

## Iron and Manganese Control

### Technical Information

Iron and manganese are common problems associated with potable water treatment. Oxidation of iron and manganese with chlorine dioxide offers utilities a simple solution, without compromising regulatory compliance.

- Broad spectrum antimicrobial activity
- Effective over a wide pH range
- 2.6 times the oxidizing capacity of chlorine
- Does not chlorinate or form halogenated disinfection by-products (DBPs)

Chlorine dioxide offers a realistic solution to intermittent or year-round iron and manganese problems. Iron and manganese concerns affect more water systems than almost any other water quality issue and are the root cause of most customer complaints received by water treatment facilities. The United States Environmental Protection Agency (U.S. EPA) established secondary maximum contaminant levels (SMCLs) for iron at 0.3 mg/L and for manganese at 0.05 mg/L. These guidelines correspond to approximate concentrations at which iron and manganese will not cause aesthetic problems, such as colored water, turbidity, staining, and bad taste, that would impact public acceptance. EPA has also issued a manganese health advisory at the 0.05 mg/L SMCL, where potential chronic health concerns at or below this level are unlikely to occur. SMCLs are monitored and regulated at the state level and are not federally enforceable.

Regulations, such as the Stage One and Stage Two Disinfectant and Disinfection By-Product (DBP) Rules limiting trihalomethane (THM) and haloacetic acid (HAA) levels, have

### Easy Solution

Chlorine dioxide when dosed properly, instantaneously reacts with soluble iron Fe(II) and manganese Mn(II) to form insoluble Fe(III) and Mn(III,IV) precipitates that are easily removed by filtration.

### Versatile Disinfectant

Chlorine dioxide's use is not limited to just iron and manganese problems in potable water systems. This versatile disinfectant also can be used as a primary disinfectant in potable water, as it reduces or controls bacteria, viruses, cysts, and algae, while being effective over wide temperature and pH ranges. Using chlorine dioxide will help optimize overall treatment efficiencies, including improved coagulation, reduced turbidities, improved particulate removals, increased CT values, and lower THM and HAA levels.

Chlorine dioxide, when used as an oxidant for iron and manganese reduction in potable water treatment, is a powerful oxidant with CT values second only to ozone in biocidal efficacy, but without the high capital expenditures or ozonation by-products. In addition, chlorine dioxide does not have the solids loading problem and the lengthy detention times associated with potassium permanganate. Using chlorine dioxide minimizes the formation of chlorinated or brominated disinfection by-products, such as THMs or HAAs. A reduction by-product of chlorine dioxide is chlorite ion, which is regulated under the Stage One and Stage Two DBP Rules at 1.0 mg/L maximum contaminant level (MCL). At typical dosage rates, chlorine dioxide can be used successfully to help control iron and manganese problems, without exceeding the MCL.



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## Stoichiometric Reactions

Chlorine dioxide's stoichiometric oxidation reactions with iron and manganese are:

- 1.2 mg/L ClO<sub>2</sub> to 1.0 mg/L Iron
- 2.5 mg/L ClO<sub>2</sub> to 1.0 mg/L Manganese

## Low Capital/Easily Implemented

Chlorine dioxide cannot be compressed and shipped in a container and must be generated on-site. An ADOX™ on-site generator produces chlorine dioxide solution under vacuum and delivers the solution to the point of application. Chlorine dioxide is fed similarly to existing chlorine disinfection treatment systems, often using the existing feed piping. The ADOX™ generators use ERCOPure™ sodium chlorite as the precursor solution to chlorine dioxide, which is available from International Dioxide. There are numerous types of affordable generators available from International Dioxide that can be quickly deployed to meet your treatment needs.

## Additional Uses

Chlorine dioxide's broad spectrum capabilities enable it to be used in a variety of potable water applications:

- Taste and Odor Control
- THM and HAA Control
- Color and Algae Control
- Cryptosporidium Control
- Nitrification Control
- Zebra Mussel Control
- Improved Disinfection Credits (C x T)

**Health and Safety Information:** Appropriate literature has been assembled which provides information concerning the health and safety precautions that must be observed when handling the International Dioxide, Inc. products mentioned in this publication. For materials mentioned which are not International Dioxide, Inc. products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be followed. Before working with any of these products, you must read and become familiar with the available information on their hazards, proper use, and handling. This cannot be overemphasized. Information is available in several forms, e.g., safety data sheets and product labels. Consult your International Dioxide representative or contact the International Dioxide, Inc. Regulatory Affairs Representative.

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Note: The information contained in this publication is current as of July 2019. Please contact International Dioxide, Inc. to determine if this publication has been revised.

## Oxidation of Ferrous Iron by Chlorine Dioxide, pH 5.5 at 2° C (36 °F)

Stoichiometric, %	Reaction Time, sec	Residual Iron, mg/L
125	0	1.98
125	5	0.13
125	10	0.12
250	0	1.63
250	2-3	0.16
250	10	0.11

## Information Available

International Dioxide, a division of ERCO Worldwide, has specialized in chlorine dioxide technologies for over 70 years, and is a leading supplier of sodium chlorite solutions and generator technology for a wide variety of markets. For additional information please contact the sales office at 1-800-477-6071 or online at [idiclo2.com](http://idiclo2.com).



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