Chlorine Safe Handling Training

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INTRODUCTIONS

AGENDA

This training will review the following information:

- Chlorine packaging process overview
- Chlorine’s physical and chemical properties
- Chlorine’s health effects
- PPE
- Safe chlorine handling practices
- Emergency response
- Regulatory requirements

Question & Answer session

Water & Wastewater Video

Chlorine Packaging

Process Overview

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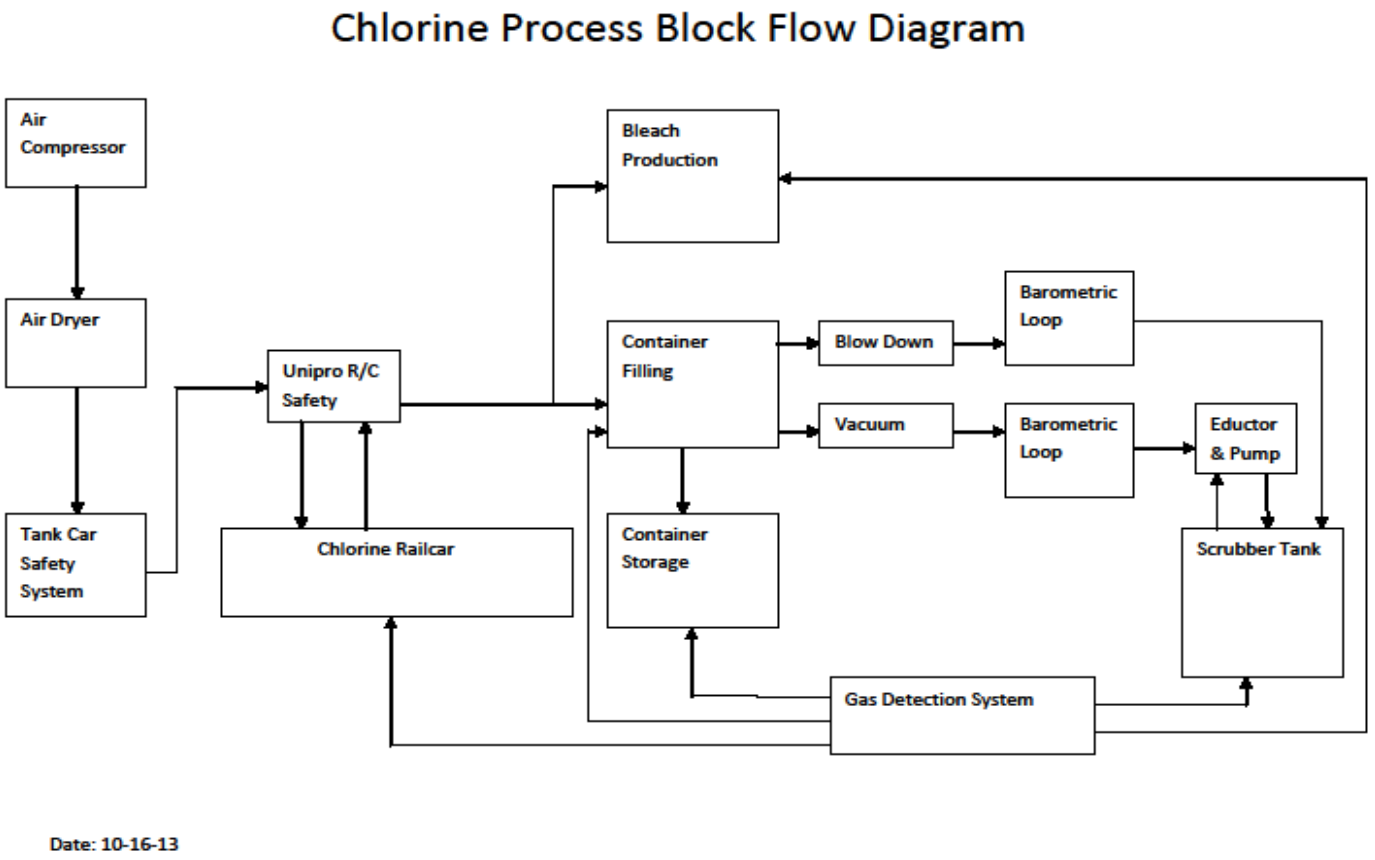
Chlorine Process Overview



Chlorine Packaging - Evacuation

•All cylinders and tons are completely evacuated upon return.

- Required to perform tare weight check.
  - Detect presence of water
  - Detect excessive corrosion
- Necessary to perform internal inspection

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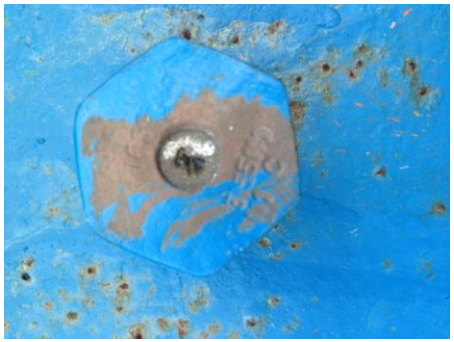
Chlorine Packaging - Inspections

- Cylinders internal inspections:
  - Rust or debris
  - Moisture
  - Completed before every refill
- Ton containers internal inspections:
  - Rust and debris
  - Excessive pitting
  - Moisture
  - Completed prior to every fourth refill
- External inspections:
  - Gouges, dents and pitting
  - Test date
  - Fuse plugs
  - Threads of openings



Chlorine Packaging – Preparation for Filling

- Valve installation:
  - Cylinders valves replaced with rebuilt valves every refill
  - Ton container valves inspected and refurbished as needed.
    - Packings replaced every refill
- Cylinders & ton containers are painted as needed
  - Footring/bottom inspection every refill
- Required markings verified

Chlorine Packaging - Filling

- Cylinders and ton containers filled on scales
  - Tare weight checks
    - 5% loss in tare and cylinder/ton container require retest
    - 10% loss in tare cylinder/ton container condemned
  - Valve operation confirmed
  - Packing nut torque confirmed
  - Valve stem closed to 20 to 50 ft-lbs.
  - Outlet cap applied
  - Protective bonnets replaced
  - Labels applied
  - Extra lead washers attached.

Chlorine Packaging – Storage and Shipping

- Cylinders/ton containers stored for 24 hours before shipping
  - Confirm no leaks
- Cylinders stored in cages for safe movement and securement
- Tons stored off the ground and with adequate spacing for inspection
- Cylinders typically shipped in cages
- Ton containers shipped on specially designed flatbeds

Physical & Chemical Properties

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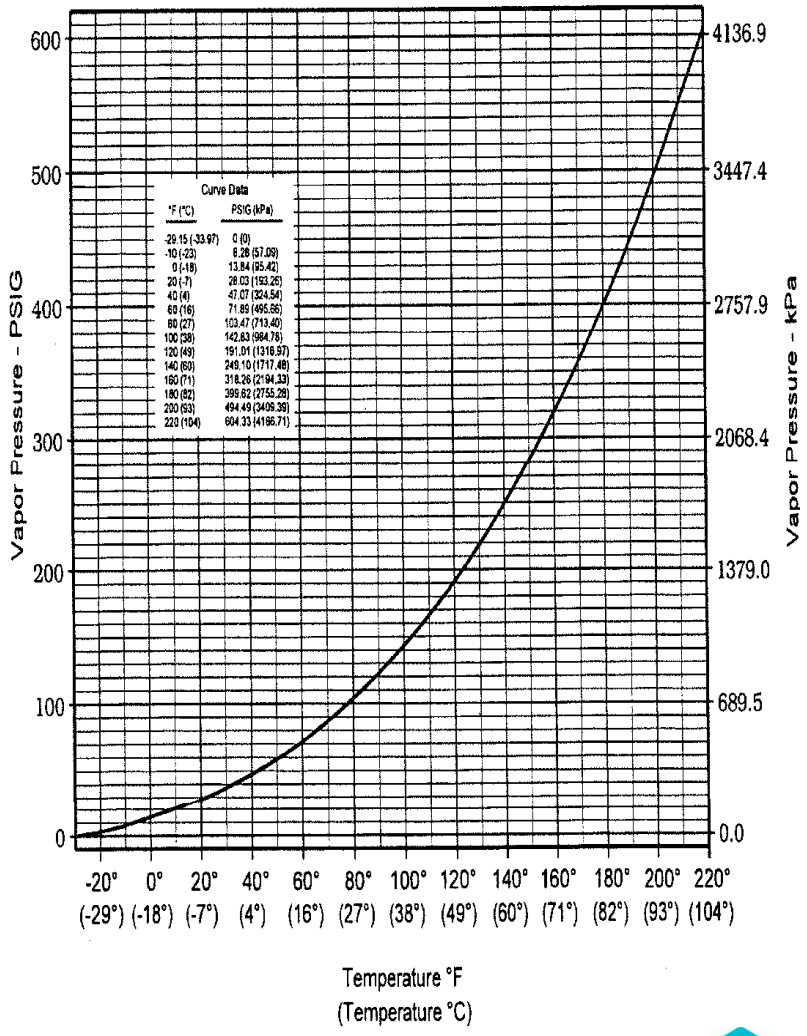
Chlorine Vapor Pressure vs Temperature

Vapor Pressure

Definition - The amount of pressure exerted by the vapor against the walls of its container at a given temperature.

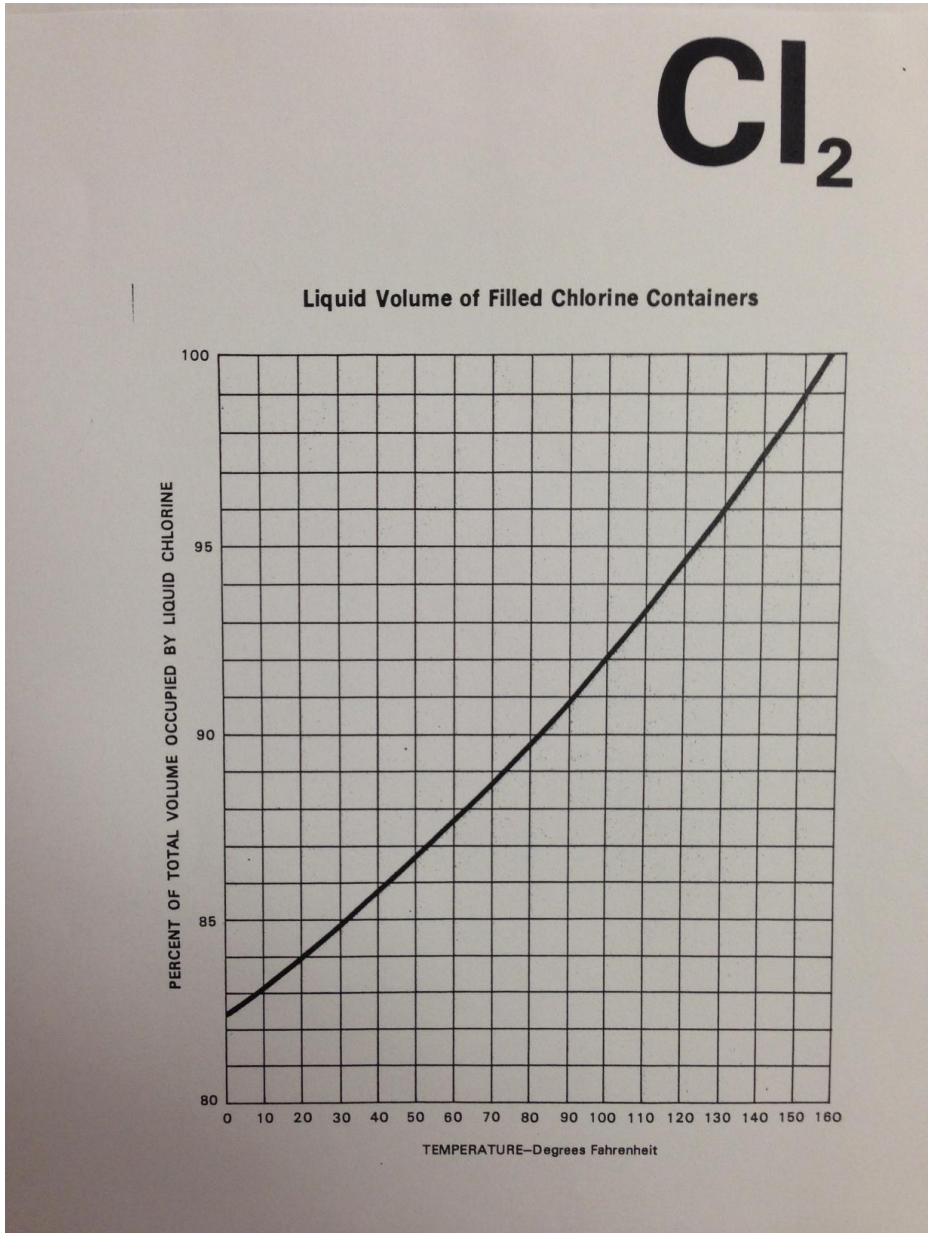
Temperature F	PSIG
-29	0
60	69
85	111
158	302

Note: Pressure increases at a greater rate as temperature increases.



Liquid Volume of Filled Containers

- Containers are only filled to 1.25 times its water capacity or approx. 82.5% at 0 F.
- At 156 F the container is completely liquid full.
- Liquids compress very little, generating high pressures when confined and temperature increases.
- Fuse plugs melt at 156 F, preventing a hydrostatic pressure from rupturing the container.



Liquid Filled Container

Physical & Chemical Properties

- Chlorine & water
  - Low solubility, < 0.7% at 20 ^{o} C
  - Liquid chlorine is approximately 1.4 time heavier than water
  - $Cl_2 + H_2O$ = HOCl and HCL

Physical & Chemical Properties

Vapor Expansion

- Definition – The amount of vapor that is produced when the liquid evaporates
- Vapor expansion of liquid chlorine is approximately 460 to 1

150 pound cylinder if released will:

- Fill a room 10’ x 10’ x 8’ with 100% chlorine gas.
- If allowed to disperse to the IDLH (10 ppm) it would cover an area of 229 acres by eight foot high.

Health Effects

Health Effects

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
EXPOSURE		AVOID ALL CONTACT! **CLOSED SYSTEM** MUST BE USED FOR SAFE HANDLING.	IN ALL CASES OF SIGNIFICANT EXPOSUE CONSULT MEDICAL ATTENTION.
• **INHALATION**	Corrosive. Burning sensation. Cough. Headache. Difficultly breathing. Nausea. Shortness of breath. Sore throat. Symptoms may be delayed (see Notes). **Good Warning Properties**.	Closed system and ventilation (placed at floor level). **EYE AND RESPIRATORY PROTECTION RECOMMENDED FOR CONTAINER CHANGES.**	Fresh air, rest. Half-upright position. Artificial respiration if indicated. Refer for medical attention. See example in video and MSDS.
• **SKIN**	Corrosive. Skin burns. Pain.	Protective gloves and protective clothing required in leak situation.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
• **EYES**	Corrosive. Pain. Blurred vision. Severe deep burns.	Full Face Respirator or Safety goggles in combination with respirator recommended for container change outs.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then seek medical attention.
• **INGESTION**	Unlikely – Changes to a gas upon loss of containment.		Refer for medical attention.

Health Effects – Chlorine Exposure

Table 2: Chlorine Exposure Thresholds and Effects[1]

Exposure Level (ppm)	Effect
0.2 - 0.4	Odor threshold (decrease in odor perception occurs over time)
Less than 0.5	No known acute or chronic effect.
0.5	TLV-TWA, REL-Ceiling
1	PEL-Ceiling, TLV-STEL, ERPG-1
1 – 3	Mild, mucous membrane irritation, tolerated up to 1 hour
5 – 15	Moderate irritation of the respiratory tract
3	ERPG-2
10	IDLH
20	ERPG-3
25	Becomes visible – estimated, humidity dependent
30	Immediate chest pain, vomiting, dyspnea, cough
40 - 60	Toxic pneumonitis and pulmonary edema
430	Lethal over 30 minutes
1000	Fatal within a few minutes

[1] CI Pamphlet 63

PPE

PPE

•For areas where chlorine is stored or used:
  - Escape Respirator available
  - Normal work clothing
  - Compliance with facility's PPE requirements

•For initial line breaks:
  - Chlorine gas – Full face respirator
  - Chlorine liquid – Full face respirator and protective gloves

•PPE recommendations above based of facility:
  - Has performed industrial hygiene sampling
  - Employees have been trained
  - Has system for purging and evacuating piping before line break

PPE

Limitations for respirators:

- Escape respirators
  - Only for evacuating contaminated area immediately
  - Must have sufficient oxygen level
- Full face respirators
  - Must be medically approved
  - Fit testing required annually
  - Must know concentration of chlorine and it be within respirator's limitations
    - If level not known, then SCBA required
  - Must have sufficient oxygen level

Transportation, Storage & Handling

Transportation, Storage & Handling

Transportation on public roads of any amount:

- Requires a CDL with hazmat endorsement
- Hazmat permit for facility
- Transportation security plan
- Driver training
- Placarding
- Shipping papers

Transportation of empty containers have the same requirements as full

Transportation, Storage & Handling

Storage concerns:

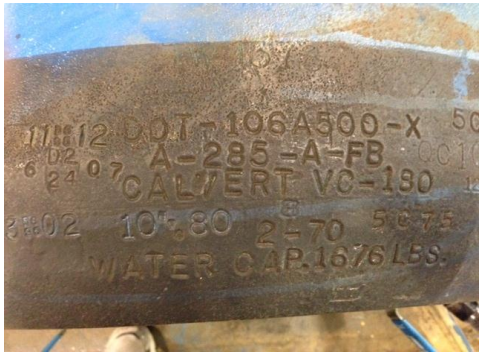
- Store in dry areas, away from direct sunlight if possible
- Away from heat sources
  - Aware of two instances where heaters in small storage rooms melted the fuse plugs resulting in a release.
- Gas detection equipment in storage areas
  - Location of probes
  - Calibration
- Access to cylinders or ton containers for emergency response
- Fire protection

Connecting, Use & Disconnecting

Containers - Ton

Ton Container Design

- Each Valve opening has an eduction tube.
  - When valves are vertically aligned top feeds gas and bottom feeds liquid.
- Each end of container has three fuse plugs.
- Valves and fuse plug openings may be ¾ inch or one inch.
- The ton container has its tare weight(s) and test date(s) marked on the chime area.
  - Typically is also marked on container near the valves



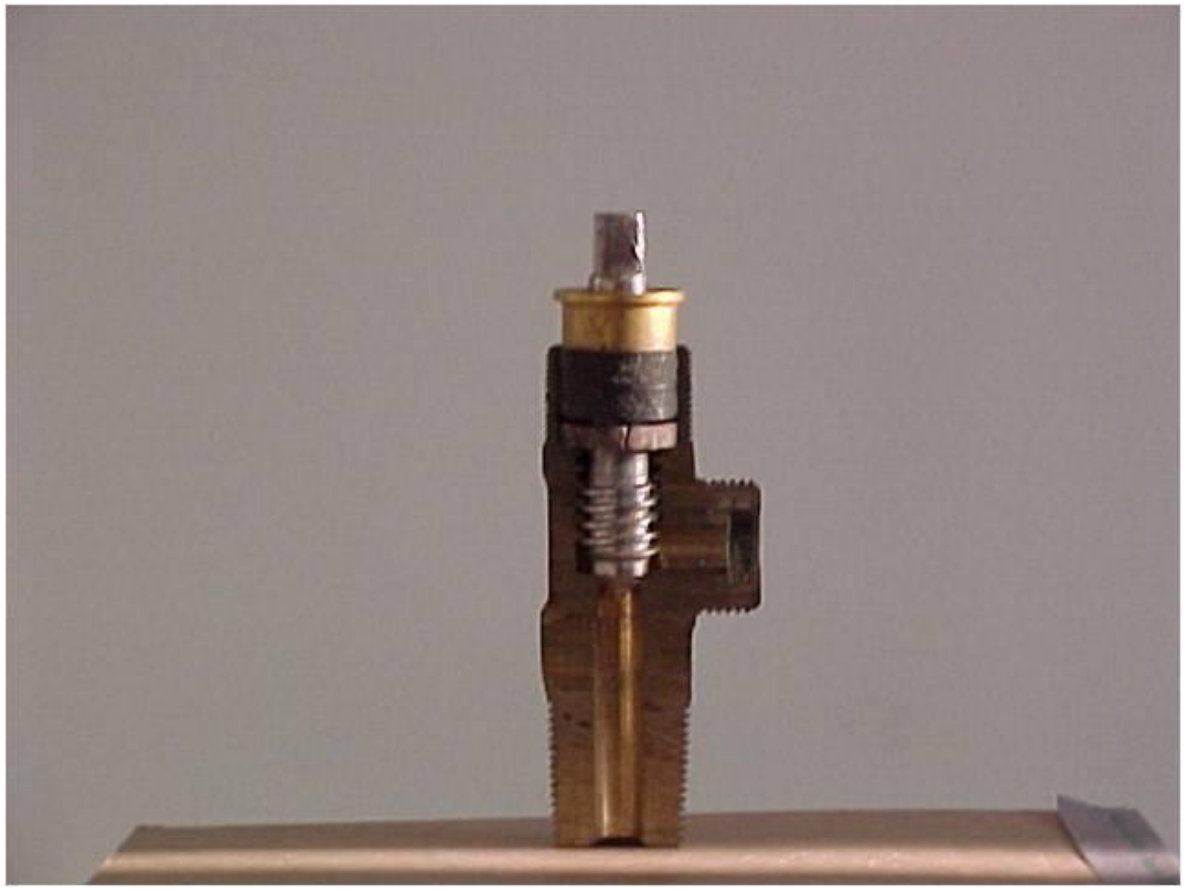
Containers - Cylinders

- Cylinder Design:
  - Foot Ring
  - Bump bottom (Heavy)
- Cylinder's test date and tare weight marked on shoulder area.
  - Hydrostatic test is valid for 5 years.
  - Tare weight – It may more than one tare weight marked indicating it has been requalified since its original manufactured date.
  - DOT markings – One inch
  - "Poison - Inhalation Hazard"
  - "Chlorine"

Chlorine Valves

Valve Design

- Body made of a brass alloy.
- Stem is monel.
- Packings may be garlock or teflon.
- One full turn allows maximum flow.
- Always check packing nut before opening.



Chlorine Valves

Cylinder Valves

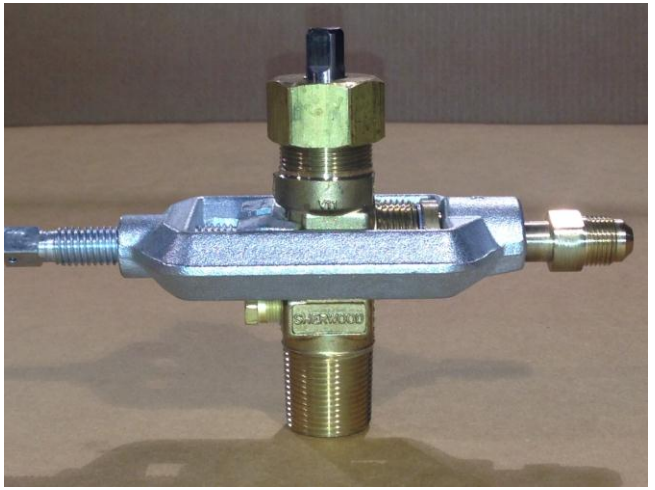
- Fuse plug is part of valve.
- Only ¾ inch NGT inlet threads.
- Four oversize versions available.

Ton Container Valves

- No fuse plug.
- May be ¾ inch or 1 inch NGT inlet threads.
- Valve seat opening may be larger than cylinder valve's.
- Four oversize versions available.

Chlorine Valves

- Connections to cylinder and ton container valves always use a yoke.
  - Lead washer , replace after each use.
    - Used lead washers must be disposed of properly.
  - Check valve's outlet face for imperfections that may prevent gasket from sealing.
  - Some Chlorinators may not require a yoke to mount.
- CGA Connection 660 is not recommended
- Valve outlet threads are not standard tapered pipe threads – do not use standard pipe fittings



Connecting

The suggested steps for connecting a cylinder or ton container are:

- Check packing nut that it is hand tight at minimum
- Verify valve stem is closed
- Remove outlet cap
- Check that valve face is clean and smooth
- Using a new gasket, connect yoke and adaptor
- Tighten yoke to make seal, but do not over tighten

Disconnecting

The suggested steps for disconnecting a cylinder or ton container are:

•Wear PPE

•Close valve using torque wrench to 25 ft-lbs.

•Check for pressure drop to 0 psig

•If leak exists (as indicated by pressure increase), increase torque to 40 ft-lbs.

•If valve still leaks, increase torque to 50 ft-lbs. Recheck for leak.

- If leak still exists, contact supplier.

•If pressure remains constant at or below 0 psig, remove connection.

•Verify outlet cap has gasket and replace valve outlet cap.

•Replace valve hood or bonnet.

Valve Torque

- Excess torque does not usually help the situation.
- If valve is difficult to open, a sharp blow to the wrench versus a slow increase in pressure on the wrench may open valve.
- Alternative is to return the cylinder to your supplier.
- Please mark any valves that are problematic so your supplier can be sure to address them.

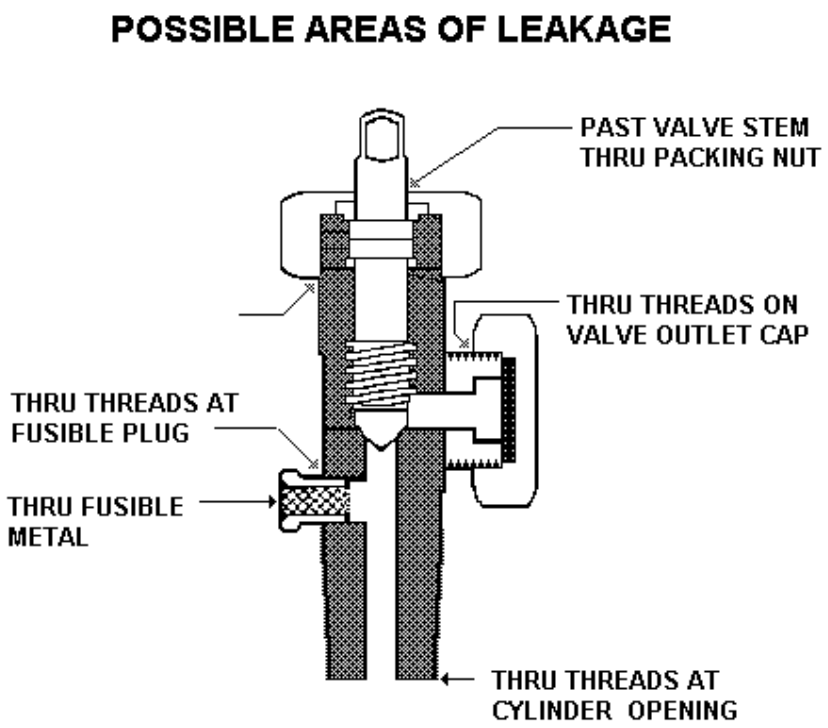
Minor Leaks

Valve leaks:

- If at packing nut, tighten nut ½ turn past hand tight. If this does not stop the leak when valve is in use contact supplier
- If through fusible plug (cylinders), apply A kit. Contact supplier.
- If through threads at cylinder or ton opening, apply A kit for cylinders and B kit for ton containers and contact supplier
- If at outlet cap threads, verify valve is closed and tighten outlet cap. Contact supplier

If valve will not completely shut off, try opening and closing the valve a few times while it is still connected to the system. If this does not stop the leak, contact supplier

If fuse plug on ton container leaks, apply B kit and contact supplier. Do not attempt to tighten the fuse plug unless your certain there is no corrosion of the threads or plug.



Minor leaks

- Remember – leaks only get worse, take action when leaks are noticed.
- Please label or tag any bad valves so supplier can follow up with the issue
- Ensure the leak detector solution is of adequate strength

Information, Training & Security

Regulatory Issues

Security

•May be required to have a Security Plan. Be aware of your responsibilities..

EPA – Pesticide

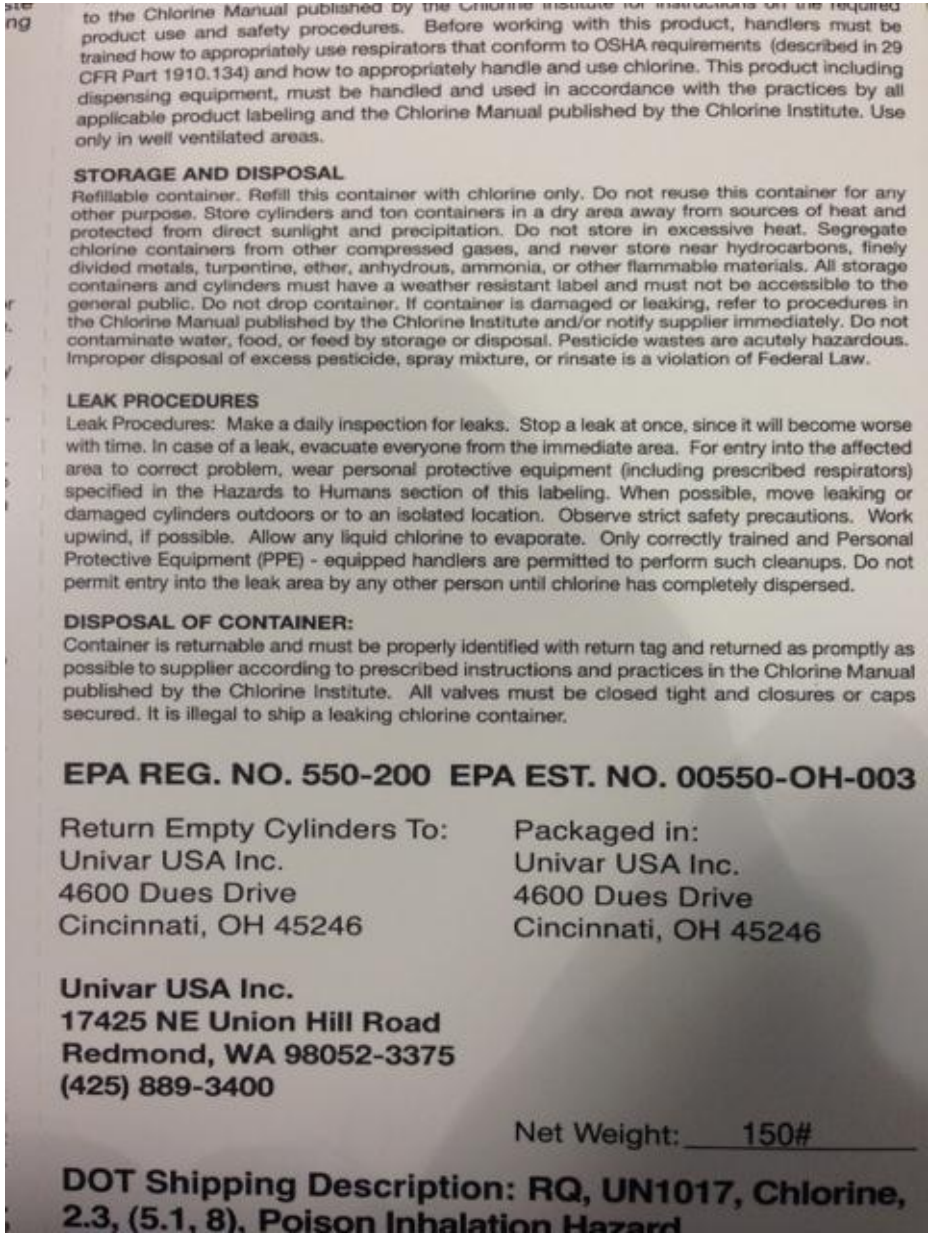
•Chlorine is a registered pesticide.

Risk Management Plans

•A plan to protect the community from hazards

Process Safety Management

• A plan to protect employees from hazards



to the Chlorine Manual published by the Chlorine Institute 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 by all applicable product labeling and the Chlorine Manual published by the Chlorine Institute. Use only in well ventilated areas.

STORAGE AND DISPOSAL

Refillable container. Refill this container with chlorine only. Do not reuse this container for any other purpose. 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 gases, 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 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

Leak Procedures: Make a daily inspection for leaks. Stop a leak at once, since it will become worse with time. In case of a 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 cleanups. Do not permit entry into the leak area by any other person until 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. All valves must be closed tight and closures or caps secured. It is illegal to ship a leaking chlorine container.

EPA REG. NO. 550-200 EPA EST. NO. 00550-OH-003

Return Empty Cylinders To:
Univar USA Inc.
4600 Dues Drive
Cincinnati, OH 45246

Packaged in:
Univar USA Inc.
4600 Dues Drive
Cincinnati, OH 45246

Univar USA Inc.
17425 NE Union Hill Road
Redmond, WA 98052-3375
(425) 889-3400

Net Weight: 150#

DOT Shipping Description: RQ, UN1017, Chlorine, 2.3, (5.1, 8), Poison Inhalation Hazard

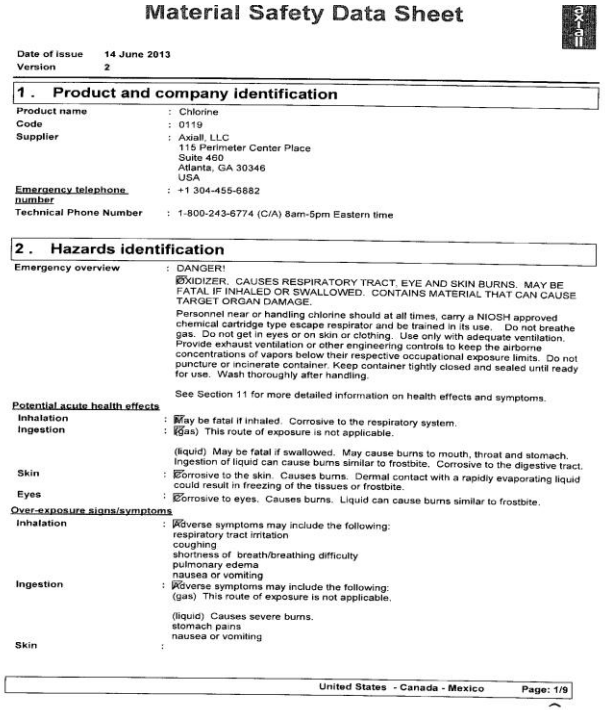
Information, Training & Security

Free Pamphlets Available at

THE CHLORINE INSTITUTE BOOKSTORE

Sources for additional information:

- The Chlorine Institute (chlorineinstitute.org)
  - Most safe handling pamphlets are available for free downloads.
  - Safety Videos on safe handling
  - Safety Postures
- Your supplier
  - Univar provides safe handling seminars
- Other Sources (WEF, AWWA, NWRA, etc)
- Safety Data Sheets
  - Available on line from Univar USA Inc. or by request



Material Safety Data Sheet

Date of issue 14 June 2013
Version 2

1. Product and company identification

Product name : Chlorine
Code : 0119
Supplier : Axiall, LLC
115 Perimeter Center Place
Suite 460
Atlanta, GA 30346
USA
Emergency telephone number : +1 304-455-6882
Technical Phone Number : 1-800-243-6774 (C/A) 8am-5pm Eastern time

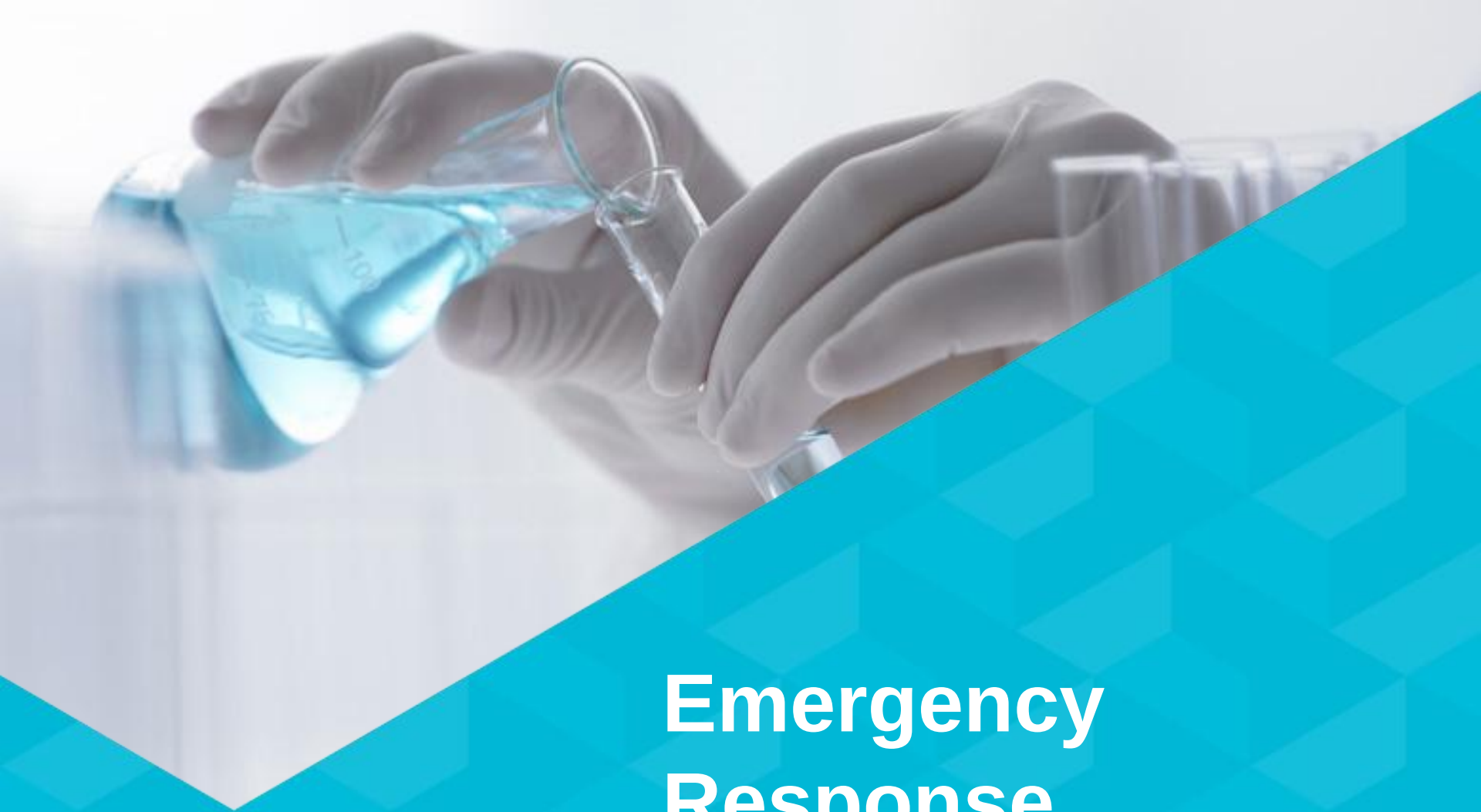
2. Hazards identification

Emergency overview : DANGER!
☒OXIDIZER. CAUSES RESPIRATORY TRACT, EYE AND SKIN BURNS. MAY BE FATAL IF INHALED OR SWALLOWED. CONTAINS MATERIAL THAT CAN CAUSE TARGET ORGAN DAMAGE.
Personnel near or handling chlorine should at all times, carry a NIOSH approved chemical cartridge type escape respirator and be trained in its use. Do not breathe gas. Do not get in eyes or on skin or clothing. Use only with adequate ventilation. Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective occupational exposure limits. Do not puncture or incinerate container. Keep container tightly closed and sealed until ready for use. Wash thoroughly after handling.

See Section 11 for more detailed information on health effects and symptoms.

Potential acute health effects
Inhalation : ☒May be fatal if inhaled. Corrosive to the respiratory system.
Ingestion : ☒(gas) This route of exposure is not applicable.
(liquid) May be fatal if swallowed. May cause burns to mouth, throat and stomach. Ingestion of liquid can cause burns similar to frostbite. Corrosive to the digestive tract.
Skin : ☒Corrosive to the skin. Causes burns. Dermal contact with a rapidly evaporating liquid could result in freezing of the tissues or frostbite.
Eyes : ☒Corrosive to eyes. Causes burns. Liquid can cause burns similar to frostbite.
Over-exposure signs/symptoms
Inhalation : ☒Adverse symptoms may include the following:
respiratory tract irritation
coughing
shortness of breath/breathing difficulty
pulmonary edema
nausea or vomiting
Ingestion : ☒Adverse symptoms may include the following:
(gas) This route of exposure is not applicable.
(liquid) Causes severe burns.
stomach pains
nausea or vomiting
Skin :

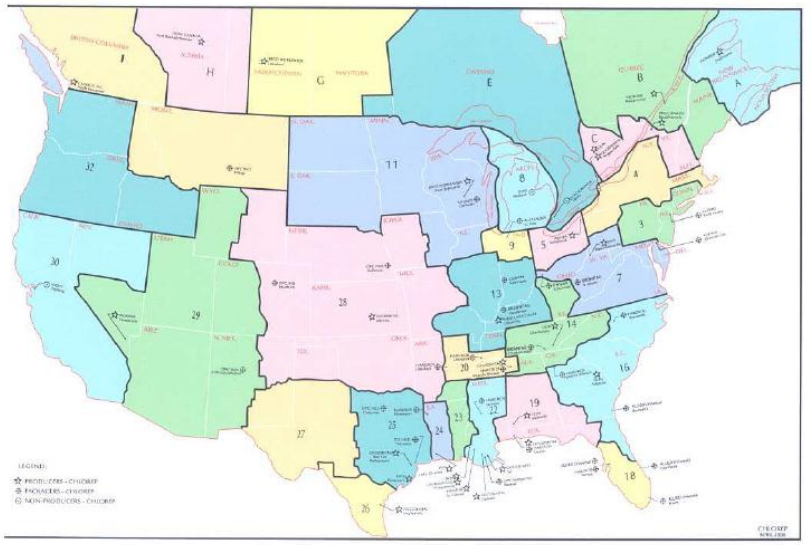
United States - Canada - Mexico Page: 1/9



Emergency Response

Chlorep

What is CHLOREP?
CHLOREP, CHLORine Emergency Plan administered and coordinated by The Chlorine Institute, is a program to provide an organized and effective system for responding to chlorine emergencies in the United States and Canada. It operates on a 24-hour, 7-day-a-week basis with established phone contacts.



How is the CHLOREP Team notified of an emergency?
CHEMTREC (Chemical Transportation Emergency Center), operated by the American Chemistry Council and CANUTEC (The Canadian Transport Emergency Centre in Ottawa) are the Emergency Dispatch Agencies. The dispatcher telephones the designated CHLOREP Emergency Contact who notifies the CHLOREP Team Leader.

Emergency Response Training

Summary of HAZMAT Responders Training Requirements (29 *CFR 1910.120)*

Response Level	Minimum Training Requirement
Awareness level	Understanding of hazardous materials, including their risks, and of how to secure the site and notify others in case of an emergency
First responder, operations level	8 hours of training, including awareness-level topics
Hazardous materials technician	24 hours of training, including operations-level topics
Hazardous materials specialist	24 hours of training equal to technician-level competency
On-scene incident commander	24 hours of training equal to operational level plus competency in commanding incidents and implementing emergency r response plans
Skilled support personnel	Initial pre-entry briefing
Specialist employees	Annual training and competency in area of specialization

Emergency Response - Planning

The facility's emergency response plan should be coordinated with the Local Emergency Planning Committee (LEPC).

- Evacuation versus Shelter in Place
- Response capabilities of the facility
- Response capabilities of outside agencies and contractors

Additional information on emergency planning is available:

- Chlorine Institute Pamphlet 64
- Chlorine Institute Video "Chlorine Emergencies"
- LEPC
- Local Fire department

LOCAL EMERGENCY PLANNING COMMITTEE

LEPC

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Wrap Up

QUESTIONS

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