

BEFORE THE
WASHINGTON UTILITIES & TRANSPORTATION COMMISSION

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CASCADIA WATER, LLC

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Issue Paper - Manganese in Drinking Water

Problem statement

Manganese (Mn) is a neurotoxin at high doses. Our current Mn regulations are not consistent with current public health knowledge, do not adequately protect the general population or our most vulnerable populations, and raise equity issues, with residents of small, lower-income communities more likely to receive water with high levels of Mn. Currently, ODW does not enforce nor encourage systems to meet the secondary maximum contaminant level (SMCL) of 0.05 mg/L for Mn. The current regulations allow water systems to install treatment at the water system's leaders' discretion.

Background

In 2004, EPA established a Mn drinking water lifetime health advisory level (HAL) of 0.3 mg/L.¹ The HAL is intended to be protective of lifetime exposure for the general population, and up to 10 days per year for infants up to 6 months of age, as formula-fed infants are the population most susceptible to Mn. EPA also established a HAL of 1.0 mg/L for acute exposure (one-day and 10-day) to Mn for the general population. At that time EPA established a SMCL for Mn based on staining and taste in drinking water. Although the SMCL is set 6x lower than the HAL, it doesn't necessarily protect health since the SMCL is not an enforceable standard.

Internationally, the World Health Organization has proposed a provisional health-based guidance value of 0.08 mg/L total Mn for bottle-fed infants and the general population (2021).² Health Canada has established a maximum acceptable concentration [or MAC, Canada's equivalent to a primary maximum contaminant level (MCL)] value of 0.12 mg/L for total Mn in drinking water and established an aesthetic objective of 0.02 mg/L total Mn in 2019.³

The Washington State Drinking Water Regulations list Mn as a secondary contaminant (not a health concern) with an SMCL of 0.05 mg/L.⁴ According to the source approval section of the regulations, a source not meeting the water quality standards may be approved if treatment is provided.⁵ However, the water quality follow-up section requires treatment only for new community and new nontransient noncommunity (NTNC) water systems without active consumers. All other systems may take follow-up action based on the "degree of consumer acceptance of the water quality and their willingness to bear the costs of meeting the secondary standard".⁶ How to access 'consumer acceptance' never defined.

Group A public water systems are required to monitor for Mn at a point representative of the source, after treatment, prior to the distribution system.⁷ Sentry sampling data from a three-year period (2019-2021) indicate that up to 46 community systems exceeded the 0.3 mg/L HAL. Three of them exceeded 1.0 mg/L. This data includes all source samples, not just those labeled as post-treatment, to account for sample location data integrity issues, and may overestimate the actual number of systems impacted. Roughly half of the impacted systems are small, serving no more than 100 people.

Number of community systems with 2019-21 sample results exceeding...		
0.05 mg/L	0.3 mg/L	1.0 mg/L
370	46	3

Current drinking water research^{8,9,10,11,12} indicates that:

- Mn accumulates in the distribution system, potentially at much higher levels than are present in the source water or at the distribution entry point.
- Mn can be released rapidly when distribution water quality changes. Since other metals such as lead and arsenic are easily adsorbed onto manganese sediment and pipe scale, arsenic and lead release can also occur.
- If Mn is in the dissolved form, high levels may not be visually apparent to the consumer.
- Exposure to >0.1 mg/L Mn at least once in the first 5 years of childhood can be associated with an increased risk for negative health outcomes.
- A threshold of >0.1 mg/L total Mn that is protective against negative neurodevelopmental health outcomes in bottle-fed infants has also been derived from and is supported by animal studies.

To avoid accumulation of Mn in the distribution system, industry guidance recommends water systems treat source water to limit the distribution entry point concentration to less than 0.02 mg/L.^{13,14} (This is Health Canada’s aesthetic objective level.)

Options/Solutions

1. Change the drinking water regulations to require all sources to meet the existing SMCL for total Mn (0.05 mg/L). This could be achieved by striking the two last sentences of 320(3)(d) (see below). Phase-in implementation by requiring all new sources to meet the SMCL.
2. Encourage systems that treat for Mn to strive for an entry point residual <0.02 mg/L Mn. Use lessons learned from our successful arsenic treatment optimization program (ATOP) to provide technical assistance.
3. Use our existing authority under the public notification rule¹⁵ to require systems that exceed acute Mn levels (0.3 mg/L for infants, 1.0 mg/L for general population) to issue a “do not use” advisory to their customers.
4. Develop a state primary MCL with comprehensive monitoring, public notification, and treatment monitoring and reporting requirements.

ETS Recommendation

Our current regulations around Mn do not provide adequate public health protection and raise equity issues around equal access to safe drinking water for communities of all income levels.

1. Implement options 1, 2, and 3 as quickly as possible.
 - a) Initiate WAC 246-290-320(3)(d) change.

- b) Prepare a fact sheet explaining the benefits of achieving a Mn treatment goal of 0.02 mg/L for use by both water systems and ODW staff. Send the fact sheet to systems treating for Mn and provide ODW staff with training on manganese treatment optimization. ODW staff advocate that Mn is a health issue and should be treated accordingly. Reminder infants are most vulnerable.
 - c) Develop a program to enact PN requirement for high Mn levels, including procedures, trigger-levels and standard language.
2. Initiate process toward creating primary MCL for Manganese.

EMT Decision July 2023

Begin implementation of all 4 options. WAC changes under #1 and #4 will take extended time. All other options should be initiated as soon as practical. (See email July 18, 2023, from Holly Myers to Deem, Feagin, Johnson).

Potential WAC Change

WAC 246-290-320(3)(d) The purveyor of any public water system providing service that has secondary inorganic MCL exceedances shall take follow-up action as required by the department. ~~Follow-up action shall be commensurate with the degree of consumer acceptance of the water quality and their willingness to bear the costs of meeting the secondary standard. For new community water systems and new nontransient noncommunity water systems without active consumers, treatment for secondary contaminant MCL exceedances will be required.~~

References

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- ¹ EPA. 2004. *Drinking Water Health Advisory for Manganese*. EPA-822-R-04-003. Washington, DC: U.S. Environmental Protection Agency.
 - ² [World Health Organization, Manganese in Drinking Water, 2021.](#)
 - ³ [Health Canada, Guidelines for Canadian Drinking Water Quality: Guideline Technical Document-Manganese, 2019.](#)
 - ⁴ [WAC 246-290-310 \(3\)](#)
 - ⁵ [WAC 246-290-130 \(4\)\(g\) & \(h\)](#)
 - ⁶ [WAC 246-290-320 \(3\)\(d\)](#)
 - ⁷ [WAC 246-290-300 \(Table 4\)](#)
 - ⁸ Hill (2022) [Beware of Legacy Manganese Issues in Distribution Systems](#), AWWA Opflow.
 - ⁹ Brandhuber (2013) Legacy of Manganese Accumulation in Water Systems, AWWA Research Foundation
 - ¹⁰ During AWOP Distribution System Optimization workshop in Rimrock, ID (2019) drinking water staff measured distribution manganese levels from 0.3 to 1.5 mg/L. Free chlorine residuals measured using the DPD method increased in the distribution system.
 - ¹¹ Schullehner (2020) Exposure to Manganese in Drinking Water during Childhood and Association with Attention-Deficit Hyperactivity Disorder: A Nationwide Cohort Study, Environmental Health Perspectives.
 - ¹² Minnesota Department of Health. 2020. Toxicological summary of manganese. Health Based Guidance for Water Health Risk Assessment Unit, Environmental Health Division.
 - ¹³ Kohl and Medlar (2006) Occurrence of Manganese in Drinking Water and Manganese Control, #91147 AWWA. S:\EPH\DW\Share\Library_ODW_Files\AwwaRF and WRF\Electronic Reports - AwwaRF and Water Research Foundation
 - ¹⁴ [Water System Design Manual \(331-123\)](#), section 10.2.6.3

¹⁵ Other violations or situations with significant potential to have serious adverse effects on human health as a result of short-term exposure, as determined by the primacy agency either in its regulations or on a case-by-case basis. [40 CFR 141.202\(a\)\(9\)](#), adopted by reference in WAC 246-290-71001