

# Chlorine Dioxide

## NITRIFICATION CONTROL

**Nitrification excursions in the distribution system are controlled by the use of chlorine dioxide. Chlorine dioxide offers utilities a simple solution to nitrification excursions without compromising regulatory compliance.**



Many potable water plants are switching to chloramines as a means of staying in compliance with the Stage 1 and the Stage 2 Disinfectant and Disinfection Byproduct (DPB) Rules. Chloramination is commonly used for secondary disinfection purposes to control microbial growth in finished water. Chloramine use is expected to increase two fold in the near future as a result of the new Stage 2 DBP Rule.

Nitrification is a microbial process by which reduced nitrogen compounds, which are mainly ammonia, are sequentially oxidized to nitrite and nitrate. The root cause for nitrification is usually the combination of excess free ammonia as a substrate to nitrifying bacteria and long detention times in the distribution system. Nitrification episodes usually result in adverse water quality problems like decreases in alkalinity, pH and dissolved oxygen, as well as depleting chloramine residuals and the promotion of bacterial re-growth in the distribution system.

Nitrification mitigation techniques like flushing, break-point chlorination, or switching to free chlorine are all strategies that have been used successfully but can result in compliance problems. Chlorine dioxide or sodium chlorite fed in low dosages has been shown to be very effective at controlling nitrification episodes while maintaining compliance with DBP Rules.

### Easy Solution

Chlorine dioxide does not react with ammonia and is fully available to oxidize ammonia and nitrogen oxidizing bacteria (AOB & NOB). This selective chemistry will retain its full capacity without having to overcome any ammonia-related demand, allowing it to be fed at extremely low dosages. The use of chlorine dioxide allows the utility to continue to feed chloramines for residual microbial protection while still achieving the intended DBP compliance.

Additionally, the reduction byproduct of chlorine dioxide is chlorite ion, which has been proven to inhibit AOB and NOB in the distribution system. This would allow a facility to utilize chlorine dioxide for a number of disinfection or oxidative purposes on the raw water along with the benefits of nitrification control from the byproduct chlorite ion in the distribution system

### Versatile Disinfectant

Chlorine dioxide's use is not limited to nitrification control 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 trihalomethanes (THMs) and haloacetic acids (HAAs).

Chlorine dioxide is a powerful oxidant with CT values second only to ozone in biocidal efficacy, but without the high capital expenditures and the ozonation byproducts. In addition, chlorine dioxide does not have the solids loading problem and the lengthy detention times associated with potassium permanganate. Using chlorine dioxide does not result in the formation of chlorinated or brominated disinfection byproducts like THMs or HAAs. A reduction byproduct of chlorine dioxide is chlorite ion, which is regulated under the Stage One and the Stage Two Disinfectant and Disinfection Byproduct (DBP) Rules at 1.0 mg/L maximum contaminant level (MCL). At typical dosage rates, chlorine dioxide can be used successfully to help control nitrification problems without exceeding the MCL.

- **Broad spectrum antimicrobial activity**
- **Effective over a wide pH range**
- **2.6 times the oxidizing capacity of chlorine**
- **Does not chlorinate or form halogenated DBPs**
- **Selective chemistry; no reaction with ammonia**
- **Easily implemented and fed to system**
- **Not temperature sensitive**
- **Residuals easily analyzed**
- **Bacteria, protozoa & virus inactivation**
- **Cost effective alternative**



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### Low Capital / Easily Implemented

Chlorine dioxide cannot be shipped in a drum and must be generated on-site. An International Dioxide, Inc. (IDI), OXYCHLOR® on-site generator produces chlorine dioxide solution safely 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 OXYCHLOR® generators use ADOX® sodium chlorite as the precursor solution to chlorine dioxide, which is available from IDI. There are numerous types of affordable generators available from IDI that can normally be installed in 1 - 2 days 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:

- Iron and Manganese Oxidation
- Improved Disinfection Credits (C x T)
- Trihalomethane (THMs) and Haloacetic Acids (HAAs) Control
- Color Removal and Algae Control
- Taste & Odor Control
- Cryptosporidium Inactivation
- Zebra Mussel Control

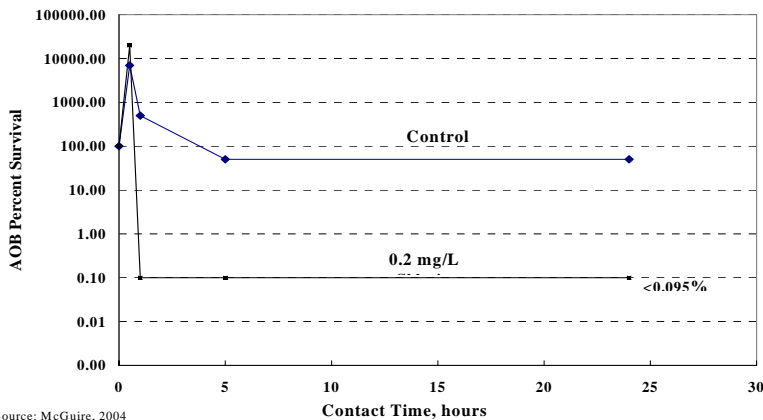
### Approvals

The use of chlorine dioxide is approved by U.S. EPA's Office of Ground Water and Drinking Water. The ADOX® sodium chlorite precursor solutions carry U.S. EPA registrations and are ANSI/NSF Standard 60 Drinking Water Additive certified.

### Information Available

International Dioxide, Inc., a DuPont Company, is a world-leading provider of chlorine dioxide products and related technology for disinfecting, sanitizing and odor control applications. IDI has specialized in chlorine dioxide technologies for over 60 years and is a leading supplier of chlorine dioxide technologies for a wide variety of markets. For additional information about International Dioxide's OXYCHLOR® chlorine dioxide generator systems and ADOX® sodium chlorite precursor solutions, please contact IDI's sales office.

Survival of AOB as Affected by Chlorite Ion



Source: McGuire, 2004

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