



U.S. ENVIRONMENTAL PROTECTION AGENCY

Office of Pesticide Programs
Antimicrobials Division (7510C)
1200 Pennsylvania Avenue NW
Washington, D.C. 20460

EPA Reg. Number:

43553-35

Date of Issuance:

January 15, 2009

Term of Issuance:

Conditional

Name of Pesticide Product:

Clean Finish

NOTICE OF PESTICIDE:

- x Registration
Reregistration

(under FIFRA, as amended)

Name and Address of Registrant (include ZIP Code):

CH20, Inc.
8820 Old Highway 99 SE
Olympia, WA 98501

Note: Changes in labeling differing in substance from that accepted in connection with this registration must be submitted to and accepted by the Registration Division prior to use of the label in commerce. In any correspondence on this product always refer to the above EPA registration number.

On the basis of information furnished by the registrant, the above named pesticide is hereby registered/reregistered under the Federal Insecticide, Fungicide and Rodenticide Act.

Registration is in no way to be construed as an endorsement or recommendation of this product by the Agency. In order to protect health and the environment, the Administrator, on his motion, may at any time suspend or cancel the registration of a pesticide in accordance with the Act. The acceptance of any name in connection with the registration of a product under this Act is not to be construed as giving the registrant a right to exclusive use of the name or to its use if it has been covered by others.

This product (OPP Decision No. 400859) is conditionally registered in accordance with FIFRA sec 3(c)(7)(A) provided that you:

- 1. Submit and/or cite all data required for registration of your product under FIFRA sec. 3(c)(5) when the Agency requires all registrants of similar products to submit such data; and submit acceptable responses required for re-registration of your product under FIFRA section 4.
2. Make the labeling change below before you release the product for shipment:

Revise the "EPA Registration Number to read, "EPA Reg. No. 43553-35".

Signature of Approving Official:

Product Manager Team 32
Regulatory Management Branch II
Antimicrobials Division (7510P)

Date:

Submit three (3) copies of your final printed labeling before distributing or selling the product bearing the revised labeling.

If these conditions are not complied with, the registration will be subject to cancellation in accordance with FIFRA sec. 6(e). Your release for shipment of the product constitutes acceptance of these conditions.

A stamped copy of the label is enclosed for your records.

Sincerely,

Emily H. Mitchell  
Product Manager (32)  
Regulatory Management Branch  
Antimicrobials Division (7510P)

Enclosure: (Stamped Label)

CONCURRENCES

SYMBOL							
JRNAME		7510P E. Mitchell					
DATE		1-15-09					

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# CLEAN FINISH

(15% Active Sodium Chlorite)

ACTIVE INGREDIENT:	
Sodium Chlorite* .....	15.0%
OTHER INGREDIENTS .....	85.0%
TOTAL .....	100.0%

\*Available chlorine \_\_\_\_\_

Contains 1.55 lbs. of sodium chlorite per gallon at 70° C.

## KEEP OUT OF REACH OF CHILDREN DANGER

FIRST AID	
<b>If in eyes:</b>	<ul style="list-style-type: none"> <li>• Hold eye open and rinse slowly and gently with water for 15-20 minutes.</li> <li>• Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.</li> <li>• Call a poison control center or doctor for treatment advice.</li> </ul>
<b>If on skin or clothing:</b>	<ul style="list-style-type: none"> <li>• Take off contaminated clothing.</li> <li>• Rinse skin immediately with plenty of water for 15-20 minutes.</li> <li>• Call a poison control center or doctor for treatment advice.</li> </ul>
<b>If swallowed:</b>	<ul style="list-style-type: none"> <li>• Call a poison control center or doctor immediately for treatment advice.</li> <li>• Have person sip a glass of water if able to swallow.</li> <li>• Do not induce vomiting unless told to do so by the poison control center or doctor.</li> <li>• Do not give anything by mouth to an unconscious person.</li> </ul>
<b>If inhaled:</b>	<ul style="list-style-type: none"> <li>• Move person to fresh air.</li> <li>• If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible.</li> <li>• Call a poison control center or doctor for further treatment advice.</li> </ul>
<b>NOTE TO PHYSICIAN:</b> Probable mucosal damage may contraindicate the use of gastric lavage.	
<b>HOT LINE NUMBER</b>	
Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may contact 1-800-424-9300 24 hours a day for emergency medical treatment information.	

EPA REG No. 43553-

EPA EST. No. 43553-VA-1

**Manufactured by:**  
CH<sub>2</sub>O, Incorporated  
8820 Old Hwy. 99 SE  
Olympia, WA 98501  
(360) 943-6063

**ACCEPTED**  
**with COMMENTS**  
**EPA Letter Dated:**  
**JAN 15 2009**

**NET CONTENTS:**

Under the Federal Insecticide, Fungicide, and Rodenticide Act as amended for the pesticide, registered under EPA Reg. No. **43553-35**

Clean Finish draft label

**PRECAUTIONARY STATEMENTS  
HAZARDS TO HUMANS & DOMESTIC ANIMALS**

**DANGER: Corrosive.** Causes eye and skin damage. Harmful if swallowed. Do not get in eyes, on skin, or on clothing. Avoid breathing mists or fumes. Wear protective eyewear (goggles, face shield or safety glasses), protective clothing and rubber gloves when handling this product. Wash thoroughly with soap and water after handling and before eating, drinking, or using tobacco. Remove and wash contaminated clothing before reuse.

**ENVIRONMENTAL HAZARDS**

This product is toxic to fish, aquatic invertebrates, oysters, and shrimp. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA.

**CHEMICAL HAZARDS**

Dry sodium chlorite is a strong oxidizing agent. This product becomes a fire or explosive hazard if allowed to dry. Mix only into water. Contamination may start a chemical reaction with generation of heat, liberating hazardous gases (chlorine dioxide, a poisonous, explosive gas), and possible fire and explosion. Do not contaminate with garbage, dirt, organic matter, household products, chemicals, soap products, paint products, solvents, acids, vinegar, beverages, oils, pine oil, dirty rags, or any other foreign matter.

**DIRECTIONS FOR USE**

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

CLEAN FINISH may be used alone or in chlorine dioxide generators. CLEAN FINISH controls the growth of microorganisms (algae, bacteria, slime and mollusks) found in aquatic environments such as food processing flumes, cooling water towers, potable water, irrigation line networks, wastewater treatment plants, poultry chill water, and other water-using equipment. CLEAN FINISH is also used to make sanitizing rinses in food processing plants.

CLEAN FINISH may be used to generate chlorine dioxide in mechanical or electrolytic generators which acts as a sanitizer or chemical oxidant in industrial applications such as

- Disinfection of and removal of sulfides in potable water.
- Bacterial slime, algae and mollusk control in industrial recirculating and one-pass cooling water systems, in food processing flumes, irrigation line networks, water-using equipment, cooling water, and recycled waters.
- Disinfection of plant and sewage wastes.
- Oxidative degradation of phenolics, simple cyanides and sulfides in treatment of wastewater.
- Control of bacterial slime in white water paper mill systems.

Follow the directions in the table below for how to use CLEAN FINISH in different systems. Also refer to the Technical Bulletins for the different uses of CLEAN FINISH.

TARGET ORGANISMS	DIRECTIONS FOR USE OF CLEAN FINISH ALONE
<b>RECIRCULATING COOLING WATER TOWERS</b>	
Algae	<p>Before using CLEAN FINISH, clean all badly fouled systems. The CLEAN FINISH dose is to be added directly into the cooling tower cold water basin (tower drip pan) which is found near the inlet to the recirculating pump.</p> <p><b>Application when algae are first detected:</b> The initial dose is 14 fluid ounces of CLEAN FINISH per 1,000 gals. of water in the system. Make repeat applications if needed to ensure control.</p> <p><b>Application when algae are under control:</b> To maintain control, add 7 fluid ounces of CLEAN FINISH solution per 1,000 gals. of water to the system two times a week or as needed.</p>

TARGET ORGANISMS	DIRECTIONS FOR GENERATION OF CHLORINE DIOXIDE USING CLEAN FINISH
<b>AQUATIC SYSTEMS</b>	
Microorganisms and Mollusks	<p>CLEAN FINISH can be used in aquatic systems to generate chlorine dioxide (using mechanical or electrolytic generators) which acts as a chemical oxidant to control microorganisms and mollusks or as a disinfectant.</p> <p>The rates of feed of CLEAN FINISH will vary depending on the degree of contamination and the extent of control desired. The dose rates of CLEAN FINISH will vary depending on the system size and the residual concentration needed to control the organisms.</p> <p><b>Chlorine dioxide generators:</b> A 3% to 15% active aqueous solution of CLEAN FINISH (depending on the type of generator employed) can be diluted at the point of use. Additional instructions on specific applications may be obtained from CH<sub>2</sub>O's Product Bulletin or from your CH<sub>2</sub>O representative.</p> <p><b>Method of Feed:</b> The most common methods used to generate large amounts of chlorine dioxide include:</p> <ul style="list-style-type: none"> <li>• The Chlorine Method: use CLEAN FINISH plus chlorine gas.</li> <li>• The Hypochlorite Method: use CLEAN FINISH, a hypochlorite solution, plus an acid.</li> <li>• The Acid-Chlorite Method: use CLEAN FINISH plus an acid as the activating agent.</li> </ul> <p>Additional information on feed systems (selection, installation and operation), may be obtained from your CH<sub>2</sub>O representative. Read all instructions for the chlorine dioxide generator before using CLEAN FINISH. The user is responsible for compliance with applicable federal, state and local laws regarding proper use and disposal of the chlorine dioxide generated.</p>

TARGET ORGANISMS	DIRECTIONS FOR USING CELAN FINISH
<b>POULTRY CHILL WATER</b>	
Microorganisms	<p>Microorganisms are controlled in poultry chill water treated with chlorine dioxide generated from CLEAN FINISH.</p> <p><b>Application:</b> Add CLEAN FINISH to a chlorine dioxide generator as needed to maintain a residual concentration of up to 3 parts per million (ppm) chlorine dioxide in the chiller water.</p> <p><b>Restrictions:</b> Do not exceed 3 ppm residual concentration of chlorine dioxide. Water must be analyzed using an appropriate method in accordance with 21 CFR 173.300.</p>
<b>FOOD PLANT PROCESS WATER TREATMENT (Flume Water Systems, Chill Water Systems, Hydrocoolers)</b>	
Microorganisms	<p>Microorganisms are controlled in flume water or other food processing water systems treated with chlorine dioxide generated from CLEAN FINISH.</p> <p>The CLEAN FINISH dose rate will depend on the process conditions, the degree of contamination present, and the requirements of the specific water system.</p> <p><b>Application:</b> Apply CLEAN FINISH continuously or intermittently through a chlorine dioxide generating system to achieve a chlorine dioxide residual concentration between 0.25 and 5.0 ppm.</p> <p><b>Washing of Fruits and Vegetables:</b> Fruits and vegetables which are not defined as raw agricultural commodities (in accordance with 21 CFR 173.300) may be washed with water containing up to 3 ppm residual chlorine dioxide. After the chlorine dioxide wash, the fruits and vegetables must either be rinsed with potable water, or be blanched, cooked or canned before consumption or distribution in commerce.</p>
<b>INDUSTRIAL COOLING WATER TREATMENT (One-Pass or Recirculating)</b>	
Bacterial Slime And Algae	<p>The CLEAN FINISH dose rate will depend on the exact application and the degree of contamination.</p> <p><b>Application:</b> For control of bacterial slime and algae, apply CLEAN FINISH through a chlorine dioxide generating system to achieve a chlorine dioxide residual concentration between 0.1 and 1.0 ppm for continuous doses, or between 0.1 and 5.0 ppm for intermittent doses. A chlorine dioxide concentration of 0.1 ppm is the minimum acceptable residual concentration for a minimum one minute contact time.</p>
<b>POTABLE WATER</b>	
Microorganisms	<p>The dosages of CLEAN FINISH will vary with source water conditions and the degree of contamination.</p> <p><b>Application:</b> An adequate disinfection/oxidation of most municipal and public potable water systems is achieved from a chlorine dioxide concentration of up to 2 ppm. Residual disinfectant byproducts must be monitored as required by the National Primary Drinking Water Regulations (40 CFR 141) and state drinking water standards.</p>

TARGET ORGANISMS	DIRECTIONS FOR USING CELAN FINISH
<p style="text-align: center;"><b>WATER SYSTEMS</b></p> <p style="text-align: center;">(including sprinkler, drip and other types of irrigation systems and commercial and industrial recirculating and one-pass cooling water systems)</p>	
Bacteria, Mollusks, and Slime	<p>Use CLEAN FINISH to generate chlorine dioxide in water systems to control bacteria, mollusks, and slime. The dosage of CLEAN FINISH depends on several factors: the water system type, system conditions, the degree of water contamination, and the desired level of control.</p> <p><b>Application:</b> Apply CLEAN FINISH continuously or intermittently through a chlorine dioxide generating system to achieve a chlorine dioxide residual concentration as noted below:</p> <p style="padding-left: 40px;"><b>Veliger Control:</b> Target the chlorine dioxide concentration to between 0.1 and 0.5 ppm from continuous dosing.</p> <p style="padding-left: 40px;"><b>Intermittent Dose:</b> Target the residual chlorine dioxide concentration to between 0.2 and 25 ppm from intermittent dosing. Repeat applications as needed to maintain control.</p> <p style="padding-left: 40px;"><b>Continuous Dose:</b> Target the chlorine dioxide concentrations to up to 2 ppm from continuous dosing.</p>
<p style="text-align: center;"><b>WASTEWATER TREATMENT</b></p>	
Microorganisms	<p>The CLEAN FINISH dose rates will vary with water conditions and the degree of contamination present. Adequate disinfection of most municipal and other wastewater systems is achieved from a chlorine dioxide concentration of up to 5 ppm.</p> <p><b>Odor control of sulfides:</b> For water with pH levels between 5 and 9, a minimum concentration of 5.2 ppm (by wt) of chlorine dioxide should be applied to oxidize 1 ppm of sulfide (measured as sulfide ion).</p> <p><b>For phenol destruction:</b> For water with pH levels less than 8, 1.5 ppm chlorine dioxide will oxidize 1 ppm phenol. For water with pH levels greater than 10, 3.3 ppm chlorine dioxide will oxidize 1 ppm phenol.</p>



**STORAGE & DISPOSAL**

Do not contaminate water, food, or feed by storage and disposal. Keep product in tightly closed container when not in use. Do not drop, roll or skid drum. Keep upright. Always replace cover. Store in a cool, dry, well-ventilated area away from heat or open flame.

**EMERGENCY HANDLING:** In case of contamination or decomposition, do not reseal container. If possible, isolate container in open and well ventilated area. Flood with large volumes of water. If fire occurs, extinguish fire by applying large quantities of water. Any unopened drums near the fire should be cooled by spraying with water.

**PESTICIDE DISPOSAL:** Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste Representative at the nearest EPA Regional Office for guidance.

**CONTAINER DISPOSAL:**

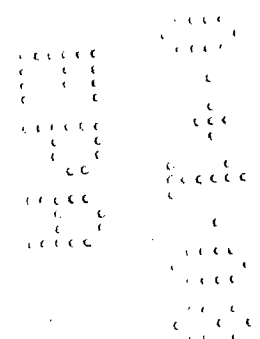
**Nonrefillable Containers 5 Gallons or Less:** Do not reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows. Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container 1/4 full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times. Offer for recycling if available.

**Nonrefillable Containers Greater than 5 Gallons:** Do not reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container 1/4 full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two more times. Then offer for recycling, if available.

**Refillable Containers:** Refillable container. Refill this container with pesticide only. Do not reuse this container for any other purpose. Cleaning the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller. To clean the container before final disposal, empty the remaining contents from this container into application equipment or mix tank. Fill the container about 10 percent full with water. Agitate vigorously or recirculate water with the pump for 2 minutes. Pour or pump rinsate into application equipment or rinsate collection system. Repeat this rinsing procedure two more times.

**WARRANTY**

As the use of this material is subject to conditions beyond the seller's control, seller makes no warranty express or implied as to this material or its use other than its chemical analysis when packed. To the extent consistent with applicable law, the total liability of seller shall be limited to the purchase price of the product. Any disputes will be settled via arbitration in accordance with purchase details on your invoice.







8820 Old Highway 99 SE, Olympia, WA, USA 98501

TEL (360) 943-6063

FAX (360) 352-4813

## Industrial Cooling Water Treatment

### Application Description

Chlorine dioxide is effective in the control of microbiological growths in industrial cooling waters under conditions unfavorable to chlorine. It is particularly effective in systems having a high pH, ammonia-nitrogen contamination, persistent slime problems, or where the microbial contamination is aggravated by contamination with vegetable or mineral oils, phenols or other high chlorine-demand producing compounds.

Unlike chlorine, chlorine dioxide does not react with organic materials to form trihalomethanes. Chlorine dioxide does not significantly hydrolyze in water, thus it retains biocidal activity over a broad pH range. Chlorine dioxide is non-reactive with ammonia and nitrogen compounds and with most treatment chemicals (corrosion and scale inhibitors) present in cooling water systems.

### Feed Requirements

For control of bacterial slime and algae in industrial recirculating and one-pass cooling systems, the required dosages will vary depending on the exact application and the degree of contamination present. The required chlorine dioxide residual concentrations range between 0.1 and 5.0 ppm. Chlorine dioxide may be applied either continuous-

ly or intermittently. The typical chlorine dioxide residual concentration range is 0.1 - 1.0 ppm for continuous doses, and 0.1 - 5.0 ppm for intermittent doses. The minimum acceptable residual concentration of chlorine dioxide is 0.1 ppm for a minimum one minute contact time.

### Method of Feed

Sodium chlorite is converted to chlorine dioxide through a chlorine dioxide generator. Chlorine dioxide solutions should be fed to the cooling tower drip pan (cold water well) or other feed point that permits adequate mixing and uniform distribution. The feed point should be well below the surface of the water to prevent volatilization of the chlorine dioxide.

### Chlorine Dioxide Analysis

Residual chlorine dioxide concentrations must be determined by substantiated methods which are specific for chlorine dioxide. Two suitable methods are published in Standard Methods for the Examination of Water and Wastewater:

4500-ClO<sub>2</sub> D DPD-Glycine Method

4500-ClO<sub>2</sub> E Amperometric Method II

CH<sub>2</sub>O, Inc. believes the information contained herein is accurate; however, CH<sub>2</sub>O, Inc. makes no guarantees with respect to such accuracy and assumes no liability in connection with the use of the information contained herein by any party. The provision of the information contained herein and the provision of information by or reliance on CH<sub>2</sub>O's Technical Department is not intended to be and should not be construed as legal advice or as ensuring compliance with any federal, state or local laws and regulations. Any party using sodium chlorite should review all such laws rules or regulations prior to using sodium chlorite.

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## Poultry Chill Water

### Application Description

The processing of poultry carcasses for packaging provides significant potential for bacterial contamination. Most bacterial contamination occurs on the body surface, and may come from the flora on the skin, mud or filth from the feet or from crop material or feces forced out of the bird during processing. Removal of this contamination is accomplished by washing during the processing operation.

Following washing, the birds are submerged in chilled water (34°F) to remove the body heat as quickly as possible. The chilled water soon becomes contaminated, and can lead to cross contamination of the birds. USDA regulations require the use of antimicrobial pesticides to control the microbial population in poultry chill water.

Chlorine has long been the pesticide of choice for poultry processing. However, chlorine has been known to react with organic contaminants in the process water to form potentially toxic trihalomethanes (e.g. chloroform).

On March 3, 1995, the FDA published a final rule permitting chlorine dioxide to be used in place of chlorine in this process. Chlorine dioxide generated from **IVR-SAN 25** has been demonstrated to be effective in this application.

Chlorine dioxide is effective at lower dosage levels than those required with chlorine. Unlike chlorine, it does not form trihalomethanes in the process.

### Feed Requirements

For effective control of the microbial population in poultry chill water, apply **IVR-SAN 25** as necessary through a chlorine dioxide generation system to maintain a residual concentration of up to 3 parts per million (ppm) chlorine dioxide at the midway point in the chill tank.

**NOTE:** The generator effluent must contain at least 90% (by wt.) purity chlorine dioxide. (21 CFR 173.69a)

### Method of Feed

For poultry chill water applications, chlorine dioxide should be fed below the water level in the chill water tank.

### Chlorine Dioxide Analysis

Residual chlorine dioxide concentrations must be determined by substantiated methods which are specific for chlorine dioxide. Two suitable methods are published in Standard Methods for the Examination of Water and Wastewater:

- 4500-ClO<sub>2</sub> D DPD-Glycine Method
- 4500-ClO<sub>2</sub> E Amperometric Method II

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## Food Plant Process Water Treatment

### Application Description

Flume water is used to transport fruits and vegetables during processing. Dirt and organic compounds leached from the fruit and vegetables provide nutrients for microorganisms. As food processing plants recycle more water, organic loading and microbiological growth increases.

Chlorine dioxide generated from sodium chlorite is effective for use in controlling microbiological growth in flume water and other food processing water systems such as chill water systems and hydrocoolers. Unlike chlorine, it does not form chlorinated organic compounds. Chlorine dioxide is effective over a wide pH range.

### Feed Requirements

The required dosages will vary with process conditions and the degree of contamination present. Depending on the requirements of the specific water system, sodium chlorite should be applied continuously or intermittently through a chlorine dioxide generating system to achieve a chlorine dioxide residual concentration between 0.25 and 5.0 ppm.

Water, containing up to 5 ppm residual chlorine dioxide may be used for rinsing

uncut and unpeeled fruits and vegetables provided that the treatment is followed by a potable water rinse.

Water, containing up to 1 ppm residual chlorine dioxide may be used for rinsing cut or peeled potatoes provided that the treatment is followed by a potable water rinse.

### Method of Feed

Sodium chlorite is converted to chlorine dioxide through a chlorine dioxide generator. Chlorine dioxide solutions should be applied to the processing system at a point, and in a manner which permits adequate mixing and uniform distribution. The feed point should be well below the surface of the water to prevent volatilization of the chlorine dioxide.

### Chlorine Dioxide Analysis

Residual chlorine dioxide concentrations must be determined by substantiated methods which are specific for chlorine dioxide. Two suitable methods are published in Standard Methods for the Examination of Water and Wastewater:

4500-CIO2 D DPD-Glycine Method  
4500-CIO2 E Amperometric Method II

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## Industrial Cooling Water Treatment

### Application Description

Chlorine dioxide is effective in the control of microbiological growths in industrial cooling waters under conditions unfavorable to chlorine. It is particularly effective in systems having a high pH, ammonia-nitrogen contamination, persistent slime problems, or where the microbial contamination is aggravated by contamination with vegetable or mineral oils, phenols or other high chlorine-demand producing compounds.

Unlike chlorine, chlorine dioxide does not react with organic materials to form trihalomethanes. Chlorine dioxide does not significantly hydrolyze in water, thus it retains biocidal activity over a broad pH range. Chlorine dioxide is non-reactive with ammonia and nitrogen compounds and with most treatment chemicals (corrosion and scale inhibitors) present in cooling water systems.

### Feed Requirements

For control of bacterial slime and algae in industrial recirculating and one-pass cooling systems, the required dosages will vary depending on the exact application and the degree of contamination present. The required chlorine dioxide residual concentrations range between 0.1 and 5.0 ppm. Chlorine dioxide may be applied either continuous-

ly or intermittently. The typical chlorine dioxide residual concentration range is 0.1 - 1.0 ppm for continuous doses, and 0.1 - 5.0 ppm for intermittent doses. The minimum acceptable residual concentration of chlorine dioxide is 0.1 ppm for a minimum one minute contact time.

### Method of Feed

Sodium chlorite is converted to chlorine dioxide through a chlorine dioxide generator. Chlorine dioxide solutions should be fed to the cooling tower drip pan (cold water well) or other feed point that permits adequate mixing and uniform distribution. The feed point should be well below the surface of the water to prevent volatilization of the chlorine dioxide.

### Chlorine Dioxide Analysis

Residual chlorine dioxide concentrations must be determined by substantiated methods which are specific for chlorine dioxide. Two suitable methods are published in Standard Methods for the Examination of Water and Wastewater:

- 4500-ClO<sub>2</sub> D DPD-Glycine Method
- 4500-ClO<sub>2</sub> E Amperometric Method II

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## Potable Water Treatment

### Application Description

Chlorine dioxide (ClO<sub>2</sub>) is used as both an oxidant and a disinfectant in drinking water treatment. It has several distinct chemical advantages which complement the traditional use of chlorine in potable water treatment.

Unlike chlorine, chlorine dioxide does not react with naturally-occurring organic materials to form trihalomethanes. Chlorine dioxide does not significantly hydrolyze in water, thus it retains biocidal activity over a broad pH range. Chlorine dioxide is non-reactive with ammonia and most nitrogen-containing compounds. It is an effective agent in controlling taste and odor compounds including phenolics, sulfides, and various algae-related organics. It is also used to oxidize iron and manganese compounds.

### Feed Requirements

The required dosages will vary with source water conditions and the degree of contamination present. For most municipal and other potable water systems, a chlorine dioxide residual concentration of up to 2 ppm is sufficient to provide adequate disinfection. Normal target residual concentrations are in the 0.20-0.75 ppm range. Chlorine dioxide must be applied at a sufficient residual concentration for a sufficient contact time (C<sub>x</sub>T

Value) to achieve the required disinfection. The concentration of total residual oxidants (chlorine dioxide, chlorite ion and chlorate ion) should be monitored such that it does not exceed 1.0 ppm in the distribution system.

### Method of Feed

Sodium chlorite is converted to chlorine dioxide through a chlorine dioxide generator. Chlorine dioxide solutions should be applied to the processing system at a point, and in a manner which permits adequate mixing and uniform distribution. The feed point should be well below the surface of the water to prevent volatilization of the chlorine dioxide. Do not apply sodium chlorite directly to potable water. Avoid co-incident feeding of ClO<sub>2</sub> with lime or powdered activated carbon.

### Chlorine Dioxide Analysis

Residual chlorine dioxide concentrations must be determined by substantiated methods which are specific for chlorine dioxide. Two suitable methods are published in Standard Methods for the Examination of Water and Wastewater:

- 4500-ClO<sub>2</sub> D DPD-Glycine Method
- 4500-ClO<sub>2</sub> E Amperometric Method II

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## Wastewater Treatment

### Application Description

Chlorine dioxide ( $\text{ClO}_2$ ) is effective as both a disinfectant and an oxidant in wastewater treatment. It has several distinct chemical advantages compared to the traditional use of chlorine in wastewater water treatment.

Chlorine dioxide does not significantly hydrolyze in water, thus it retains biocidal activity over a broad pH range. Chlorine dioxide is non-reactive with ammonia and most nitrogen-containing compounds, and thus is effective at lower dose levels than chlorine. It destroys phenolics, simple cyanides and sulfides by oxidation. For odor control, chlorine dioxide will oxidize sulfides without the formation of colloidal sulfur. It is also used to oxidize iron and manganese compounds.

### Feed Requirements

The required dosages will vary with water conditions and the degree of contamination present. For most municipal and other wastewater systems, a chlorine dioxide residual concentration of up to 5 ppm is sufficient to provide adequate disinfection.

For sulfide odor control, between pH 5 - 9, a minimum of 5.2 ppm (wt) of chlorine dioxide should be applied to oxidize 1 ppm of sulfide

(measured as sulfide ion). For phenol destruction, at pH less than 8, 1.5 ppm chlorine dioxide will oxidize 1 ppm phenol; at pH greater than 10, 3.3 ppm chlorine dioxide will oxidize 1 ppm phenol.

### Method of Feed

Sodium chlorite is converted to chlorine dioxide through a chlorine dioxide generator. Chlorine dioxide solutions should be applied to the processing system at a point, and in a manner which permits adequate mixing and uniform distribution. The feed point should be well below the surface of the water to prevent volatilization of the chlorine dioxide. Avoid co-incident feeding of  $\text{ClO}_2$  with lime or powdered activated carbon.

### Chlorine Dioxide Analysis

Residual chlorine dioxide concentrations must be determined by substantiated methods which are specific for chlorine dioxide. Two suitable methods are published in Standard Methods for the Examination of Water and Wastewater:

4500- $\text{ClO}_2$  D DPD-Glycine Method

4500- $\text{ClO}_2$  E Amperometric Method II

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