



US Army Corps
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Waterways Experiment
Station

Zebra Mussel Research

Technical Notes

Section 2 — Control Methods

Technical Note ZMR-2-08

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Nontoxic Foul-Release Coatings for Zebra Mussel Control

Purpose The purpose of this note is to discuss the use of nontoxic foul-release materials as deterrents to zebra mussel attachment and subsequent macrofouling at public facilities.

Additional information For additional information, contact the author of this note, Mr. Tim Race, (217) 373-6769, U.S. Army Construction Engineering Research Laboratories. Dr. Ed Theriot, U.S. Army Engineer Waterways Experiment Station (WES), (601) 634-2678, is Manager of the Zebra Mussel Research Program.

Definition A nontoxic foul-release coating is a paint or other material used to prevent or weaken the attachment of zebra mussels or other macrofouling organisms. The material operates through a nontoxic mechanism.

Description Antifouling coatings typically incorporate compounds such as cuprous oxide or tributyl tin oxide which are toxic to fouling organisms. Unfortunately, these toxicants also have a negative effect on nontarget aquatic organisms. The nuclear and fossil fuel power industry has a long-standing problem with macrofouling at coastal facilities which use marine water for cooling. This industry, through the efforts of the Electric Power Research Institute, has shown an interest in nontoxic foul-release coatings.

Most nontoxic foul-release coatings and materials fall into two categories: ablative hydrophilic polymer films and low free surface energy films or materials. The ablative materials require a constant water flow past the surface which acts as a scouring mechanism to renew the surface. Low free surface energy materials prevent or reduce the strength of attachment of fouling organisms by presenting a nearly nonstick or nonadhesive surface. Successful low free surface energy products contain either silicone or fluoropolymer resins. The effectiveness of nonadhesive coatings is greatly enhanced by water flow. Water velocities in excess of 30 ft/sec (fps) will effectively remove attached fouling organisms from surfaces coated with low free surface energy coatings.

The range of water velocities needed to remove zebra mussels from surfaces coated with adhesive materials is not known. Structural components that are subject to widely varying water velocities may be good candidates for these types of materials. During periods of relatively low water velocity (less than 6 fps) settlement would occur. High water velocity events, often encountered during operation of hydraulic structures, might then clean the zebra mussels

from the surface. This shearing mechanism would be enhanced by either higher water velocities or increased surface area of the fouling layer or individual mussels.

Ablative materials are most effective at consistently high water velocities. Zebra mussel veligers are unlikely to settle and attach under these conditions. Some ablative coatings also contain a toxin such as cuprous oxide to provide protection against fouling under stagnant or low water velocity conditions.

Low free surface energy plastics are commercially available in sheets or as fabricated components. Examples of these materials are silicone rubber m-polymer and ultra high molecular weight polyethylene. These products can also incorporate an oil which exudes and further lowers the surface free energy.

Recommendations Small-diameter culverts, valves, trash racks, and other components which under normal operating conditions are subject to intermittent low and high water velocities are good candidates for protection with low surface free energy coatings and plastics. Ablative coatings without a toxin probably are not of use in controlling zebra mussels. Zebra mussels are unlikely to colonize components exposed to continuous high water velocities. The use of ablative coatings for controlling fouling organisms under conditions of variable water velocity is not well documented. Foul-release plastics could be used as protective cladding or to make fabricated components such as trash racks, ladders, small valves, pipes, and other items that are difficult to paint.

Nontoxic foul-release coatings are quite expensive, ranging from \$100 to over \$300 per gal or about \$2 to \$4 per sq ft for materials. Typical toxic antifoulants based on cuprous oxide average about \$50 per gal or roughly \$0.50 to \$1.00 per sq ft. Foul-release plastics cost about \$5 to \$10 per sq ft.

Commercially available nontoxic foul-release coatings and plastics will be evaluated in laboratory and field tests beginning in 1993 as part of this program. Further information on the effectiveness of these materials for controlling zebra mussels will be available at the conclusion of this study.