OSHA Hazardous Materials Awareness Refresher

Glenn C. Clapp, CHMM, CFPS

Wake County Emergency Management

Introduction

Topics Covered

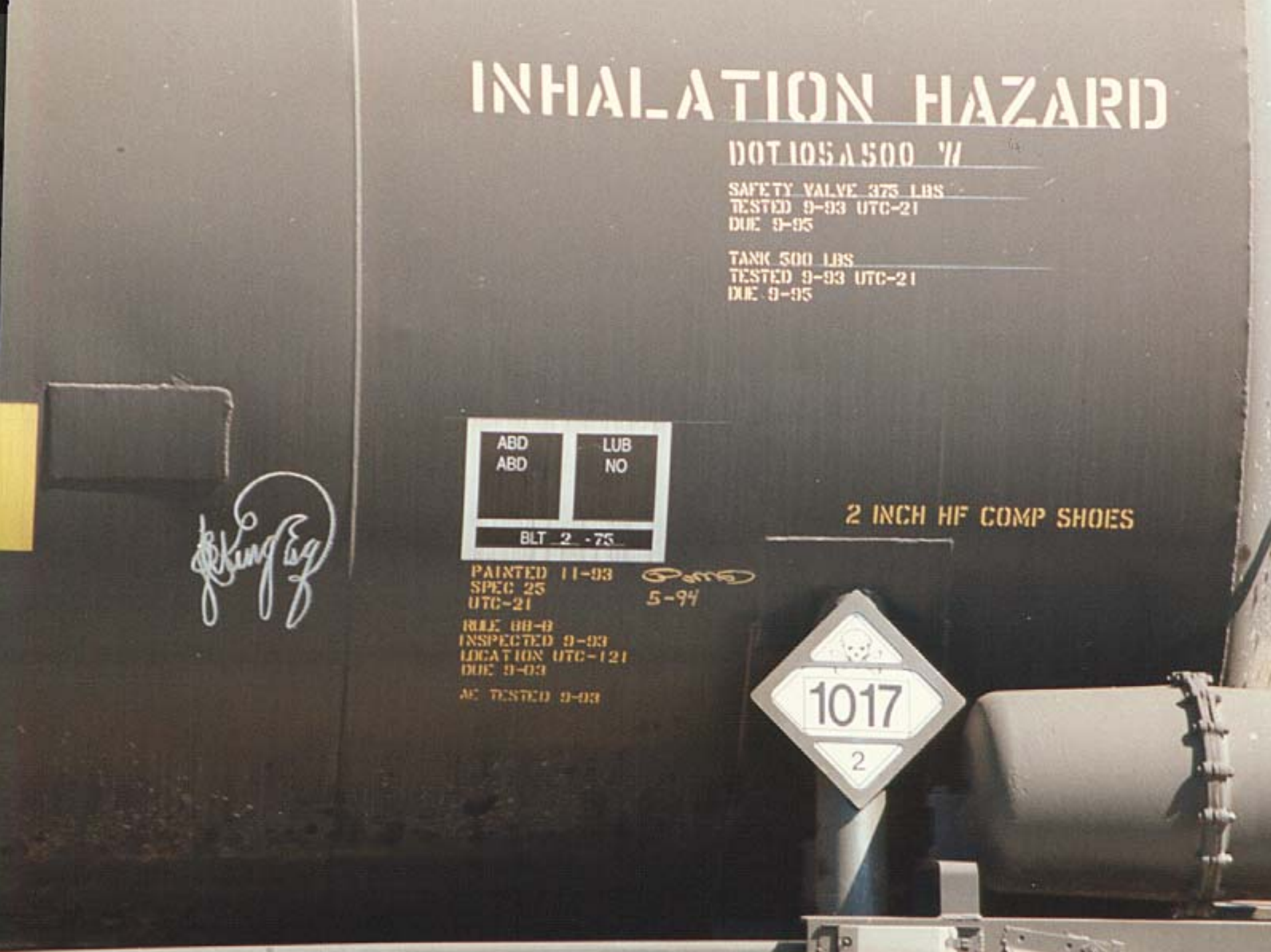
- ERG Review
- Recognition/Identification of Hazardous Materials
- ICS
- Chemical Properties of Hazardous Materials
- Reporting Requirements

ERG Review

ERG Sections

- Placards
- Rail and Highway Schematics
- Yellow Pages
- Blue Pages
- Orange Pages
- Green Pages

Identify the Following Chemical:


INHALATION HAZARD
DOT 105A500 W
SAFETY VALVE 375 LBS
TESTED 9-93 UTC-21
DUE 9-95
TANK 500 LBS
TESTED 9-93 UTC-21
DUE 9-95
ABD
ABD
LUB
NO
BLT 2 - 75
2 INCH HF COMP SHOES
PAINTED 11-93
SPEC 25
UTC-21
5-94
RULE 88-B
INSPECTED 9-93
LOCATION UTC-121
DUE 9-03
AE TESTED 9-03
1017
2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UTC-21
5-94
RULE 88-B
INSPECTED 9-93
LOCATION UTC-121
DUE 9-03
AE TESTED 9-03
2 INCH HF COMP SHOES
1017
2

Chlorine

Identify the Following Chemical:


1005
XQ00684


1005
ANHYDROUS AMMONIA
XQ00684

Identify the Following Chemical and the Proper Guide:


FOR CHEMICAL EMERGENCY
800-424-9300
21-2025
1719
8
02166A


FOR CHEMICAL EMERGENCY
800-424-9300
21-2025
1719
8
Caustic Alkali
Liquid
Guide 154
02166A

Identify the Following Chemical and the Proper Guide:


KIRSON
1072
2
07079F
K-2


Oxygen
Guide 122
1072
2
07079F
K-2

Identify the Following Chemicals and the Proper Guide:


2067
5.1
PEI
1993
2
2067
5.1
1.5
BLASTING
AGENTS
D
1
DRIVE
SAFELY

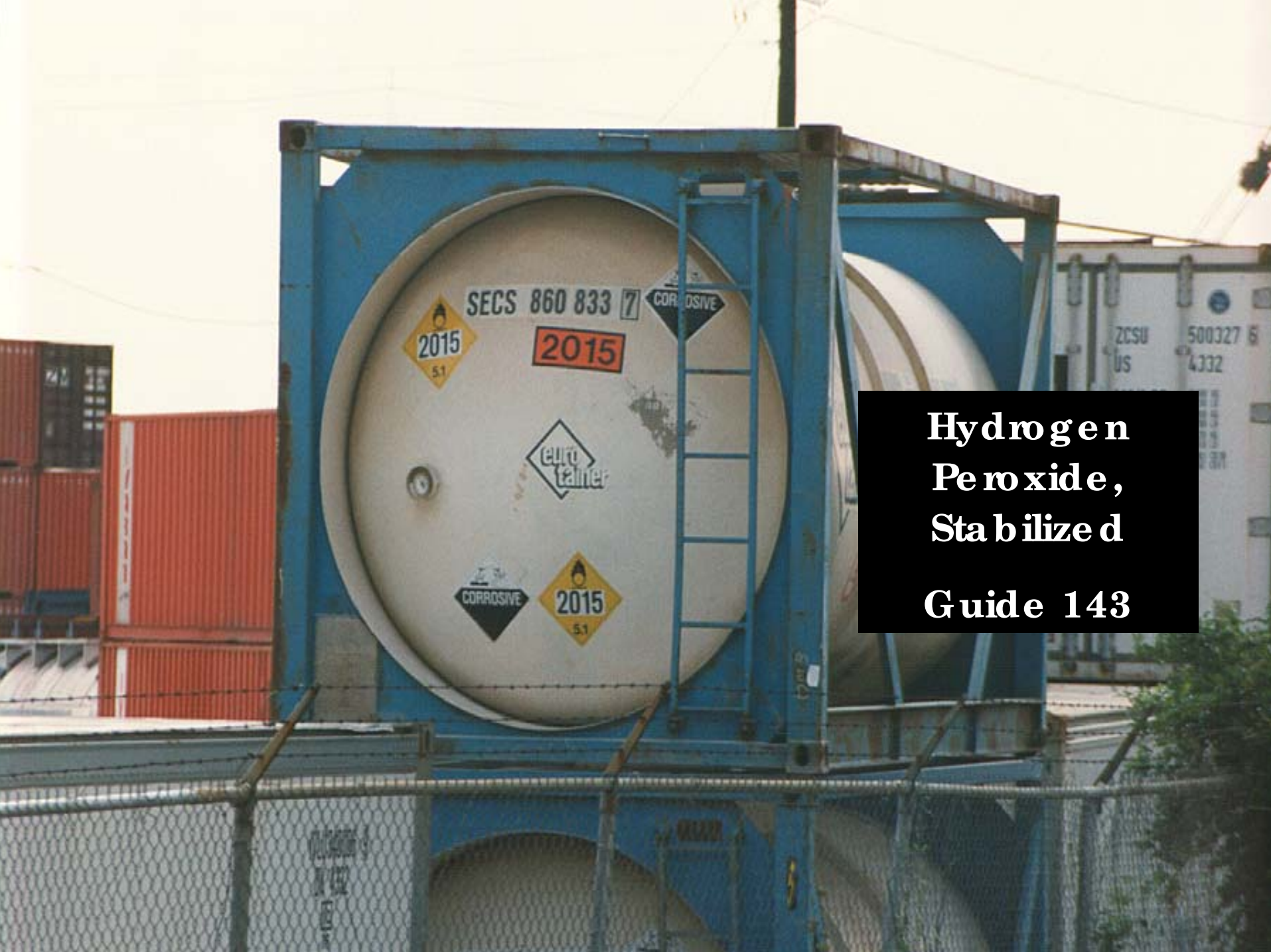

Diesel Fuel
Guide 128
2067
5.1
PEI
1993
2
1.5
BLASTING
AGENTS
D
1
2067
5.1
DRIVE
SAFELY


Diesel Fuel
Guide 128
Ammonium
Nitrate
Fertilizers
Guide 140
2067
5.1
1993
2
1.5
BLASTING
AGENTS
D
1
2067
5.1
DRIVE
SAFELY
PEI

What Possibly Occurs When You Mix Them?

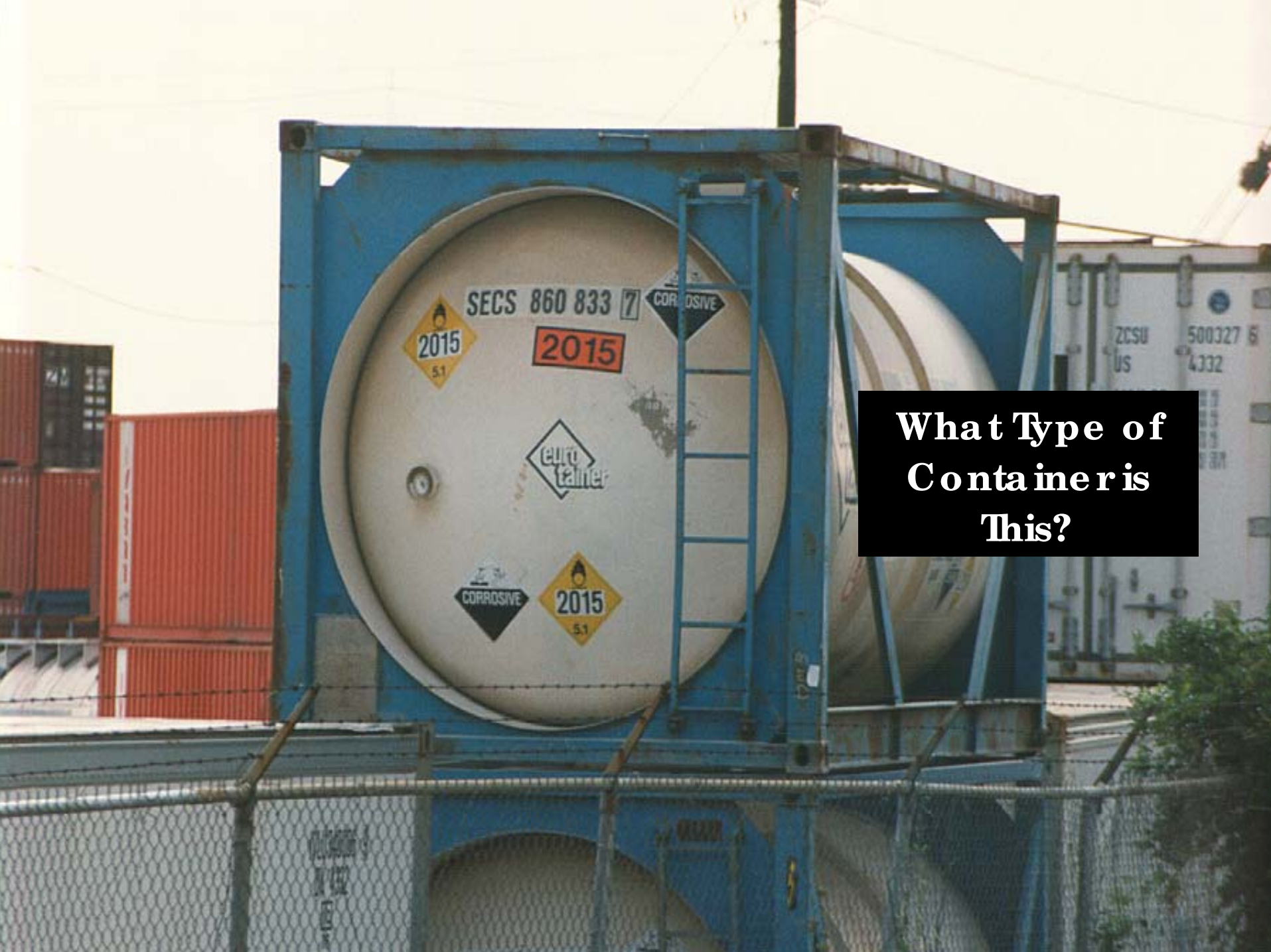
Identify the Following Chemical and the Proper Guide:


SECS 860 833 7
2015
5.1
2015
CORROSIVE
eurotainer
CORROSIVE
2015
5.1
ZCSU 500327 6
US 4332
MAX. GR.
TARE
NET
CU.CAP

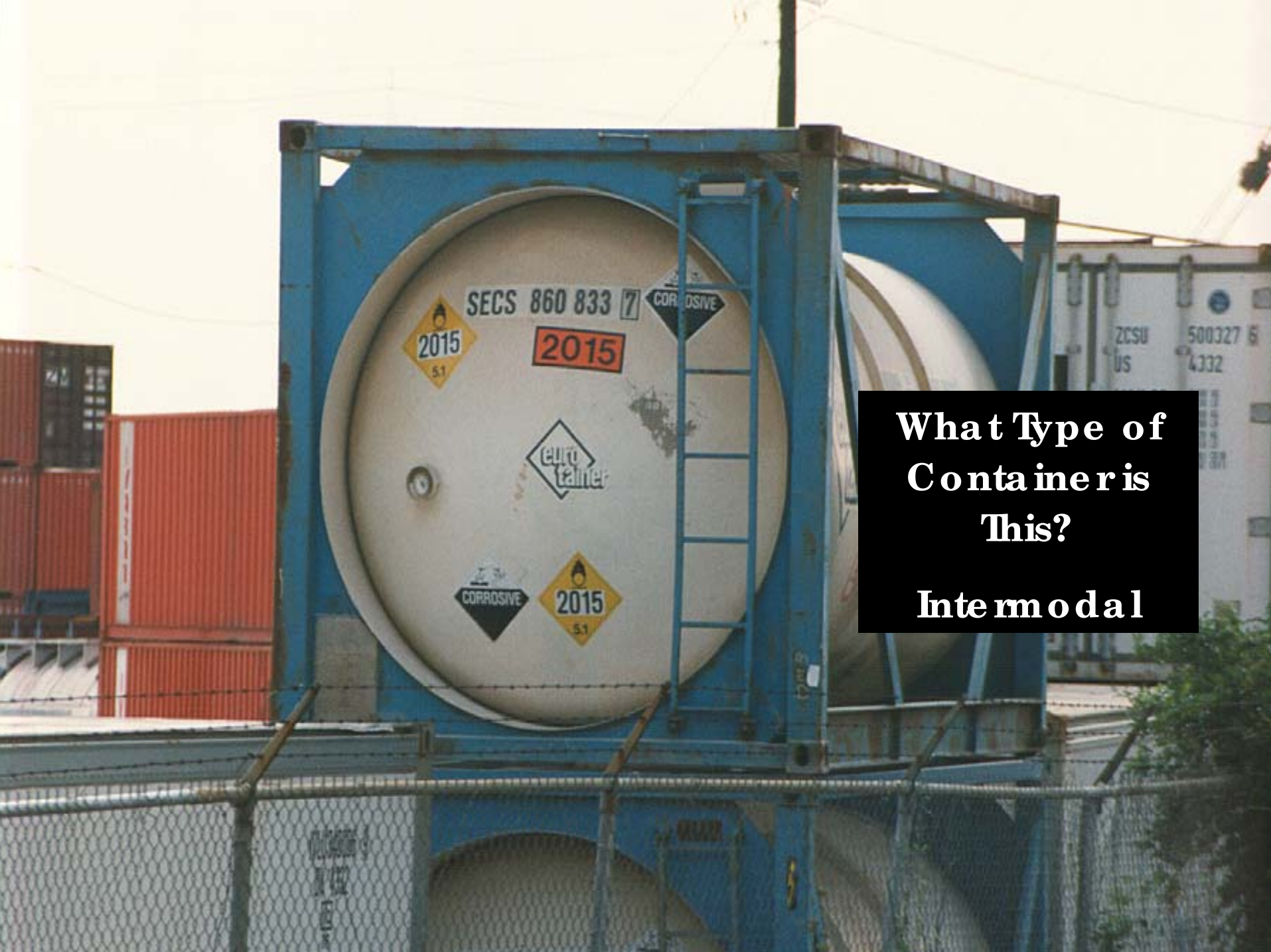


Hydrogen Peroxide, Stabilized

Guide 143



What Type of Container is This?



What Type of Container is This?

Intermodal

Identify the Following Chemical and the Proper Guide:


Krohnert
FMC
2014
5.1
TIG 521
FRUEHAUF
FRUEHAUF
FRUEHAUF

Hydrogen Peroxide, Aqueous, 20% – 60%

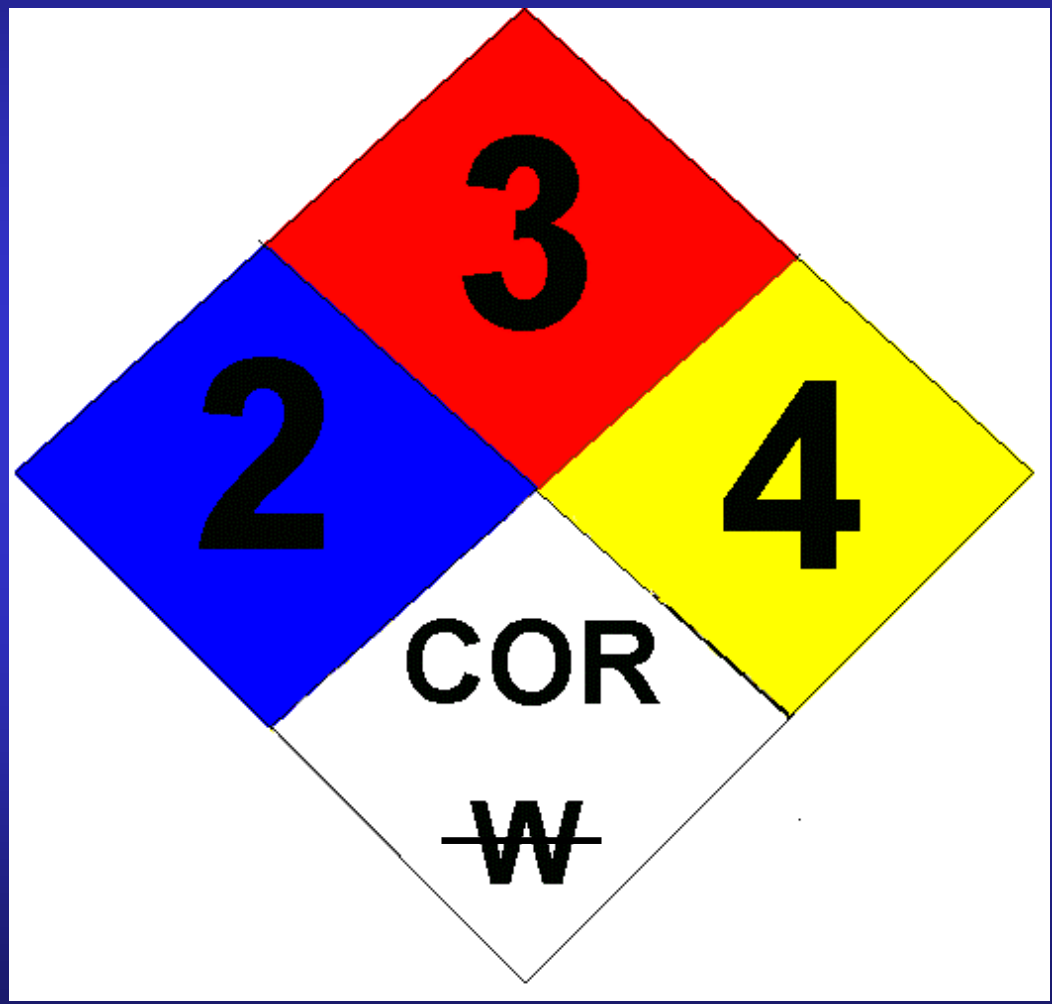
Recognition/Identification of Hazardous Materials

Markings and Colors:

Warning Systems:

- NFPA 704 Symbols
- Placards
- UN/NA Numbers
- Tank Colors/Stripes

NFPA 704 Symbol:




4
4
4
OXY
ACID
COR

Placards

Hazard Classes

Every Good Fire Fighter Ought to Practice Reading Current Manuals”

Explosives

Gases

Flammable Liquids

Flammable Solids

Oxidizers

Poisons

Radioactive

Corrosives

Miscellaneous

Class 1 Explosives

- Major Hazard: Explosion
- Any substance or article, including a device, that is designed to function by explosion (i.e. an extremely rapid release of gas and heat) or that, by chemical reaction with itself, is able to function by explosion.

Divisions

- DOT has divided Class 1 hazards fall into 6 divisions.

Class 1.1

- Mass explosion that affects almost the entire load

Class 1.2

- Projection hazard but not a mass explosion hazard

Class 1.3

- Fire hazard and either a minor blast or minor projection hazard

Class 1.4

- Presents a minor explosion hazard

Class 1.5

- Very insensitive explosives with mass explosion hazard

Class 1.6

- Extremely insensitive explosives

Class 2
Compressed Gases

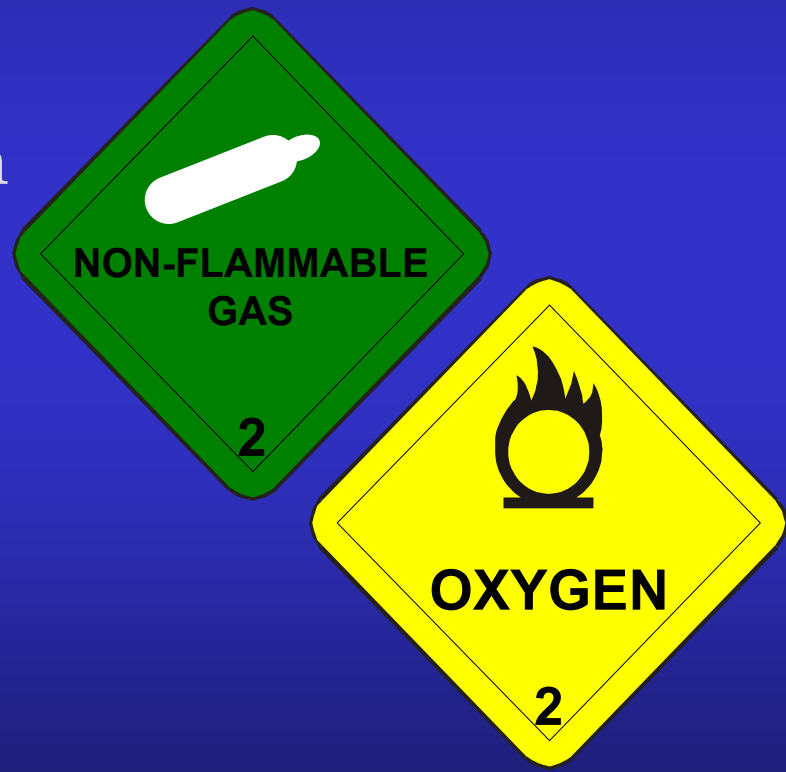
- Major Hazard: BLEVE
- Sub Hazards
  - Flammable
  - Oxidizer
  - Poisonous
  - Nonflammable
- Divided into 3 divisions

Class 2.1
Flammable Gases

- A material that is a gas at 68° F or less at 14.7 psi or has a boiling point of 68° degrees or less at 14.7 psi.
  - Ignitable at 14.7 psi in a mixture of 13% or less by volume with air
  - Has a flammable range of at least 12% regardless of the lower limit.

Class 2.2 - Nonflammable, Nonpoisonous Gases

- Any material or mixture that exerts an absolute pressure of 41 psia at 68° F.
- Compressed gases, including liquefied gas, pressurized cryogenic gas, and compressed gas in solution.



Class 2.3 Poisonous Gas

- Vaporize easily and very dangerous to life, even in small amounts.
- Known to be so toxic to humans as to pose a hazard to health during transportation.
- Presumed to be toxic because of laboratory testing.

Class 3 Flammable Liquids

- Major Hazard: Burns readily
- Flammable and Combustible liquids

Flammable Liquids

- Any liquid having a flash point (FP) of not more than 141 degrees F.
  - Three divisions
    - **3.1 - FP < 0 degrees F**
    - **3.2 - FP 0 to < 73 degrees F**
    - **3.3 - FP 73 to < 141 degrees F**

Combustible Liquids

- Any liquid that does not meet the definition of any other hazard class and has a flash point above 141 degrees F and below 200 degrees F.

  NOTE: A flammable liquid with a flash point at or above 100 degrees that does not meet the definition of any other hazard class except 9, may be reclassified as combustible.

Class 4
(Flammable Solids)

- Major Hazard: Rapid combustion with a liberation of mass quantities of smoke (toxic).
  - Divided into 3 divisions
    - 4.1 Flammable Solids
    - 4.2 Spontaneously Combustible
    - 4.3 Dangerous When Wet

4.1 Flammable Solids

- Three types
  - Wetted explosives
  - Self-reactive materials
  - Readily combustible solids

Wetted Explosives

- Explosives wetted with sufficient water, alcohol, or a plasticizer to suppress explosive properties.

Self-Reactive Materials

- Materials that are liable to undergo, at normal or elevated temperatures, a strongly exothermic decomposition.

Readily Combustible Solids

- Solids that may cause a fire through friction and metal powders that can be ignited.

4.2 Spontaneously Combustible Materials

- Pyrophoric Materials
- A liquid or solid that, even in small quantities and without an external ignition source, can ignite within 5 minutes after coming in contact with air.

4.2 Spontaneously Combustible Materials

- Self-Heating Material
- A material that, when in contact with air and without an energy supply, is liable to self-heat.

4.3 Dangerous When Wet Materials

- Material that, by contact with water is liable to become spontaneously flammable or to give off flammable or toxic gas at a rate of greater than 1 l/kg of the material, per hour.

Class 5 (Oxidizers)

- 2 Divisions

  Major Hazard 5.1:

  – Supports combustion and intensifies fire

  Major Hazard 5.2:

  – Unstable/reactive explosives

5.1 Oxidizers

- Materials that may, generally by yielding oxygen, cause or enhance the combustion of other materials.

5.2 Organic Peroxides

- Any organic compound containing oxygen in the bivalent O-O structure that may be considered a derivative of hydrogen peroxide, where one or more of the hydrogen atoms have been replaced by organic radicals.
- Organic peroxides have been further broken down into types a-g (worst to least hazardous).

Class 6 Poisons

- 2 Divisions
- NOTE: Poisonous gases are Class 2 Division 3
  - 6.1 Poisonous Material
    - Major Hazard: Toxicity
  - 6.2 Infectious Substances
    - Major Hazard: Infectious

6.1 Poisonous Materials

- A material, other than a gas, that is either known to be so toxic to humans as to afford a hazard to health during transportation, or in the absence of adequate data on human toxicity, is presumed to be toxic to humans, including irritating materials that cause irritation.

6.2 Infectious Substances

- A viable microorganism, or its toxin, that causes disease in humans or animals.
- Infectious substance and etiologic agents are the same.
- No Placards (labels only)

Class 7 Radioactive

- Major Hazard: Radioactive poisonous burns
- Definition: Materials having a specific activity greater than 0.002 microcurie per gram

Class 8 Corrosives

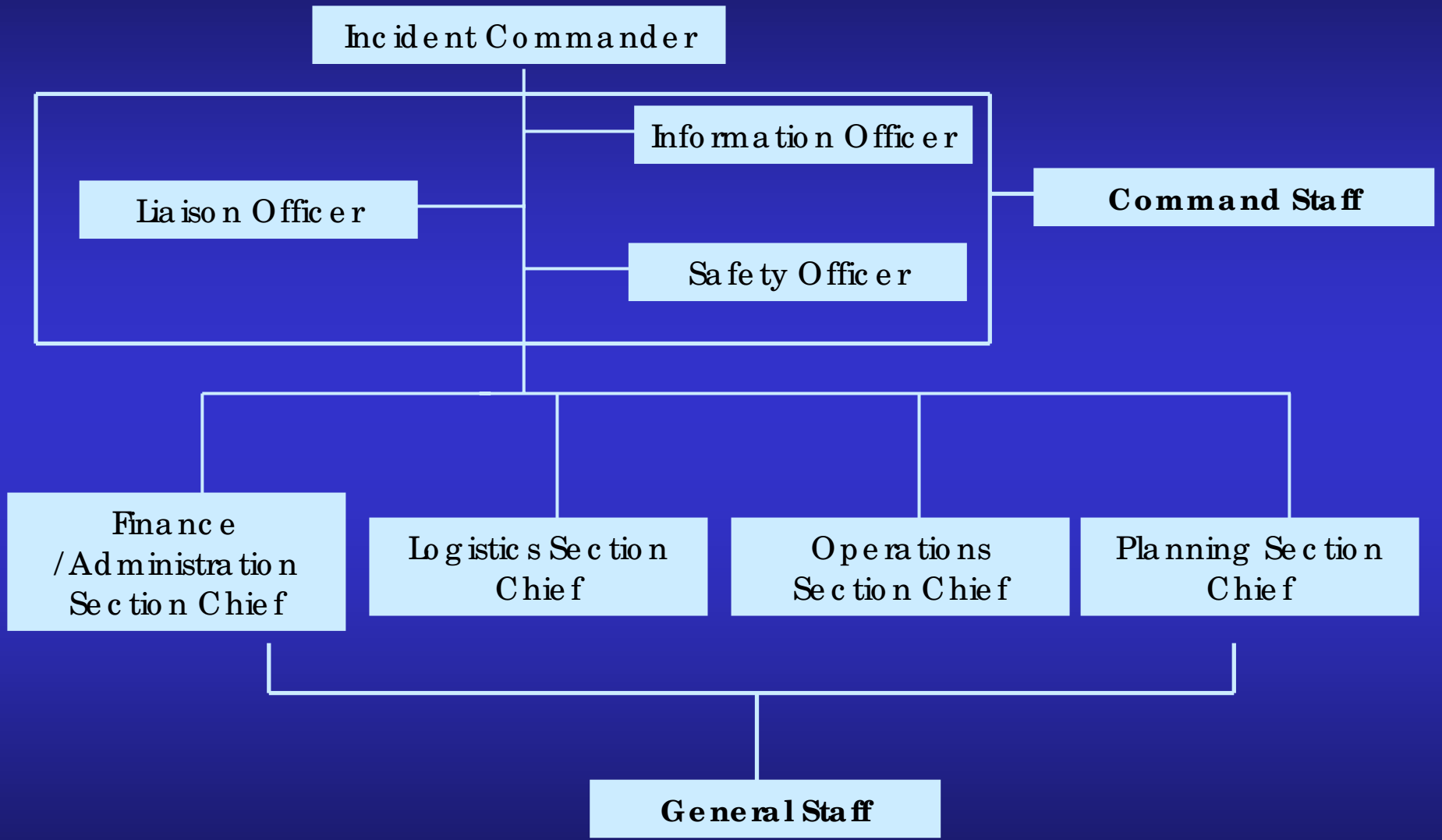
- Major Hazard: Burns/emulsification skin damage
- Definition: A liquid or solid that causes visible or irreversible alterations in human skin tissue at the site of contact, or a liquid that has a severe corrosion rate on steel or aluminum.

Class 9 Miscellaneous

- A material that presents a hazard during transport, but that is not included in another hazard class

ICS Basic Concepts

Command and General Staff



Chemical Properties of Hazardous Materials

Chemical Properties

- Five Fundamental Hazards:
  - Flammability
  - Toxicity
  - Corrosiveness
  - Reactivity
  - Radioactivity

- Use this easy "Assessment Technique" to help expedite your Hazard and Risk Assessment – focus on these hazards initially!

Flammability

- Flash Point
  - "The minimum temperature at which a flammable or combustible liquid will produce sufficient vapors to create a flammable vapor-to-air mixture at the surface of the liquid.

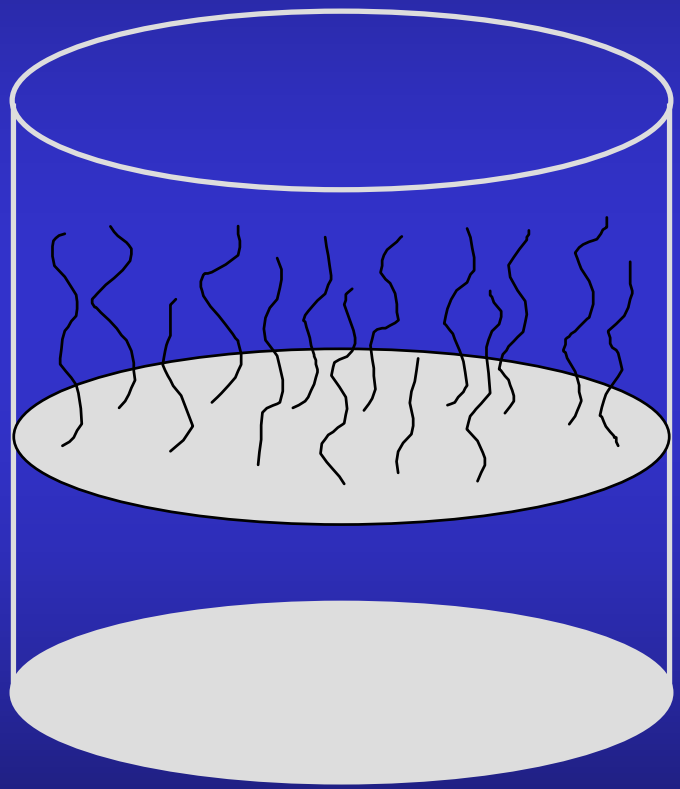
    When ignited, this mixture will "flash" and be consumed by the fire, but not continue to burn."

- Flash Point indicates the temperature at which the flammable or combustible liquid becomes an immediate fire hazard.

Flashpoint

The temperature of the liquid will affect the vapor production

"It all relates to EVAPORATION"



The warmer the liquid, the more vapor production

Can you rank these in Order of Hazard…

Examples of Flashpoint

• Gasoline	-45° F
• Kerosene	120° F
• Diesel Fuel	124° F
• Ethyl Alcohol	55° F
• Ethylene Glycol	232° F
• JP-5 (Jet Fuel)	140° F
• Nitrobenzene	190° F
• Nitromethane	95° F

Gotcha !!! – It's not all in the "Name"

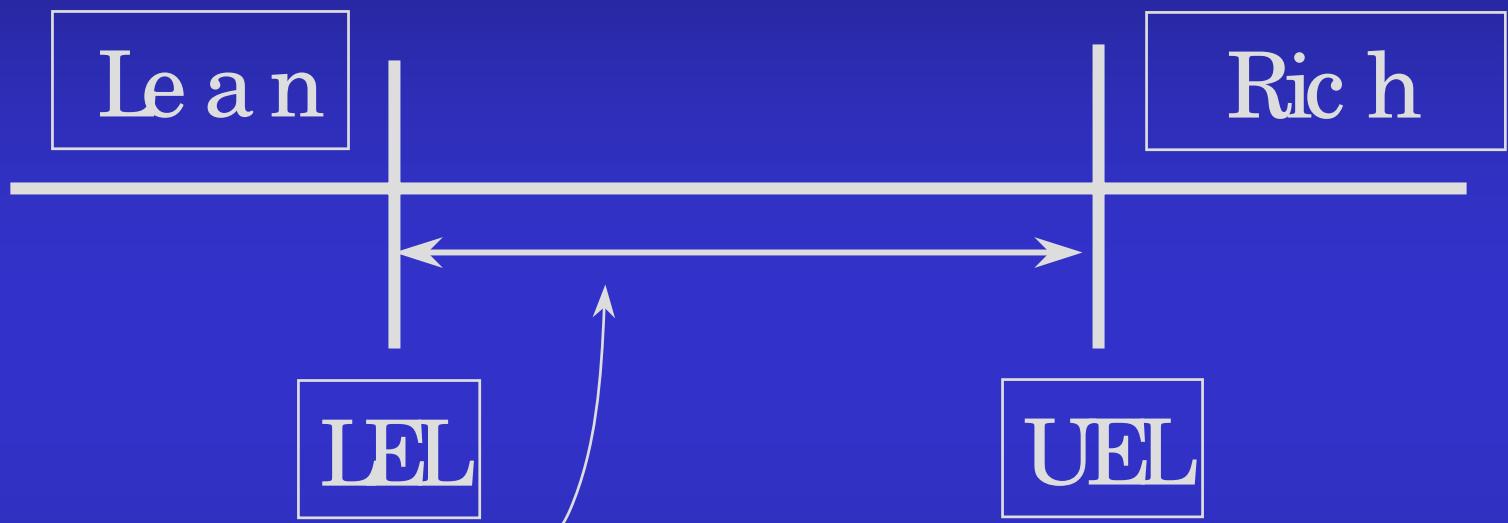
States of Matter

Flashpoint is an event which occurs in the course of a liquid's evaporation

Flammability

- Flammable / Explosive Limits
  - "The range in which a fuel vapor, when mixed proportionally in air, will burn or explode."
  - Is expressed as LEL and UEL

Flammable Limits



Examples of LEL/UEL

	LEL	UEL
• Kerosene	1.0%	5.0%
• Gasoline	1.4%	7.6%
• Ethyl Alcohol	3.3%	19%
• Isopropyl Alcohol	2.0%	12.7%
• Propane	2.2%	9.5%
• Natural Gas	3.8%	17%
• Methane	5.0%	15%
• Acetylene	2.0%	99%
• Hydrogen	4.0%	75%
• Anhydrous Ammonia	15%	28%
• Ethylene Oxide	3.0%	100%

Flammability

- Ignition Temperature
  - "The temperature at which a substance must be heated to sustain its own combustion process."

... more effectively, it is how hot the ignition source must be for ignition to occur, when a gas vapor is within its flammable range.

Ignition Temperature

Gasoline	700°F (approx.)
Kerosene	410°F
Diesel Fuel	494°F
Propane	842°F
Natural Gas	900°F
Ethyl Alcohol	685°F

Vapor Pressure

- Vapor Pressure:

  "the ability of a liquid or solid to evaporate into the air"

- Sometimes may be expressed as "Volatility"

- "How much does the material want to become airborne or evaporate"

Volatility

- Volatility
  - "The ability of a liquid to evaporate."
  - The more volatile a substance is, the faster it will evaporate

  "How long is the chemical going to linger…?"

Vo la tility

- "…the ability of a substance to evaporate."
- Relates to Vapor Pressure
- The higher the vapor pressure, the more volatile the product is considered. (>760 mm Hg will be a gas)
- ***Vapor Pressures (at 70°F.):***
  - Diesel Fuel — 2.17 mm Hg
  - Water — 25 mm Hg
  - Isopropyl Alcohol — 33 mm Hg
  - Acetone — 180 mm Hg
  - Gasoline — 200 mm Hg
  - Hydrochloric Acid — 414 mm Hg
  - Butane — 1,800 mm Hg
  - Propane — 9,823 mm Hg (7.5 atm)
  - Methane — 258,574 mm Hg (at 100°F.) (340 atm)

Volatility "Rule of Thumb"

- Use the "2, 20, 200 Rule of Thumb"
- To assess the probable vapor production of volatile chemicals, let's use some materials that are familiar:
  - Diesel Fuel = approx 2 mm/Hg at 70° F
  - Water = approx 20 mm/Hg at 70° F
  - Gasoline = approx 200 mm/hg at 70° F

- Remember – these vapor pressures are representative for comparison… they are temperature dependent – the hotter it is, the more vapors and etc.

Volatility - Examples

- What could we compare the following to for a prediction of vapor production? ("2, 20, 200")
  - Acetone = 180 mm/Hg at 70° F
  - Nitrobenzene = 0.3 mm/Hg at 70° F
  - Methyl Ethyl Keytone (MEK) = 78 mm/Hg at 70° F
  - Methanol = 96 mm/Hg at 70° F

Vapor Density

- … is the comparison of the weight of a gas to the weight of an equal volume of air (air =1)
  - Gasoline 3.5
  - Propane 1.5
  - Natural Gas .8
  - Methane .6
  - Acetylene .9
  - Chlorine 2.3

Specific Gravity

- … is the comparison of the weight of a liquid substance as compared with an equal volume of water (water=1)
  - Gasoline .8
  - Ethyl Alcohol .8
  - Sulfuric Acid 1.8
  - Bromine 3.12

Solubility (miscibility)

- .. is the ability of a material to dissolve in another substance

Polar Solvents

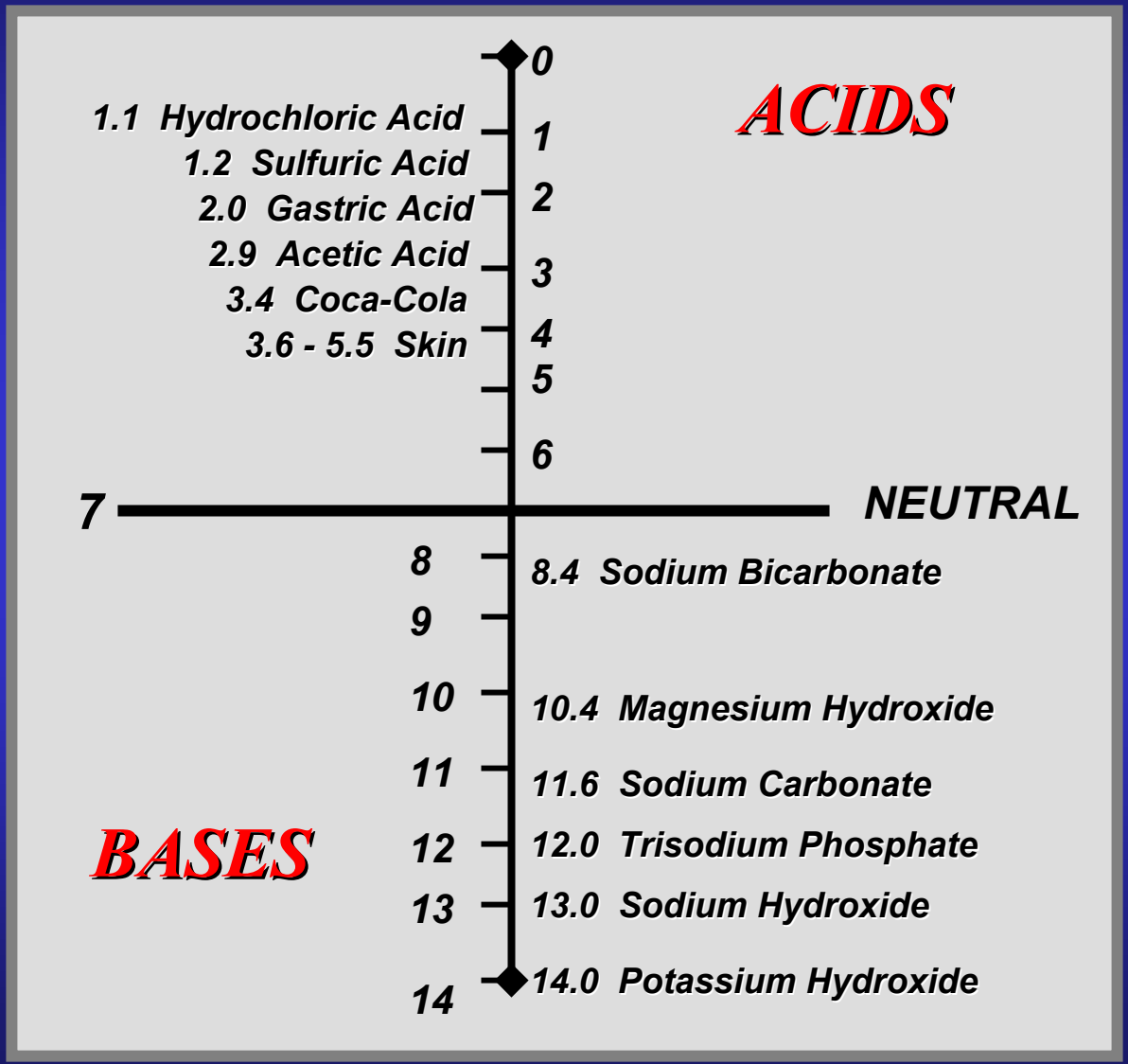
- "Polar" - will mix with water
  - Alcohols, Keytones, Ethers, Esters, Aldehydes
- "Non-Polar" - will not mix with water
  - Gasoline, Diesel Fuel, Fuel Oils

Corrosiveness

Corrosives

- Includes acids and bases
- Strength (hazard) is determined by measuring the pH.
  - Acid = pH<7.0
  - Base = pH>7.0
- Different concentrations (%) of corrosives are a result of dilution - the pH will remain the same
- Some acids are flammable (organic)
  - Acetic Acid, Formic Acid

Corrosives - pH Scale



Reactivity

Reactivity

- Relates to a materials ability to "break down" or to combine and from new compounds
- Polymers, Oxidizers, and Explosives are typically found in this grouping
- Oxidation and reduction occur when some materials contact each other, or may be affected by temperature
- **WATCH OUT WHEN YOU HAVE MULTIPLE CHEMICALS – IF THEY MIX… (???) Something REACTIVE may happen !!!**

Oxidation

- Provides the ability to create an unlimited array of substances
- Molecules that contain oxygen, free oxygen, and halogens (Fluorine, Chlorine, Bromine, Iodine) are very willing to accept electrons from other elements to form new compounds
- This process causes "oxidation", and thus "breaks down" substances

Reactivity

- When the oxidizer itself contains a fuel, a higher level of instability is present
  - Organic Peroxides
  - Explosives
- Some organic peroxides require refrigeration
  - SADT(Self Accelerating Decomposition Temperature)
  - MSST(Maximum Safe Storage Temperature)
- Explosives may require special handling and storage to maintain separation

Polymerization

- Monomers
  - (liquids and liquefied gases - Ethylene, Styrene, Butadiene, Vinyl Chloride, and Acrylonitrile are common monomers)
- These materials react with themselves to from "polymers"
- Monomers usually require initiation through the use of a catalyst (usually an Organic Peroxide) Sometimes heat may initiate the reaction.
- If the initiation occurs while the monomer is still in its container, the reaction could result in an explosive force

Radioactivity

Radioactive Materials

- Alpha
- Beta
- Gamma

Radioactive Materials - Alpha and Beta

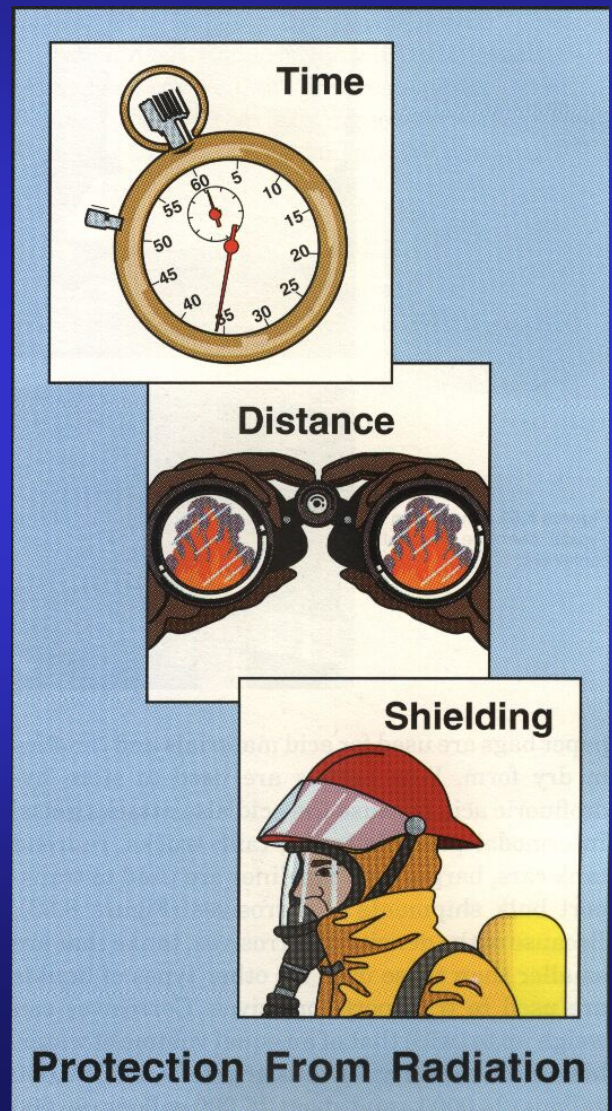
- Radiation is a result of the decay of an atom's nucleus, which contains many subatomic particles
- These particles are "Alpha" and "Beta" and have mass (size and weight) - and also have an electrical charge
- "Alpha" particles are relatively large and have a positive charge
- "Beta" particles are smaller and may have a positive or negative charge
- These ionized particles will have an effect on human cellular tissue when contact is made

Radioactive Materials - Gamma

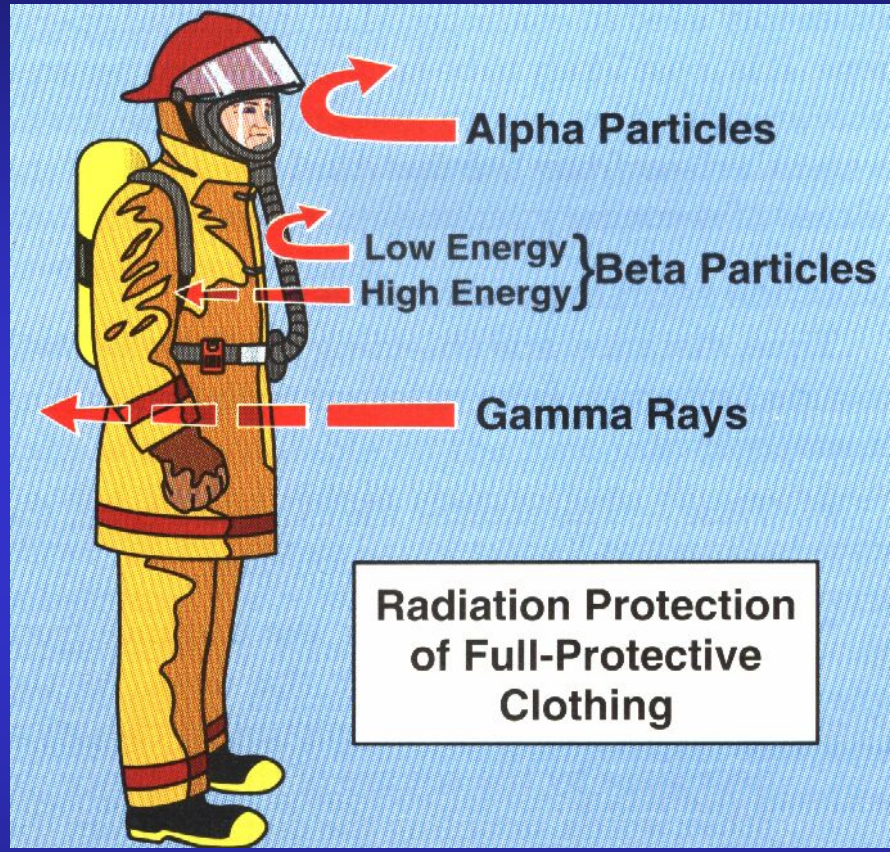
- Is a very short energy wave, capable of penetrating skin and clothing
- Contains no mass or electrical charge
- Damages human tissue by disrupting the electrical charge of the subject's molecular and cellular structure (DNA)
- This can cause serous illness and even death
- If DNA strands are damaged, the cell cannot replicate or repair itself, and the cell dies

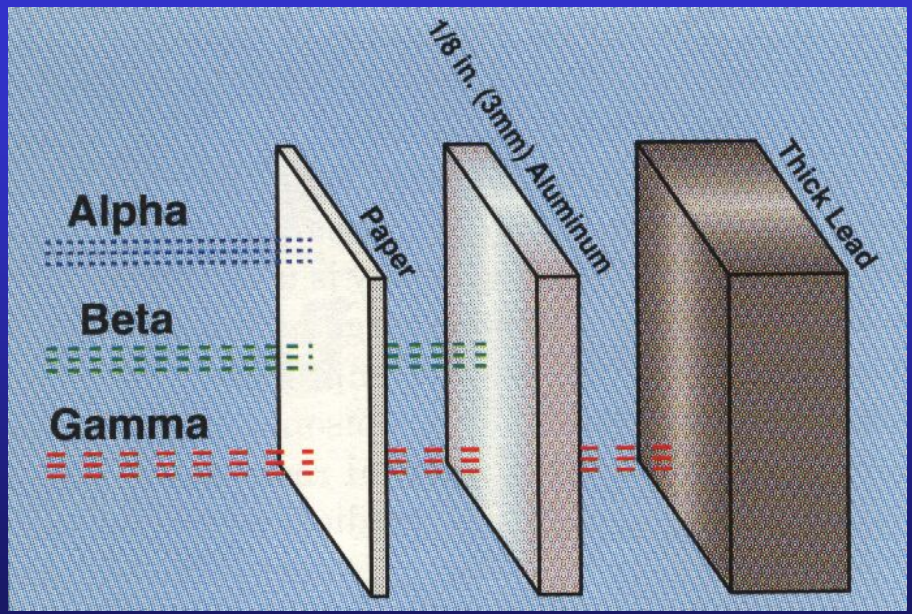
Radiation Protection

- Time
- Distance
- Shielding



Radiation Protection





Reporting of Hazardous Chemical Spills/Releases

Remember to follow the "Thumb Rule" at any HAZMAT incident!

The most important action in any chemical-related emergency is the early activation of the 911 system

In any significant HAZMAT incident within Wake County, the WCEM Staff Duty Officer will respond and will ensure that all required reporting is completed

In the Event of a Hazardous Chemical Spill/Release, the Following Question Must be Asked.....

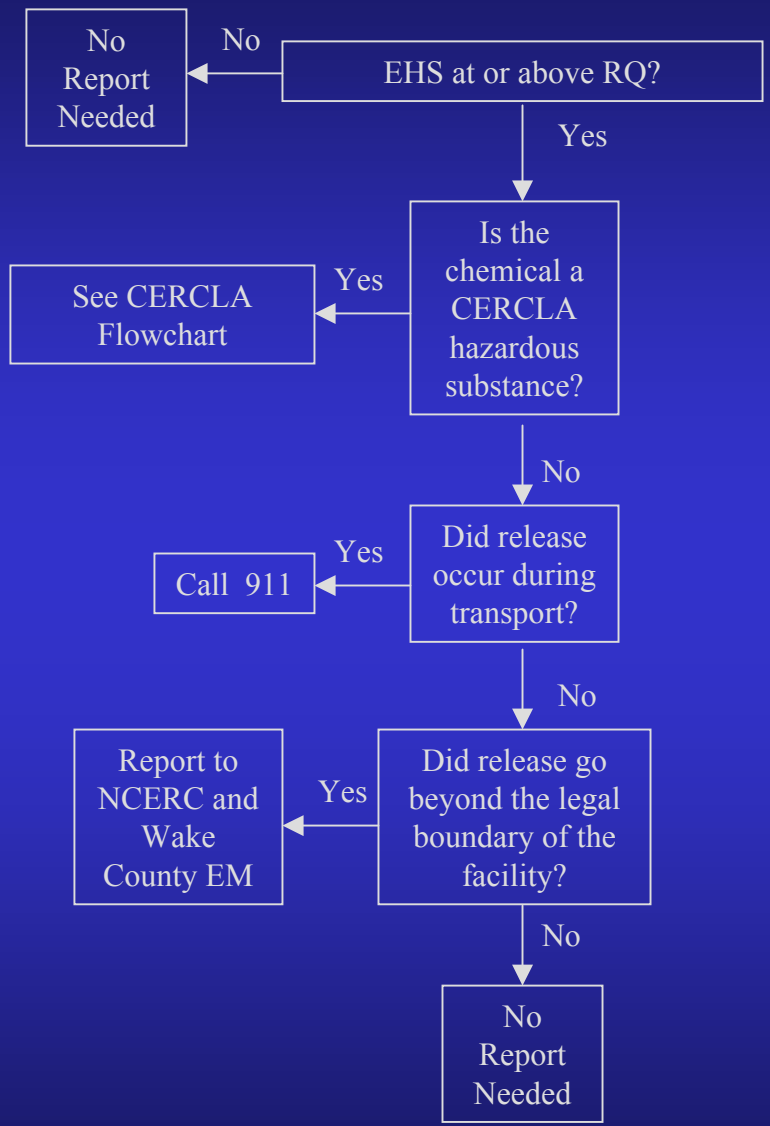
- Did the spill/release involve an EHS chemical or a CERCLA chemical?

If an EHS, then proceed to the EHS Flowchart:

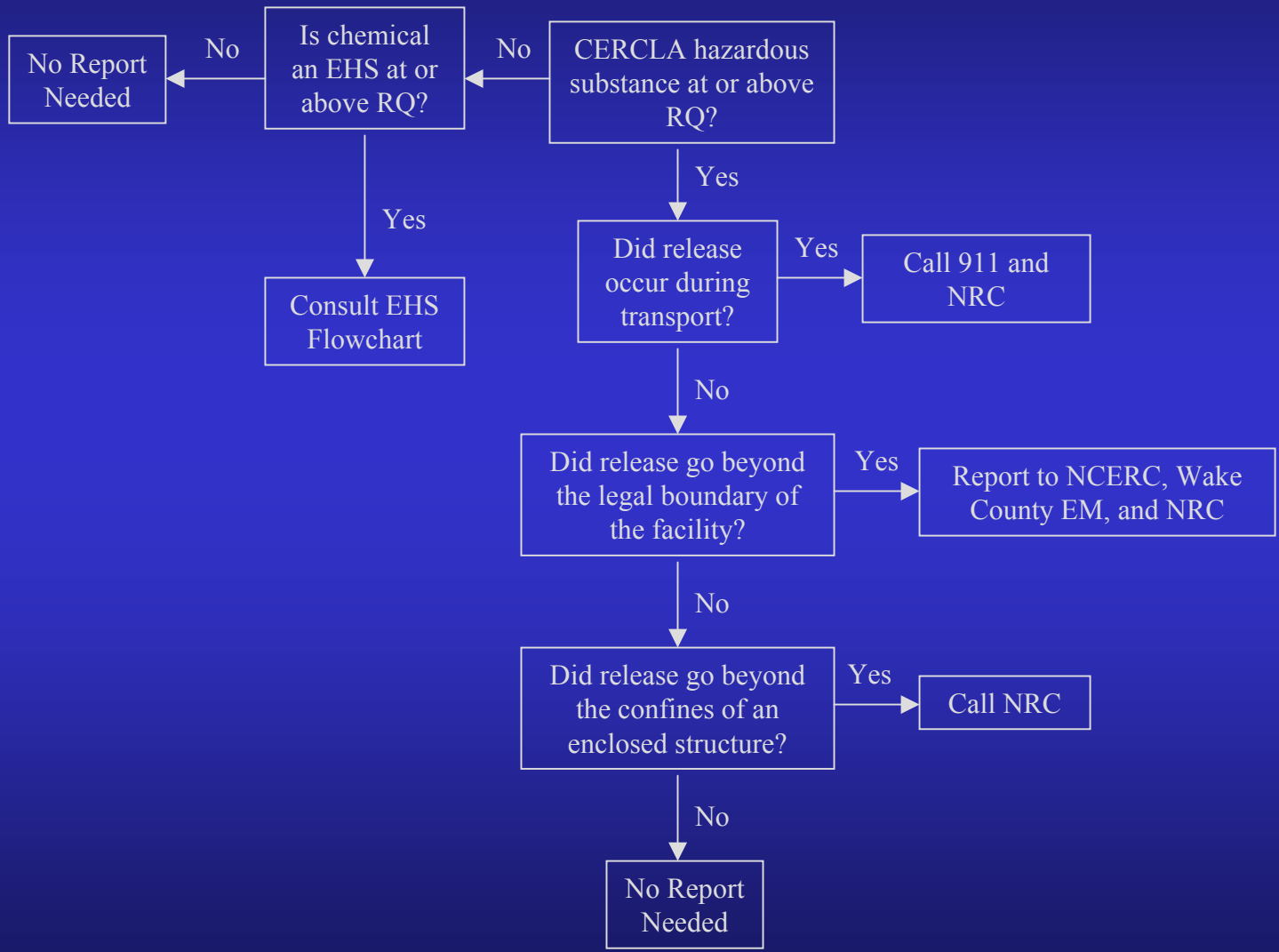
If a CERCLA chemical, then proceed to the CERCLA Flowchart

NAME	CAS/ 313 Category Codes	Section 302 (EHS) TPQ	Section 304 EHS RQ	CERCLA RQ	Section 313	RCRA CODE	CAA 112(r) TQ
1,1-Dichloropropane	78-99-9			1,000			
1,1,2-Trichloroethane	79-00-5			100	313	U227	
Trichloroethylene	79-01-6			100	313	U228	
Acrylamide	79-06-1	1,000/10,000	5,000	5,000	313	U007	
Propionic acid	79-09-4			5,000			
Acrylic acid	79-10-7			5,000	313	U008	
Chloroacetic acid	79-11-8	100/10,000	100	100	313		
Thiosemicarbazide	79-19-6	100/10,000	100	100	313	P116	
Ethaneperoxoic acid	79-21-0	500	500		X		10,000
Peracetic acid	79-21-0	500	500		313		10,000
Carbonochloridic acid, methylester	79-22-1	500	1,000	1,000	X	U156	5,000
Methyl chlorocarbonate	79-22-1	500	1,000	1,000	313	U156	5,000
Methyl chloroformate	79-22-1	500	1,000	1,000	X	U156	5,000
iso-Butyric acid	79-31-2			5,000			
1,1,2,2-Tetrachloroethane	79-34-5			100	313	U209	
Ethene, chlorotrifluoro-	79-38-9						10,000
Trifluorochloroethylene	79-38-9						10,000
Dimethylcarbamyl chloride	79-44-7			1	313	U097	
2-Nitropropane	79-46-9			10	313	U171	
Tetrabromobisphenol A	79-94-7				313^		

EHS Flowchart



CERCLA Chemical Flowchart



In simpler Terms.....

In a spill/release event involving an EHS substance, the NCERC and Wake County EM should be notified if the quantity of the EHS spilled/released is at or above the RQ and the product has any impact on areas outside the legal boundary of the facility. In instances in which the release occurs during transport, call 911.

In cases in which a CERCLA hazardous chemical is involved, the National Response Center (NRC) is notified if the spill/release meets or exceeds the CERCLA RQ and extends beyond the confines of any enclosed structure at the facility. The reporting regulations for EHS's (i.e. reporting to the NCERC and Wake county EM if the substance is an EHS, meets or exceeds the RQ, and areas outside of the legal boundary of the facility are impacted) still apply.

Wake County Emergency Management will also assist with notifying other applicable agencies (i.e. NC DENR, Environmental Services, DAQ, etc.)

Wake County RQ Form

WAKE COUNTY
LOCAL EMERGENCY PLANNING COMMITTEE
C/O WAKE COUNTY EMERGENCY MANAGEMENT
A DIVISION OF THE DEPARTMENT OF PUBLIC SAFETY

REPORTABLE QUANTITY FORM

Notice to Spillers:
Page 1 of 2

Section 304 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) requires facilities that use, produce or store certain listed hazardous substances to immediately report accidental releases of those materials. The facility must immediately report the release to the Local Emergency Planning Committee (LEPC), the State Emergency Response Commission (SERC), and the National Response Center (NRC). The agencies that this form must be sent on are listed on the next page.

On-scene responders have indicated that you are required to make a written legal notification of an incident at your facility. This form must be completed and returned to the appropriate agencies immediately. The lists of chemical subject to Section 304 notification and the corresponding RQ are found in 40 CFR Table 302.4

Facility Name _____
Release Occurred At _____
Contact Person _____ **Phone** _____

Type of Release: **[ ]** Chemical Release in Excess of Threshold RQ **[ ]** Release of Unknown Chemicals
[ ] Release with a potential for off-site exposure **[ ]** Other_____

Name of Chemical(s) and Quantity Released:
_____ Amt._____
_____ Amt._____
Time and Duration of Release: _____
_____

The Release was: **[ ]** air **[ ]** land **[ ]** surface water **[ ]** ground water

Anticipated acute or chronic health risks: _____
_____
_____

Medical Attention Required: **[ ]** Yes (statement attached) **[ ]** No

Precautions: _____
_____

Evacuation Information: _____
_____

Response Actions: _____
_____
_____
_____

****For questions or to make a notification to Wake County LEPC call 919-856-6480 or fax 919-856-7046****

If you have any further questions, contact:

Glenn Clapp

Wake County Emergency Management

(919) 856-5587

glenn.clapp@co.wake.nc.us