

Chlorine Dioxide Application Guide

Common Uses and P.P.M. General Reference Guide

This chart is for general reference only. Some applications such as commercial water applications may require a different ppm or CT time depending on the specific application, amount of contamination, and microbes being targeted.

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APPLICATION	PPM	CT	USE AREAS	TREATMENT APPLICATION
Sanitizer for Hard Surfaces	15	5 Min	Previously cleaned utensils Food Preparation Areas Cutting Boards Beverage Dispensers Food Processing Equipment Beer Processing Equipment Food Conveyor Belts	Solution prepared and sprayed onto the desired surface. The sprayed solution is allowed to sit for 15 minutes and then wiped cleaned. For large surfaces ClO ₂ gas can reach unhealthy levels requiring a respirator or ventilation.
Disinfection for Hard Surfaces	30 50 100 150	50 min 30 min 15 min 10 min	Hard Surfaces in: Hotels Factories Hospitals Sick Rooms Ships Schools Clean Rooms Any other contaminated areas	Prepared solutions are used for floor wash, spray downs and equipment/part soaks. Solutions of this strength have a strong odor and should be applied by trained techs or with proper PPE and instructions.
Disinfectant for Clean, in place, Potable Water Systems	10 20 50 100	100 min 50 min 20 min 10 min	Use to disinfect lines in fountain drink, or any other beverage preparation, transfer, or storage device.	Circulate solution through lines and fittings for prescribed length of time. Recirculated systems can be dosed at their holding tanks and run through the system back to the tank Single Pass system requires dosing the water proportional to flow to achieve the desired dosage for the prescribed time frame. Water must be drained and flushed prior to being used for consumption.
Anti Microbial and General Cleaner non-potable water systems in Horticulture Applications	5	N/A	Reduces Microbial Activity in non-potable water used for cut flower, prevents microbial transfer from water to flower, Extends shelf life of Cut Flowers.	Dose added using PV's or Pure3000 to treat a small tank/container

APPLICATION	PPM	CT	USE AREAS	TREATMENT APPLICATION
Disinfectant, Sanitizer, Algaecide, for Horticulture and Greenhouse non-potable water storage and systems	50	20 Min	Disinfect	Disinfection and Sanitization levels will have a strong ClO ₂ odor and require ventilation and PPE to administer. Maintaining levels at 0.25 to 0.5 will clean and prevent infection continuously.
	100	10 Min	Disinfect	
	20	5 Min	Sanitize	
	50	12 Hours	Treat, control, prevent	
	.25	continuous	Prevent and inhibit re-growth	
Fruit and Vegetable wash to extend freshness	5	1 minute	Reduces Micro Organisms and Spoilage	Spray or Dip, Follow with rinsing, blanching, canning, or cooking
Poultry Processing	3	Continuous	Reduces Micro Organisms and Spoilage	Chill water at no more than 3ppm Processing water may leave no more than 3ppm residual.
Potable Water Treatment	1.0* 0.5	Continuous dose residual	Controls Microbial activity Oxidant Disinfectant * variable due to conditions	Requires monitoring of ClO ₂ levels. Max ClO ₂ Residual 0.8ppm Max Chlorite Residual 1.0ppm
Wastewater	5*	Continuous residual	Oxidizes and Deodorizes Reduces COD and BOD	Typically dosed at waste water collection tank. Batch or continuous process. Continuous process typically requires residual monitoring.
Cooling Towers	0.5-2	Slug Dose Residual	Microbial and Bacterial control Biofilm remove/prevention	Dosed to basin to achieve the target residual in the return water to the tower. Dosage based on flow not water volume. 1-4hrs treatments 1-4 times per day.
Chilled Water Loops	0.25 to 1.0	Continuous residual	Microbial and Bacterial control Biofilm remove/prevention	Dosed to circulating line periodically to maintain residual at target level. Dosage based on system water volume not circulation rate Typically, levels are checked daily and ClO ₂ added as needed.

This chart is a work in progress.

This chart is representative of the amounts of chlorine dioxide known to be used for applications based on product information, EPA, and FDA reports.

Although we believe this chart to be accurate to the best of our knowledge, we make no guarantees.

*Some applications may require adjustment to PPM and CT due to conditions such as contamination level, and type of pathogen targeted

APPLICATION METHODOLOGY

Potable Water Systems

1) Facility Cold Water

a. Flowpacing

- i. Most facilities use city or well water which is supplied via a pressurized line at a variable flowrate. The water must be treated on demand. This requires a flow signal and a system capable of dosing ClO₂ accurately and proportional to flow.

1. HP systems

- a. Treats up to ~2000gpm flowrates (3 million GPD)

2. Pure2 and Pure3 Systems w/ batch tank and distribution pump

- a. Treats up to ~7000gpm flowrates (10 million GPD)

ii. Levels can be checked manually daily to ensure ClO₂ levels are within Spec

iii. In-line residual monitors are used in most hospitals and food processing facilities.

1. Tied to alarms for low levels and as a secondary safety system to deactivate dosing pumps if levels exceed allowable limits.

b. Residual Control

- i. Typically used when a facility has a water holding tank. The tank as a circulation line with residual monitor and ClO₂ is dosed to maintain a residual range (Typically 0.3 to 0.6ppm).

1. HP systems

- a. Treats up to ~2000gpm flowrates (3 million GPD)

2. Pure2 and Pure3 Systems

- a. Treats up to ~7000gpm flowrates (10 million GPD)
- b. Base system can treat atmospheric tank without booster pumps
- c. Not recommend for tanks less than 5,000 gallons

3. Pure3000

- a. Treats up to ~2000gpm flowrates (Recommended for 100,000GPD or Less for financial reasons.
 - i. Low cost dosing systems and premade active ClO₂ solution available in 1 to 265 gallon containers.
 - ii. 10,000GPD requires ~3-4GPD of Pure3000 solution

2) Facility Hot Water Loop

a. Residual control

- i. Larger buildings have hot water loops instead of hot water tanks. These loops circulate hot water throughout the building for on demand use. These water systems can grow legionella which requires continuous low dose ClO₂ to remove and prevent re-growth.
- ii. Because the water is circulated and water is only added as necessary the typical control method is to add ClO₂ to the loop until the required ClO₂ is achieved and then dose On/Off to maintain a ClO₂ residual range (Typically target 0.1 to 0.2ppm as higher levels are difficult to achieve because ClO₂ reacts more rapidly at the elevated temperatures in the hot water system.

Non-Potable Water Systems

1) Cooling Towers

- a. Cooling towers use ClO₂ to remove biofilm and legionella from the system for performance and safety reasons. Cooling towers are an open loop system that scrub the water with countercurrent air flow for energy transfer. The scrubbing also removes ClO₂ by stripping it into the air. Because of this, the dosage is added to the basin after the tower and dosed at a rate to achieve 0.5 to 2ppm dosage at the circulation rate of the system (The amount of water in the basin or pipe is not needed).
 - i. HP Systems
 1. Small towers – up to ~4000gpm flowrate
 2. No pH shift with this technology
 - ii. CG Systems
 1. Medium to Large Towers – up to 500,000gpm flowrate
 2. Uses sulfuric acid and PureMax solution
 - a. Lowers pH of system due to excesses sulfuric acid used in process
 - i. This is beneficial in a lot of towers
 - iii. Pure2/Pure3 systems
 1. Small to Large Towers – Up to 250,000gpm flowrate
 2. HCl Acid used.
 - a. Slight lowering of pH (more for Pure2 versus Pure3)

iv. DC3

1. Small to Large Towers – Up to 500,000gpm flowrate

b. Calculate size by the following

i. $\text{Flowrate(gpm)} * 8.34 * \text{PPM (0.5 to 2.0)} / 1,000,000 * 60 = \text{lbs ClO}_2 \text{ per hour}$

2) Chilled Loops

a. Chilled Loops use ClO₂ to remove biofilm and corrosive bacteria from the system for performance and reliability reasons. Chilled Loops are a closed loop system that circulate water through non-contact heat exchangers for energy transfer. Because of this, there is minimal losses except for load in the water and system. The dosage is based on the volume of water in the system and ClO₂ is added over time to achieve ~0.5 residual in the system (The rate of circulation in the loop is not significant).

i. HP Systems

1. Small to large loops – 10 million gallons

2. No pH shift with this technology

ii. Pure2/Pure3 systems

1. Small to Large loops – Up to 20million gallons

2. HCl Acid used.

a. Slight lowering of pH (more for Pure2 versus Pure3)

iii. DC3

1. Small to Large Towers – Up to 20million gallons

b. Calculate size by the following

i. $\text{Volume(gal)} * 8.34 * \text{PPM (0.5 to 1.0)} / 1,000,000 * 60 / \text{Time}(\text{Time to bring residual up typical 2-24hrs}) = \text{lbs ClO}_2 \text{ per hour}$