Agenda

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

• Application of A and/or B Kit
Uses of Chlorine

• Water Purification
• Sewage Treatment
• PVC Plastic Manufacture
• Chemical Intermediate
• Metal Precipitate
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)
Characteristics of Chlorine Cont...
Hazard Identification

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

- Inhalation
- Skin Contact
- Eye Contact

Note: Please refer to MSDS for additional information.
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
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
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
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
Storage Area

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

- Container Valves
- Cylinder Features & Design
- Cylinder Handling
- Tonner Features & Design
- Tonner Handling
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)
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
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
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
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)
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
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)
Tonner Handling Cont...
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
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
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
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
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
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
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
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!!