

Operational Guideline for Manitoba Water Suppliers

Managing Manganese in Drinking Water

Purpose

This guideline has been established to ensure public and semi-public drinking water suppliers throughout the Province of Manitoba meet their regulatory requirements with regard to managing manganese in drinking water.

Guidelines for Canadian Drinking Water Quality

Health Canada established a health-based maximum acceptable concentration (MAC) for manganese and lowered the aesthetic objective (AO) for manganese in 2019.

The MAC for total manganese in drinking water is 0.12 mg/L (120 µg/L) for water entering and within the distribution system and at the consumer's tap. The MAC was established based on studies that suggest an association between manganese in drinking water and neurological effects in children.

The AO was lowered to 0.02 mg/L (20 µg/L) for treated water entering the distribution system. Manganese in drinking water is often related to discoloured water complaints. The AO of 0.02 mg/L is intended to prevent build up in the distribution system, minimize discoloured water complaints and improve consumer confidence in drinking water.

Legislation

Section 3 of The Drinking Water Safety Act states that every public and semi-public water supplier must comply with the applicable drinking water quality standards specified in the Drinking Water Quality Standards Regulation (MR 41/2007) or in the water system operating licence.

Manganese in Drinking Water

Manganese is found naturally in many groundwater sources and in some surface water sources in Manitoba. Manganese can also be added to a water supply as an oxidizing agent (potassium permanganate) or as an impurity in coagulants (ferric chloride) used in the treatment of drinking water.

The most effective treatment process depends on the form of manganese and its concentration in the source water. It is possible to lower the manganese concentration in drinking water by managing manganese levels in the source water before it enters the water treatment plant.

Test methods

Colourimetric methods are available in desktop or handheld units for routine/operational testing of total manganese in drinking water. The colourimetric method provides fast and reasonably accurate results.

Water samples collected for compliance purposes must be submitted to a laboratory for analysis. Colourimetric results are not acceptable for compliance purposes.

Based on the test results water suppliers can

- assess and optimize treatment processes;
 - plan for installation of additional treatment processes or a new water source as needed;
 - assess current distribution system practices such as flushing programs and watermain repairs;
 - develop standard operating procedures that take manganese into consideration; and
- be prepared for any necessary public communications.

Source water

Manganese levels tend to be higher in groundwater. Water systems with well-fields can alternate or blend wells that have higher concentrations with those that are lower to reduce levels overall or to maintain consistent concentrations entering the water treatment plant.

In surface water, manganese tends to precipitate out and accumulate in sediments that can be re-suspended during spring and fall turnover and high run-off events. Where there are rapid shifts in manganese concentrations in surface water, aeration or intake depth control may assist in lowering manganese levels prior to entering the plant.

Water supplies with elevated or fluctuating manganese in the raw water should test total manganese daily with a handheld unit to record and track concentrations entering the water treatment plant.

Consider submitting raw water samples to a laboratory for analysis twice a year for groundwater systems and four times a year for surface water systems to verify the handheld results.

Regular raw water monitoring allows operators to make treatment adjustments in advance of a failure that could result in treated water manganese levels higher than the AO or MAC entering the distribution system.

Treatment plant

Water systems that are actively reducing or removing manganese should be frequently monitoring manganese concentrations at various points throughout the water treatment processes to ensure effective control or removal of manganese. Where manganese concentrations fluctuate, key water treatment processes should be monitored daily.

Water systems having difficulties controlling manganese should submit samples to the laboratory to test for total, dissolved and particulate manganese following key treatment processes. This will help to assess individual treatment process performance, including oxidation and filtration processes in order to determine which process should be optimized or upgraded.

The goal of monitoring manganese throughout the treatment plant is to ensure that the treated water entering the distribution system is meeting the AO. Health Canada suggests that water systems that are well operated and optimized can achieve manganese levels as low as 0.015 mg/L entering the distribution system thus effectively managing manganese deposits and subsequent releases within the distribution system.

Treatment options and control

Determining the type and concentration of manganese in the source water is important as the effectiveness of treatment processes depends on whether the manganese is in particulate or dissolved form – or both.

Physical filtration processes such as conventional treatment or low-pressure membranes are very effective at removing particulate manganese.

The most common form of treatment used to control or remove manganese is to oxidize dissolved manganese to form a particulate then remove it through a filtration process. The addition of a coated filter media (greensand) that adsorbs dissolved manganese typically achieves higher removal rates. Bio-filtration and softening processes are also effective for controlling manganese.

Any manganese treatment and control method must consider deposition and release in the distribution system. Elevated manganese at the tap is not always associated with elevated manganese in the source water or following the treatment process.

Distribution system

Manganese levels can be very low in the treated water entering the distribution system but still precipitate and settle out within the distribution system. Sediment accumulation tends to be higher in the distribution system in areas closer to the water treatment plant.

Manganese deposits (sediment), or legacy manganese in distribution systems is easily released during hydraulic disturbances (reverse flow, depressurization), or changes in water quality (ex: pH), and can cause sporadic discoloured water events.

Manganese should be routinely monitored within the distribution system at hydrants, or public or private buildings, focusing on areas just downstream of the water treatment plant. Water suppliers with historic manganese issues should also collect water samples in response to discoloured water complaints.

Manganese, when released, may contain other metals such as iron, arsenic and lead. Consideration should be given to including other metals when testing for manganese in the distribution system.

Distribution management:

Water suppliers are encouraged to develop standard operating procedures for minimizing physical disturbances in the distribution system including:

- valve replacements, leaks and repairs;
- low flow spot flushing; and
- unidirectional flushing programs.

Comprehensive water quality monitoring programs should also be developed to ensure stable water quality throughout the distribution system.

Sequestration:

At best, the addition of a sequestrate is a temporary measure to control discoloured water events and should only be considered for use in water systems with manganese levels below the AO in the source and treated water.

Impact on lead and corrosion control:

Manganese concentration and distribution management strategies should be considered before introducing corrosion control measures as manganese deposits can disrupt the formation of stable corrosion scale and hamper efforts to reduce lead levels at consumer's taps.

Information on compliance monitoring: [ODW-OG-18 Monitoring for Manganese in Drinking Water](#).

Information on Manganese in Manitoba Water Supplies is available at:

https://www.gov.mb.ca/sd/pubs/water/drinking_water/manganese.pdf

Information on Manganese in Manitoba Well Water is available at: [Factsheets](#)

For more detailed information on manganese in drinking water visit [Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Manganese](#).

Office of Drinking Water

Regional [Drinking Water Officers](#) are available for operational and monitoring advice and to provide technical assistance.

After hours, please call the Environmental Emergency Response line at 204-944-4888 and ask for the on-call drinking water officer

For information related to Manitoba's drinking water and how it is regulated visit:

www.manitoba.ca/drinkingwater