

37982-2

09/07/2001

1/29



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

OFFICE OF  
PREVENTION, PESTICIDES  
AND TOXIC SUBSTANCES

September 7, 2001

Karl Moll  
Senior Registration Specialist  
Pioneer Amercas, Inc.  
26700 South Banta Road  
Tracy, California 95376

Dear Mr. Moll:

Subject: Chlorine Liquefied Gas Master Label  
EPA Registration No. 37982-2  
Your Amendment Dated August 10, 2001.

The amendment referred to above, submitted in connection with registration under the Federal Insecticide, Fungicide, and Rodenticide Act, as amended, will be acceptable provided that you make the labeling change listed below before you release the product for shipment bearing the amended label.

1. Correct the language in parenthesis in first paragraph on page 24 (Chlorinator Operation) to state:

“(wrench no longer than 8” (200 mm)).”

2. Delete the following language from the top of page 1:


**“RESTRICTED USE PESTICIDE  
DUE TO HIGH ACUTE TOXICITY  
For sale and use only by Certified Applicators or persons under their direct  
supervision and only for those uses covered by the Certified Applicator’s  
certification.”**

It is not necessary, at this time, to amend your registration to restricted use. The Agency has not yet completed its determination of the applicability of restricted use with regard to the

reregistration of chlorine gas. A stamped copy is enclosed for your records. Submit one copy of the final printed label before you release the product for shipment bearing the amended label.

If you have any questions, please call Patrick Dobak at (703) 308-8180.

Sincerely yours,



Robert S. Brennis  
Product Manager (32)  
Regulatory Management Branch II  
Antimicrobial Division (7504C)

3/29

~~RESTRICTED USE PESTICIDE~~

~~DUE TO HIGH ACUTE TOXICITY~~

~~For Retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification.~~

**CHLORINE LIQUEFIED GAS UNDER PRESSURE**

For use as a sanitizer on hard surfaces, as a sanitizer for wash water treatment of food handling premises and equipment (fruit, vegetable, meat, poultry or seafood), as a sanitizer for public and commercial swimming pools, as an algaecide and slimicide in recirculating cooling towers and pulp and paper mill process water systems and for use in the control of bacteria, algae, slime build-up and clogging of drip irrigation systems.

ACTIVE INGREDIENT - Chlorine	99.5%
INERT INGREDIENTS	0.5%
<hr/>	<hr/>
TOTAL	100.0%

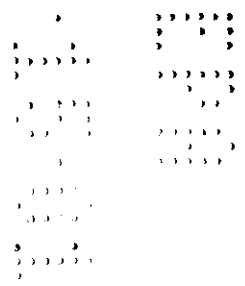
ACCEPTED  
with COMMENTS  
in EPA Letter Dated:

SEP 07 2001

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

37982-2

Pages 1, 24



**MASTER LABEL**

# KEEP OUT OF REACH OF CHILDREN



## DANGER POISON

### FATAL IF INHALED

### LIQUID CAUSES SEVERE BURNS

FIRST AID	
If Inhaled	<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>
If in eyes	<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 five minutes, then continue rinsing eye.</li> <li>• Call a poison control center or doctor for treatment advice.</li> </ul>
If on skin or clothing	<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>HOT LINE NUMBER</b>	
Have the product container or label with you when you call a poison control center or doctor, or when going for treatment.	
<b>NOTE TO PHYSICIAN</b>	

See other precautions on this label.

Pioneer Americas, Inc.  
Houston, Texas 77002

EPA REG. NO 37982-2  
EPA EST. NO. 61667-CA-1, CA-2, LA-1, NV-1, WA-1, WA-2  
71207-CAN-1, CAN-2, CAN-3

NET CONTENTS XXXX lbs.

## PRECAUTIONARY STATEMENTS

### HAZARDS TO HUMANS AND DOMESTIC ANIMALS

**DANGER.** Fatal if inhaled or absorbed through skin. Corrosive. Causes irreversible eye damage and skin burns. Do not breathe vapors or get in eyes, on skin or clothing. Wear goggles, protective clothing and rubber gloves as discussed below. Wash hands thoroughly with soap and water after handling and before eating, drinking, or using tobacco. Remove contaminated clothing and wash clothing before reuse. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.

**PERSONAL PROTECTIVE EQUIPMENT** - Applicators and other handlers must wear long-sleeved shirts, long pants, shoes, and socks.

**IN CASE OF LEAKAGE** - Under normal use conditions, no protective eyewear, respirator, or gloves are required. However, in case of a spill or leak, handlers must wear chemical-resistant gloves (such as nitrile or butyl) and a full-face canister-style (gas mask) respirator with a canister approved for chlorine (MSHA/NIOSH approval number prefix TC-13F). Since there is always the possibility of a spill or leak, gloves and a respirator of a type specified above must be available and are required for anyone entering into an affected area in the event of a leak or spill.

### ENVIRONMENTAL HAZARDS

This pesticide is toxic or highly toxic to fish and aquatic invertebrates. 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.

### PHYSICAL AND CHEMICAL HAZARDS

Chlorine is a non-flammable gas, liquefied, under pressure. Do not drop container. Do not heat container. Keep away from intense heat or open sunlight. Corrosive to most metals in the presence of moisture.

## DIRECTIONS FOR USE

It is a violation of federal law to use this product in a manner inconsistent with its labeling. Refer to the "Chlorine Manual" published by The Chlorine Institute, Inc. for instructions on the required product use and safety procedures. Before working with this product, handlers must be trained how to appropriately use respirators that conform to OSHA requirements (described in 29 CFR Part 1910.134) and how to appropriately handle and use chlorine. This product, including dispensing equipment, must be handled and used in accordance with the practices specified by all applicable product labeling and the "Chlorine Manual" published by The Chlorine Institute, Inc. Use only in well ventilated areas.

Due to changing chlorine demands with varying water temperatures it is imperative that users of chlorine gas use a colorimetric or titrimetric test kit to accurately determine residual chlorine levels. Flow meter set points must be adjusted continuously to compensate for changing chlorine demands for any water flow rate.

The following chlorine dosage chart is provided to aid in preparing different treatment solutions.

GALS WATER	Oz of CHLORINE REQUIRED TO YIELD AVAILABLE CHLORINE							
	1 ppm	3 ppm	5 ppm	10 ppm	25 ppm	50 ppm	200 ppm	600 ppm
50	0.01	0.02	0.03	0.07	0.17	0.33	1.33	3.34
100	0.01	0.04	0.07	0.13	0.33	0.67	2.67	8.01
200	0.03	0.08	0.13	0.27	0.67	1.33	5.34	13.34
500	0.07	0.20	0.33	0.67	1.67	3.34	13.34	33.36
1,000	0.13	0.40	0.67	1.33	3.34	6.67	26.69	66.72
10,000	1.33	4.00	6.67	13.34	33.36	66.72	266.88	667.20

## RESIDENTIAL SWIMMING POOL WATER DISINFECTION

For a new pool or spring start-up, superchlorinate with 5 to 10 ppm available chlorine by weight. Check the level of available chlorine with a test kit. Adjust and maintain pool water pH to between 7.2 to 7.6. Adjust and maintain the alkalinity of the pool to between 50 to 100 ppm.

To maintain the pool, add manually or by a feeder device to yield an available chlorine residual between 0.6 to 1.0 ppm by weight. Stabilized pools should maintain a residual of 1.0 to 1.5 ppm available chlorine. Test the pH, available chlorine residual and alkalinity of the water frequently with appropriate test kits. Frequency of water treatment will depend upon temperature and number of swimmers.

Every 7 days, or as necessary, superchlorinate the pool by raising the available chlorine to 5 to 10 ppm available chlorine by weight. Check the level of available chlorine with a test kit. Do not re-enter pool until the chlorine residual is between 1.0 to 3.0 ppm.

At the end of the swimming pool season or when water is to be drained from the pool, chlorine must be allowed to dissipate from treated pool water before discharge. Do not chlorinate the pool within 24 hours prior to discharge.

**WINTERIZING POOLS** - While water is still clear and clean, apply sufficient chlorine while the filter is running, to obtain a 3 ppm available chlorine residual, as determined by a suitable test kit. Cover pool, prepare heater, filter and heater components for winter by following manufactures' instructions.

### SPAS, HOT-TUBS, IMMERSION TANKS, ETC.

**SPAS/HOT-TUBS** - Apply sufficient chlorine to obtain 5 ppm, as determined by a suitable chlorine test kit. Adjust and maintain pool water pH to between 7.2 and 7.8. Some oils, lotions, fragrances, cleaners, etc. may cause foaming or cloudy water as well as reduce the efficiency of the product.

Maintain the water at 5 ppm available chlorine during use.

During extended periods of disuse, maintain a 3 ppm chlorine concentration.

**HUBBARD AND IMMERSION TANKS** - Before patient use adjust bath to obtain a chlorine residual of 25 ppm, as determined by a suitable test kit. Adjust and maintain the water pH to between 7.2 and 7.6. After each use drain the tank. Prepare a fresh 25 ppm available chlorine solution in a bucket and circulate this solution through the agitator of the tank for 15 minutes and then rinse out the solution. Clean tank thoroughly and dry with clean cloths.

**HYDROTHERAPY TANKS** - Adjust to obtain a 1 ppm residual, as determined by a suitable chlorine test kit. Pool should not be entered until the chlorine residual is below 3

ppm. Adjust and maintain the water pH to between 7.2 and 7.6. Operate pool filter continuously. Drain pool weekly and clean before refilling.

**ALGAE AND SLIME IN FOUNTAINS, PONDS AND ORNAMENTAL LAKES**

The recommended concentration level of available chlorine for the control of algae and slime in fountains, ponds and ornamental lakes containing no fish or wildlife is 3 - 5 ppm.

**SEWAGE and WASTEWATER TREATMENT**

The disinfection of sewage and effluent must be evaluated by determining that the total number of coliform bacteria and/or fecal coliform bacteria, as determined by the Most Probable Number (MPN) procedure, of the chlorinated effluent has been reduced to or below the maximum permitted by the controlling regulatory jurisdiction.

On the average, satisfactory disinfection of secondary wastewater effluent can be obtained when the chlorine residual is 0.5 ppm after 15 minutes contact. Although the chlorine residual is the critical factor in disinfection, the importance of correlating chlorine residual with bacterial kill must be emphasized. The MPN of the effluent, which is directly related to the water quality standards requirement, should be the final and primary standard, and the chlorine residual should be considered an operating standard valid only to the extent verified by the coliform quality of the effluent.

The following are critical factors affecting wastewater disinfection.

- 1. Mixing: It is imperative that the product and the wastewater be instantaneously and completely flash mixed to assure reaction with every chemically active, soluble and particulate component of the wastewater.
- 2. Contacting: Upon flash mixing, the flow through the system must be maintained.
- 3. Dosage/Residual Control: Successful disinfection is extremely dependent on response to fluctuating chlorine demand to maintain a predetermined, desirable chlorine level. Secondary effluent should contain 0.2 to 1.0 ppm chlorine residual after a 15 to 30 minute contact time. A reasonable average of residual chlorine is 0.5 ppm after 15 minutes contact time.

**EFFLUENT SLIME CONTROL** - Apply a 100 to 1000 ppm available chlorine solution at a location which will allow complete mixing. Once control has become evident apply a 15 ppm available chlorine solution.

**FILTER BEDS AND SLIME CONTROL** - Remove filter from service and drain. Prepare a 100 to 1000 ppm available chlorine solution and fill to a depth of 1 foot above filter



sand. Wait 30 minutes before draining water to a level that is even with the top of the filter. Wait for 4 to 6 hours before completely draining and backwashing filter.

## DISINFECTION OF DRINKING WATER

**PUBLIC SYTEMS-** Prepare a 100 ppm available chlorine solution. Begin feeding this solution with a hypochlorinator until a free available chlorine residual of at least 0.2 ppm and no more than 0.6 ppm is attained throughout the distribution system. Check water frequently with a chlorine test kit. Bacteriological sampling must be conducted at a frequency no less than that prescribed by the National Interim Primary Drinking Water Regulations. Contact your local Health Department for further details.

**INDIVIDUAL SYSTEMS – DUG WELLS-** Upon completion of the casing (lining) wash the interior of casing (lining) with a 100 ppm available chlorine solution using a stiff brush. After covering the well, pour the sanitizing solution into the well through both the pipe sleeve opening and the pipeline. Wash the exterior of the pump cylinder also with the sanitizing solution. Start pump and pump water until strong odor of chlorine in water is noted. Stop pump and wait at least 24 hours. After 24 hours flush well until all traces of chlorine have been removed from the water. Consult your local Health Department for further details.

**INDIVIDUAL SYSTEMS – DRILLED, DRIVEN, and BORED WELLS-** Run pump until water is as free from turbidity as possible. Pour a 100 ppm available chlorine sanitizing solution into the well. Add 5 to 10 gallons of clean chlorinated water to the well in order to force the sanitizer into the rock formation. Wash the exterior of pump cylinder with the sanitizer. Drop pipeline into well, start pump and pump water until strong odor of chlorine in water is noted. Stop pump and wait at least 24 hours. After 24 hours flush well until all traces of chlorine have been removed from the water. Deep wells with high water levels may necessitate the use of special methods for introduction of the sanitizer into the well. Consult your local Health Department for further details.

**INDIVIDUAL SYSTEMS – FLOWING ARTESIAN WELLS-** Artesian wells generally do not require disinfection. If analyses indicate persistent contamination, the well should be disinfected. Consult your local Health Department for further details.

**EMERGENCY DISINFECTION** - When boiling of water for 1 minute is not practical, water can be made potable by using this product. Prior to addition of the sanitizer, remove all suspended material by filtration or by allowing it to settle to the bottom. Decant the clarified, contaminated water to a clean container and add sufficient chlorine to obtain 0.5 ppm. Allow the treated water to stand for 30 minutes. Properly treated water should have a slight chlorine odor, if not, repeat dosage and allow the water to stand an additional 15 minutes. The treated water can then be made palatable by pouring it between clean containers several times.

## PUBLIC WATER SYSTEMS

**ALGAE CONTROL IN RESERVOIRS** – Hypochlorinate streams feeding the reservoir. Suitable feeding points should be selected on each stream at least 50 yards upstream from the points of entry into the reservoir.

**MAINS** - Thoroughly flush section to be sanitized by discharging from hydrants. Permit a water flow of at least 2.5 feet per minute to continue under pressure while injecting this product by means of a hypochlorinator. Stop water flow when a chlorine residual test of 50 ppm is obtained at the low pressure end of the new main section after a 24 hour retention time. When chlorination is completed, the system must be flushed free of all heavily chlorinated water.

**NEW TANKS, BASINS, ETC** - Remove all physical soil from surfaces. Prepare a 500 ppm available chlorine solution. Fill to working capacity and allow to stand for at least 4 hours. Drain and flush with potable water and place in service.

**NEW FILTER SAND** – Before placing filter in service, prepare a 100 to 1000 ppm available chlorine solution and fill to a depth of 1 foot above filter sand. Wait 30 minutes before draining water to a level that is even with the top of the filter. Wait for 4 to 6 hours before completely draining and backwashing filter.

**NEW WELLS** - Flush the casing with a 50 ppm available chlorine solution. The solution should be pumped or fed by gravity into the well after thorough mixing with agitation. The well should stand for several hours or overnight under chlorination. It may then be pumped until a representative raw water sample is obtained. Bacterial examination of the water will indicate whether further treatment is necessary.

**EXISTING EQUIPMENT** - Remove equipment from service, and thoroughly clean surfaces of all physical soil. Sanitize with a 500 ppm available chlorine solution. Fill to working capacity and let stand at least 4 hours. Drain and return to service. If the previous treatment is not practical, surfaces may be sprayed with a solution containing 1000 ppm available chlorine. After drying, flush with water and return to service.

### **EMERGENCY DISINFECTION AFTER FLOODS**

**WELLS** - Thoroughly flush contaminated casing with a 500 ppm available chlorine solution. Backwash the well to increase yield and reduce turbidity, adding sufficient chlorinating solution to the backwash to produce a 10 ppm available chlorine residual as determined by a chlorine test kit. After the turbidity has been reduced and the casing has been treated, add sufficient chlorinating solution to produce a 50 ppm available chlorine residual. Agitate the well water for several hours and take a representative water sample. Re-treat well if water samples are biologically unacceptable.

**RESERVOIRS** - In case of contamination by overflowing streams, establish hypochlorinating stations upstream of the reservoir. Chlorinate the inlet water until the entire reservoir obtains a 0.2 ppm available chlorine residual, as determined by a suitable chlorine test kit. In case of contamination from surface drainage, apply sufficient

product directly to the reservoir to obtain a 0.2 ppm available chlorine residual in all parts of the reservoir.

**BASINS, TANKS AND FLUMES, ETC** - Thoroughly clean all equipment, then prepare a 500 ppm available chlorine solution, as determined by a suitable test kit. After 24 hours drain, flush, and return to service. If the previous method is not suitable, spray or flush the equipment with a solution containing 1000 ppm available chlorine. Allow to stand for 2 to 4 hours, flush and return to service.

**FILTERS** - Remove filter from service and drain. Prepare a 100 to 1000 ppm available chlorine solution and fill to a depth of 1 foot above filter sand. Wait 30 minutes before draining water to a level that is even with the top of the filter. Wait for 4 to 6 hours before completely draining and backwashing filter.

**DISTRIBUTION SYSTEM** - Flush repaired or replaced section with water. Establish a hypochlorinating station and apply sufficient product until a consistent available chlorine residual of at least 10 ppm remains after a 24 hour retention time. Use a chlorine test kit.

**EMERGENCY DISINFECTION AFTER FIRES**

**CROSS CONNECTIONS OR EMERGENCY CONNECTIONS** - Hypochlorination or gravity feed equipment should be set up near the intake of the untreated water supply. Apply sufficient product to give a chlorine residual of at least 0.1 to 0.2 ppm at the point where the untreated supply enters the regular distribution system. Use a chlorine test kit.

**EMERGENCY DISINFECTION AFTER DROUGHTS**

**SUPPLEMENTARY WATER SUPPLIES** - Gravity or mechanical hypochlorite feeders should be set up on a supplementary line to dose the water to a minimum chlorine residual of 0.2 ppm after a 20 minute contact time. Use a chlorine test kit.

**WATER SHIPPED IN BY TANKS, TANK CARS, TRUCKS ETC.** - Thoroughly clean all containers and equipment. Spray a 500 ppm available chlorine solution and rinse with potable water after 5 minutes. During the filling of the containers, dose with sufficient amounts of this product to provide at least a 0.2 ppm chlorine residual. Use a chlorine test kit.

**EMERGENCY DISINFECTION AFTER MAIN BREAKS**

**MAINS** - Before assembly of the repaired section, flush out mud and soil. Permit a water flow at least 2.5 feet per minute to continue under pressure while injecting this product by means of a hypochlorinator. Stop water flow when a chlorine residual test of 50 ppm is obtained at the low pressure end of the new main section after a 24 hour

retention time. When chlorination is completed, the system must be flushed free of all heavily chlorinated water.

**SANITIZING EGG HANDLING EQUIPMENT**

**SPRAY METHOD** - Cover or remove all food and packaging materials. Pre-clean equipment with an appropriate cleaning solution and rinse. Spray the equipment with a 50 ppm available chlorine solution.

**SANITIZING EGG PLANT, HATCHERIES, BROODER ROOMS AND SHOE BATHS**

**SPRAY METHOD** - Cover or remove all food and packaging materials. Pre-clean equipment with an appropriate cleaning solution and rinse. Spray the equipment with a 50 ppm available chlorine solution.

**SANITIZING FISH AND SEAFOOD PROCESSING EQUIPMENT AND PREMISES**

**SPRAY/FOOD CONTACT SURFACES** - Cover or remove all food and packaging materials. Pre-clean equipment with an appropriate cleaning solution and rinse. Spray the equipment with a 50 ppm available chlorine solution.

**SPRAY/NON-FOOD CONTACT SURFACES** - Cover or remove all food and packaging materials. Pre-clean equipment with an appropriate cleaning solution and rinse. Spray the equipment with a 50 ppm available chlorine solution.

**SANITIZING MEAT PROCESSING EQUIPMENT AND PREMISES**

**SPRAY/FOOD CONTACT SURFACES** - Cover or remove all food and packaging materials. Pre-clean equipment with an appropriate cleaning solution and rinse. Spray the equipment with a 50 ppm available chlorine solution.

**SPRAY/NON-FOOD CONTACT SURFACES** - Cover or remove all food and packaging materials. Pre-clean equipment with an appropriate cleaning solution and rinse. Spray the equipment with a 50 ppm available chlorine solution.

**SANITIZING POULTRY PROCESSING EQUIPMENT AND PREMISES**

**SPRAY/FOOD CONTACT SURFACES** - Cover or remove all food and packaging materials. Pre-clean equipment with an appropriate cleaning solution and rinse. Spray the equipment with a 50 ppm available chlorine solution.

**SPRAY/NON-FOOD CONTACT SURFACES** - Cover or remove all food and packaging materials. Pre-clean equipment with an appropriate cleaning solution and rinse. Spray the equipment with a 50 ppm available chlorine solution.

### **SANITIZING HARD FOOD CONTACT SURFACES**

Fresh sanitizer solution should be prepared daily, or more frequently if the solution becomes diluted or soiled. Sanitizers used in automated systems may be used for general cleaning but may not be re-used for sanitizing purposes.

**RINSE METHOD** A solution of 100 ppm available chlorine may be used in the sanitizing solution if a chlorine test kit is available. Solutions containing an initial concentration of 100 ppm available chlorine must be tested and adjusted periodically to insure that the available chlorine does not drop below 50 ppm. Prepare a 100 ppm sanitizing solution if a test kit is available. If no test kit is available, prepare a 200 ppm sanitizing solution.

Clean equipment surfaces in the normal manner. Remove all soils and food particles by flushing, scraping and/or pre-soaking. Wash thoroughly with a good detergent followed by a potable water rinse. Prior to use, rinse all surfaces thoroughly with the sanitizing solution, maintaining contact with the sanitizer for at least 2 minutes. If solution contains less than 50 ppm available chlorine, as determined by a suitable test kit, either discard the solution or add sufficient product to re-establish a 200 ppm residual. Do not rinse equipment with water after treatment and do not soak equipment overnight.

**IMMERSION METHOD** - A solution of 100 ppm available chlorine may be used as the sanitizing solution if a chlorine test kit is available. Solutions containing an initial concentration of 100 ppm available chlorine must be tested and adjusted periodically to insure that the available chlorine does not drop below 50 ppm. Prepare a 100 ppm sanitizing solution if a test kit is available. If no test kit is available, prepare a 200 ppm sanitizing solution.

Clean equipment surfaces in the normal manner. Remove all soils and food particles by flushing, scraping and/or pre-soaking. Wash thoroughly with a good detergent followed by a potable water rinse. Prior to use, immerse equipment in the sanitizing solution for at least 2 minutes and allow the sanitizer to drain. If solution contains less than 50 ppm available chlorine, as determined by a suitable test kit, either discard the solution or add sufficient product to re-establish a 200 ppm residual. Do not rinse equipment with water after treatment.

**FLOW/PRESSURE METHOD** - Disassemble equipment and clean equipment surfaces in the normal manner. Remove all soils and food particles by flushing, scraping and/or pre-soaking. Wash thoroughly with a good detergent followed by a potable water rinse. Assemble equipment in operating position prior to use. Prepare a volume of a 200 ppm available chlorine sanitizing solution equal to 110% of volume capacity of the equipment. Pump solution through the system until full flow is obtained at all extremities,

the system is completely filled with the sanitizer and all air is removed from the system. Close drain valves and hold under pressure for at least 2 minutes to insure contact with all internal surfaces. Remove some cleaning solution from drain valve and test with a chlorine test kit. Repeat entire cleaning/sanitizing process if effluent contains less than 50 ppm available chlorine.

**CLEAN-IN-PLACE METHOD** - Clean equipment surfaces in the normal manner. Remove all soils and food particles by flushing, scraping and/or pre-soaking. Wash thoroughly with a good detergent followed by a potable water rinse. Prepare a volume of a 200 ppm available chlorine sanitizing solution equal to 110% of volume capacity of the equipment. Pump solution through the system until full flow is obtained at all extremities, the system is completely filled with the sanitizer and all air is removed from the system. Close drain valves and hold under pressure for at least 10 minutes to insure contact with all internal surfaces. Remove some cleaning solution from drain valve and test with a chlorine test kit. Repeat entire cleaning/sanitizing process if effluent contains less than 50 ppm available chlorine.

**SPRAY/FOG METHOD** - Clean equipment surfaces in the normal manner. Remove all soils and food particles by flushing, scraping and/or pre-soaking. Wash thoroughly with a good detergent followed by a potable water rinse. Use a 200 ppm available chlorine solution to control bacteria, mold or fungi and a 600 ppm solution to control bacteriophage. Use spray or fogging equipment which can resist hypochlorite solutions. Always empty and rinse spray/fog equipment with potable water after use. Thoroughly spray or fog all surfaces until wet, allowing excess sanitizer to drain. Vacate area for at least 2 hours. Prior to using equipment, thoroughly rinse all wetted and cleaned surfaces with a final sanitizing rinse solution of 200 ppm available chlorine.

### **SANITIZING HARD NON-FOOD CONTACT SURFACES**

**RINSE METHOD** - Prepare a sanitizing solution containing 200 ppm available chlorine by weight. Clean equipment surfaces in the normal manner. Prior to use, rinse all surfaces thoroughly with the sanitizing solution, maintaining contact with the sanitizer for at least 2 minutes. Do not rinse equipment with water after treatment and do not soak equipment overnight.

**IMMERSION METHOD** - Prepare a sanitizing solution containing 200 ppm available chlorine by weight. Clean equipment in the normal manner. Prior to use, immerse equipment in the sanitizing solution for at least 2 minutes and allow the sanitizer to drain. Do not rinse equipment with water after treatment and do not soak equipment overnight.

**SPRAY/FOG METHOD** - Pre-clean all surfaces after use. Prepare a 200 ppm available chlorine sanitizing solution. Use spray or fogging equipment which can resist hypochlorite solutions. Prior to using equipment, thoroughly spray or fog all surfaces until wet, allowing excess sanitizer to drain. Vacate area for at least 2 hours. Do not rinse equipment with water after treatment and do not soak equipment overnight.

## **CLEANING AND DISINFECTING FOOD PREPARATION AND PROCESSING FACILITIES AND EQUIPMENT**

Cover or remove all food and packaging materials. Pre-clean equipment with an appropriate cleaning solution and rinse. Saturate all surfaces with a 600 ppm available chlorine solution. Allow to soak for at least 10 minutes. Thoroughly rinse all wetted and cleaned surfaces with a final sanitizing rinse solution of 200 ppm available chlorine.

## **POST HARVEST TREATMENT OF FRUITS AND VEGETABLES**

For the control of microorganisms causing decay of fruits and vegetables, please refer to the following tables for the recommended concentration levels of available chlorine.

For treatment of fruit and vegetable commodities, do not rinse with fresh water after treatment. After treatment, moisture must be removed by centrifuging. Mushrooms must be treated with an anti-oxidant after chlorine treatment to prevent browning.

**CHLORINE DOSAGE IN FRUIT AND VEGETABLE TREATMENT**  
**Available Chlorine Required in Treatment Water**

COMMODITY	TREATMENT METHOD	AVAILABLE CHLORINE TO APPLY (ppm)	COMMENTS
Apples	Dump Tank	100 - 150	Submerge the apples for a minimum of 45 seconds. Do not exceed 90 seconds contact time in dump tank or flume. <b>Spray until thoroughly wet.</b>
	Flume	30 - 50	
	Spray	100 - 150	
Artichokes	Spray	100 - 150	Spray until thoroughly wet.
Bell Peppers	Dump Tank	100 - 135	Remove after 2 - 5 minutes contact time in the dump tank. <b>Spray until thoroughly wet.</b>
	Spray	300 - 400	
Broccoli	Spray	100 - 150	Spray until thoroughly wet.
Brussels Sprouts	Spray	100 - 150	Spray until thoroughly wet.
Cabbage (Chopped)	Spray	80 - 100	Spray until thoroughly wet. After treatment, the adhering moisture must be removed by centrifuging.
Carrots	Dump Tank	100 - 200	Remove the carrots from dump tank and flume after 1 - 5 minutes contact time. <b>Spray until thoroughly wet.</b>
	Flume	100 - 200	
	Spray	50 - 100	
Cauliflower	Spray	300 - 400	Spray until thoroughly wet.
Celery	Spray	100	Spray until thoroughly wet.



Cherries	Spray	75 - 100	Spray until thoroughly wet.
Chopped Salad	Spray	80 - 100	Spray until thoroughly wet. After treatment the adhering moisture must be removed by centrifuging.
Corn	Spray	75 - 100	Spray until thoroughly wet.
Cucumbers	Spray	75 - 100	Spray until thoroughly wet.
Garlic	Tank	75 - 150	Remove from tank after 3 - 5 minutes contact.
Grapefruits	Spray Drench	40 - 75 100 - 150	Spray until thoroughly wet. Drench for 3 - 5 minutes. For citrus quarantine treatment, use 200 ppm of available chlorine at pH 6.0 - 7.5 in drench tank.
Kiwi Fruit	Spray	100	Spray until thoroughly wet.
Lemons	Spray Drench	40 - 75 100 - 150	Spray until thoroughly wet. Drench for 3 - 5 minutes. For citrus quarantine treatment, use 200 ppm of available chlorine at pH 6.0 - 7.5 in drench tank.
Lettuce (Butter)	Spray	10 - 20	Spray until thoroughly wet.
Lettuce (Chopped)	Spray	80 - 100	Spray until thoroughly wet. After treatment the adhered moisture must be removed by centrifuging.
Lettuce (Romaine)	Spray	20 - 40	Spray until thoroughly wet.
Melons (all varieties)	Hydrocooler Spray	30 - 75 100 - 200	Hydrocool for 20 - 30 minutes. Spray until thoroughly wet.

Olives	Spray	10 - 100	Spray until thoroughly wet.
Onion	Spray / Tank	75 - 100	Remove from tank after 2 - 3 minutes contact time. Spray until thoroughly wet.
Onions (green)	Spray	10 - 100	Spray until thoroughly wet.
Oranges	Drench Spray	100 - 150 40 - 75	Drench for 3 - 5 minutes. For citrus quarantine treatment, use 200 ppm of available chlorine at pH 6.0 - 7.5 in drench tank. Spray until thoroughly wet.
Nectarines	Hydrocooler Spray	30 - 75 50 - 100	Spray until thoroughly wet. Hydrocool for 20 - 30 minutes.
Peaches	Hydrocooler Spray	30 - 75 50 - 100	Hydrocool for 20 - 30 minutes. Spray until thoroughly wet.
Pears	Dump Tank	200 - 300	Remove from tank after 2 - 3 minutes contact time.
Peas (pod)	Spray	50 - 100	Spray until thoroughly wet.
Peppers	Spray	300 - 400	Spray until thoroughly wet.
Plums	Hydrocooler Spray	30 - 75 50 - 100	Hydrocool for 20 - 30 minutes. Spray until thoroughly wet.
Potatoes	Dump Tank Flume Spray	30 - 100 200 - 300 100 - 200	Remove from tank and flume after 2 - 5 minutes contact time. Spray until thoroughly wet.
Potatoes (white)	Spray	500 - 600	This concentration of chlorine should be used only if bleaching of potatoes is desirable. Spray until thoroughly wet on cleaned potatoes.

Prunes	Spray / Tank	50 - 100	Spray until thoroughly wet. Remove from tank after 2 - 5 minutes contact time.
Pumpkins	Spray	100 - 200	Spray until thoroughly wet.
Radishes	Spray Tank	100 - 150 10 - 25	Remove from tank after 1 - 1 1/5 minutes contact time. Spray until thoroughly wet.
Spinach	Spray	75 - 150	Spray until thoroughly wet.
Squash	Spray	75 - 150	Spray until thoroughly wet.
Sweet Potatoes	Tank	100 - 150	Remove after 2 - 3 minutes of contact time in the tank.
Tomatoes	Tank Spray	200 - 350 100 - 150	Remove after 2 - 3 minutes of contact time in the tank. Spray until thoroughly wet.
Turnips	Tank	100 - 200	Remove after 2 - 3 minutes of contact time the tank.

## **BACTERIA, ALGAE, SLIME BUILD-UP AND CLOGGING IN IRRIGATION SYSTEMS**

This product is to be applied through drip/trickle sprinkler irrigation systems only for agricultural crops and only where this manner of use will not cause crop damage. As packaged, chlorine gas has 99.5% or higher chlorine content. While using chlorine gas is generally considered the least expensive method of applying chlorine, it is also hazardous if used without following the direction of trained or qualified service personnel.

Irrigators wishing to apply chlorine gas should use suitably designed vacuum injector equipment (Venturi ejector device) rated for chlorine. Do not attempt to use ejectors designed for other purposes (such as fertigation) because crop injury, hazardous equipment failure and/or lack of product effectiveness can result. Questions regarding equipment use and calibration should be directed to chlorine suppliers or other experts such as your state or local Agriculture Research Center.

**DO NOT** connect any irrigation system, including greenhouse systems into which chlorine is to be added, to a public water system unless safety devices prescribed by the state Department of Health, Safe Drinking Water Branch, for cross connection protection are in place.

A certified applicator or someone under the direct supervision of a certified applicator shall start up, shut down, and make necessary adjustments to the system as needed to maintain proper performance of the chlorine application and compliance with this label.

**CALIBRATION** - If the irrigation water has high levels of nutrients causing bacterial, algae, or other bio-fouling that reduces system performance, continuous chlorination may be necessary. The recommended level of free residual chlorine for continuous feed is 1 to 2 ppm, measured at the end of the farthest lateral using a good quality test kit for free chlorine (also called "free residual" or "free available" chlorine).

Periodic shock treatments at a higher chlorine rate of up to 20 ppm free residual may be appropriate where bacteria and/or algae clogging and build-up are not managed by maintaining a continuous residual. The frequency of the chlorine shock application depends upon the frequency and extent of bio-clogging.

Superchlorination, bringing chlorine concentrations to as much as 100 ppm total chlorine, is recommended for reclaiming low-volume irrigation systems if clogged by algae and bacterial slimes. Set the chlorinator to deliver 100 ppm in the drip system and monitor the free chlorine residual at the end of the farthest lateral. As soon as it is established that the free residual reading is between 10 and 20 ppm, shut the system down and leave it undisturbed for up to 24 hours. Then flush all sub-mains and laterals with fresh water. Superchlorination will not dissolve or remove scale or inorganic sediment fouling.

The chlorine gas application rate can be determined from the following formula:

$$\begin{array}{l} \text{Chlorine Gas} \\ \text{Injection Rate in} \\ \text{lbs./day} \end{array} = \begin{array}{l} \text{System Flow Rate} \\ \text{in gpm} \end{array} \times \begin{array}{l} \text{Desired Chlorine} \\ \text{Concentration in} \\ \text{ppm} \end{array} \times 0.012$$

Example:

How much chlorine will be required daily to obtain 2 ppm available chlorine with a water flow rate of 1500 gallons per minute?

$$\begin{array}{l} \text{Chlorine Gas} \\ \text{Injection Rate in} \\ \text{lbs./day} \end{array} = 1500 \text{ gpm} \times 2.0 \text{ ppm} \times 0.012$$

Chlorine Gas Injection Rate = 36 lbs./day

**NOTE:** This calculation, when applied to clean water which is free of amine nitrogen and organic nutrients, will give a result close to the actual chlorine gas dose setting required. In this case, the chlorine gas dose rate (in ppm) approximately equals the desired free chlorine concentration (in ppm). In actual practice, however, contaminants in the water may consume chlorine such that the desired free chlorine concentration is less than the chlorine gas dose rate as calculated above. To correctly establish the chlorine gas dose setting required, it is necessary to measure the free chlorine concentration (ppm) at the end of the treated increment in the field and adjust the chlorine gas dose setting until the desired free chlorine concentration is obtained. Only experience can establish the actual chlorinator settings required to provide the amount of free chlorine at the end of the farthest lateral (and consequent treatment of the irrigation system).

Chlorination should be started during irrigation, near the end of the irrigation sequence, but early enough to establish the desired free chlorine concentration throughout the system being treated. Apply the chlorine upstream of the filter to help keep the filter clean. Determine the level of free chlorine as described in the "Calibration" section, above, using a free chlorine test kit. Allow sufficient time to achieve a steady reading.

**DO NOT** apply chlorine when fertilizers, herbicides, and insecticides are being injected since they will consume the chlorine and may produce toxic reaction products.

Shut down the chlorine feed as soon as the irrigation water is switched to the next irrigation sector. Leave the treated water residing in the section which has been shut down.

If its source water is connected to a potable water system, the irrigation water system must contain a functional reduced-pressure-principle back-flow prevention device approved by your state Department of Health, appropriately situated to prevent

contamination of the potable water system. This device must be certified operational by an agent authorized for making certifications by the state Department of Health.

The chlorine vacuum ejector must contain a functional, integral check valve to prevent the flow of water into the chlorine line, toward the chlorine regulator. The chlorine vacuum line may also contain an optional chlorine-rated, normally-closed solenoid valve connected to a system power interlock and/or a secondary vacuum check valve for additional protection of the chlorine regulator.

**SENSITIVE PLANT SPECIES** - Certain plants, including various species of trees, flowers, shrubs, agronomic crops, fruits and vegetables are adversely affected by chlorinated irrigation. The use of this product can impact the growth, appearance and health of the plants.

Applications of chlorine in irrigation systems must be done by a certified applicator and, if necessary, on a trial basis until sufficient experience relative to sensitive plants, including crops and their specific varieties, is gained.

Begonias, geraniums and other ornamental plant species are known to be sensitive to continuous chlorination at levels of 1-2 ppm free chlorine. Plant species such as tomato, lettuce, broccoli, and petunia are sensitive to periodic chlorination levels of 10-20 ppm free chlorine.

If uncertain of a plant's tolerance, consult an agronomist or a support agency such as your local University Extension Service or use an alternate method to remove bio-fouling from the irrigation system.

## **FOOD PROCESSING WATER SYSTEMS**

**SLUG FEED METHOD** - Initial Dose: When system is noticeably fouled apply sufficient chlorine to obtain 20 ppm available chlorine. Repeat until control is achieved. Badly fouled systems must be cleaned before initial treatment.

Subsequent Doses: When microbial control becomes evident, test daily and maintain a 1 ppm residual.

**INTERMITTENT FEED METHOD** - Initial Dose: When system is noticeably fouled, apply sufficient chlorine to obtain 20 ppm available chlorine. Apply half (or 1/3, 1/4, or 1/5) of this initial dose when half (or 1/3, 1/4, or 1/5) of the water in the system has been lost by blowdown. Badly fouled systems must be cleaned before initial treatment.

Subsequent Doses: When microbial control becomes evident, test daily and maintain a 1 ppm residual. Apply half ( or 1/3, 1/4, or 1/5) of this initial dose when half ( or 1/3, 1/4, or 1/5) of the water in the system has been lost by blowdown.

**CONTINUOUS FEED METHOD** - Initial Dose: When system is noticeably fouled apply sufficient chlorine to obtain from 20 ppm available chlorine. Repeat until control is achieved. Badly fouled systems must be cleaned before initial treatment.

Subsequent Doses: When microbial control becomes evident, start a continuous feed and test daily to maintain a 1 ppm residual.

## **PULP AND PAPER MILL PROCESS WATER SYSTEMS**

**SLUG FEED METHOD** - Initial Dose: When system is noticeably fouled apply sufficient chlorine to obtain from 5 to 10 ppm available chlorine. Repeat until control is achieved. Badly fouled systems must be cleaned before initial treatment.

Subsequent Doses: When microbial control becomes evident, test daily and maintain a 1 ppm residual.

**INTERMITTENT FEED METHOD** - Initial Dose: When system is noticeably fouled, apply sufficient chlorine to obtain 5 to 10 ppm available chlorine. Apply half (or 1/3, 1/4, or 1/5) of this initial dose when half (or 1/3, 1/4, or 1/5) of the water in the system has been lost by blowdown. Badly fouled systems must be cleaned before initial treatment.

Subsequent Doses: When microbial control becomes evident, test daily and maintain a 1 ppm residual. Apply half ( or 1/3, 1/4, or 1/5) of this initial dose when half ( or 1/3, 1/4, or 1/5) of the water in the system has been lost by blowdown.

**CONTINUOUS FEED METHOD** - Initial Dose: When system is noticeably fouled apply sufficient chlorine to obtain from 5 to 10 ppm available chlorine. Repeat until control is achieved. Badly fouled systems must be cleaned before initial treatment.

Subsequent Doses: When microbial control becomes evident, start a continuous feed and test daily to maintain a 1 ppm residual.

## **COOLING TOWER, AIR WASHER AND EVAPORATIVE CONDENSER WATER**

**SLUG FEED METHOD** - Initial Dose: When system is noticeably fouled apply sufficient chlorine to obtain from 5 to 10 ppm available chlorine. Repeat until control is achieved. Badly fouled systems must be cleaned before initial treatment.

Subsequent Doses: When microbial control becomes evident, test daily and maintain a 1 ppm residual.

**INTERMITTENT FEED METHOD** - Initial Dose: When system is noticeably fouled, apply sufficient chlorine to obtain 5 to 10 ppm available chlorine. Apply half (or 1/3, 1/4, or 1/5) of this initial dose when half (or 1/3, 1/4, or 1/5) of the water in the system has been lost by blowdown. Badly fouled systems must be cleaned before initial treatment.

Subsequent Doses: When microbial control becomes evident, test daily and maintain a 1 ppm residual. Apply half ( or 1/3, 1/4, or 1/5) of this initial dose when half ( or 1/3, 1/4, or 1/5) of the water in the system has been lost by blowdown.

**CONTINUOUS FEED METHOD** - Initial Dose: When system is noticeably fouled apply sufficient chlorine to obtain from 5 to 10 ppm available chlorine. Repeat until control is achieved. Badly fouled systems must be cleaned before initial treatment.

Subsequent Doses: When microbial control becomes evident, start a continuous feed and test daily to maintain a 1 ppm residual.

### **PASTURIZER, WARMER AND CANNERY COOLING WATER SYSTEMS, INCLUDING CHILLERS**

**SLUG FEED METHOD** - Initial Dose: When system is noticeably fouled apply sufficient chlorine to obtain from 5 to 10 ppm available chlorine. Repeat until control is achieved. Badly fouled systems must be cleaned before initial treatment.

Subsequent Doses: When microbial control becomes evident, test daily and maintain a 1 ppm residual.

**INTERMITTENT FEED METHOD** - Initial Dose: When system is noticeably fouled, apply sufficient chlorine to obtain 5 to 10 ppm available chlorine. Apply half (or 1/3, 1/4, or 1/5) of this initial dose when half (or 1/3, 1/4, or 1/5) of the water in the system has been lost by blowdown. Badly fouled systems must be cleaned before initial treatment.

Subsequent Doses: When microbial control becomes evident, test daily and maintain a 1 ppm residual. Apply half ( or 1/3, 1/4, or 1/5) of this initial dose when half ( or 1/3, 1/4, or 1/5) of the water in the system has been lost by blowdown.

**CONTINUOUS FEED METHOD** - Initial Dose: When system is noticeably fouled apply sufficient chlorine to obtain from 5 to 10 ppm available chlorine. Repeat until control is achieved. Badly fouled systems must be cleaned before initial treatment.

Subsequent Doses: When microbial control becomes evident, start a continuous feed and test daily to maintain a 1 ppm residual.

### **NON-RESIDENTIAL SWIMMING POOL WATER DISINFECTION**

For a new pool or spring start-up, superchlorinate with 5 to 10 ppm available chlorine by weight. Check the level of available chlorine with a test kit. Adjust and maintain pool water pH to between 7.2 to 7.6. Adjust and maintain the alkalinity of the pool to between 50 to 100 ppm.



To maintain the pool, add manually or by a feeder device to yield an available chlorine residual between 0.6 to 1.0 ppm by weight. Stabilized pools should maintain a residual of 1.0 to 1.5 ppm available chlorine. Test the pH, available chlorine residual and alkalinity of the water frequently with appropriate test kits. Frequency of water treatment will depend upon temperature and number of swimmers.

Every 7 days, or as necessary, superchlorinate the pool by raising the available chlorine to 5 to 10 ppm available chlorine by weight. Check the level of available chlorine with a test kit. Do not re-enter pool until the chlorine residual is between 1.0 to 3.0 ppm.

At the end of the swimming pool season or when water is to be drained from the pool, chlorine must be allowed to dissipate from treated pool water before discharge. Do not chlorinate the pool within 24 hours prior to discharge.

**WINTERIZING POOLS** - While water is still clear and clean, apply sufficient chlorine while the filter is running, to obtain a 3 ppm available chlorine residual, as determined by a suitable test kit. Cover pool, prepare heater, filter and heater components for winter by following manufactures' instructions.

### **SPAS, HOT-TUBS, IMMERSION TANKS, ETC.**

**SPAS/HOT-TUBS** - Apply sufficient chlorine to obtain 5 ppm, as determined by a suitable chlorine test kit. Adjust and maintain pool water pH to between 7.2 and 7.8. Some oils, lotions, fragrances, cleaners, etc. may cause foaming or cloudy water as well as reduce the efficiency of the product.

Maintain the water at 5 ppm available chlorine during use.

During extended periods of disuse, maintain a 3 ppm chlorine concentration.

**HUBBARD AND IMMERSION TANKS** - Before patient use adjust bath to obtain a chlorine residual of 25 ppm, as determined by a suitable test kit. Adjust and maintain the water pH to between 7.2 and 7.6. After each use drain the tank. Prepare a fresh 25 ppm available chlorine solution in a bucket and circulate this solution through the agitator of the tank for 15 minutes and then rinse out the solution. Clean tank thoroughly and dry with clean cloths.

**HYDROTHERAPY TANKS** - Adjust to obtain a 1 ppm residual, as determined by a suitable chlorine test kit. Pool should not be entered until the chlorine residual is below 3 ppm. Adjust and maintain the water pH to between 7.2 and 7.6. Operate pool filter continuously. Drain pool weekly and clean before refilling.

## CHLORINATOR OPERATION

min

### CONNECTING THE CHLORINE GAS CYLINDER TO THE CHLORINATION SYSTEM

- Always leave bonnet and outlet cap on the chlorine cylinder until it is set in place and secured properly. Remove bonnet, then the outlet cap, using only a cylinder wrench specified by the Chlorine Institute (wrench no longer than 8" (200 ~~mm~~)). Make sure all fittings are clean and have no oily residue. Use a new chlorine gasket every time you hook up or re-connect a cylinder. As appropriate to the particular feed system, attach a pigtail, yoke connector or cylinder mounted regulator. Do not over-tighten either the pigtail or regulator to the cylinder valve.

Start the water flow for the chlorination system and make sure the hydraulic conditions are satisfactory. Remove the tubing at the ejector vacuum inlet and place your finger over the opening while the ejector water is running. There will be a strong suction. If suction is weak, investigate hydraulic conditions further. You may have to replace the vacuum tubing on the ejector.

Verify that all the tubing, manifold and auxiliary valves are correct and that all joints are properly gasketed. Be sure the chlorine valve on the cylinder is still closed.

If the chlorinator is connected to an automatic system put it on manual. Then, when you are sure the ejector system is operating properly, open the chlorine cylinder valve 1/8 to 1/4 turn and close it immediately. Use an aqua ammonia (5% household ammonia or stronger) vapor bottle to check for chlorine leaks around the valve and valve connections. Never apply ammonia liquid onto fittings or the valve assembly. If leaks are detected but not pin-pointed, open and re-close the chlorine cylinder valve again, venting ammonia vapor around individual connections to find the leak(s). Properly secure all fittings to eliminate leaks.

Next, open the chlorine cylinder valve 1/2 turn. Re-check all connections and tubing from the cylinder downstream to the ejector with aqua ammonia vapor. If there is a leak, close the cylinder valve immediately. Use the aqua ammonia vapor bottle to again check for chlorine leaks around the valve and valve connections until all leaks are identified and corrected.

Following the manufacturer's directions, check the chlorinator (regulator) for proper operation. Assure that it will reach its maximum feed capacity. In doing so, and while running the actual chlorination, never open the chlorine valve more than one full turn. If it will not operate to capacity, check the regulator for an empty cylinder indication. If necessary, close the chlorine valve, repair or replace the chlorinator. Note: All chlorine valves are closed by turning clockwise.

**DO NOT** tamper with or attempt to repair any fusible plugs. Refer problems to qualified personnel.

In case of an emergency, avoid exposing yourself to chlorine vapors. If you can do so safely, shut the cylinder valve; evacuate the area quickly and get qualified, properly trained personnel to deal with the problem. Do not attempt to approach a leaking system without HAZWOPER certification and without conforming to HAZWOPER procedures.

**DO NOT** proceed with chlorination if you have any questions or uncertainties. All personnel involved in the chlorination process must be HAZCOM trained and must attend annual classes on chlorine use and safety.

**CONNECTING OR REPLACING EMPTY CHLORINE CYLINDERS** - Perform the following operations with the system running as this will draw any chlorine remaining within the feed system into the irrigation water. If using an automatic system, switch to manual. Begin these procedures when the chlorine vacuum regulator indicates the attached cylinder is empty.

Close the chlorine cylinder valve using the Chlorine Institute approved wrench. Loosen the vacuum regulator, yoke or pigtail nut (whichever is connected to the cylinder valve). Step away from the chlorine cylinder so as not to breathe any remnants of low pressure chlorine left on the cylinder side of the regulator diaphragm. Then check the area around the cylinder valve with ammonia vapors to assure that the cylinder valve is fully closed.

Remove the chlorine vacuum regulator, yoke or pigtail from the chlorine cylinder valve. Replace the valve outlet cap and cylinder bonnet. Store and secure all empty cylinder together, separate from those that are full.

## CHLORINE DOSAGE IN CONTINUOUS FLOW SYSTEMS

### Weight of Chlorine Gas Required per Day

WATER FLOW		DESIRED LEVEL OF AVAILABLE CHLORINE							
G/MIN	G/DAY	0.5 ppm	1.0 ppm	2.0 ppm	3.0 ppm	4.0 ppm	5.0 ppm	6.0 ppm	8.0 ppm
10	14,400	1 oz	2 oz	4 oz	6 oz	8 oz	10 oz	12 oz	16 oz
15	21,600	1.5 oz	3 oz	6 oz	9 oz	12 oz	15 oz	18 oz	21 oz
20	28,800	2 oz	4 oz	8 oz	12 oz	16 oz	20 oz	24 oz	32 oz
30	43,200	3 oz	6 oz	12 oz	18 oz	24 oz	30 oz	36 oz	48 oz
40	57,600	4 oz	8 oz	16 oz	24 oz	32 oz	40 oz	48 oz	64 oz
50	72,000	5 oz	10 oz	20 oz	30 oz	40 oz	50 oz	60 oz	80 oz
60	86,400	6 oz	12 oz	24 oz	36 oz	48 oz	60 oz	72 oz	96 oz
70	100,800	7 oz	14 oz	28 oz	42 oz	56 oz	70 oz	84 oz	112 oz
80	115,200	8 oz	16 oz	32 oz	48 oz	64 oz	80 oz	96 oz	128 oz
90	129,600	9 oz	18 oz	36 oz	54 oz	72 oz	90 oz	108 oz	144 oz
100	144,400	10 oz	20 oz	40 oz	60 oz	80 oz	100 oz	120 oz	160 oz
150	216,000	15 oz	30 oz	60 oz	90 oz	120 oz	150 oz	180 oz	240 oz
200	288,000	20 oz	40 oz	80 oz	120 oz	160 oz	200 oz	240 oz	320 oz
300	432,000	30 oz	60 oz	120 oz	180 oz	240 oz	300 oz	360 oz	480 oz

1 lb. = 16 oz

To obtain a desired chlorine level for a known water flow rate, find the desired chlorine level in ppm at the top of the chart. Follow the column down until you are opposite the flow rate for your equipment. The figure in that column is the weight of chlorine that must be added daily. If the desired chlorine level is not shown on the chart, multiply the chart values to get the correct dosage level.

Example: To obtain 4 ppm at a flow rate of 100 gallons per minute, add 80 oz or  $80/16 = 5$  lb. of chlorine per day. To obtain 100 ppm at a flow rate of 60 gallons per minute, use  $12 \times 100 = 1200$  oz or  $1200/16 = 75$  lb. chlorine per day.

29/29

## **STORAGE AND DISPOSAL**

### **STORAGE**

Store cylinders and ton containers in a dry area away from sources of heat and protected from direct sunlight and precipitation. Do not store in excessive heat. Segregate chlorine containers from other compressed gasses, and never store near hydrocarbons, finely divided metals, turpentine, ether, anhydrous ammonia, or other flammable materials. All storage containers and cylinders must have a weather resistant label and must not be accessible to the general public. Do not drop container. If container is damaged or leaking, refer to procedures in the "Chlorine Manual" published by The Chlorine Institute, Inc. and/or notify supplier immediately. Do not contaminate water, food, or feed by storage or disposal. Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law.

### **LEAK PROCEDURES**

Make daily inspections for leaks. Stop a leak at once, since it will become worse with time.

In case of leak, evacuate everyone from the immediate area. For entry into the affected area to correct problem, wear personal protective equipment (including prescribed respirators) specified in the Hazards to Humans section of this labeling. When possible, move leaking or damaged cylinders outdoors or to an isolated location. Observe strict safety precautions. Work upwind, if possible. Allow any liquid chlorine to evaporate. Only correctly trained and Personal Protective Equipment (PPE)-equipped handlers are permitted to perform such cleanup. Do not permit entry into the leak area by any other person until the chlorine has completely dispersed.

### **DISPOSAL OF CONTAINER**

Container is returnable and must be properly identified with return tag and returned as promptly as possible to supplier according to prescribed instructions and practices in the "Chlorine Manual" published by The Chlorine Institute, Inc. All valves must be closed tight and closures or caps secured. It is illegal to ship a leaking chlorine container.