State Water Resources Control Board
Division of Drinking Water

TO: Kristina Thayer, Ph.D., Director
Office of Environmental Health Hazard Assessment

Kimberly Gettmann, Ph.D., Deputy Director for Scientific Programs
Office of Environmental health Hazard Assessment

FROM: Darrin Polhemus, P.E.
Deputy Director
DIVISION OF DRINKING WATER
State Water Resources Control Board

DATE: June 2, 2026

SUBJECT: REQUEST TO ESTABLISH PUBLIC HEALTH GOAL FOR MANGANESE

Manganese is a naturally occurring element that can be found in the air, soil, and water, and is an essential nutrient for humans and animals. Adverse health effects can be caused by either inadequate intake or over exposure. Manganese deficiency in humans is thought to be rare because manganese is present in many foods and available as a dietary supplement.

The Food and Nutrition Board at the National Academies of Sciences, Engineering, and Medicine has developed Dietary Reference Intake recommendations for manganese and tolerable upper limits (UL) for people in various age groups (US Institute of Medicine, 2006). It is worth noting that for infants in the age group of 0–12 months a UL could not be established. In contrast, the United States Food and Drug Administration (USFDA) has established nutritional requirements for infant formulas which include a minimum manganese concentration of 5 micrograms per 100 kilocalorie (5 ug/100 kcal).

The Agency for Toxic Substances & Disease Registry (ATSDR), the United States Environmental Protection Agency (USEPA), and the World Health Organization (WHO) have found that high levels of exposure to manganese can pose a neurotoxic risk (ATSDR, 2012; USEPA, 2004; WHO, 2021). For example, neurologic damage characterized as mental and emotional disturbances, as well as a movement disorder (a syndrome referred to as "manganism") has been reported to be permanent among manganese miners and other workers exposed to high levels of airborne manganese for long periods of time. Lower chronic exposures in the workplace resulted in decrements in certain motor skills, balance, and coordination, as well as increased memory loss, anxiety, and sleeplessness (ATSDR, 2012). Young children are particularly susceptible

to the possible health effects from manganese exposure because they absorb and/or retain more manganese than adults (ATSDR, 2012; USEPA, 2004)

USEPA established a manganese health advisory (HA) level of 0.3 mg/L (USEPA, 2004) for children 0 – 6 months old, and similarly, WHO, developed a manganese health guideline level of 0.4 mg/L (WHO, 2004).

In 2003, the California Department of Public Health's Drinking Water Program, now the State Water Resources Control Board's Division of Drinking Water, established a manganese notification level of 0.5 mg/L.

Currently, California regulates manganese in community water systems with a 0.05 mg/L secondary maximum contaminant level (MCL), a standard established to address issues of aesthetics (discoloration) rather than health concerns.

There are several agencies that have developed guidance for exposure to manganese in drinking water. In 2018, Minnesota's Department of Health established a short-term Health Based Value (HBV) of 100 ug/L (0.1 mg/L) for manganese. This value was intended to protect bottle-fed infants less than one year of age, the most sensitive population. In 2019, Health Canada developed a maximum acceptable concentration (MAC) of 0.12 mg/L (120 µg/L), based on infants, the most sensitive population. In 2021, the World Health Organization established a provisional health-based guideline value (pGV) of 0.08 mg/L for manganese, specifically for bottle-fed infants.

Recent research on manganese prompted the Division of Drinking Water (DDW) to re-examine the 2003 health-based notification level. DDW's risk assessment identified that the vulnerable population is infants and young children. DDW staff derived a health protective concentration (HPC) of 0.02 mg/L for total manganese in drinking water (Miguelino, 2022). DDW staff consulted with the Office of Environmental Health Hazard Assessment (OEHHA) for concurrence on the HPC methodology, specifically the relative source contribution (RSC) from drinking water given that federal law requires infant formulas to include a minimum concentration of manganese. While all risk assessments from the other agencies applied a drinking water RSC of 50%, OEHHA concurred that since there is a significant manganese exposure from infant formula, DDW's drinking water RSC of 20% was appropriate. In June 2026, DDW used the HPC as the basis for revising notification and response levels for manganese to 0.05 mg/L and 0.20 mg/L, respectively.

Based on occurrence data gathered from September 25, 2020 to September 25, 2025, there have been over 114,000 manganese results reported to the Safe Drinking Water Information System (SDWIS). Of these results, there were over 35,000 reported detections that had concentration greater than 0.02 mg/L, and they represent 3,326 unique sample points belonging to 1,467 public water systems. Community water systems that exceed a running annual average of 0.05 mg/L of manganese in drinking water should be treating their sources to remove manganese to comply with the secondary MCL. There are some community water systems that have been granted

waivers to allow exceedance of no greater than 150 µg/L. DDW's March 2026 revision to the manganese notification and response levels cancels applicability of manganese secondary MCL waivers in accordance with California Code of Regulations, title 22, division 4, chapter 15, section 64449.2, which prohibits waivers for source water quality above the notification level. All community water systems will be required to comply with the secondary MCL monitoring, public notice, and treatment requirements.

California has a policy to ensure that water delivered by public water systems is pure, wholesome, and potable. In the interim, a notification level can offer some public health benefit, but establishing a primary (*i.e.*, health-based) MCL for manganese has become a priority for DDW.

Health and Safety Code §116365(a) requires an MCL to be established at a level as close to its Public Health Goal (PHG) as is technologically and economically feasible, placing primary emphasis on the protection of public health. The State Water Board hereby requests that OEHHA establish a PHG for manganese so that the manganese MCL rulemaking work may proceed.

References

- Agency for Toxic Substances and Disease Registry (ATSDR). (2012). Toxicological Profile for Manganese. http://www.atsdr.cdc.gov/toxprofiles/tp151.pdf
- Health Canada, 2019. Guidelines for Canadian Drinking Water Quality. Guidelines for Canadian Drinking Water Quality. http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/index-eng.php#tech_doc
- Institute of Medicine. 2006. Dietary Reference Intakes: The Essential Guide to Nutrient Requirements. Washington, DC: The National Academies Press. https://doi.org/10.17226/11537
- Miguelino, E. (Division of Drinking Water, State Water Resources Control Board), 2022. Recommendation for revised notification and response levels for manganese. California State Water Resources Control Board, Sacramento. https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/manganese-nl-rl-technical-memo-20220406.pdf
- MDH (Minnesota Department of Health), 2020. Toxicological Summary for Manganese, Health Based Guidance for Water Health Risk Assessment Unit, Environmental Health Division, Minnesota Department of Health, St. Paul, MN.
- USEPA, 2004, Drinking Water Health Advisory for Manganese, January 2004. https://www.epa.gov/sites/default/files/2014-09/documents/support_cc1_magnese_dwreport_0.pdf

- U.S. Food and Drug Administration. (2015). Nutrient specifications. *Code of Federal Regulations, Title 21, Part 107.100*. https://www.ecfr.gov/current/title-21/chapter-I/subchapter-B/part-107/subpart-D/section-107.100

- WHO, 2004, Manganese in Drinking-water, Background document for development of WHO Guidelines for Drinking-water Quality.

- WHO, 2021, Manganese in Drinking-water, Background document for development of WHO Guidelines for Drinking-water Quality, https://www.who.int/publications/i/item/WHO-HEP-ECH-WSH-2021.5

cc:

Christopher Banks, Ph.D., OEHHA
David Edwards, Ph.D., OEHHA
Robert Brownwood, P.E., SWRCB- DDW
Dan Newton, P.E., SWRCB- DDW
Michelle Frederick, P.E., SWRCB- DDW
Sean McCarthy, P.E., SWRCB- DDW
Randy Barnard, P.E., SWRCB- DDW
Melissa Hall, P.E., SWRCB- DDW
Lawrence Sanchez, P.E., SWRCB- DDW
Eric Miguelino, M.D., SWRCB- DDW
Feng Xu, Ph.D., SWRCB- DDW