

Operational Guideline for Manitoba Water Suppliers

Office of Drinking Water

Operational Guideline ODW – OG –13

Dealing With Zebra Mussels in Drinking Water Systems

PURPOSE

This guideline has been prepared to provide public and semi-public drinking water suppliers throughout Manitoba with information on how to mitigate, control, or eliminate a potential zebra mussel infestation of water system intake structures and/or water treatment components or equipment within treatment plants.

Background

Zebra mussels are an emerging issue in Manitoba surface waters and have been found in Lake Winnipeg in 2013 and the Red River and Cedar Lake in 2015.

Zebra mussels were first discovered in North America in 1988 in Lake St. Clair that connects Lake Huron to Lake Erie. By 1990, zebra mussels were found in all the Great Lakes, except Lake Superior (where temperature, mineral composition, and food scarcity are suspected to be the limiting factors). Since then, zebra mussels have moved westward into many jurisdictions within North America, thereby illustrating their high ability to colonize freshwater ecosystems. While preventing the spread of these macrofouling mussels is a key management priority, in places where they have already colonized, there are some adaptation strategies that can be applied.

Lake Winnipeg is in the early stages of an invasion by zebra mussels – however, eradication is no longer an option. An adult zebra mussel can produce up to one million

eggs in a spawning season, resulting in rapid colonisation of invaded waterbodies.

Zebra mussels are members of the mollusc family that includes clams and oysters.

What to Look For

Immature zebra mussels, called veligers, are invisible to the naked eye. As they grow, they look like sand grains attached to hard surfaces like boats or intakes.



Microscopic zebra mussel veligers in a sample of water

Adult zebra mussels have dark black shells and white stripes. They can be up to five centimetres long but most are smaller than two centimetres in length.



Adult Zebra Mussel

Effect of Zebra Mussels on Drinking Water Utilities

Zebra mussels can clog surface water intake pipes of public or semi-public water systems, or even intake pipes in an infested river or lake serving private homes or cottages. This can cause a loss in pumping ability or obstructed valves, sometimes leading to plant shutdowns. Zebra mussels can also increase corrosion of cast iron pipes and are a safety hazard when hydrant systems are clogged and fail to deliver fire-fighting water.



A three-foot-diameter pipe clogged by zebra mussels in less than three months (U.S. Department of Energy)



Water intake pipe in Ohio (credit: City of Toledo)

Mitigation or Control of Zebra Mussel Infestations

There are several methods to control zebra mussels in water systems, including intake structures:

- **Zebra mussel resistant biostatic materials.** High-copper alloy screens, zinc-based alloys. These

control solutions use materials unattractive for colonization, and do not require authorization. It is highly advisable to use these materials for new intake screens to reduce future maintenance requirements.

- **Zebra mussel-resistant paints or coatings.** These are products such as Jacquelyn®, Prezi®, AMIAD®, ecological coatings®, or fluorinated silicone coatings, to name just a few. Products already authorized by the Pest Management Regulatory Agency (PMRA) of Health Canada should be used. Information on these products may be obtained from PMRA at the following location: (<https://www.canada.ca/en/health-canada/corporate/about-health-canada/branches-agencies/pest-management-regulatory-agency.html>)
- **Sand-bed filtration.** This involves the use of a sand filter placed over an intake to prevent colonization on metallic intake components. While no chemical products are required, authorization may be required if the filter has a significant footprint and affects aquatic habitat. Questions on this method of intake protection may be referred to the Environmental Approvals Branch (see contact information at the end of this guideline).
- **Switching to a new source.** This may include a new infiltration gallery or shoreline, horizontal or directionally drilled well adjacent to the original water source. In most cases, the Office of Drinking Water's minor alteration approval requirements would apply.
- **Prechlorination.** As discussed in more detail below, prechlorination is the most commonly-used control measure for zebra mussels in water

intake structures. The Office of Drinking Water has received PMRA authorization to use chlorine as a pesticide to combat zebra mussels under certain conditions. Manitoba drinking water systems complying with these conditions should contact the Office of Drinking Water for approval as a minor alteration to their water system. Utilities interested in using chlorine in a manner that does not comply with these conditions will have to obtain their own approval from PMRA before contacting the Office of Drinking Water.

- **Other oxidants and control products.** Products used in other jurisdictions for zebra mussel control include potassium permanganate injection, ozone feed, and copper ion injection. No authorization has been sought by Manitoba nor granted by PMRA for use of these products on zebra mussels. Utilities interested in using these products will have to obtain their own approval from PMRA before contacting the Office of Drinking Water.

Prechlorination – Manitoba Conditions for Use

On behalf of Manitoba public and semi-public water systems, the Office of Drinking Water has obtained authorization from PMRA to use chlorine as a pesticide to control zebra mussel colonization in water intake works that meet the following conditions:

1. Chlorine dosing equipment is professionally designed and supplied by manufacturers with expertise in this application so that public and operator safety and environmental protection are not compromised;
2. Chlorine will be applied a short distance from the exterior of the screen to prevent colonization on the surface of the screen, within the intake structure, and in pipes connecting the intake structure with downstream raw water supply works;

3. Chlorine is applied only when flow into the intake is occurring, to prevent the loss of chlorine to the surrounding waterbody. Therefore, chlorine application occurs only when direct pumping through the intake or downstream pumping from a wet well is occurring;
4. Chlorine is applied as sodium hypochlorite at a dosage of free residual chlorine not exceeding 5.0 mg/L at the dosing location.
5. Chlorine is applied only at water temperatures of 10°C or more.

Public or semi-public water systems complying with these requirements must notify the Office of Drinking Water and receive approval as a minor alteration to their water system. The equipment can then be installed and used.

Water system owners are encouraged to use compliant equipment so that they can take advantage of the PMRA authorization obtained by the Office of Drinking Water.

Approval Requirements

Water system owners must first obtain PMRA approval if they want to use:

- oxidants or control products other than chlorine;
- mussel-resistant paints or coatings other than those already approved by PMRA; or
- pre-chlorination in a manner that does not conform to Manitoba's conditions for use as outlined in this guideline.

Once PMRA approval is in place, water system owners should discuss approval requirements with their regional Drinking Water Officer or the Office of Drinking Water's Approval Unit (see contact information at the end of this guideline). In most cases, including a change in the water source, intake construction or alteration or pre-chlorination in a manner that conforms with Manitoba's conditions for use, a minor alteration approval will be sufficient. Some

conditions, such as enhanced disinfection by-product monitoring may apply.

Water system owners doing work on an intake or in a fish-bearing water body should contact the federal department of Fisheries and Oceans to identify any additional approval requirements that may apply.

Additional Warnings/Cautions

Water system owners should be aware that chlorine and other chemicals may be toxic to fish and other aquatic species. In all cases, the water system owner is responsible for any safety or environmental issues arising from pre-chlorination at the water intake works or any other zebra control measures taken.

Office of Drinking Water

Regional [Drinking Water Officers](#) are available for operational and monitoring advice, and to provide technical assistance. After hours, please call 204-944-4888.

For the Office of Drinking Water Approvals Unit, call 204-945-5762. For Environmental Approvals call 204-945-8321.

For more information related to Manitoba's drinking water and how it is regulated, visit: www.manitoba.ca/drinkingwater