

CHLORINE GAS, HAZARDS, AND EMERGENCY PREPAREDNESS & RESPONSE

Mark J. Schaffer, CHMM
October 5, 2018



Welcome

Disclaimer

The information in this presentation is drawn from sources believed to be reliable. Both the Chlorine Institute Inc. and Univar USA and its members, jointly and severally, make no guarantee, and assume no liability either as to the instruction manual or the equipment to which it applies. Responders should be aware that changing technology may require a change in equipment or in the instructions concerning its use. Appropriate steps should be taken to ensure that materials and equipment is current when used. These suggestions should not be confused with federal, state, provincial, municipal or insurance requirements, or with national safety codes. Some of the pictures and captions contained in this presentation have been obtained from public sources over the internet and may be subject to copyright. No infringement of the owner's rights is intended.

History of Chlorine

- First produced by Carl Wilhelm Scheele, a Swedish chemist, when he combined the mineral pyrolusite (MnO_2) with hydrochloric acid (HCl) in 1774.
- Sir Humphry Davy proved in 1810 that it was actually a distinct element.
- In the U.S., the first electrolytically produced chlorine for bleach was at a plant in Rumford Falls, Maine in 1892.
- The first commercial delivery of liquefied chlorine in cylinders in the U.S. was made in 1909.
- Due to its hazardous nature, chlorine was one of the first poisonous gases used in warfare in 1915 during World War I.
- Despite its hazardous nature, chlorine remains as one of the most widely used elements ranging from the manufacturing of plastics to disinfection of drinking water.
- By 1994, more than 12 Million tons of chlorine were produced annually.

Learning Objectives

1

- Describe chemical and physical properties of chlorine

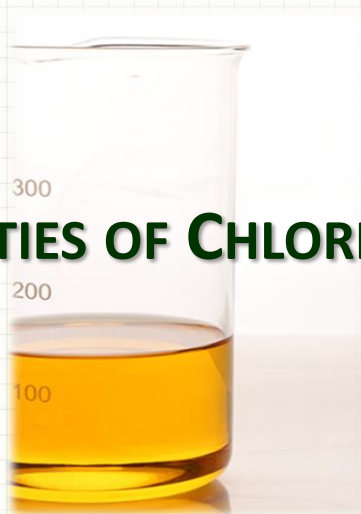
2

- Outline different chlorine storage vessels and their physical properties

3

- Review emergency preparedness and emergency response procedures

PROPERTIES OF CHLORINE



Chlorine

- Liquid boils above -29°F at atmospheric pressure
- 2.5 times heavier than air
- 1 volume liquid will yield about 460 volumes of gas
- United Nations designation – UN 1017
- Chemical Abstract Service (CAS#) 7782-50-5
- Reportable Quantity (RQ) 10 Lbs



Chlorine

- Low concentrations, gas is colorless
- Higher concentrations, gas is greenish yellow to green
- Leaks are easily detectable with strong ammonia vapor (26°Bé or 29.4% by weight)
- Not flammable but will support combustion (strong oxidizer)
- Only slightly soluble in water



Chlorine

- Liquid is a clear amber color
- Cryogenic Hazard
- Reactivity with Water:
 - Forms Hydrochloric and Hypochlorous Acid
- Forms weak solutions of Ferric/Ferrous Chloride
- Severe corrosion will persist



Chlorine Exposure Levels (ppm)

0.02 - 0.2.....	Odor Threshold
<0.5.....	No known chronic or acute effects
0.5.....	OSHA TWA
1.0.....	OSHA Ceiling
1-10.....	Irritation to the eyes and mucous membranes of the upper respiratory
10.....	NIOSH IDLH
25.....	You can see a whitish-yellow haze
30.....	Chest pain, nausea and vomiting
60.....	Chemical pneumonia
430.....	30 minute exposure is fatal
1,000.....	A few deep breaths are fatal



Chlorine Containers

Available in many sizes though common industrial sizes are:

- 100 pound vertical
- 150 pound vertical (USDOT 3A480 & 3AA480)
- Horizontal Ton containers (USDOT 106A500X)
- 90 ton railcars



Chlorine Cylinders

- 100 pound vertical
 - Approximately 65 - 115 Lbs empty
 - Outside diameter 8.25" – 10.75"
 - Height from 40" - 60"
 - Contains approximately 8.18 gal Cl_2
 - Equipped with a safety relief device in the valve



Chlorine Cylinders

- 150 pound vertical
(USDOT 3A480 & 3AA480)
 - Approximately 85 - 140 Lbs empty
 - Outside diameter 10.25" – 10.75"
 - Height from 53" - 56"
 - Contains approximately 12.27 gal Cl_2
 - Equipped with a safety relief device in the valve



Chlorine Cylinders

- Horizontal Ton containers (USDOT 106A500X)



- Approximately 1300-1650#s empty
- Outside diameter 30"
- Length approximately 53-56"
- Contains approximately 164 gal Cl_2
- 6 safety relief devices in both chimes

EMERGENCY RESPONSE & EMERGENCY PREPAREDNESS



Emergency Response

- Emergency responders must be properly trained and equipped to respond to chlorine emergencies.
- Proper PPE (personal protective equipment) must be used in the event a chlorine release has occurred.
- Additional training is required to install the Chlorine Institute's Emergency Kits A, B, and C.
- Federal, state and provincial regulations, as well as various local fire and building codes regulate reporting of chlorine releases.
- All persons responding to chlorine emergencies must be familiar with the content of those regulations.

Emergency Response

In the event of a leak, what do you do?



Emergency Response

- Leaking 100# or 150# cylinder:



Emergency Response

- Leaking Ton container:



Emergency Response

- Leaking chlorine railcar:



Emergency Preparedness

- Manufacturing, transportation and use of chlorine are managed under controlled circumstances designed to prevent a release.
- Good chlorine stewardship involves developing and maintaining response plans.
- Trained employees and written emergency response plan are necessary to mitigate the consequences of an emergency.
- Federal, state and provincial regulations, as well as various local fire and building codes regulate chemical emergency preparedness and response.
- All persons handling chlorine must be familiar with the content of those requirements.

Emergency Preparedness Resources

■ Chlorine Response / CHLOREP®

- Chlorine Institute's mutual aid program
- Quick access to industry expertise and support
- Fast and effective response for US and Canada
- 90 response teams from 21 Chlorine Institute member companies
- 11 emergency response contractors who meet the Institute's stringent performance requirements

In the U.S. & Canada (also accept international calls)
Call CHEMTREC®
Toll-Free 800-424-9300
Toll 703-527-3887

In Canada
Call CANUTEC
Toll-Free 888-226-8832
Toll 613-996-6666

ER Training, Exercises & Outreach

- TRANSCAER® - Transportation Community Awareness and Emergency Response
 - Partnership between chemical industry and transportation providers to train communities on how to respond to a chlorine incident
- Webinars – visit the Chlorine Institute's website to register for awareness-level training videos
- Exercises – VTTX (Virtual Table Top Exercise) and live on-site demonstrations and training provided by Chlorine Institute

Summary

- Although dangerous, chlorine plays a vital role in providing good quality of life in everything from manufacturing to disinfection
- Know the chemical & physical properties of chlorine in order to protect yourself and others in the event of a release
- Understand how chlorine is packaged, stored, transported and handled
- Be prepared by developing a plan and train yourself and others on what to do in an emergency
- Know what resources are available and *use* them!

THANK YOU!



Resources

- Chlorine - History Of Chlorine, Properties And Uses Of Chlorine, Compounds Of Chlorine
<http://science.jrank.org/pages/1440/Chlorine.html#ixzz5PftzsKpK>
- It's Elemental – The Element Chlorine
<https://education.jlab.org/itselemental/ele017.html>
- The Chlorine Institute, Inc.
<https://www.chlorineinstitute.org/>
- Responsible Care®
<https://responsiblecare.americanchemistry.com/>
- Univar®
<https://www.univar.com/>