolated pockets in all of the Great Lakes as well as in the St. Lawrence River near Cornwall.

Zebra mussels present the following threats:

1. the clogging of water intake systems;
2. the broader threat to the Great Lakes ecosystem (e.g., altering established food chains, reducing fish populations by colonizing spawning areas);
3. the impact on recreational activities (e.g. reducing beach quality due to accumulation of washed-up shells);
4. the impact on navigational activities (e.g., sinking of buoys due to this accumulated weight of zebra mussels attached to the buoy).

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Native to the Black, Caspian, and Azov Seas of eastern Europe, zebra mussels have spread across Europe during the past two centuries. In Europe, this species has an extensive history as a "bio-fouler" of municipal and industrial raw water facilities. It's establishment in North American waters presents a threat to the operation of industrial facilities using raw water, including fossil-fuelled and nuclear power stations.

The zebra mussel population has grown rapidly, because of ideal conditions in the Great Lakes, including favorable temperature regimes, abundant food supply (primarily planktonic algae), and calcium levels required for shell formation. The burgeoning population of zebra mussel has subsequently led to the fouling of water intakes. Four characteristics of the zebra mussel help it to infest raw water systems:

1. a free-floating larval stage,
2. ability of larvae to attach to hard surfaces,
3. preference for flowing-water environments, and
4. production of large numbers of eggs (35,000 per female).

Free-swimming zebra mussel larvae remain in the water column for about 10 days before settling. During this period they are easily dispersed by currents including those entering water intakes. They use tough elastic byssal threads to attach themselves to silt-free substrates including other zebra mussels. The habit of attaching to other mussels leads to the development of thick layers of mussels that block pipes and other conduits.

The most significant problems have occurred at plants using water on a once-through basis. Because of the lack of registered pest control products, zebra mussels must be physically removed. The high cost of this treatment has placed a heavy financial burden on the affected industries.

Because they can survive out of water for several days, zebra mussels can be transported on the hulls of boats from one body of water to another.

CONTROL STRATEGIES

In the spring of 1990, senior officers of the Ontario Ministry of the Environment (OME) met with representatives of the federal government to discuss means of controlling the zebra mussel, in the absence of any product registered for this purpose. OME proposed that chlorine be used to control zebra mussels during the summer of 1990 and provided the following rationale:

1. The system modification (change in injection location), required to prevent buildup of zebra mussels in intake pipes, falls within existing requirements and standards for traditional potable water application of chlorine.

2. The same mechanical and engineering design as for injection of chlorine into potable water systems would be applicable to industrial facilities. However, in these cases, an additional requirement is superimposed, i.e., effluent/return water must meet traditionally recognized and accepted environmental and water quality objectives.

3. The chlorine treatment rates in both cases would be consistent with rates for traditional potable water treatment.

4. In both cases, i.e., potable and industrial applications, the proposed use of chlorine would meet existing Ontario and federal health, environmental and aquatic objectives.

5. A regulatory regime for drinking water is already in place under the federal Food and Drugs Act. Applicable objectives would be met in both potable and industrial water.

6. A second regime exists under the Ontario Water Resources Act, which is applicable to both potable and industrial water users. Again, applicable objectives would be met for both types of water treatment facilities.

Following consultation with the Ontario Ministry of the Environment, the Ontario Ministry of Natural Resources, Agriculture Canada, Health and Welfare Canada, and Environment Canada, the use of chlorine for the control of zebra mussels was deemed to be a minor modification of the current traditional chlorine treatment of potable water. The Department of Fisheries and Oceans (DFO) did not adopt the proposal but conducted a screening pursuant to the Environmental Assessment and Review Process (EARP) Guideline Order and concluded that, due to mitigation by dechlorination or by very substantial dilution, the use of chlorine will result in insignificant fisheries effects.

Against this background, the use of chlorine to prevent buildup of zebra mussels in intake pipes for both potable and industrial water was, and still is, considered acceptable within the context of the following federal and provincial statutes:

1. Food and Drugs Act (Health and Welfare Canada)
2. Pest Control Products Act (Agriculture Canada)
3. Fisheries Act (DFO) and
4. Ontario Water Resources Act (OME).

PEST CONTROL PRODUCTS

The Pesticides Directorate of Agriculture Canada has received four applications for registration of products proposed for the control of zebra mussels. These submissions involved the use of the following chemicals individually or in combination:

- Sodium Bromide
- Alkyl dimethyl benzyl ammonium chloride, also known as ADBAC.
- poly [oxyethylene(dimethyliminio)ethylene (dimethyliminio)ethylene dichloride], also known as WSCP.
- Dodecyl guanidine hydrochloride, also known as DGH.
- B-Bromo-B-nitrostyrene.

No zebra mussel control products have been granted registration because the data provided with the applications have not been sufficient to enable a complete assessment of health and environmental concerns. Several research permits, however, have been granted to study the efficacy of various products.

Agriculture Canada has also received applications for the registration of anti-fouling paints for the control of zebra mussels in holding tanks and on the hulls of boats. These applications are under review.

Registration requirements for antifouling paints have been outlined in Trade Memorandum T-1-254 and CAPCO Notes 89-02 and 90-08. These documents are to be updated in the near future.

NATIONAL AND INTERNATIONAL IMPACT

The control of zebra mussels is not just a concern to the Canadian and Ontario governments. It is a cause for concern to other provinces and has international ramifications. This pest is not limited by international or provincial borders. The Pesticides Directorate has received requests for information from Quebec and Manitoba. As well, products registered for use in the United States may not be registered in Canada, and vice versa.

A meeting between Canadian and U.S. authorities took place in Washington in October 1990. To avoid potential duplication of effort and because of the difficulty of tracking activities, this meeting was convened to discuss programs and the possibility of establishing a coordinating mechanism. The meeting resulted in naming representatives from key federal, provincial and state departments with responsibility for natural resource management.

- The U.S. delegates were led by Dwight Mason from the State Department (Bureau of Oceans, International, Scientific and Environmental Affairs).

- DFO is the lead technical agency in Canada. The Canadian lead at the Washington meeting was Ross Glasgow, External Affairs.

This international meeting was preceded by a federal-provincial meeting which took place in September 1990 in Toronto. The purpose of this earlier meeting was to: 1) coordinate provincial and federal activities with regard to zebra mussel, 2) discuss appropriate future action and 3) determine representation at the Washington meeting. Two potential cooperative mechanisms were identified, i.e., the Great Lakes Water Quality Agreement (GLWQA) and the Great Lakes Fishery Commission (GLFC). Participants at the Toronto meeting included representatives from the federal Departments of Environment, Fisheries and Oceans, External Affairs, Agriculture and Transport (Coast Guard), as well as representatives of the Ontario provincial Ministries of Environment, Natural Resources and Industry, Trade and Technology.

The zebra mussel infestation was viewed not only as a Great Lakes problem but one with strong potential to quickly spread to other basin/water systems.

As well, the international scope of this problem has been discussed at two International (Canada, U.S.) Zebra Mussel Conferences which took place in February 1991 and 1992.

DATA REQUIREMENTS FOR PRODUCTS FOR THE CONTROL OF ZEBRA MUSSEL

No special data requirements have been developed under the Pest Control Products Act for these products. All current guidelines apply, including the following:

- Organization of data, Memoranda T-1-237, T-1-239
- Chemistry, Memoranda T-1-238, T-1-240
- Toxicology, Memorandum T-1-245
- Environmental Chemistry and Fate, Memorandum T-1-255

Canada does not yet have a guideline to cover environmental toxicology. For information on environmental toxicology data requirements, please consult Environment Canada.

Any comments or other information should be forwarded to:

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