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Quality Products, Superior Services...Coast to Coast



Chlorine Safe Handling

Gander Workshop, NL.

March 21, 2007



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Agenda

- Introduction
- Product Characteristics
- First Aid
- Storage & Transportation
- Handling
- Preventative Measures
- Personal Protective Equipment
- Chlorine Releases
- Summary

- Application of A and/or B Kit



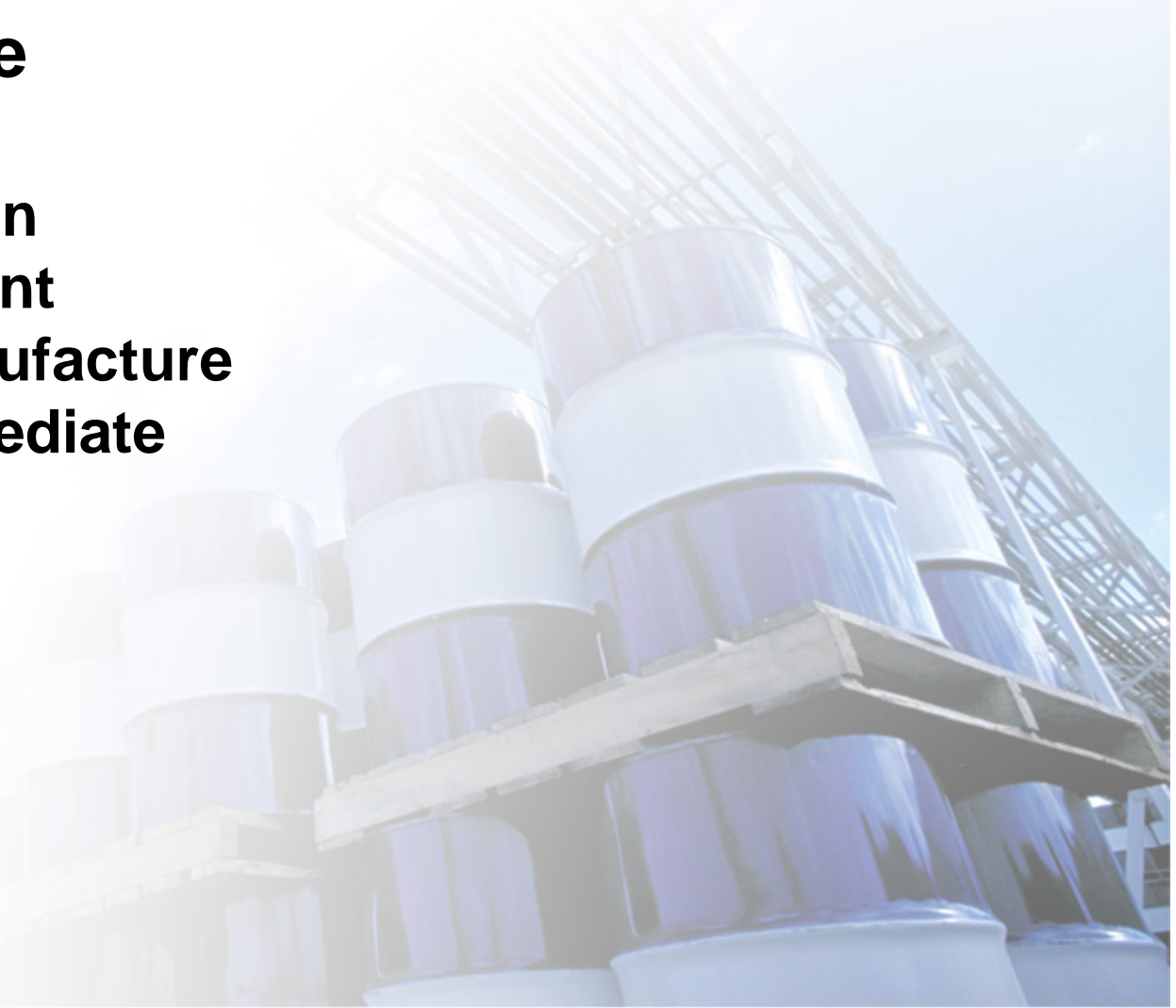
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Uses of Chlorine

- **Water Purification**
- **Sewage Treatment**
- **PVC Plastic Manufacture**
- **Chemical Intermediate**
- **Metal Precipitate**



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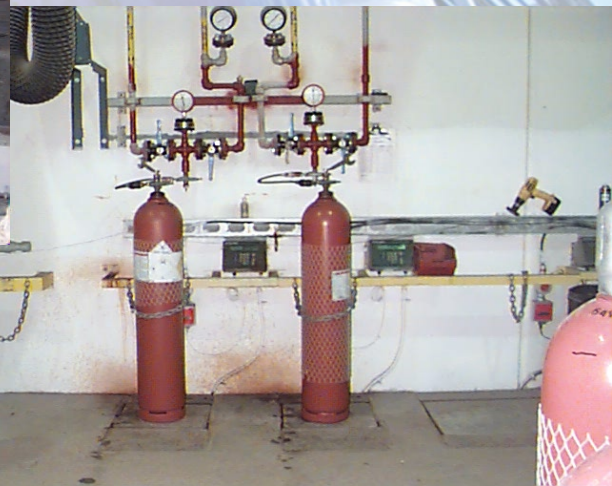
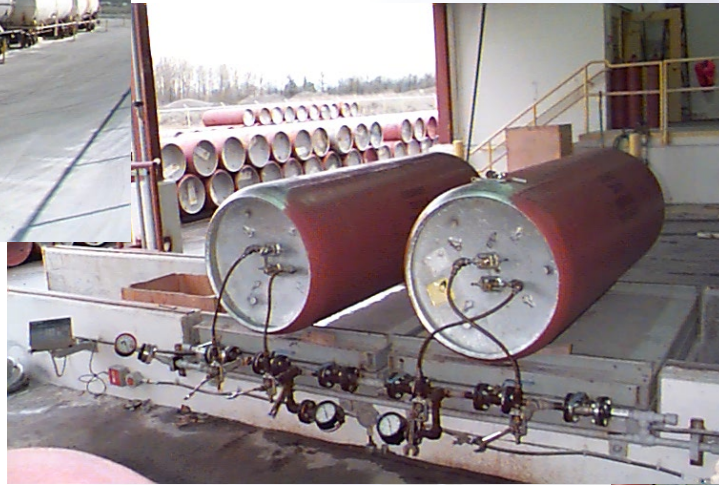
Characteristics of Chlorine

- **Liquefied Compressed Gas**
- **Sold in Bulk - Railcars, Trucks and Barges**
- **Large Packages - Tonners**
- **Small Packages - Cylinders**
- **Greenish/Yellow Gas (when concentration > 1000ppm)**
- **Amber Liquid (while liquid is boiling)**
- **Potent bleach like smell (subjective 0.02 – 0.3 ppm perception)**



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Characteristics of Chlorine Cont...



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Hazard Identification

- **WHMIS Symbols:**
 - **A-Compressed Gas**
 - **C-Oxidizer**
 - **D-1A-Very Toxic (Acute Effects)**
 - **D-2A-Very Toxic (Chronic Effects)**
 - **E-Corrosive**





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Hazard Identification Cont...

- **Liquefied Compressed Gas**
- **Boiling Point Liquid to Gas**
-34degC
- **Freezing Point**
-101degC
- **Heavier than air (2.5:1) lies in low areas**
- **1 volume liquid = 460 volume gas**
- **Vapor pressure in cylinder at 20degC is about 85psig (temperature dependant)**
- **Slightly soluble in Water**



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Hazard Identification Cont...

- **Accelerates burning (like oxygen)**
 - **avoid sparks, high temperature, open flames**
- **Chemically reactive**
 - **combines with water to form acid that will react with steel (avoid high humidity)**
 - **reacts with organics, combustibles and nitrogen based products (sometimes violently)**
 - **avoid hydrocarbons, cleaning solvents, paints & thinners, oil, grease, etc.**



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Hazard Identification Cont...

- **Dry chlorine is NOT Corrosive**
- **Wet Chlorine (reacted with moisture in Air) IS Corrosive**
- **Chlorine reacts with moisture to form hydrochloric or hypochlorous acid which can/will corrode most steels**
- **Chlorine gas combines with moisture on skin and in eyes to cause burning and irritation**



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First Aid Procedures

- **Inhalation**
- **Skin Contact**
- **Eye Contact**

Note: Please refer to MSDS for additional information.



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Inhalation

- **30 ppm shortness of breath, chest pain, possible vomiting**
- **40 - 60 ppm severe irritation of lungs, fluid collecting**
- **Prolonged exposure above 50 ppm: unconsciousness & death**
- **100 ppm may cause lethal dose**
- **Average Lethal Dose: 300 - 400 ppm for 30 minutes**



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Inhalation Cont...

- **Move victim to fresh air**
- **Give Artificial Respiration if breathing has stopped**
- **Give CPR if there is no pulse**
- **Administering of Oxygen should only be done by trained professionals**
- **Seek medical attention immediately**



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Skin Contact

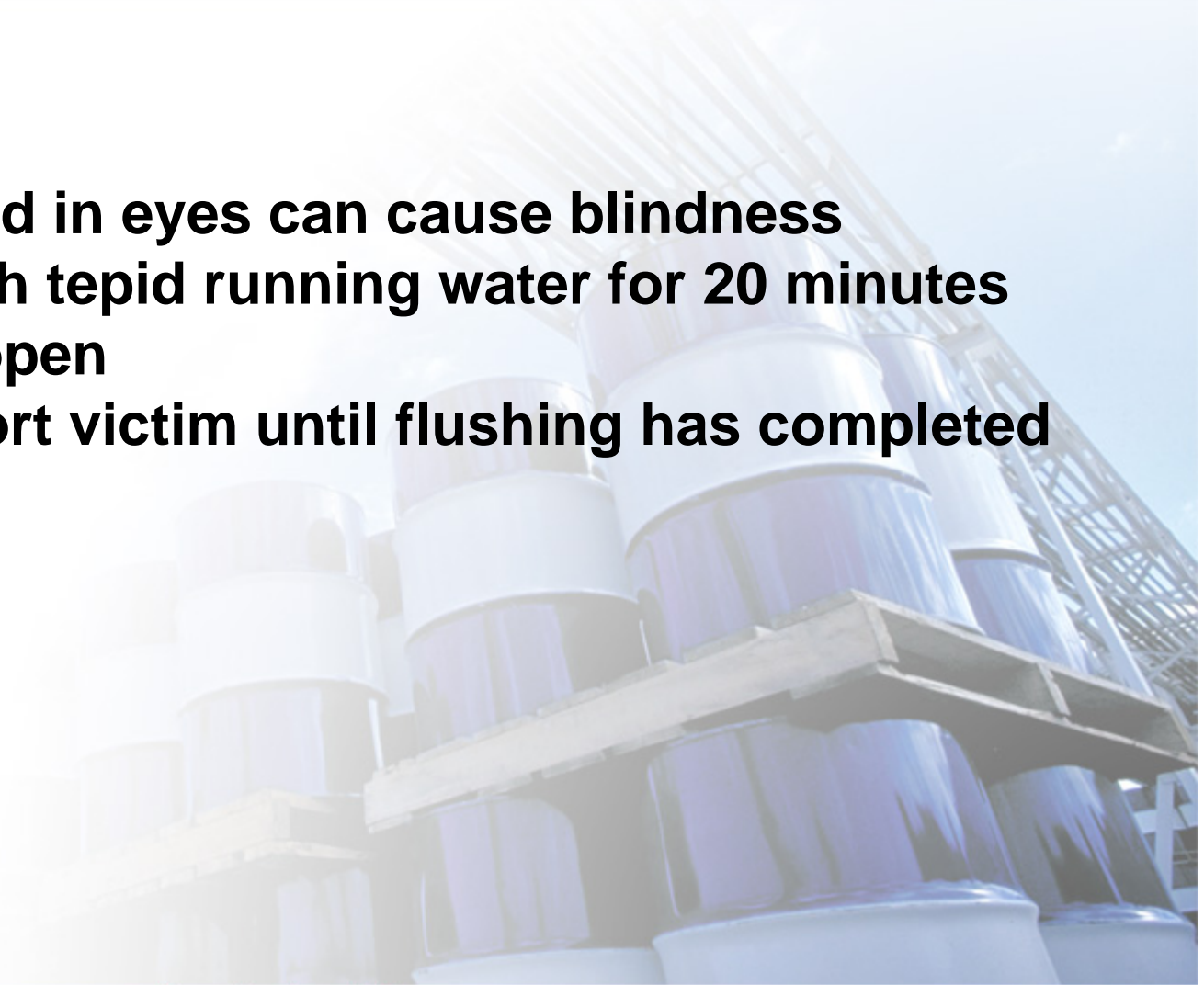
- **Gaseous Contact**
 - Itching will develop as acid is formed on the skin
 - Flush area with a continuous stream of tepid water for 20 minutes and seek medical attention
 - Do NOT use ointments without medical direction
- **Liquid Contact**
 - Liquid will boil to gas drawing heat from skin and generating a gaseous exposure
 - Treat area for frostbite and chemical exposure with a continuous stream of tepid water for 20 minutes and seek medical attention



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Eye Contact

- **Acids produced in eyes can cause blindness**
- **Flush eyes with tepid running water for 20 minutes holding eyes open**
- **Do not transport victim until flushing has completed**





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Storage Area

- **Store Containers in a dedicated, well marked, secure area that allows full access to containers**
- **Ideal temperature is between 10 and 27degC and away from heat sources**
- **Detector equipped (low level mounting)**
- **Adequate ventilation**
- **Secure container in position**



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Transportation

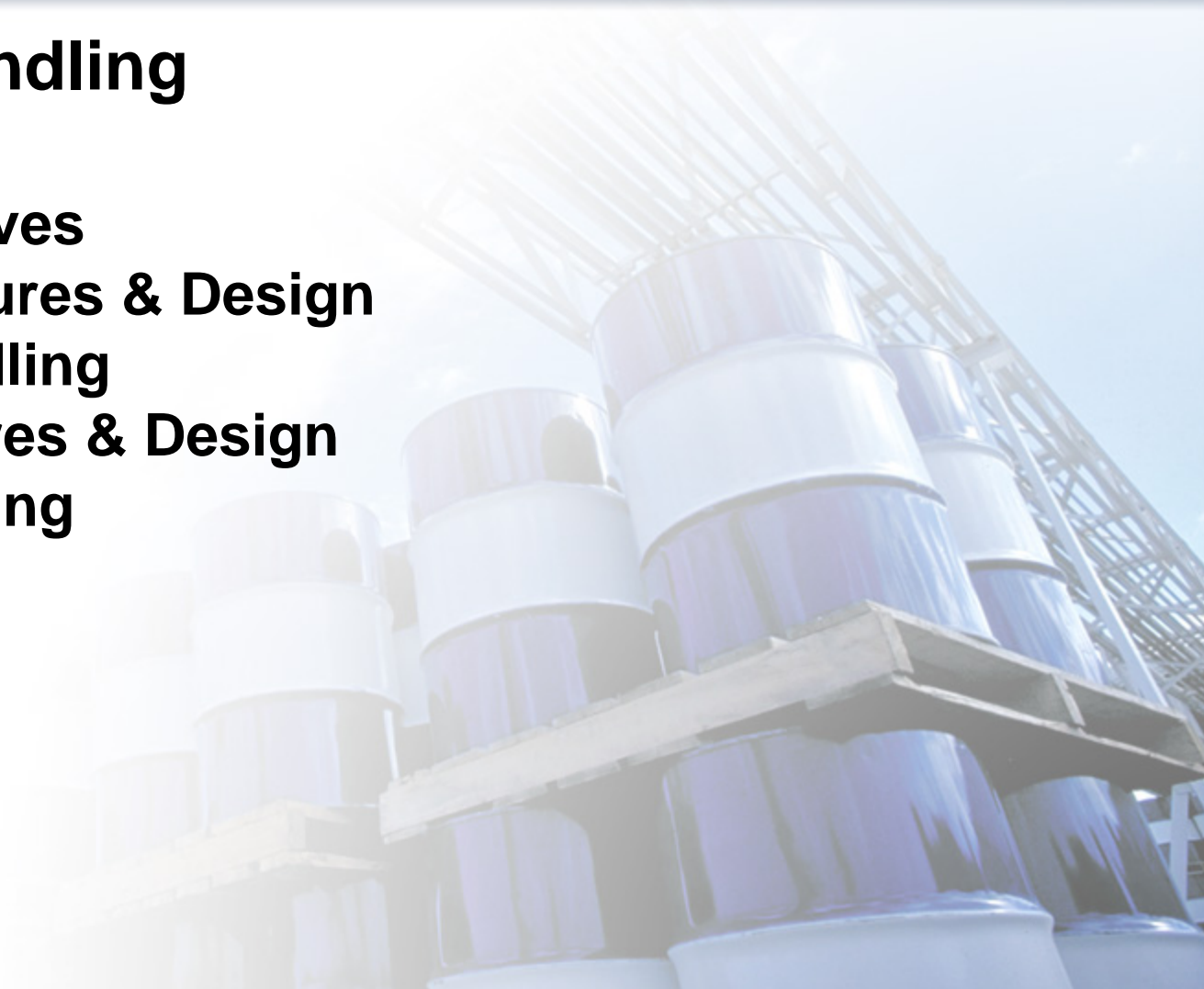
- **TDG 2.3(8) - Poison Gas, Corrosive**
- **Packaging Group: X**
- **UN1017**
- **Marine Pollutant**
- **Reportable Release Quantity is 10lbs**
- **Railcar shipments are chlorine alone/RC**
- **Tonner truck shipments maybe combined with sulphur dioxide and/or anhydrous ammonia**
- **Cylinders are delivered by common carrier van trucks**
- **Cylinders must be stored and transported in an upright position.**



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Container Handling

- **Container Valves**
- **Cylinder Features & Design**
- **Cylinder Handling**
- **Tonner Features & Design**
- **Tonner Handling**



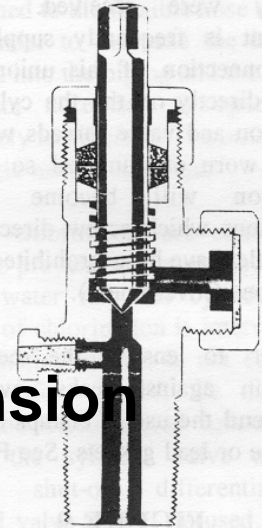


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Cylinder Valves

- Valve Wrench
- Valves
 - Metal/metal contact seal
 - Packing gland material and packing nut tension
 - Outlet plug valve leak containment
 - Valve Threads
 - Fusible plug pressure relief (cylinder only)

STANDARD CYLINDER VALVE





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Valve Opening Procedure

- **Verify valve is closed**
- **Remove Outlet cap and check that the outlet valve face is clean and smooth**
- **Connect the “pigtail” using proper yoke and a new washer**
- **Tighten connection, close upstream valve - preparing to allow a small amount of chlorine into the line**
- **Open the valve momentarily and close**
- **Check for leaks using full strength aqua ammonia VAPORS**
- **Open the valve one complete turn and leave the wrench on the valve**



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Valve Closing Procedure

- **Close cylinder valve after verifying that the cylinder is empty**
- **Allow the system to draw any chlorine remaining in line from the valve connection area and then close the upstream valve**
- **Loosen the yoke connection and check for leaks with ammonia VAPOR**
- **Disconnect cylinder and protect process line from moist air pick up**
- **Reapply Outlet cap with a “blind” gasket tightly**
- **Apply valve “bonnet” before returning cylinder to empty pile**



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Cylinder Features & Design

- 1/4" steel package with approximately 80lb tare weight (base dependant)
- Protective valve cover (bonnet)
- Capable of dispensing liquid or gas (depending cylinder orientation)
- High Temperature Pressure relief device in valve (fuse plug)
- Emergency Capping Kit A

FIGURE 7
CHLORINE CYLINDER





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Cylinder Handling

- **Normal Transport & Hook Up**
 - Transport vertically and secured (cages, carts, chains)
 - Store and transport with bonnet and outlet cap in position except while in use
 - While in use, cylinder should be secured to prevent falls and a wrench should be left on the valve for quick closing if necessary.
- **Emergency Cylinder Handling**
 - Isolate cylinder
 - Correct leak at source
 - Contain leak if not correctable (A Kit, Iron Lung)



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Tonner Features & Design

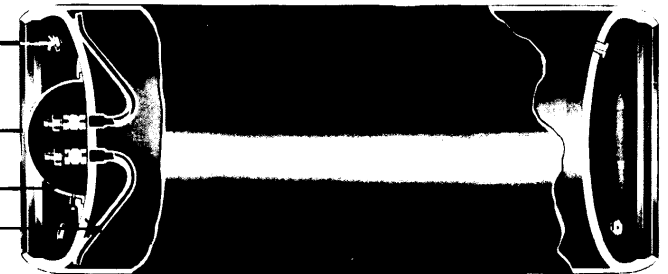
- **3/8” steel package with approximate tare weight of 1400lbs**
- **Capacity of 2000lbs/907Kg**
- **protective valve cover (bonnet)**
- **capable of dispensing liquid (bottom valve) or gas (top valve)**
- **6 High Temperature Pressure relief devices in tonner (fuse plugs)**
- **Emergency Capping Kit B**

FUSIBLE PLUG
(3 each end)

CONTAINER VALVES

VALVE PROTECTION HOOD

EDUCTION PIPE





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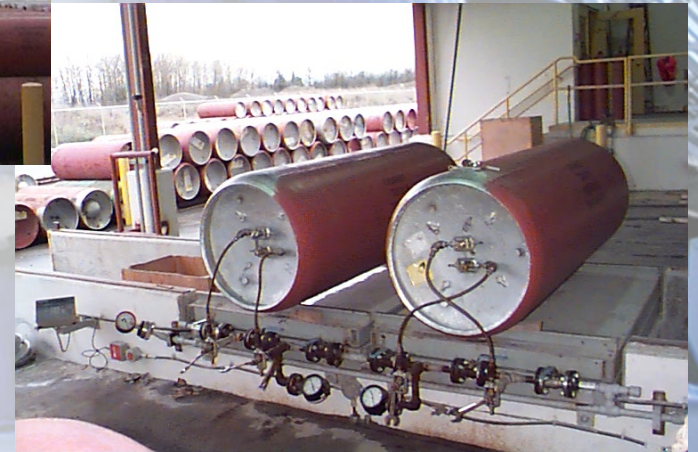
Tonner Handling

- **Normal Transport & Hook Up**
 - **Transport horizontally and secure to prevent rolling**
 - **Store and transport with bonnet and outlet caps in position**
 - **Top valve dispenses gas, bottom valve dispenses liquid**
 - **Use proper Chlorine Wrench only for valve operation (no cheating)**
- **Emergency Cylinder Handling**
 - **Correct leak at source**
 - **Contain leak if not correctable (B Kit)**



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Tonner Handling Cont...





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Brenntag's Preventative Measures

- **All containers are cleaned, inspected & tested every 5 years**
- **New or reconditioned valves installed**
- **New Washers shipped with every tonner & cylinder**
- **Containers held for 24hrs before shipping**



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Personal Protective Gear

- **Changing Bottles**
 - **Low risk of contact - local rules govern**
 - **Eye protection recommended (No contact lenses)**
 - **Gloves to protect hands from impact and dirt**
 - **Respirator fitted for corrosive gas readily accessible**
 - **Steel toed shoes or boots**
- **Emergency Gear Minor Leaks**
 - **Full face respirator plus equipment above**
- **Emergency Gear Major Leaks**
 - **SCBA and possibly fully contained chemical suit**



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Accidental Release Measures

- **Have an action plan and train to that plan**
- **Secure affected and potentially affected areas**
- **Inform people before taking any action yourself**
- **Assess extent of leak and/or problem**
- **Determine your ability to deal with it (equipment, personnel, training)**
- **Deal with the situation**
- **Call supplier for advice**

- **Call Emergency Responders for Action - 911**



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Minor Valve & System Leaks

- **Stop leak at source (upstream)**
- **If the valve can not be closed, apply outlet cap with good gasket**
- **Inform supplier and carrier of problem by appropriately marking container**

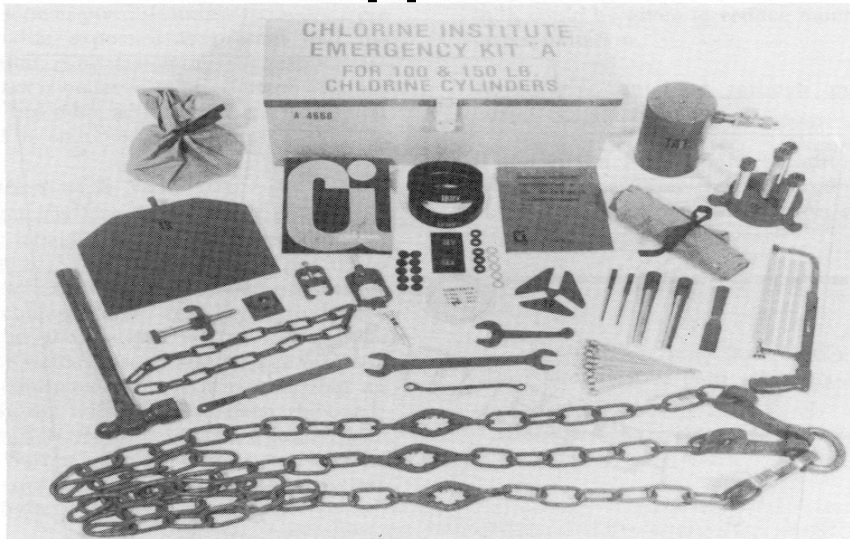
- **If leak can not be corrected, apply containment**
- **Chlorine Capping Kit A or B**
- **Inform supplier to make arrangements for return**



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Major Container or System Leaks

- **Have an Emergency Action Plan Rehearsed**
- **Call Emergency Responders for Action - 911**
- **Secure the area to protect public and employees**
- **Call supplier for advice**





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Fire Fighting Measures

- **Not Flammable**
- **Hazardous and Toxic Decomposition Products**
- **Fuse Plugs will melt if the container is involved in fire (70degC or 165degF)**
- **Keep containers cool**
- **Use Extinguishing media appropriate for surrounding material**



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Environmental Impact

- **Chlorine will have an adverse effect on the environment due to the properties that make it effective (toxic and corrosive)**
- **It will kill anything if exposed in high enough concentrations**



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Summary

- **Chlorine is a hazardous chemical**
- **Treat it with respect by knowing the risks and proper handling techniques**
- **Focus on preventing accidental releases**
- **Chlorine is handled safely by thousands of people daily**
- **Nothing gives a residual like Chlorine !!**