

CHLORINE DIOXIDE AND BYPRODUCTS IN DRINKING WATER

A FACT SHEET FOR RENAL DIALYSIS WATER SUPPLIERS

California Department of Health Services
Drinking Water Technical Programs Branch
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What is chlorine dioxide? Chlorine dioxide (ClO_2) is a chemical used in drinking water treatment for disinfection, taste and odor control, algae control, disinfection byproduct (DBP) control, and iron and manganese removal.

Chlorine dioxide has been used safely in the US and Europe for many years. Water treated with chlorine dioxide is safe for bathing, drinking, cooking and all other everyday uses for water. Kidney dialysis patients may need to take extra precautions.

Why haven't we heard of chlorine dioxide before? California limited chlorine dioxide use while the US Environmental Protection Agency (USEPA) conducted additional research on its health effects. In December 1998, the USEPA set safe levels for chlorine dioxide and its byproducts in drinking water. California now allows chlorine dioxide use and requires conformance with the safe levels specified by the USEPA.

Does chlorine dioxide form any byproducts? Chlorine dioxide disappears fairly rapidly once applied to water and is converted primarily to chlorite (ClO_2^-). The USEPA has set safe levels for both chlorine dioxide and chlorite in drinking water.

What levels are safe in drinking water? The maximum allowable levels in drinking water are 1.0 mg/L for chlorite and 0.8 mg/L for chlorine dioxide. Water suppliers should not serve water if the levels exceed these limits.

Why should kidney dialysis patients take extra precautions? In the dialysis process, water comes in contact with the blood across a permeable membrane and might pose a risk if the water is not properly treated to remove residual disinfectants (including chlorine and chloramines) prior to dialysis. Though no adverse effects have been reported by dialysis clinics using potable water treated with ClO_2 , some health effects studies with

levels significantly above the maximum allowable limit in drinking water indicate chlorite may have adverse effects on red blood cells.

What treatment is recommended at dialysis facilities? The dual-bed granular activated carbon (GAC) required for chloramine control will remove a large percentage of chlorite, though removal may not be complete. For additional removal, DHS recommends that reverse osmosis (RO) be used following the GAC.

Do I still need to monitor for chlorine and chloramines? Yes, it is *extremely* important that dialysis facilities continue to monitor for chloramines and chlorine. Both of these disinfectants may be used in addition to chlorine dioxide. More importantly, the health risks of chloramines and chlorine are believed to be orders of magnitude higher than chlorite.

Can DPD test kits be used for chlorite monitoring? The DPD test kit must still be used for chlorine and chloramine detection, but it is not appropriate for chlorite detection. No simple field test is currently available specifically for chlorite detection. For a minimal cost (approx. \$50), samples can be sent to a lab and analyzed using USEPA method 300.0 or 300.1 (ion chromatography). Standard method 4500- ClO_2^- E (amperometric titration) has also been approved by the USEPA for chlorite analysis.

The California Department of Health Services (DHS) recognizes that selection of the most appropriate water treatment technique is a site-specific decision. As such, this guidance should be used solely as an information source to assist in the selection of appropriate technologies and to meet the specific goals of the dialysis treatment facility.

**SUMMARY OF DISINFECTANT RESIDUAL TREATMENT AND MONITORING
FOR DIALYSIS FACILITIES**

	Free chlorine	Chloramines	Chlorite
Drinking water limit	4.0 mg/L	4.0 mg/L	1.0 mg/L
Limits in dialysate	0.5 mg/L	0.1 mg/L	No AAMI limit
Treatment¹	Two GAC filters in series, each with 5 min empty bed contact time (EBCT)		Two GAC filters in series, each with 5 min EBCT + Reverse Osmosis (RO)
Testing frequency	Each shift		As circumstances warrant
Testing site(s)	Between carbon tanks #1 and #2		From common source where water enters dialysate supply system
Approved testing methods²	On site with DPD test kit		USEPA Method 300.0 and 300.1 (ion chromatography) Standard Method 4500-ClO ₂ E (amperometric titration)

¹ Since GAC usage rates for chlorite may be higher than for free chlorine or chloramines and may vary depending on the carbon source, dialysis clinics should obtain guidance from the GAC supplier to establish proper replacement frequencies.

² The analytical methods for chlorite require trained analysts and specialized equipment, unlike the simplified N,N-diethyl-p-phenylenediamine (DPD) test kit used for chlorine and chloramine detection. Since a simple field test is not available, DHS suggests dialysis facilities confer with their water supplier for information on the residual chlorine dioxide and chlorite concentrations entering the distribution system, in addition to analyzing samples from the dialysis facility.

References

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