Collaborative Bachelor's Degree Program of Fire Protection and Safety Engineering Technology between Southwest Jiaotong University and Oklahoma State University, U.S.A.

FPST 1213 Fire and Safety Hazard Recognition

Hazardous Materials

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Laws, Regulations, and Standards

- Hazardous materials (HazMat) operations involving the manufacture, transport, use, disposal, and emergency response are affected by:
  - Federal Regulations
  - State and Local Codes
  - Consensus standards
  - Corporate requirements

2

Classification of Hazardous Materials

- Certificate of Occupancy
  - Occupancy classification
  - Construction type
  - Automatic fire sprinkler protection

3

Physical Hazards

- Flammable and combustible liquids
  - flashpoint
- Compressed gasses
  - Liquefied and non-liquefied
- Organic peroxides
  - Exist only as solids or liquids
  - Combine both fuel (carbon) and oxygen in the same compound
- Oxidizers
  - They do not burn but accelerate burn rate
    - Ammonium nitrate
- Pyrophorics
  - Auto-ignition in air 130ºF or less due to contact with moisture in air
- Cryogenics
  - Liquid at -130 ºF or less
- Explosives
  - detonation vs. deflagration

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Material Hazards

- Need to be aware of chemical compatibilities
  - Flammable liquids and oxidizers
  - Acids and bases

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Health Hazards

- How can something enter the human body?
  - Inhalation
    - Fastest
  - Skin Absorption
    - Most common – Dermatitis
  - Ingestion
  - Injection
- Toxicity
  - TLV
  - LD_{50} - LC_{50}
- Corrosive

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WHAT IS A HAZARDOUS MATERIAL?

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Definitions

- OSHA
  - Hazardous chemical means any chemical which is classified as a physical hazard or a health hazard, a simple asphyxiant, combustible dust, pyrophoric gas, or hazard not otherwise classified
- Department of Transportation – DOT
  - Hazardous material means a substance or material that the Secretary of Transportation has determined is capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and has designated as hazardous under section 5103 of Federal hazardous materials transportation law (49 U.S.C. 5103). The term includes hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials designated as hazardous in the Hazardous Materials Table (see 49 CFR 172.101), and materials that meet the defining criteria for hazard classes and divisions in part 173 of subchapter C of this chapter

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Definitions

- Environmental Protection Agency – EPA
  - https://www.ecfr.gov/cgi-bin/text-idx?SID=d75fd848052016de12034c71509e75b2&mc=true&node=se40.28.261_13&rgn=div8
- NFPA

3.3.62.4* ***Hazardous Material.*** A chemical or substance that is classified as a physical hazard material or a health hazard material, whether the chemical or substance is in usable or waste condition. *(See also 3.3.62.3.1, Health Hazard Material, and 3.3.62.3.2, Physical Hazard Material.)*

A.3.3.62.4 Hazardous Material. Hazardous wastes might or might not be classified as hazardous materials. Management and disposal of hazardous waste is regulated by the EPA under the Resource Conservation and Recovery Act (RCRA). EPA requires wastes identified as hazardous to be handled, stored, treated, and disposed of according to the stipulations of the RCRA hazardous waste program in 40 CFR 260–299, "Solid Wastes."

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OSHA
29 CFR 1910.1200
Hazard Communication

"HazCom"

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OSHA

- Main standard governing day-to-day handling of hazardous substances in the workplace
  - Written program
  - Chemical inventory
  - Safety Data Sheets (SDS's)
  - Chemical labeling

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Physical Hazards

- Explosives
- Flammable gases
- Flammable aerosols
- Oxidizing gases
- Gases under pressure
- Flammable liquids
  - Know Table 10.1 in textbook
- Flammable solids
- Self-reactive substances and mixtures
- Pyrophoric liquids
- Pyrophoric solids
- Self-heating substances and mixtures
- Substances and mixtures which, in contact with water, emit flammable gases
- Oxidizing liquids
- Oxidizing solids
- Organic peroxides
- Corrosive to metals

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Health Hazards

- Acute Toxicity
- Skin corrosion/Irritation
- Serious eye damage/eye irritation
- Respiratory or skin sensitization
- Germ cell mutagenicity
- Carcinogenicity
- Reproductive toxicity
- Target organ system toxicity – Single exposure
- Target organ system toxicity – repeated exposure
- Aspiration hazard

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SDS Sections

- Identification
- Hazard(s) identification
- Composition/information on ingredients
- First-aid measures
- Fire-fighting measures
- Accidental release measures
- Handling and Storage
- Exposure controls/personal protection
- Physical and chemical properties
- Stability and reactivity
- Toxicological information
- Ecological information
- Disposal considerations
- Transport information
- Regulatory information
- Other information

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SDS EXAMPLE

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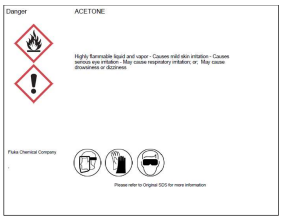
HazCom Labels

- Labels should have the following information:
  - CHEMICAL NAME
  - SIGNAL WORD
  - HAZARD STATEMENT
  - PICTOGRAM
  - PRECAUTIONARY STATEMENT



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HazCom Pictograms

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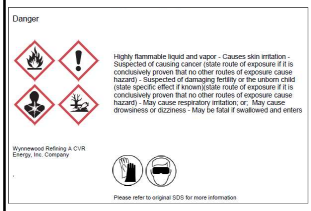
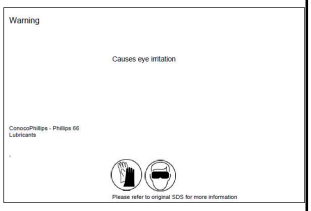
Which one is more hazardous?





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Chemical Labeling

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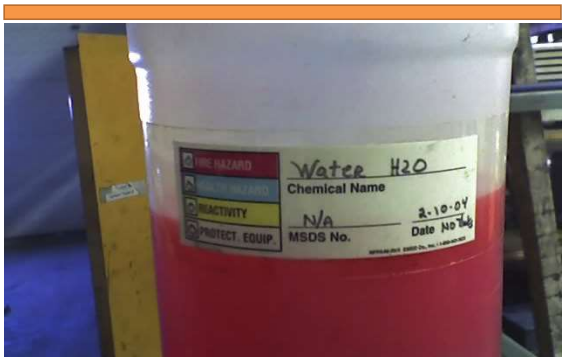
Chemical Labeling



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Pipe Labeling

Content Type	Description	Required Colors	Example
FLAMMABLE	Fluids that are a vapor or produce vapors that can ignite and continue to burn in air.	Black on Yellow	HYDROGEN
COMBUSTIBLE	Fluids that may burn but are not flammable.	White on Brown	ACETIC ACID
TOXIC/CORROSIVE	Fluids that are corrosive or toxic or will produce corrosive or toxic substances.	Black on Orange	NITRIC ACID
FIRE QUENCHING	Water and other substances used in sprinkler fire-fighting piping systems.	White on Red	HALON
OTHER WATER	Any other water except for water used in sprinkler & fire-fighting piping systems.	White on Green	BOILER WATER
COMPRESSED AIR	Any vapor or gas under pressure that does not fit a category above.	White on Blue	COMPRESSED AIR
OTHER	Definable by user.	White on Purple	OTHER
OTHER	Definable by user.	White on Black	OTHER
OTHER	Definable by user.	Black on White	OTHER
OTHER	Definable by user.	White on Gray	OTHER

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Pipe Labeling

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NFPA

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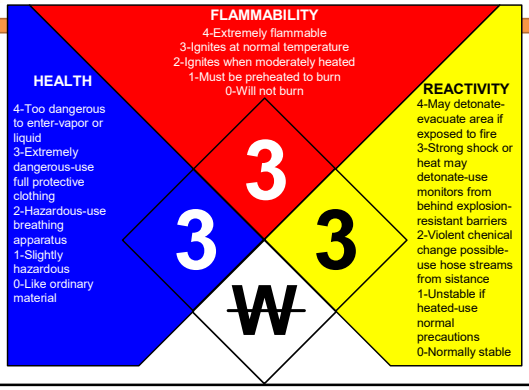
NFPA 704
Third Party First Responders



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NFPA 704 vs HazCom

	NFPA 704	HazCom 2012
Purpose	Provides basic information for emergency personnel responding to a fire or spill and those planning for emergency response.	Informs workers about the hazards of chemicals in workplace under normal conditions of use and foreseeable emergencies.
Number System: NFPA Rating and OSHA's Classification System	0-4 0-least hazardous 4-most hazardous	1-4 1-most severe hazard 4-least severe hazard • The Hazard category numbers are NOT required to be on labels but are required on SDSs in Section 2. • Numbers are used to CLASSIFY hazards to determine what label information is required.
Information Provided on Label	• Health-Blue • Flammability-Red • Instability-Yellow • Special Hazards*-White *OX Oxidizers W Water Reactives SA Simple Asphyxiants	• Product Identifier • Signal Word • Hazard Statement(s) • Pictogram(s) • Precautionary statement(s); and • Name address and phone number of responsible party.

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High Hazard Occupancies

- ICC
  - Group H-1
    - Explosives and blasting agents
  - Group H-2
    - Deflagration hazard
  - Group H-3
    - Unpressurized flammable liquids
    - Low reactive oxidizers
  - Group H-4
    - Health hazards
- Requirements included but are not limited to:
  - Engineering controls
    - Automatic fire sprinklers
    - Continuous mechanical ventilation
    - Fire resistive separation

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Placards and Labels

- Placards and labels provide recognition and general hazard classification by way of:
  - Colored background
  - Hazard class symbol
  - Hazard class/division number
  - Hazard class description wording or the four-digit identification number

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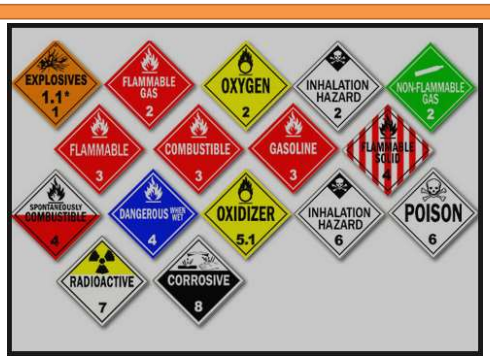
DOT



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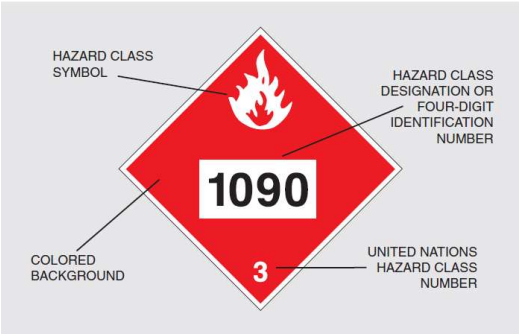
Placards



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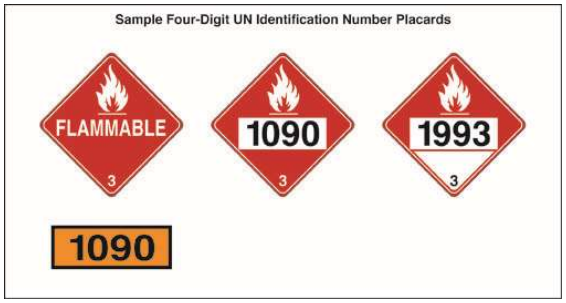
Transportation Placards



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Placarding

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Placards

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DOT New Product Labels

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DOT Hazardous Waste Labeling

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ENVIRONMENTAL PROTECTION AGENCY EPA

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CERCLA

- Comprehensive Environmental Response, Compensation and Liability Act
  - Superfund
- Love Canal
  - Most publicized

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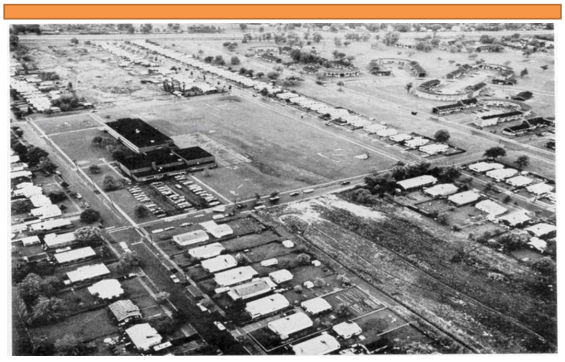
Love Canal



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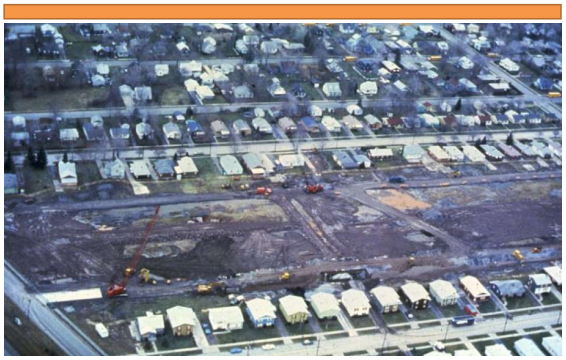
Love Canal



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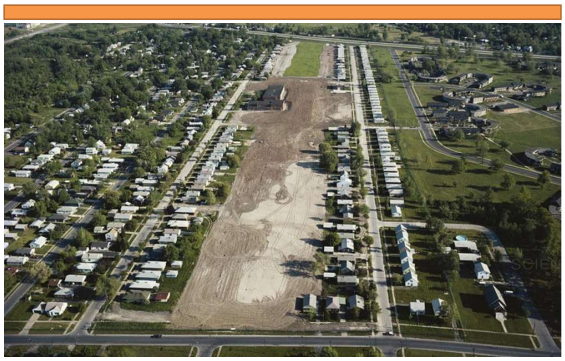
Love Canal



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EPCRA

- Emergency Planning and Community Right-to-know Act
  - Bhopal, India
    - 12/1984
      - Methyl iscocyanate
    - West Virginia
      - Months later

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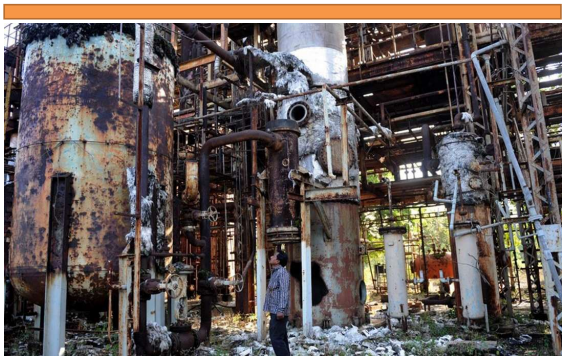
Bhopal India



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EPCRA

- SERC
  - State Emergency Response Commission
  - Implement EPCRA provisions within its state
- LEPC
  - Local Emergency Planning Committee
    - Every county
- TRI - Toxic Release Inventory
  - Specific list. What are we doing with the materials
- Tier II Report
  - Specific list. How much do we have and where

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RCRA

No specific event occurred sparking the regulation

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RCRA

- Three "sizes" of hazardous waste generators
  - Large (LQG)
  - Small (SQG)
  - Very Small (VSQG)
- TSDF
  - Treatment, Storage and Disposal Facility
- Biennial Reports

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OPA Background

- 1972 - Federal Water Pollution Control Act
  - Amended in 1977 as Clean Water Act
  - Primary Federal statute for protection of water resources in U.S.
- 1973 - Initial SPCC regulations adopted by U.S. EPA.
  - Spill Prevention Control and Countermeasures
- January 1988
  - Ashland Oil Company's four million gallon aboveground storage tank collapsed spilling 3.8 million gallons of diesel fuel into Monongahela and Ohio Rivers. Drinking water supplies were impacted for one million people in Pennsylvania, Ohio and West Virginia.

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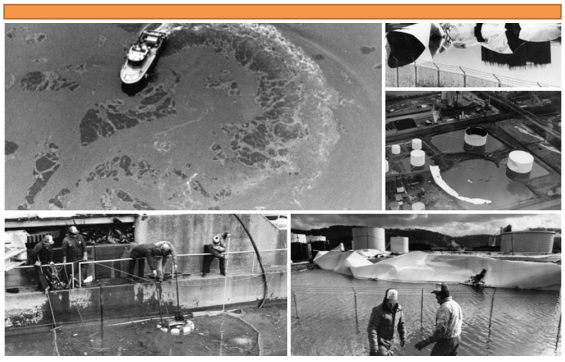

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Background (cont.)

- In response to the '88 Ashland spill, EPA formed an SPCC Task Force:
  - Focus on the prevention of large, catastrophic oil spills
  - Make recommendations on the SPCC program
- "Oil" is any petroleum based product
- 1,320 gallons of oil storage capacity 55 gallon container or bigger onsite

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Background (cont.)

- In response to the '88 Ashland spill, EPA formed an SPCC Task Force:
  - Focus on the prevention of large, catastrophic oil spills
  - Make recommendations on the SPCC program
- March 1990
  - Exxon Valdez
  - How much spilled?
  - 11 million gallons of crude

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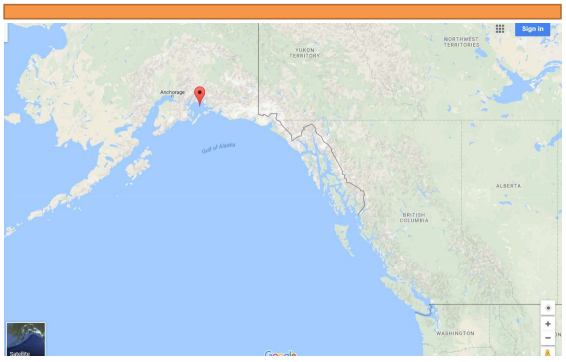
Prince William Sound, Alaska



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Background (cont.)

- Overhaul of SPCC rules
- 2002 - New SPCC rules adopted by U.S. EPA.
  - EPA sued
- January 2010 - all rules became effective
  - 20 Years after Exxon Valdez

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HAZARDOUS MATERIAL STORAGE

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HazMat Storage

- IFC and NFPA
  - Maximum Allowable Quantity (MAQ)
    - Largest amount of a particular class of hazmat permitted inside a building without changing the occupancy classification to High Hazard
- OSHA
  - Limits on how much flammables can be in one fire zone

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Flammables Storage

- Based on flashpoint

Combustible
vs.
Flammable

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HazMat Storage

- Containers
  - NFPA 30 – Safety cans
    - 5 gallon maximum

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HazMat Storage

- Packaging
  - Non-bulk
    - ≤ 119 gallons
    - ≤ 882 pounds
  - Intermediate bulk
    - 119 – 793 gallons
      - Tote
  - Bulk
    - Cargo tank
    - Railcar
    - Portable and stationary tanks
      - AST
      - UST

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HazMat Storage

- ASTs
  - 60 – 60,000 gallons
  - Properly sized and functioning emergency vent
  - May require its own fire protection if local FD does not have the proper resources
- USTs
  - Gasoline
  - Diesel
  - Introduce environmental concerns

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IBC or "Tote"

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AST

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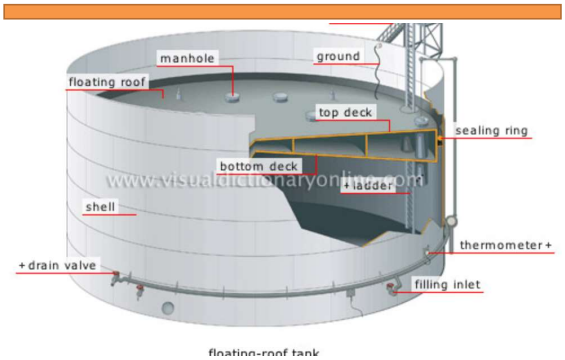
AST



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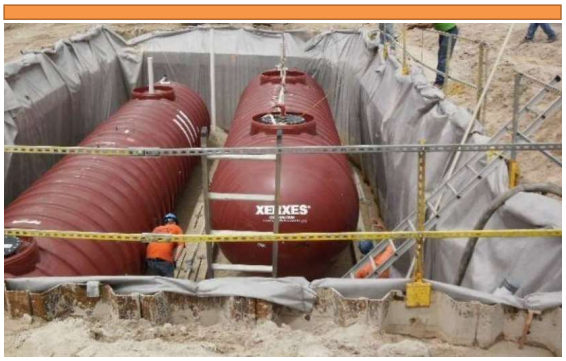
UST



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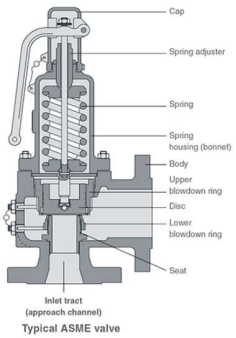
Pressure Vessels

- ASME Boiler and Pressure Vessel Code
  - Spring loaded safety valves



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Facility Documents

- Chemical inventories
- Shipping manifests
- Risk management plans
- Emergency response plans
- SDSs
- Inspections, Tests, Maintenance
- Annual regulatory reports