

## **Advancing the Science of Water Managing Manganese**

Manganese is an element that occurs naturally in water, soil, air, and food, and can be found in North American ground and surface water supplies. Manganese is an essential nutrient for humans, but overexposure may be linked to health issues. Ingestion from drinking water is assumed to represent a small proportion of total intake; however, manganese intake from water may have more negative effects than intake from other sources. Manganese chemistry, treatment, and impacts can be very complex. Typically, utilities have problems with manganese when they experience concentrations spikes and are not prepared to treat it. Conversely, utilities that have consistently higher levels of manganese usually have an effective treatment plan. Water utilities have historically managed manganese because of its potential to cause aesthetic issues such as black water events, unpleasant tastes and odors, and laundry staining, as well as its tendency to accumulate in distribution systems and cause operational problems.

### **Regulatory Update**

Manganese in drinking water is not regulated, but there is a non-enforceable limit of 0.05 mg/L suggested in the USEPA's National Secondary Drinking Water Regulations. Many state and international agencies have issued regulatory guidelines or limits for manganese in drinking water. Connecticut and California have set a health based limit of 0.5 mg/L, 10 times the secondary standard.

### **Treating Manganese**

Manganese can be removed or controlled using a variety of treatment techniques. Each has advantages and disadvantages depending on the level of manganese present, other water quality parameters, competing treatment objectives, and treatment's role in the utility's overall manganese control strategy. In situ treatment, biological treatment, chemical oxidation, oxide-coated media, physical separation, ion exchange, precipitation, and sequestration are common manganese control techniques. Even if utilities remove most of the manganese from their source water, substantial manganese accumulation can still occur in the distribution system. Stabilizing water chemistry and flushing pipes may help prevent and remove pipe scales.

## **Research on Manganese**

The Foundation has conducted numerous studies that utilities can draw upon to address manganese control and removal:

### ***Overview Projects***

- Occurrence of Manganese in Drinking Water and Benefits of Enhanced Manganese Control ([Project #2863/Order 91147](#))
- Legacy of Manganese Accumulation in Water Systems: Assessment, Consequence, Remediation, and Prevention (Project #4314, This project was recently awarded and is expected to be completed in 2013)

### ***Treatment Specific Projects***

- Occurrence, Impacts, and Removal of Manganese in Biofiltration Processes ([Project #4021](#))(In progress, to be published in 2011)
- Characterization and Performance of Filter Media for Manganese Control ([Project #2951/Order #91215](#))
- Advanced Processes for Simultaneous Arsenic and Manganese Removal ([Project #2748/Order #91091](#))
- Removal of Soluble Manganese From Water By Oxide-Coated Filter Media/ Oxidants for the Removal of Soluble Iron and Manganese ([Project #306/Order #90557/90573](#))
- Sequestering Methods of Iron and Manganese Treatment ([Project #229/Order #90558](#))
- Manganese Treatment by the Addition of Sodium Silicate and Sodium Hypochlorite ([Project #60/Order #90511](#))

### ***Related WaterRF Projects***

- Assessment of Inorganics Accumulation in Drinking Water System Scales and Sediments ([Project/Order #3118](#))
- Establishing Site-Specific Flushing Velocities ([Project #2606/Order 90964F](#))

### ***Other Related Documents***

- Connecticut Department of Public Health fact sheet on manganese in drinking water [http://www.ct.gov/dph/lib/dph/drinking\\_water/pdf/manganese.pdf](http://www.ct.gov/dph/lib/dph/drinking_water/pdf/manganese.pdf)
- USEPA guidance on the Secondary Drinking Water Regulations <http://water.epa.gov/drink/contaminants/secondarystandards.cfm>
- World Health Organization document on manganese in drinking water [http://www.who.int/water\\_sanitation\\_health/dwq/chemicals/manganese.pdf](http://www.who.int/water_sanitation_health/dwq/chemicals/manganese.pdf)