# Identification and Hazard Assessment for Hazmat Incidents

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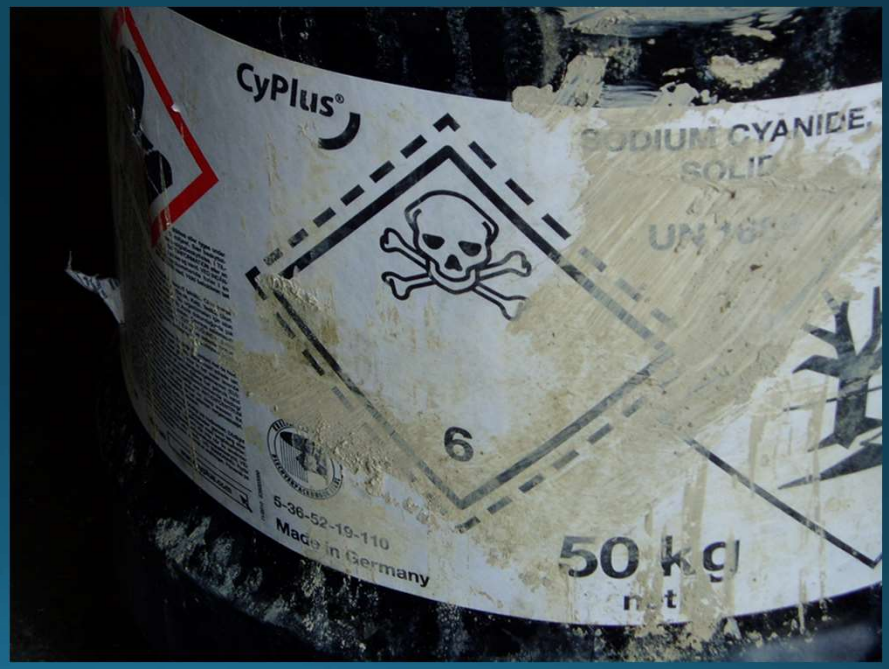
# Riverside County Railcar Incident

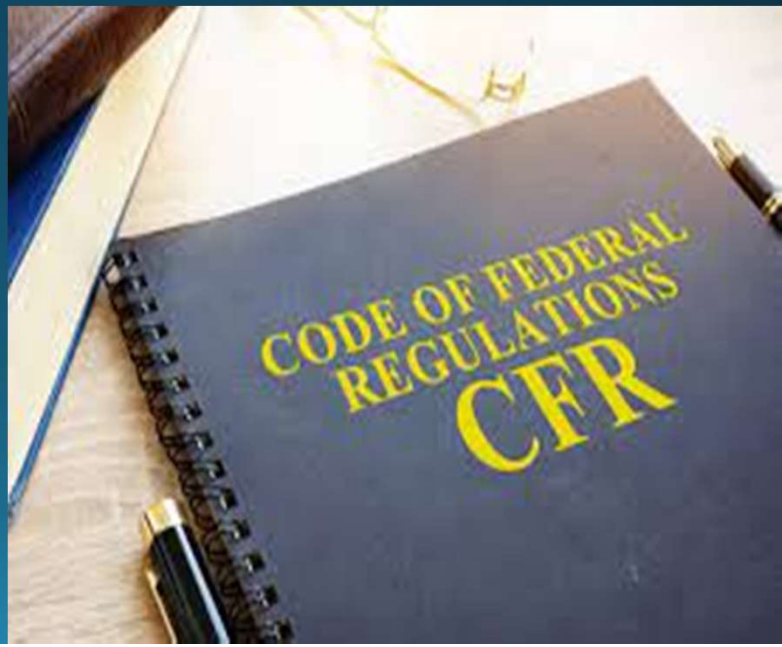
# Role of IDHA in the early stages of a HazMat Incident

- Identification & Hazard Assessment starts with initial discovery/notification
- The Incident Commander is responsible for ensuring that it is performed
- IDHA determines response options, decontamination protocols, and zone and perimeter set ups
- The IDHA process continues until the termination of the incident



# Regulatory Requirements

- 1910.120(c)(3)***Hazard identification***. All suspected conditions that may pose inhalation or skin absorption hazards that are immediately dangerous to life or health (IDLH), or other conditions that may cause death or serious harm, shall be identified during the preliminary survey and evaluated during the detailed survey. Examples of such hazards include, but are not limited to, confined space entry, potentially explosive or flammable situations, visible vapor clouds, or areas where biological indicators such as dead animals or vegetation are located.

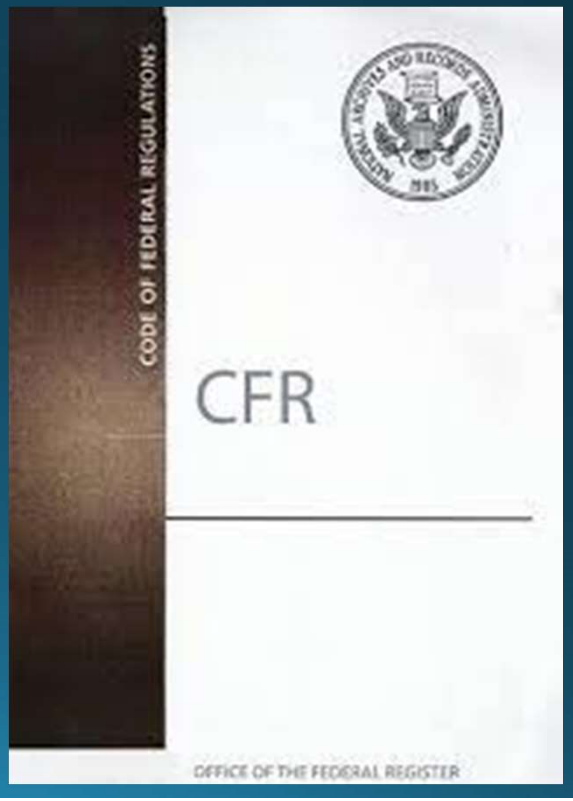


# Regulatory Requirements

- 1910.120(c)(7)***Risk identification***. Once the presence and concentrations of specific hazardous substances and health hazards have been established, the risks associated with these substances shall be identified. Employees who will be working on the site shall be informed of any risks that have been identified…

- Risks to consider include, but are not limited to:

  (a) Exposures exceeding the permissible exposure limits and published exposure levels.
  (b) IDLH concentrations.
  (c) Potential skin absorption and irritation sources.
  (d) Potential eye irritation sources.
  (e) Explosion sensitivity and flammability ranges.
  (f) Oxygen deficiency.



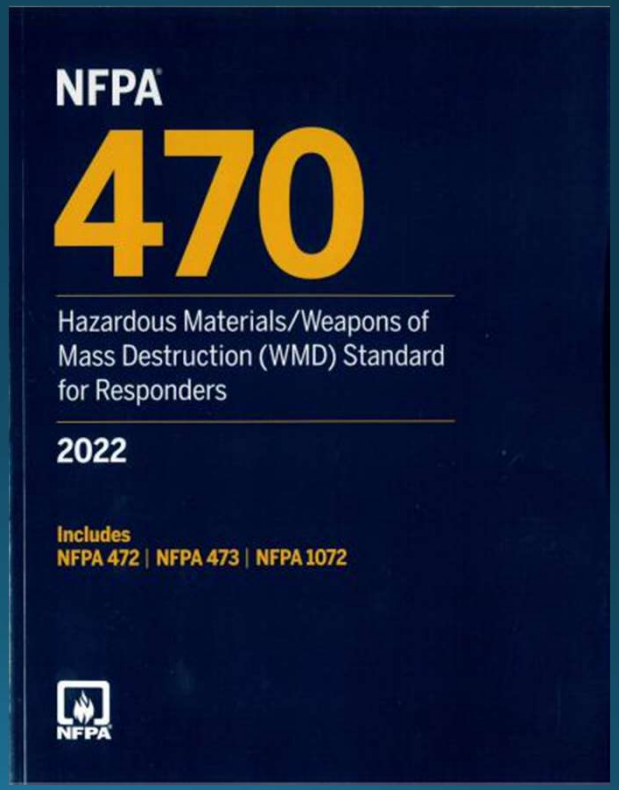
# Regulatory Requirements

## Cal/OSHA

- CA Code Regulations Title 8 Sec. 5192 (q)(3)(B) - Procedures for handling emergency response
- "The **individual in charge of the ICS shall identify, to the extent possible, all hazardous substances** or conditions present and shall address as appropriate site analysis…"

# Industry Standards – NFPA 470

- Provides minimum level of competence required by responders to incidents involving hazmat/WMD
- Section 6.1.2.2 - Operations Level shall:
  1. Identify the scope of the problem
  1. Identify the ***the containers and materials involved*** and the surrounding conditions
  1. Collect hazard and response information from sources
  1. Identify the potential hazards, harm, and outcomes

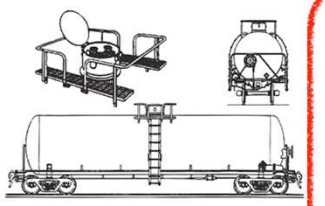


# Tools for Identification

# SHAPE AND DESIGN OF RAIL CARS

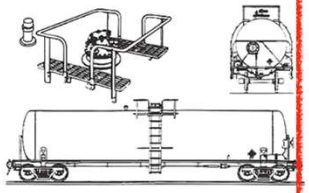
## RAIL CAR IDENTIFICATION CHART*

**117 Pressure tank car**



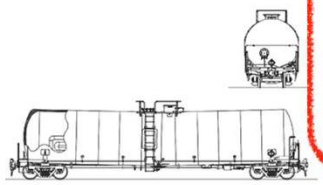
- For flammable, non-flammable, toxic and/or liquefied compressed gases
- Protective housing
- No bottom fittings
- Pressures usually above 40 psi

**131 General service tank car (low pressure)**



- For variety of hazardous and non-hazardous materials
- Fittings and valves normally visible at the top of the tank
- Some may have bottom outlet valve
- Pressures usually below 25 psi

**128 Low pressure tank car (TC117, DOT117)**



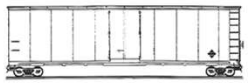
- For flammable liquids (e.g., Petroleum crude oil, ethanol)
- Protective housing separate from manway
- Bottom outlet valve
- Pressures usually below 25 psi

(Image provided as a courtesy of The Greenbrier Companies, Inc.)



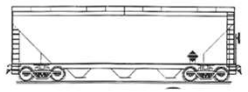
## RAIL CAR IDENTIFICATION CHART*

**111 Box car**



- For general freight that carry bulk or non-bulk packages
- May transport hazardous materials in small packages or "tote bins"
- Single or double sliding door

**140 Hopper car**



- For bulk commodities and bulk cargo (e.g., coal, ore, cement and solid granular materials)
- Bulk lading discharged by gravity through the hopper bottom doors when doors opened


**CAUTION:** Emergency response personnel must be aware that rail tank cars vary widely in construction, fittings and purpose. Tank cars could transport products that may be solids, liquids or gases. The products may be under pressure. It is essential that products be identified by consulting shipping documents or train consist or contacting dispatch centers before emergency response is initiated.

The information stenciled on the sides or ends of tank cars, as illustrated above, may be used to identify the product utilizing:

a. the commodity name shown; or
b. the other information shown, especially reporting marks and car number which, when supplied to a dispatch center, will facilitate the identification of the product.

* **The recommended guides should be considered as last resort if the material cannot be identified by any other means.**

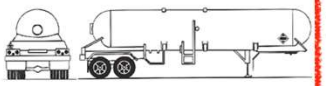
# SHAPE AND DESIGN OF ROAD TRAILERS

## ROAD TRAILER IDENTIFICATION CHART*

**WARNING:** Road trailers may be jacketed, the cross-section may look different than shown and external ring stiffeners would be invisible.

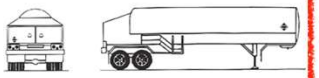
**NOTE:** An emergency shut-off valve is commonly found at the front of the tank, near the driver door.

**117 MC331, TC331, SCT331**



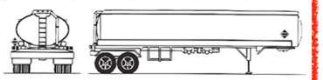
- For liquefied compressed gases (e.g., LPG, ammonia)
- Rounded heads
- Design pressure between 100-500 psi**

**117 MC338, TC338, SCT338, TC341, CGA341**



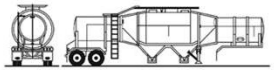
- For refrigerated liquefied gases (cryogenic liquids)
- Similar to a "giant thermo-bottle"
- Fitting compartments located in a cabinet at the rear of the tank
- MAWP between 25-500 psi**

**131 DOT406, TC406, SCT306, MC306, TC306**



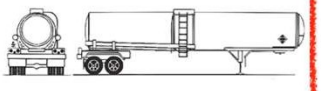
- For flammable liquids (e.g., gasoline, diesel)
- Elliptical cross-section
- Rollover protection at the top
- Bottom outlet valves
- MAWP between 3-15 psi**

**112 TC423**



- For emulsion and water-gel explosives
- Hopper-style configuration
- MAWP between 5-15 psi**

**137 DOT407, TC407, SCT307, MC307, TC307**

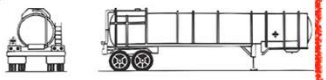


- For toxic, corrosive, and flammable liquids
- Circular cross-section
- May have external ring stiffeners
- MAWP of at least 25 psi**



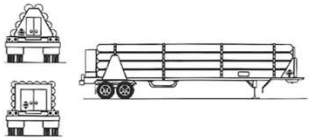
## ROAD TRAILER IDENTIFICATION CHART*

**137 DOT412, TC412, SCT312, MC312, TC312**

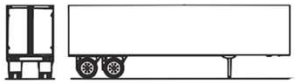


- Usually for corrosive liquids
- Circular cross-section
- External ring stiffeners
- Tank diameter is relatively small
- MAWP of at least 15 psi**

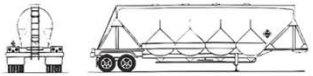
**117 Compressed Gas/Tube Trailer**



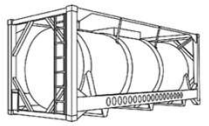
**111 Mixed Cargo**



**134 Dry Bulk Cargo Trailer**



**117 Intermodal Tank**



**137 Vacuum Tanker**

**CAUTION:** This chart depicts only the most general shapes of road trailers. Emergency response personnel must be aware that there are many variations of road trailers, not illustrated above, that are used for shipping chemical products. The suggested guides are for the most hazardous products that may be transported in these trailer types.

* **The recommended guides should be considered as last resort if the material cannot be identified by any other means.**

** **MAWP: Maximum Allowable Working Pressure.**

## Benefits

- In the absence of other identifiers, allows for initial size up from a safe distance

## Limitations

- Provides only general guidance as to potential hazards

# DOT Placards


Explosives


Gases


Flam/Comb Liquids

# DOT Placards


Flam. Solids

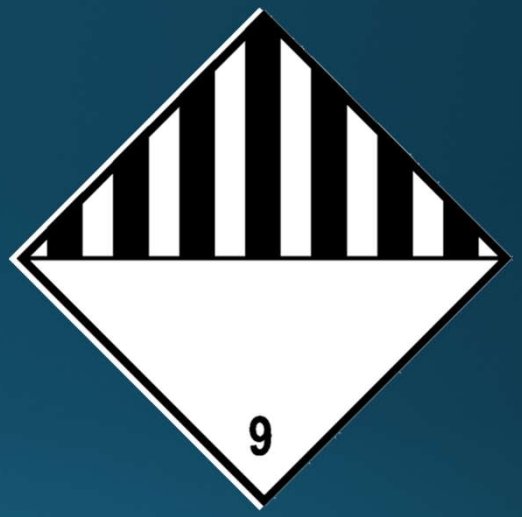

Oxidizers/O.P.


Toxics

# DOT Placards


Radioactive


Corrosives




Misc. Hazards

# DOT Placards with UN Number

# How Are We Going To Remember All That?

Class:

| | |
|---|---|
| 1. Every | (Explosives) |
| 2. Good | (Gas) |
| 3. Firefighter | (Flammable) |
| 4. Shouts | (Solid flam/reactive) |
| 5. Out | (Oxidizer) |
| 6. To | (Toxic) |
| 7. Receive | (Radiation) |
| 8. Cash | (Corrosive) |
| 9. Money | (Misc.) |

## Benefits

- Provides visual indicator of primary hazard class
- UN Number may provide more specific identification of the material

## Limitations

- Does not identify secondary or tertiary hazards
- Hazard are categorized by DOT definitions (e.g. Ammonia)
- Mixed loads may only be placarded as “Dangerous”

# NFPA 704 System


- Blue = Health
- Red = Flammability
- Yellow = Instability
- No color = special hazards

# Numerical Rating Scale

- 0= no hazard
- 4 = highest hazard


Propane


$CO_2$

# Special Hazards

- This section can provide more specific information about the hazard.
- NFPA only designates symbols for Water-Reactive, Oxidizer and Simple Asphyxiant
- "SA" designation can be used for liquified $CO_2$




## Benefits

- Provides a warning to first-in responders regarding the presence of hazardous materials
- Does not require any special knowledge of hazardous materials to interpret

## Limitations

- Does not specify the nature of health hazards
- May represent a collective rating for hazards at the facility
- Often are out of date or contain inaccurate ratings

# GHS

## The Globally Harmonized System of Classification and Labeling of Chemicals

# Pictograms: Hazard symbol, Border, Background

| Health Hazard | Flame | Exclamation Mark |
| --- | --- | --- |
|  |  |  |
| • Carcinogen<br>• Mutagenicity<br>• Reproductive Toxicity<br>• Respiratory Sensitizer<br>• Target Organ Toxicity<br>• Aspiration Toxicity | • Flammables<br>• Pyrophorics<br>• Self-Heating<br>• Emits Flammable Gas<br>• Self-Reactives<br>• Organic Peroxides | • Irritant (skin and eye)<br>• Skin Sensitizer<br>• Acute Toxicity (harmful)<br>• Narcotic Effects<br>• Respiratory Tract Irritant<br>• Hazardous to Ozone Layer (Non-Mandatory) |

# Communicates Hazards

# Pictograms: Hazard symbol, Border, Background

| Gas Cylinder | Corrosion | Exploding Bomb |
| --- | --- | --- |
|  |  |  |
| • Gases Under Pressure | • Skin Corrosion/ Burns<br>• Eye Damage<br>• Corrosive to Metals | • Explosives<br>• Self-Reactives<br>• Organic Peroxides |

## Communicates Hazards

# Pictograms: Hazard symbol, Border, Background

| Flame Over Circle | Environment (Non-Mandatory) | Skull and Crossbones |
|---|---|---|
|  |  |  |
| • Oxidizers | • Aquatic Toxicity | • Acute Toxicity (fatal or toxic) |

## Communicates Hazards

## Benefits

- Provides a visual warning at the individual container level
- Pictograms can provide warning of secondary and tertiary hazards

## Limitations

- Some pictograms are associated with a variety of hazards

# Geiger-Muller Survey Meter

## Benefits

- Can detect Gamma and high-energy Beta and Alpha radiation

## Limitations

- Does not distinguish between types of radiation
- May not detect lower energy Beta radiation
- Should not be used to calculate exposure rate to Gamma radiation

# Four Gas/PID Meter

## Benefits

- Can provide information on the atmosphere including O2 levels and presence of flammable/combustible material
- O2 meter may provide warning of contaminants not detected by other sensors

## Limitations

- Detection abilities limited by sensor array and/or ionization capacity of PID
- CGI provides a relative response for LEL
- Only reliable if properly calibrated and maintained

# Draeger Field Kit

## Benefits

- Can provide accurate information on the concentration of a known contaminant in the atmosphere
- Can be useful for determining perimeter and zone distances in the presence an airborne contaminant

## Limitations

- Limited by the detector tubes available
- Results subject to cross-sensitivity
- Tubes should not be used post-expiration date

# HazCat Field Kit

## Benefits

- Can help identify a wide variety of hazardous materials
- Only requires a small amount of material to perform analysis

## Limitations

- Requires obtaining a sample of the material
- Can only be performed by sufficiently trained personnel
- Results may be ambiguous

# Field IR Spectrometer

## Benefits

- Can help identify a wide variety of hazardous materials
- Only requires a small amount of material to perform analysis

## Limitations

- Requires obtaining a sample of the material
- Can only be performed by sufficiently trained personnel
- Results may be ambiguous, especially with mixtures and organic materials

# Safety Data Sheets

- Identifies chemical
- Provides detailed information on chemical hazards
- Provides information on physical properties that can be used in hazard identification

## SAFETY DATA SHEET

Dichlorosilane

Airgas
an Air Liquide company

### Section 1. Identification

| | | |
|---|---|---|
| GHS product identifier | : | Dichlorosilane |
| Chemical name | : | dichlorosilane |
| Other means of identification | : | Silane, dichloro- |
| Product use | : | Synthetic/Analytical chemistry. |
| Synonym | : | Silane, dichloro- |
| SDS # | : | 001074 |
| Supplier's details | : | Airgas USA, LLC and its affiliates<br>259 North Radnor-Chester Road<br>Suite 100<br>Radnor, PA 19087-5283<br>1-610-687-5253 |
| 24-hour telephone | : | 1-866-734-3438 |

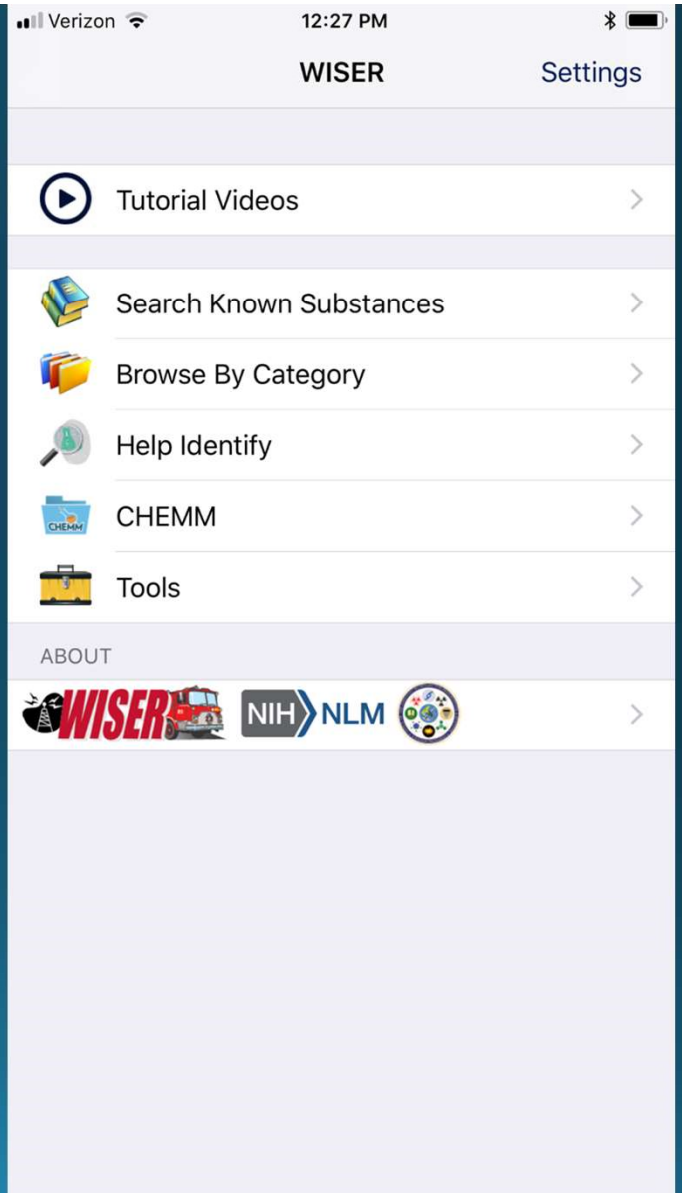
### Section 2. Hazards identification

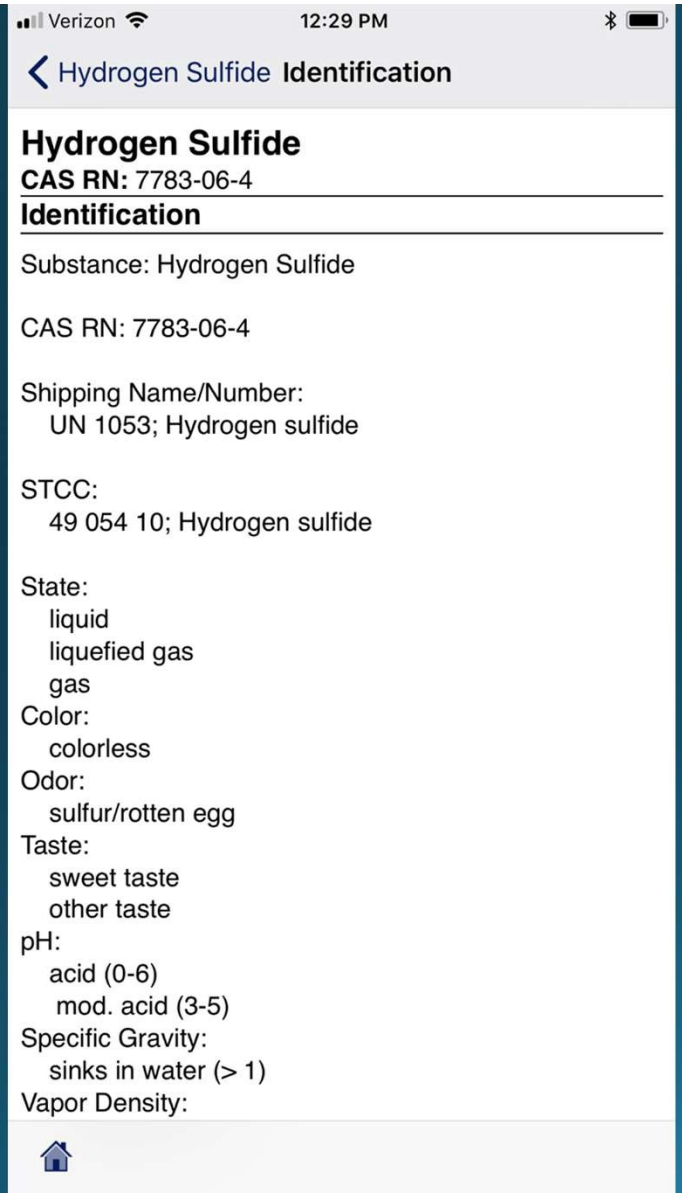
| | | |
|---|---|---|
| OSHA/HCS status | : | This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200). |
| Classification of the substance or mixture | : | FLAMMABLE GASES - Category 1<br>GASES UNDER PRESSURE - Liquefied gas<br>ACUTE TOXICITY (inhalation) - Category 2<br>SKIN CORROSION/IRRITATION - Category 1<br>SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 1 |
| GHS label elements | | |
| Hazard pictograms | : |  |
| Signal word | : | Danger |
| Hazard statements | : | Extremely flammable gas.<br>Contains gas under pressure; may explode if heated.<br>May cause frostbite.<br>May form explosive mixtures in Air.<br>Fatal if inhaled.<br>Causes severe skin burns and eye damage. |

# CERS

- Can provide chemical inventory
- Can provide facility site map
- Can provide facility contingency plan and contact information


WISER


Verizon
12:27 PM
WISER
Settings
Tutorial Videos
Search Known Substances
Browse By Category
Help Identify
CHEMM
Tools
ABOUT
WISER
NIH
NLM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Hydrogen Sulfide Identification
Hydrogen Sulfide
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Identification
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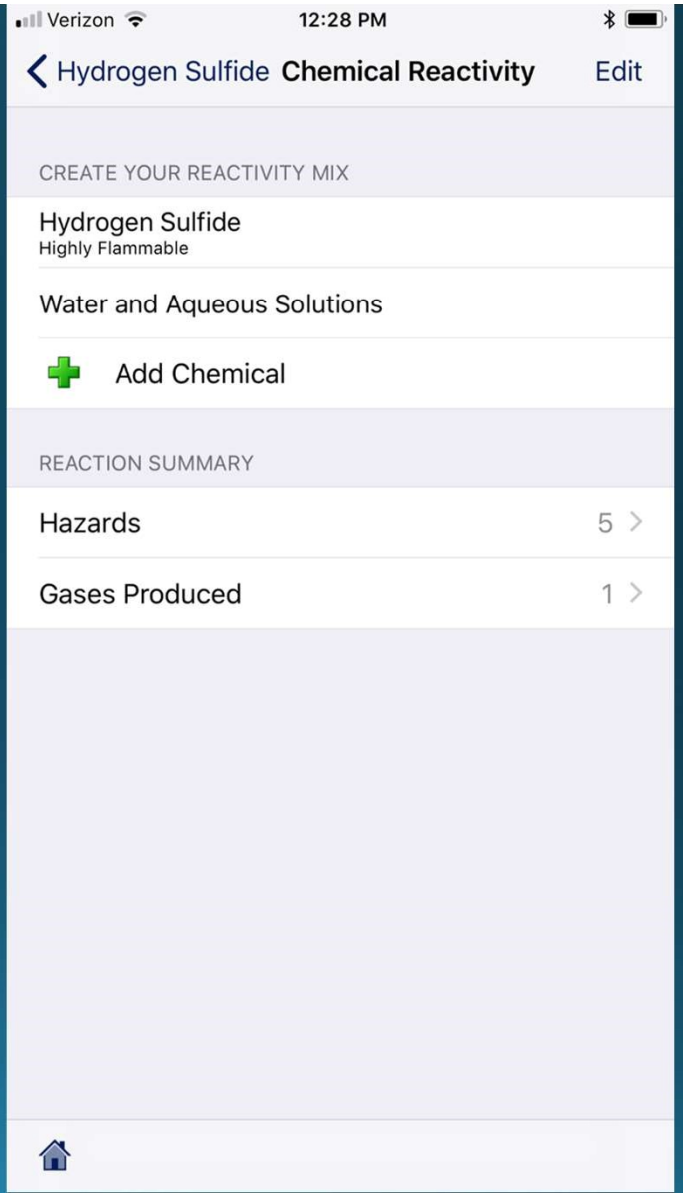
CAS RN: 7783-06-4
Shipping Name/Number:
UN 1053; Hydrogen sulfide
STCC:
49 054 10; Hydrogen sulfide
State:
liquid
liquefied gas
gas
Color:
colorless
Odor:
sulfur/rotten egg
Taste:
sweet taste
other taste
pH:
acid (0-6)
mod. acid (3-5)
Specific Gravity:
sinks in water (> 1)
Vapor Density:


Verizon
12:28 PM
Hydrogen Sulfide Chemical Reactivity
Edit
CREATE YOUR REACTIVITY MIX
Hydrogen Sulfide
Highly Flammable
Water and Aqueous Solutions
Add Chemical
REACTION SUMMARY
Hazards 5
Gases Produced 1

Verizon 10:05 AM

Chemical Reactivity

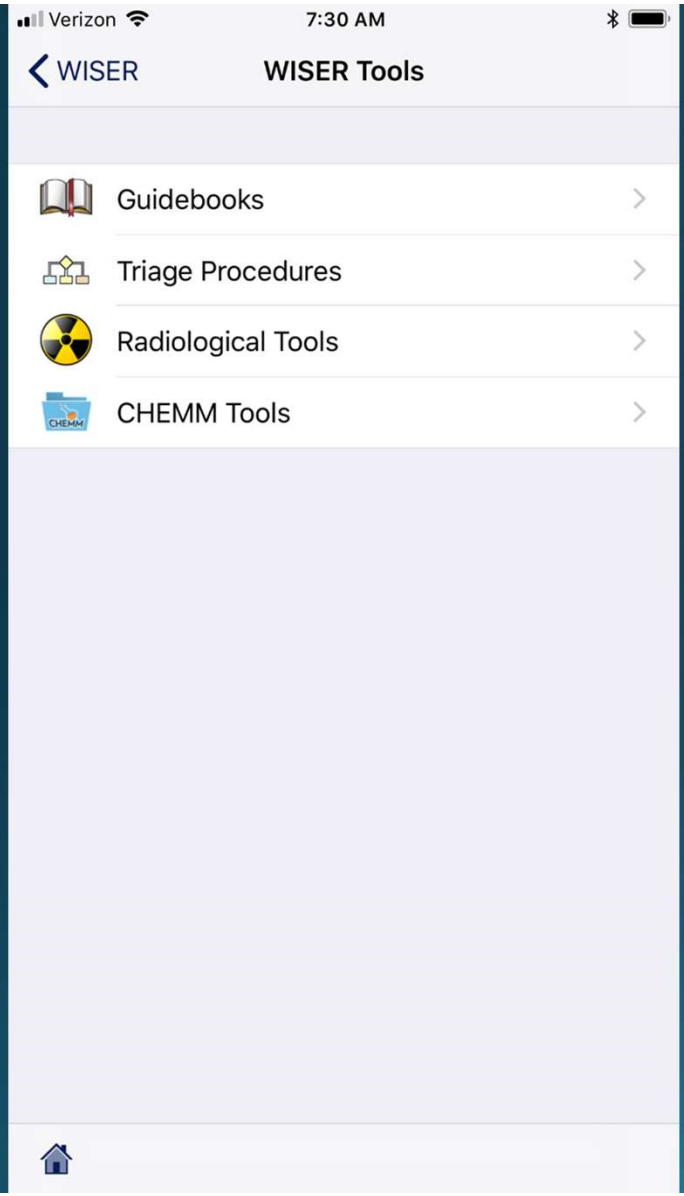

Exothermic reaction at ambient temperatures (releases heat)


Reaction liberates gaseous products and may cause pressurization


Reaction products may be corrosive


Reaction products may be flammable


Reaction products may be toxic


Verizon
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WISER
WISER Tools
Guidebooks
Triage Procedures
Radiological Tools
CHEMM Tools


Verizon
7:30 AM
WISER Tools
Guidebooks
Emergency Response Guidebook 2016
WMD Response Guidebook

# OCCUPANCY & LOCATION

# OCCUPANCY & LOCATION

# OCCUPANCY & LOCATION

# EMPLOYEES/BUSINESS OWNER

# OTHER IDENTIFICATION CONSIDERATIONS

- Mislabeling
- Contamination
- Mixing/Reaction Products

# HAZARD ASSESSMENT

# Old School Hazard Analyses

# HAZARD ASSESSMENT

- Ongoing process continuing through all phases of a response

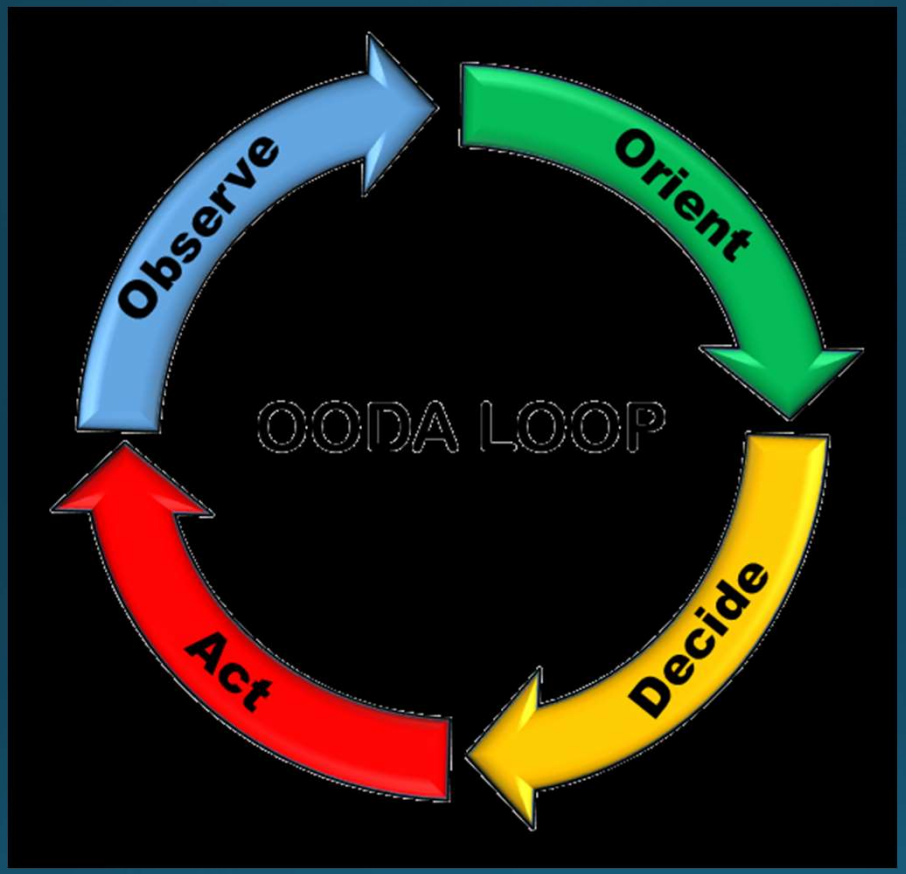
- Basic Emergency Response Strategies
  - Procedure-based
  - Risk-based

- Basic Steps of **Risk-based Response**
  - Analyze the problem
  - Assess the hazards
  - Evaluate the risk (potential consequences)

# THE HAZARD ASSESSMENT PROCESS

Answers several critical questions:

- What will material do
- Will it do something bad right now
- How can it hurt me (others)
- How can I protect myself (others)




# Boyd's OODA loop

# VARIABLES OF MATERIAL BEHAVIOR

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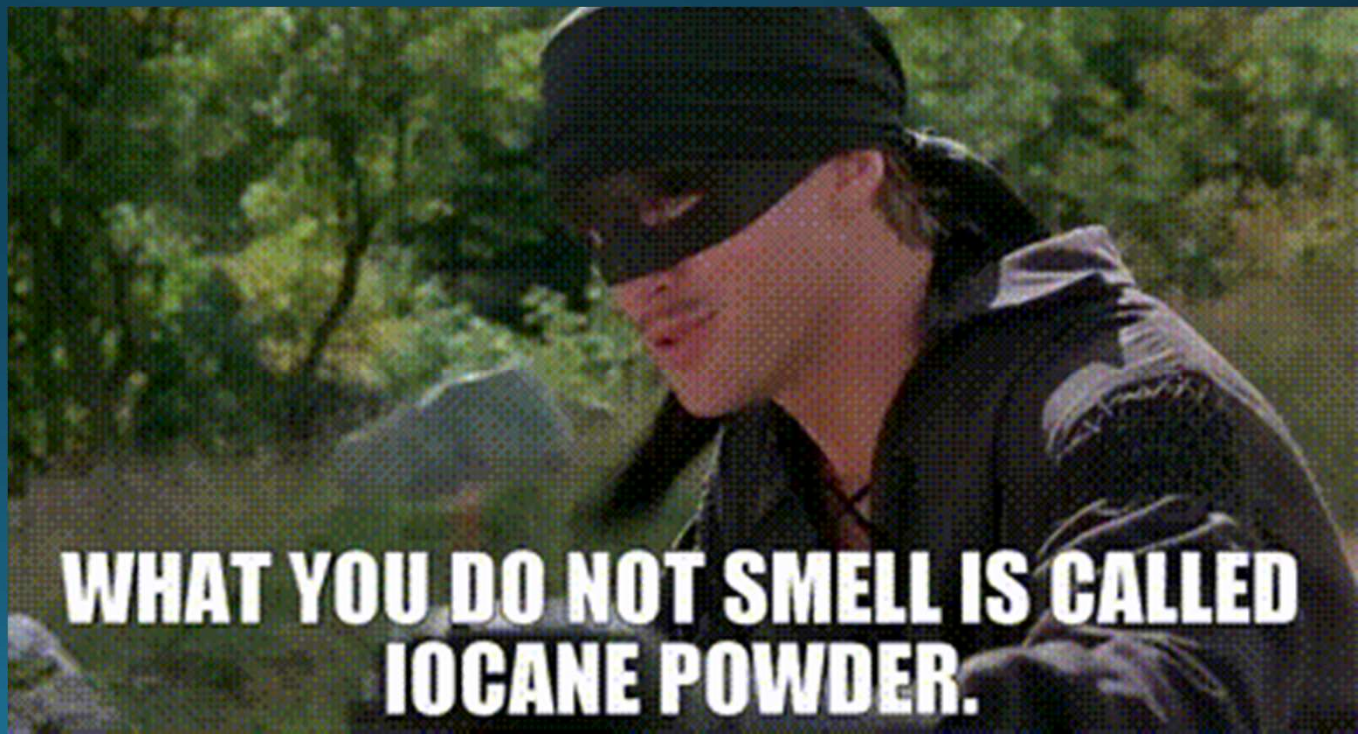
## Toxicity

- Concentration
- LD50/LC50
- Route of Entry
  - Inhalation
  - Absorption
  - Ingestion
  - Injection



IDLH or **Immediately dangerous to life or health** means an atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere.

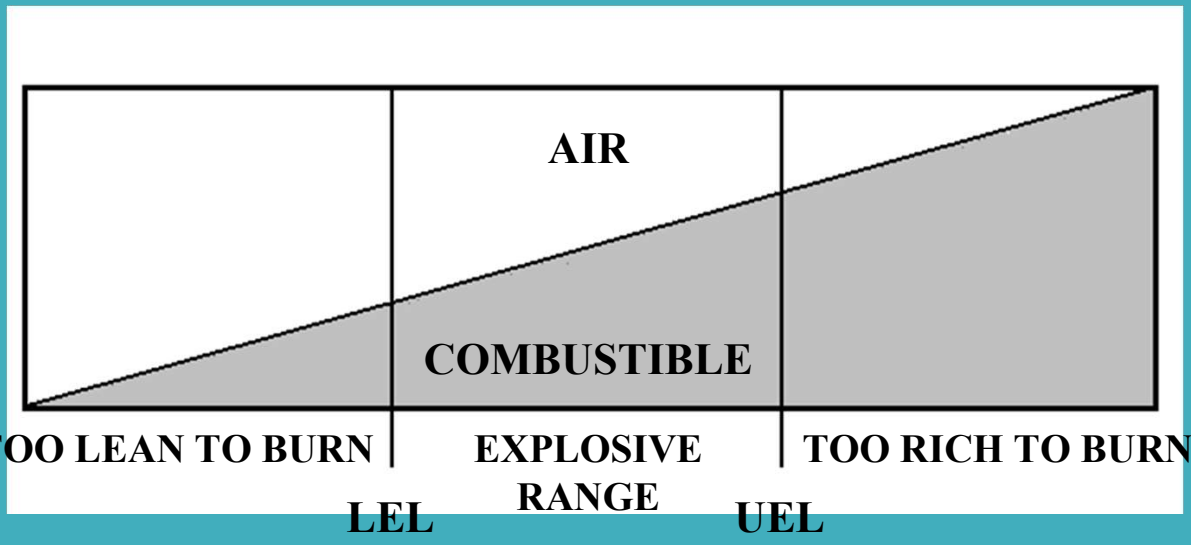
# IDLH

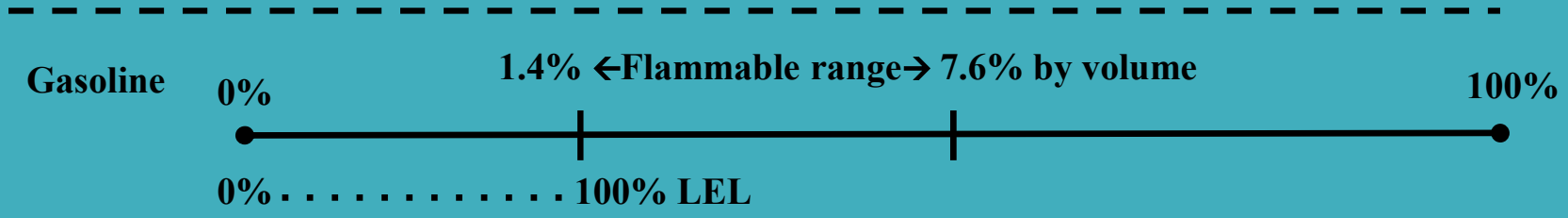
# VARIABLES OF MATERIAL BEHAVIOR

## Flammability

- Oxygen content
- Flammable gases or vapors
- Flammable dust (particulate size)
- Air/gas mixture
- Presence of Ignition Sources

# Lower Explosive Limit vs. Upper Explosive Limit



# VARIABLES OF MATERIAL BEHAVIOR

## Instability

- Heat
- Impact
- Contamination
- Concentration

# VARIABLES OF MATERIAL BEHAVIOR

## Corrosivity

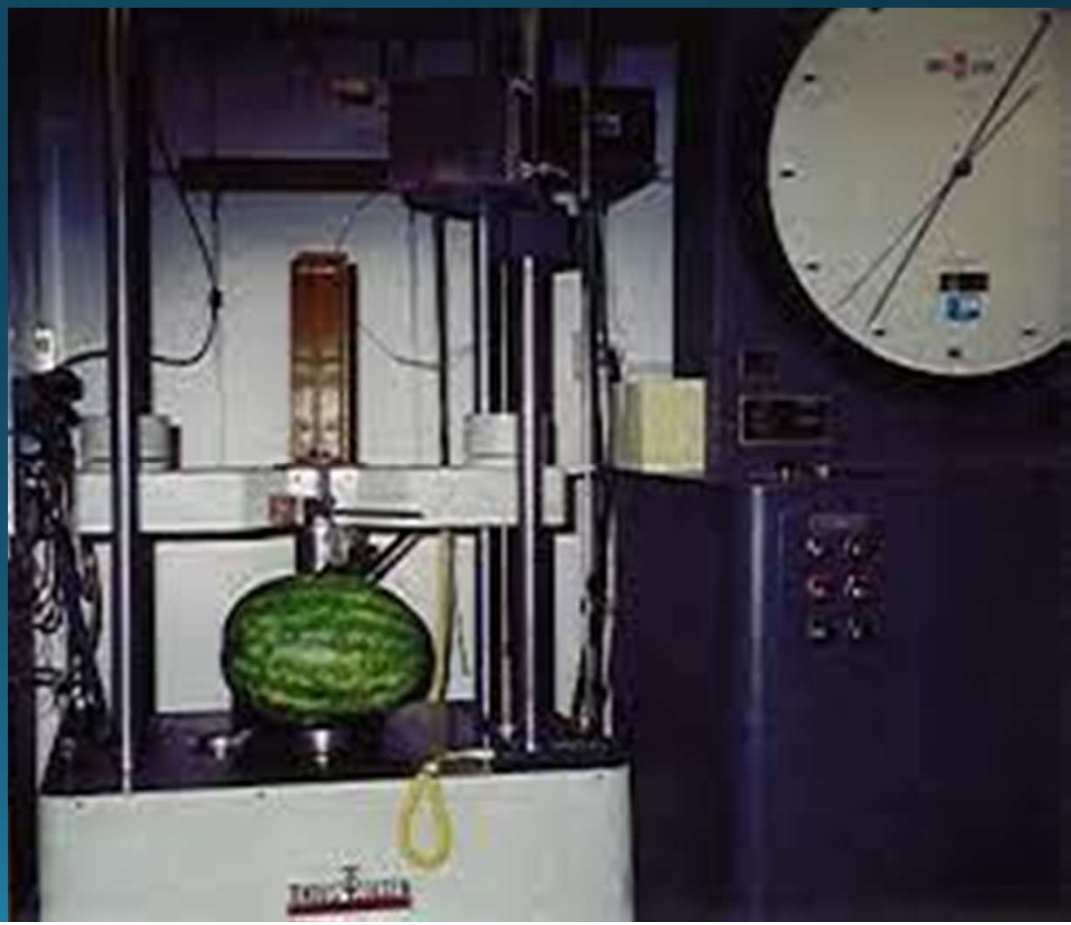
- Concentration
- Secondary Hazards

# Physical Properties May Influence Behavior

- Boiling Point
- Flash Point
- Ignition Temperature
- Flammable Range
- Solubility

# Physical Properties May Influence Behavior

- Specific Gravity
- Vapor Density
- Vapor Pressure
- Acidity/Alkalinity



# Vapor Pressure

Butane (1600 mm Hg) — Gases

Acetone (180 mm Hg) — Volatile Liquids

Water (23 mm Hg) — Less Volatile Liquids

# Boiling Point

Water (212°F)

Less Volatile Liquids

Acetone (133°F)

Volatile Liquids

Butane (31°F)

Gases

# Vapor Density

# Specific Gravity

# Flash Point

| | |
|---|---|
| Pine Oil (172°F) | Combustible |
| Acetone (0°F) | Flammable |
| Pentane (-57°F) | Highly Flammable |

# Flammable Range

Acetylene

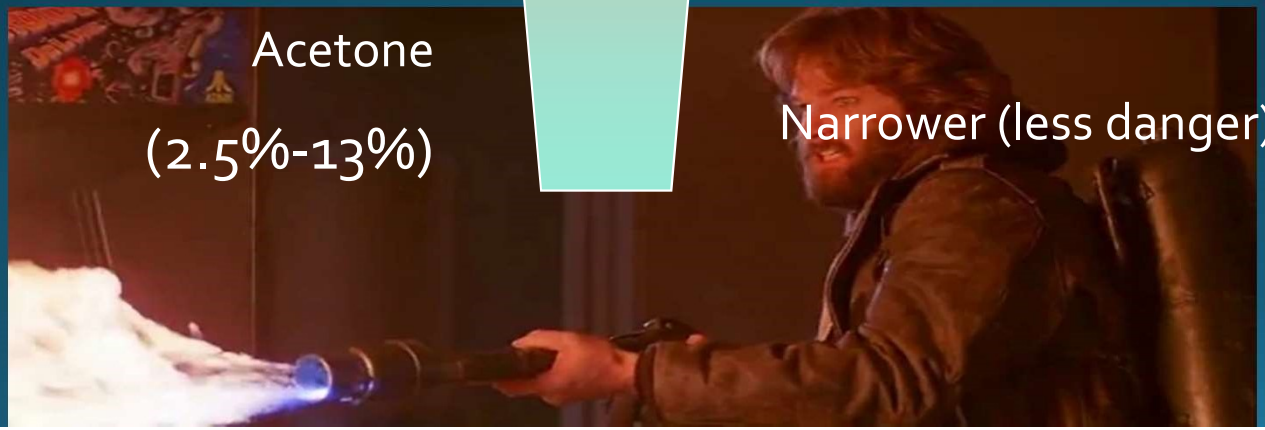
(2.5%-83%)

Acrolein

(3%-31%)

Acetone

(2.5%-13%)



Wider (more danger)

Narrower (less danger)

# Incident Variables

Weather

# Incident Variables

Geography/Terrain

# Incident Variables

Receptors


# Incident Variables

Resources

- On-Scene
- Available

# Incident Variables

Materials will react with:

- The environment
- Other materials
- Responder actions

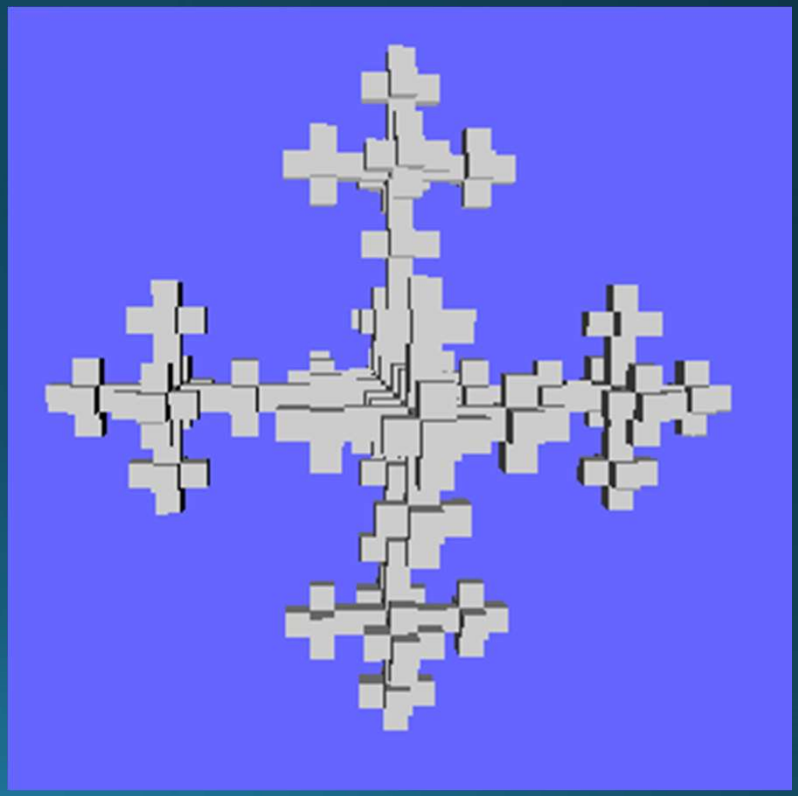
# Titanium Reaction at Industrial fire

# Other Hazards

- Traffic
- Animals
- Slip/Trip hazards
- Structural hazards

# Lessons From Chaos Theory

- Small changes in initial conditions can create drastic changes in results.
- Because we can not know all the initial conditions perfectly, predicting behavior is difficult.
- HazMat incidents occur as transitions between order and disorder.
- Chaos often increases where feedback is present.  BLEVE's are an example of this.

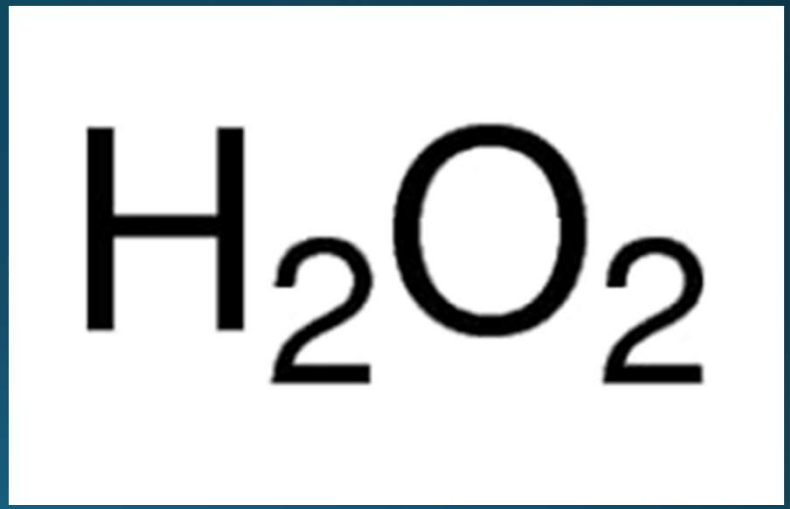


# Scenario #1

A structure fire has occurred at a dry cleaners. Containers of new and waste liquid dry cleaning solvent were compromised during the fire and have leaked. In assessing the hazard to responders, what information will you prioritize and where will you try to obtain it?

# Scenario #2

You respond to a report of a liquid running into the storm drain from a manufacturing facility. Facility personnel inform you that the liquid is Hydrogen Peroxide that has leaked from a 300 gallon tote on the loading dock. What questions will you ask to better assess the hazard this release poses?



# Scenario #3

At 01:26 hours, an Anhydrous Ammonia minor leak alarm is activated inside a compressor room at a beverage bottling plant. 4 minutes after initial alarm activation, a major leak alarm is triggered with Ammonia concentrations inside the compressor room at 82 ppm and rising. 911 is called reporting the release. What information is required to properly assess the hazard? What variables are present that may affect this incident?

# Conclusions

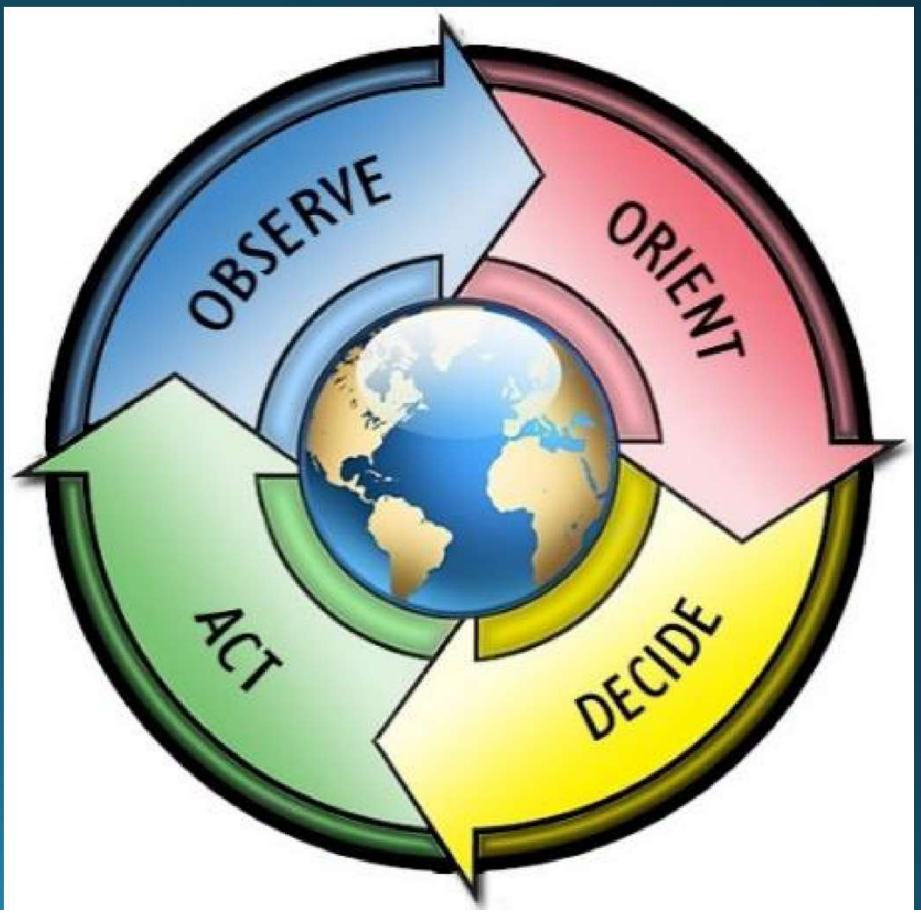
IDHA is the hub of the response wheel. It determines:

- The Incident Action Plan
- Decontamination procedures
- Perimeters and zones
- Evacuation/Shelter in place
- Response options, i.e.
  - Defensive
  - Offensive
  - Non-intervention

# Conclusions

IDHA requires continual reassessment and revision throughout the course of the incident

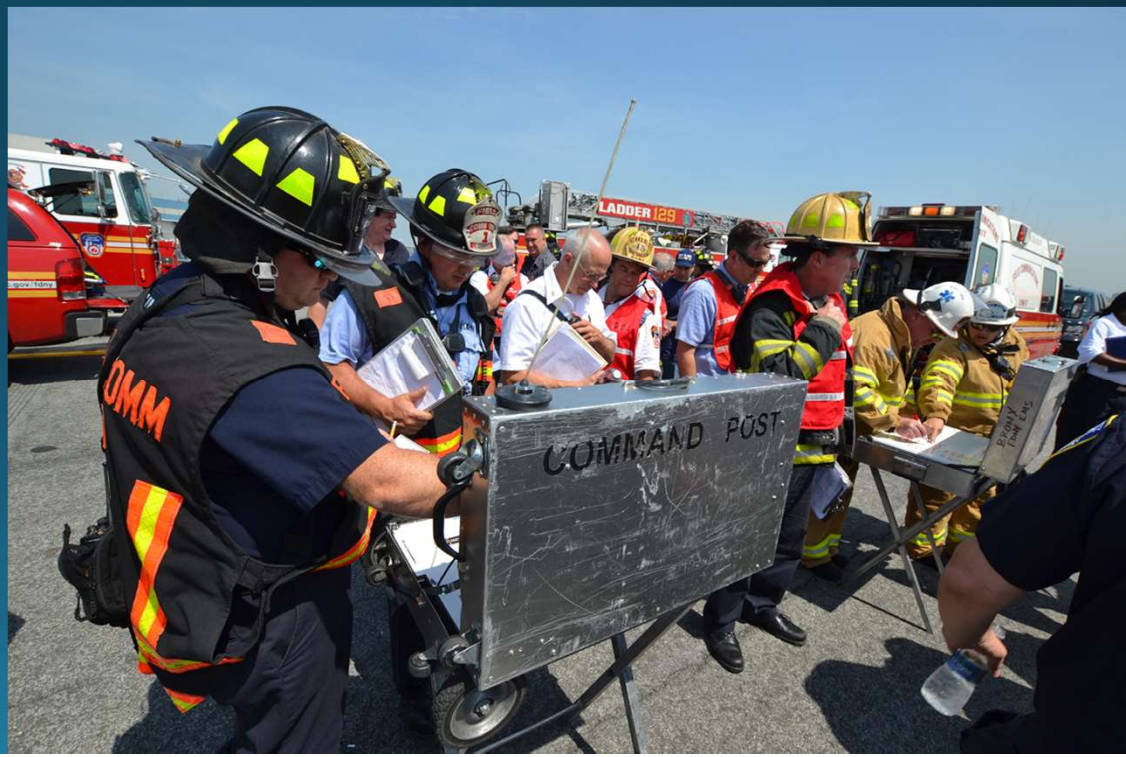
- As new information becomes available
- As conditions of materials and/or containers change
- As environmental factors change
- As responder actions impact hazards



# Conclusions

It is imperative to analyze IDHA successes and failures in

- Incident Debriefing (Hot Wash)
- Incident Critique
- Post-incident analysis



# Questions/Comments

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