

# Tier 1 HAZWOPER Annual Refresher Training

Prepared by:  
The Palladino Company, Inc.

2007

Presented to:  
California Integrated Waste Management Board



# Instructor Contact Information

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# Course Agenda

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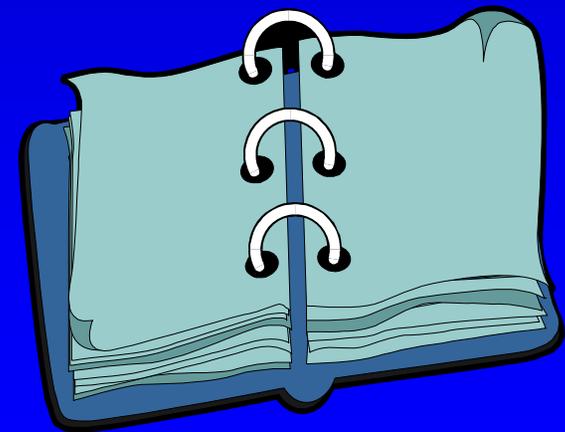
- 1.0 HAZWOPER Overview
- 2.0 Hazard Communication
- 3.0 Health and Safety Terminology
- 4.0 Lessons Learned
- 5.0 Hazard Recognition and Avoidance
- 6.0 Vehicle Safety/Heavy Equipment Hazards
- 7.0 Personal Protective Equipment and Decontamination
- 8.0 Labels and Signs for Hazardous Materials
- 9.0 Air Monitoring Instrumentation
- 10.0 Emergency Response Plan
- 11.0 Pre and Post Planning for Field Activities
- 12.0 Confined Space

# Course Purpose

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- Review important Health and Safety topics
- Remind ourselves of proper procedures
- Learn from past experiences
- Meet the regulatory requirements for annual HAZWOPER training
- Have fun

# Hazardous Waste Operations and Emergency Response Overview



# Scope of HAZWOPER

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- Clean-up operations or hazardous substance removal work
- Corrective actions involving hazardous waste clean-up operations
- Voluntary clean-up operations
- Operations involving hazardous wastes that are conducted at treatment, storage, and disposal (TSD) facilities
- Emergency response operations for releases of hazardous substances

# Who's Covered?

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- All employees working on site exposed to hazardous substances, health hazards, or safety hazards
- Supervisors and management responsible for the site

# Training Requirements

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- Regulations require training
  - ☒ Federal OSHA (Occupational Safety and Health Administration) – 29 CFR 1910.120(e)
    - [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9765](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9765)
  - ☒ CAL/OSHA – 8 CCR 5192(e)
    - <http://www.dir.ca.gov/title8/5192.html>
- Requirement for 8 hours annual refresher training on specific and general health and safety topics

# Medical Surveillance Program

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- Medical surveillance is a program developed to
  - ☒ Monitor possible health effects from exposure to hazardous chemicals
  - ☒ Determine whether an employee is physically fit to perform tasks required by the job
- Regulatory requirement 29 CFR 1910.120(f) and 8 CCR 5192(f)
- Employer must develop and implement program

# Who's Covered?

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- All who may be exposed above PELs 30 days or more a year
- All who wear a respirator for 30 days or more a year or who are required to wear a respirator in compliance with 29 CFR 1910.34 or 8 CCR 5144 “Respiratory Protection”
- All who are injured, become ill, or develop symptoms due to possible exposure
- Members of a HAZMAT team

# Program Elements

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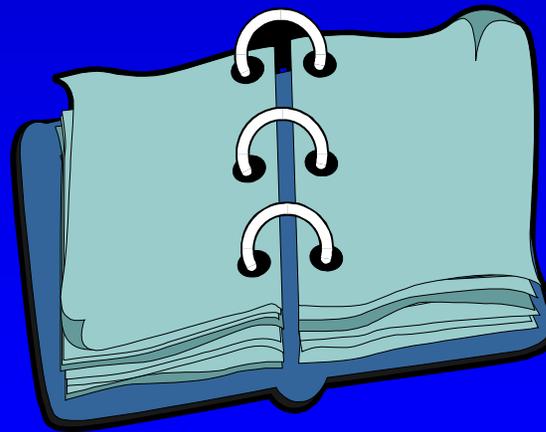
- Medical Exams and Consultations
  - ☐ Baseline – before employment or any exposure
  - ☐ Annual – health exam and medical tests
  - ☐ Termination – after employment
  - ☐ Exposure – special exam for a specific exposure
- Record Keeping
  - ☐ 30 year retention
  - ☐ Your right to medical records

# IIPP

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- CIWMB Health & Safety Manual found on internet at <http://www.ciwmb.ca.gov/Safety/Manual/>
- You should read it every year!
- Really you should!!
- Just do it!!!

# Hazard Communication



# Hazard Communication

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- Hazard Communication Standard
  - ☒ Federal OSHA: 29 CFR 1910.1200
  - ☒ Cal/OSHA: 8 CCR 5194
- Purpose: Safety awareness when working with hazardous chemicals
- You have the **RIGHT TO KNOW** about work place hazardous chemicals that you use
- Also known as Chemical Hazard Awareness

# Haz Com (continued)

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- Chemical manufacturer requirements
  - ☐ Determine hazards of chemicals
  - ☐ Provide labels and Material Safety and Data Sheets (MSDS)
- Employers requirements
  - ☐ Provide a hazard communication program
  - ☐ Maintain MSDSs
  - ☐ Provide training on hazardous materials

# Haz Com (continued)

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- Employee requirements
  - ☐ Read and follow labels and MSDSs
  - ☐ Follow employer instructions and warnings
  - ☐ Identify hazards before starting a job
  - ☐ Take training

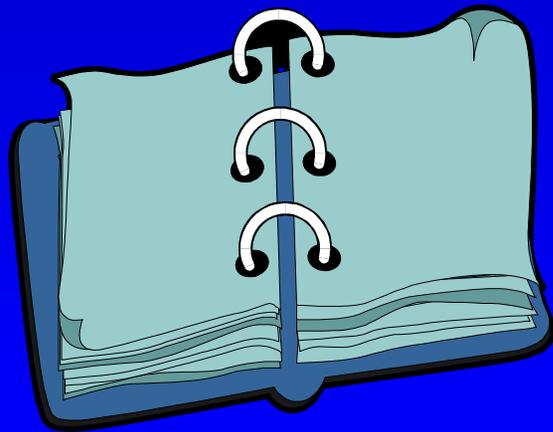
Safety is primarily  
**YOUR** responsibility!

# MSDS Requirements

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- Section I. Manufacturer's Name & Contact Information
- Section II. Hazardous Ingredients/Identity Information
- Section III. Physical/Chemical Characteristics
- Section IV. Fire and Explosion Hazard Data
- Section V. Reactivity Data
- Section VI. Health Hazard Data
- Section VII. Precautions for Safe Handling and Use
- Section VIII. Control Measures
  
- NOTE: Format is not standardized!

# Health and Safety Terminology



# H&S Terminology

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- Buddy System: two person team that stays together during an entry into a hazardous area
- Exclusion or Hot Zone: area of contamination with restricted access requiring PPE
- Decontamination Reduction or Warm Zone: area of reduced contamination where decon is performed
- Support or Cold Zone: area of no contamination

# CAL/OSHA Definitions

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- PEL: Permissible exposure limit
  - ☒ H<sub>2</sub>S = 10 ppm with a 15 minute maximum of 50 ppm
  - ☒ CO = 25 ppm
- TWA: Time-weighted average = 8 hours/day for 40 hour/week
- STEL: Short-term exposure limit = 15 min max
- C: ceiling = Not to be exceeded
- IDLH: Immediately Dangerous to Life and Health = 30 minute rescue
  - ☒ H<sub>2</sub>S = 100 ppm



# Definitions

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- LEL: lower explosive limit
  - ☒ Gasoline = 1.4%
- LFL: lower flammability limit
- UEL: upper explosive limit
  - ☒ Gasoline = 7.6%
- ppm: parts per million (10,000 ppm = 1%)
- ppb: parts per billion

# Lessons Learned



# Landfill Gas Exposure

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- Board staff conducted landfill inspection
- Inspector walked into a swale adjacent to an exposed landfill liner and a high landfill cell
- Inspector smelt strong landfill gas odor and experienced a slight headache for 10 minutes
- Landfill operator disclosed that a small landfill gas geyser was near the location
- No warning signs were posted

# Landfill Gas Exposure (cont.)

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- Sulfides in landfill gas have a very strong rotten-egg smell at very low concentrations
- Odor thresholds for sulfides are 0.5 - 1 ppb
- Exposure may cause nausea or headache that passes with time
- Medical attention is usually not required

# Animal Attack

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- Pre-field Prevention

- 📁 Review site file

- 📁 Use buddy system

- On-site Prevention

- 📁 Ask owner to restrain animals

- 📁 Carry animal repellent

- Understand signs of aggression and how to avoid a potentially hazardous animals



# Rattlesnake Avoidance

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- Wear high ankle leather boots and long pants
- Tap the ground with walking stick
- Do not turn/jump over rock, logs, etc.
- Rattle sound means stay clear!
- If encountered remain still then back away slowly



# Rattlesnake Bite

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- 1. Remain calm to reduce venom spread
- 2. Remove anything that may cause swelling below the bite area (i.e., rings, watch, shoes, tight clothing, etc.)
- 3. Wash the wound with soap and water. Use a Sawyer Extractor Pump to remove some of the venom
- 4. Immobilize the bite area, keeping it in a neutral to below the heart position
- 5. Get to the hospital immediately



# Snake Bite

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- Justin's arm bit by a rattlesnake in Yosemite
- Two years and 13 surgeries to recover
- <http://www.rattlesnakebite.org/index.htm>

# Dog Attack Warnings

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- Growling, snarling or aggressive barking
- Shyness or fear (crouches, head low or tail between legs)
- Fur raised up, ears erect, body stiff, tail high
- Unnaturally still or unresponsive dog
- A dog in pain will bite anyone who touches him
- Attempts to mount you or bumps into you

# Dog Avoidance

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- If a loose dog approaches you:
  - ☐ Do not run away, yell or make loud noises
  - ☐ Stand very still like a tree
  - ☐ Cross your arms over your chest (look like a tree trunk)
  - ☐ Look away from the dog
  - ☐ Toss an object away from you and away from the dog, if the dog goes to the object, walk away

# Dog Attack

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- Minimize injury
  - ☒ If being bitten and the dog does not release, slowly move closer
  - ☒ Worst damage occurs when you try to pull away or the dog shakes its head
- Use anything to put distance between you and the dog including a jacket, purse, and clipboard
- If you fall or are knocked to the ground
  - ☒ Curl into a ball
  - ☒ Cover your ears with hands and remain motionless
  - ☒ Try NOT to scream or roll around

# Bear Avoidance

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- Stay with your buddy while performing your inspection
- Make bears aware of your presence by making loud noises such as shouting or singing
- In a high bear area, try to avoid conducting your inspections after dark
- Be careful while walking near a landfill without cover as bears will defend their food sources

# Bear Encounter

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- Do not run (bears can run over 30 miles per hour)
- If the bear is unaware of you, detour away from the bear
- If the bear is aware of you slowly back away
- Tree climbing is not very practical and all black bears can climb trees. Running to a tree may provoke bear
- Some bears will bluff charge, then veer off or stopping abruptly, so standing still until bear stops and then *slowly* backing away

# Bear Attack

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- Drop to the ground
- Lie face down
- Clasp your hands behind your neck
- Remain motionless and silent
- Before moving, listen and look around carefully to make sure the bear is no longer nearby

# Mountain Lion/Lynx/Bobcat Avoidance

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- Stay with your “buddy” while performing your inspection
- Make noise
- Be extra careful if you are inspecting at your site during early morning or early evening hours
- Avoid dead animals especially a “fresh kill” since the mountain lion protect the kill

# Mountain Lion/Lynx/Bobcat Avoidance

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- Never turn your back on the animal
- Remain upright at all times
- Try to make yourself look larger
- Do **NOT** try to hide or roll up into a ball
- Fight back as hard as you can! Use anything to protect yourself including rocks, sticks etc.

# Actions if Attacked

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- Seek immediate medical attention, if necessary
- Report to supervisor
- Report to police
- Report to facility

# Hazard Recognition and Avoidance



# Hazard Recognition

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- Job Hazard Analysis (JHA)
- Proper training
- Safety plan
- Experience
- Common sense
- Thinking before acting
- Using your senses: Sight and Hearing only (avoid Smell, Taste and Touch)



# COMPASS

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## Hazard to Observer

- **C**ontainer Shape
- **O**ccupancy/Location
- **M**arking/Colors
- **P**lacards/Labels
- **A**ssume Hazardous Materials
- **S**hipping Papers and Documents
- **S**enses

Lowest



Highest

# Container Shape

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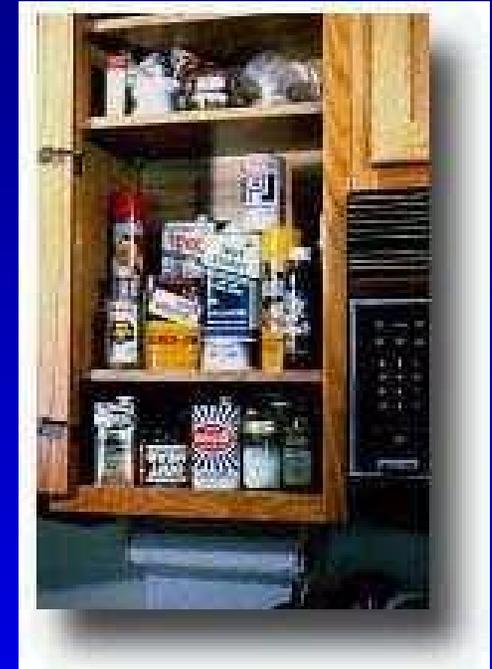
- Drums
- Tanks
- Cylinders
- Boxes
- Container construction
  - ☐ Plastic
  - ☐ Stainless steel
  - ☐ Metal
  - ☐ Glass



# Occupancy/Location

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- Landfills and dumps
- Industrial facilities
- Transportation vehicles
- Work office
- Under your kitchen sink or your garage

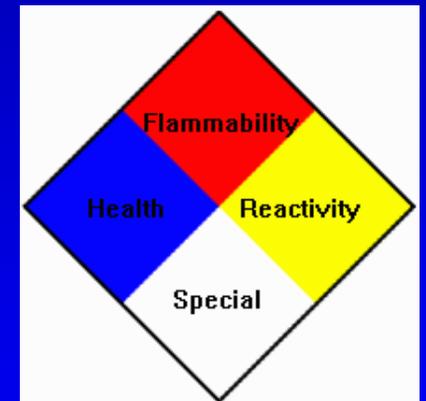


# Markings/Colors

- Markings



- National Fire Protection Agency (NFPA) 704 labels
- Color of container (compressed gasses)



**HAZARDOUS WASTE**  
FEDERAL LAW PROHIBITS IMPROPER DISPOSAL  
IF FOUND, CONTACT THE NEAREST POLICE OR PUBLIC SAFETY AUTHORITY  
OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY

Generator's Name \_\_\_\_\_  
Generator's Address \_\_\_\_\_ Phone \_\_\_\_\_  
Generator's City \_\_\_\_\_ State \_\_\_\_\_ Zip Code \_\_\_\_\_  
EPA ID No. \_\_\_\_\_  
Date of Generation/Removal \_\_\_\_\_ DOT Hazard No. \_\_\_\_\_  
DOT Proper Shipping Name \_\_\_\_\_  
Hazardous Material ( ) \_\_\_\_\_  
UN ID No. \_\_\_\_\_

HANDLE WITH CARE - THIS CONTAINER IS DANGEROUS AND CONTAINS  
HAZARDOUS OR TOXIC WASTE

In the event of a spill or release of this hazardous waste, contact the  
U.S. Coast Guard National Response Center at (800) 424-8802  
for information and assistance.

**NON-HAZARDOUS WASTE**

OPTIONAL INFORMATION:

SHIPPER \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY STATE ZIP \_\_\_\_\_  
CONTENTS \_\_\_\_\_

**NON-HAZARDOUS WASTE**

# NFPA Section 704 Marking System

## HEALTH HAZARD

- 4 - Deadly
- 3 - Extreme danger
- 2 - Hazardous
- 1 - Slightly hazardous
- 0 - Normal material

## FIRE HAZARD

Flash Point

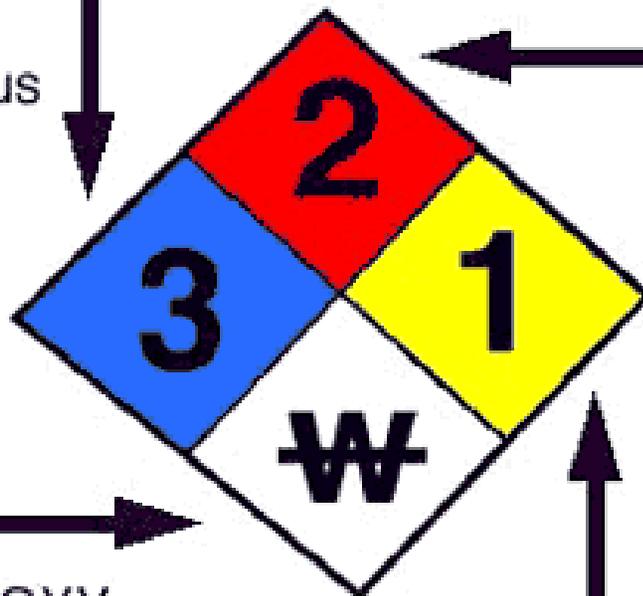
- 4 - Below 73° F
- 3 - Below 100° F
- 2 - Below 200° F
- 1 - Above 200° F
- 0 - Will not burn

## SPECIFIC HAZARD

- |                  |   |
|------------------|---|
| Oxidizer         | OXY   |
| Acid             | ACID  |
| Alkali           | ALK   |
| Corrosive        | COR   |
| Use NO WATER     | <del>W</del>  |
| Radiation Hazard |  |

## REACTIVITY

- 4 - May detonate
- 3 - Shock and heat may detonate
- 2 - Violent Chemical change
- 1 - Unstable if heated
- 0 - Stable



# Compressed Gas Association

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- Suggested standards for color-coding cylinders

 Air                      Yellow

 Cyclopropane                      Orange

 Ethylene                      Red

 Oxygen                      Green

 Nitrous Oxide                      Blue

- NON-mandatory system

# Placards/Labels

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- Department of Transportation (DOT) specifies HAZMAT labeling and placarding

- ☒ Emergency Response Guidebook (ERG)

- Placards are required on:

- ☒ Tank trucks

- ☒ Trailers

- ☒ Railroad tank cars (bulk) and labels on small containers (non-bulk)



# Assume Hazardous Material

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- Assume UNKNOWN HAZARDS exist
- Unknown contamination means a non-hazardous task can become hazardous
- HAZMAT is everywhere
  - 📁 Home, Office, Field, Public Locations

# Shipping Papers & Documents

- Truck - Bill of Lading
- Air - Air Bill
- Rail - Waybill
- Ship - Dangerous Cargo Manifest

The image shows the EPA Form 9700-22, titled "UNIFORM HAZARDOUS WASTE MANIFEST". The form is divided into several sections for data entry:

- Section 1:** Generator's Name and Mailing Address, Phone, and US EPA ID Number.
- Section 2:** Transporter's Name, Company, Mailing Address, Phone, and US EPA ID Number.
- Section 3:** Designated Facility Name and Address, and Phone.
- Section 4:** Material Description, including quantity, weight, and volume.
- Section 5:** Special Handling Instructions and Additional Information.
- Section 6:** Generator's Certification, where the generator certifies that the waste is properly described and that it is being shipped in accordance with applicable regulations.
- Section 7:** Transporter's Acknowledgment of Receipt of Materials, where the transporter certifies that the waste has been received and is being transported in accordance with applicable regulations.
- Section 8:** Facility's Acknowledgment of Receipt of Materials, where the facility certifies that the waste has been received and is being managed in accordance with applicable regulations.

The form includes a table for listing hazardous waste materials, with columns for Material No., Type, Quantity, and Weight/Volume. It also includes a section for "Special Handling Instructions and Additional Information" and a section for "Generator's Certification".

- Must include:
  - 📁 ID (proper shipping name, weight, volume)
  - 📁 Shipper's and receiver's name and address
  - 📁 Classification of shipment

# Senses

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- Visual inspection
  - ☒ Bulging drums, stressed vegetation, etc.
- Audio observation
  - ☒ Popping drums, venting tanks, high pitch
- Do not rely on sense of smell, touch, or taste
  - ☒ Observations from victims may provide clues to the hazardous materials
- Don't forget to use common sense!

# Type of Hazards

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- Five Hazard Types

- ☐ Chemical

- ☐ Fire and Explosion

- ☐ Radiological

- ☐ Biological

- ☐ Physical



# Chemical Hazard

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- Effect varies widely by
  - ☐ Exposure route
  - ☐ Acute & chronic exposure



- Effect can be local and/or systemic
- Thousands of chemicals are found in society
- Chemicals are found everywhere; work, home, environment

# Chemical Hazards

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- Routes of exposure
- Acute vs. Chronic
- Local vs. Systemic
- Thousands of chemical
- Located everywhere

# Fire and Explosion Hazards

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- Chemical reactions
- Ignition of flammable material
- Shock-sensitive compounds
- Boiling Liquid Expanding Vapor Explosion (BLEVE)
- Unexploded Ordinance (UXO)

# Radiological Hazards

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- Medical
- Industrial
- Low level waste



# Biological Hazards

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- MICROBIOLOGY

- ☐ Viruses

- ☐ Bacteria

- ☐ Parasites



- MACRO-BIOLOGY

- ☐ Snakes

- ☐ Animals

- ☐ Poisonous insects & plants



# Poison Oak

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A



B



C

# Physical Hazards

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- Slip Trip Fall
- Sharp Objects
- Low Light
- Electrical
- Noise
- Oxygen Deficiency
- Temperature Extremes
- Power tools
- Vibration



# Guidelines to Cope With Hazards

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- Use common sense
- Good judgment
- Take work breaks
- Provide shelter from elements
- Dress appropriately
- Recognize limitations
- Be aware of surroundings!!!!

# Hazard Avoidance

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- Engineering controls
- Administrative controls
- PPE



# Engineering Controls

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- Elimination/minimization of hazard

- ☒ Dust control

- Removal of hazard

- ☒ Exhaust ventilation

- Isolation of hazard

- ☒ Barrier tape



# Administrative Controls

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- SOPs
  - 📁 Collection of hazard waste samples
- Exposure limits
  - 📁 LEL or VOCs
- Signs
  - 📁 Hazardous waste labels
- Training
  - 📁 This class



# Personal Protective Equipment

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- Respirators
- Hearing protection
- Protective clothing
- Safety glasses
- Hardhats
- Steel toe boots



# Spill Containment

- Inspect containers before moving
- Containment
  - ☐ Cover
  - ☐ Disperse or Absorb
  - ☐ Plug or Patch
  - ☐ Close valve
  - ☐ Overpack
- Wear proper PPE
- Known the hazards of the spilled material



# Site Safety Plans

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- Define protocols for protecting workers from site hazards associated with work
- Provide information about hazards and establish site safety and health policies and procedures
- Serve as a “working document” to address hazards and changing conditions
- Must be developed before site activities proceed

# Vehicle/Heavy Equipment Safety



# Vehicle Safety

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- Bureau of Labor Statistics (BLS):
  - ▣ More than 2,000 deaths a year result from occupational motor vehicle incidents
  - ▣ That is more than 30 percent of the annual number of fatalities from occupational injuries
- Semi-trucks (28%), Automobiles (24%), Pickup trucks (12%)
- 49% were collisions between vehicles
- 53% occurred between 7 a.m. and 4 p.m.
- 38% occurred on U.S. or State-designated highways
- 89% of fatally injured workers were male
- Risk of fatality increased at age 55 and older
- Transportation (33%), Services (14%), Construction (11%)

# Vehicle Safety

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- Wear your seat belt
- Familiarize yourself with the controls
- Adjust mirrors and seat
- Do not drive with work boots
- Do not drive when drowsy

# Vehicle Safety (Continued)

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- No distractions: cell phone, radio, eating, etc.
  - ☒ California law: hands free cell phone while driving – starting July 2008
- Use the mirrors and check blind spots when turning or changing lanes
- Keep up vehicle maintenance and repairs
- Bad weather increases hazards dramatically

# Working Near Heavy Equipment

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- Stay alert at all times
- Hand signals
- Line of sight with operator
- Wear safety vest and hard hat
- Approach only after operator has given the go ahead

# 36-year Old Inspector Killed

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- Asphalt dump truck carrying hot asphalt for a new road
- Back-up alarm was functioning properly
- Traveled 770 feet in reverse before backing over the inspector
- Inspector was wearing an orange reflective vest and hardhat
- Inspector had his back to the vehicle
- Truck driver stated he was traveling 5 to 10 mph and never saw the inspector

# Personal Protective Equipment (PPE) and Decontamination



# PPE Selection Criteria

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- Chemicals and hazards present
- Physical characteristics of chemicals:
  - ☐ physical state
  - ☐ flammability/volatility
  - ☐ reactivity
- Tasks to be performed
- Cost



# Other Selection Considerations

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- No single protective material is:
  - ❑ Totally impermeable forever
  - ❑ Protects against all chemicals
  - ❑ Protective for more than one hour after initial contact (for some specific chemicals)
- PPE is the last line of defense against chemical contaminants (but important to use properly)



# Options to Reduce Exposure

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- Reduce number of workers
- Use tools or technology to reduce time
- Prepare and plan prior to entry
- Re-design tasks





# Levels of Protection

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- Level A

- ☒ Supplied Air Respirator (SAR), SCBA, In-line

- ☒ Totally encapsulated suit (vapor protective)

- Level B

- ☒ SAR or SCBA

- ☒ Chemical protection - not specified

- Level C

- ☒ Air Purifying Respirator (APR)

- ☒ Chemical protection - not specified

- Level D

- ☒ Work clothes

- ☒ No chemical protection

# LEVEL A



# LEVEL B



# LEVEL C



# LEVEL D



# Protective Clothing Breakthrough

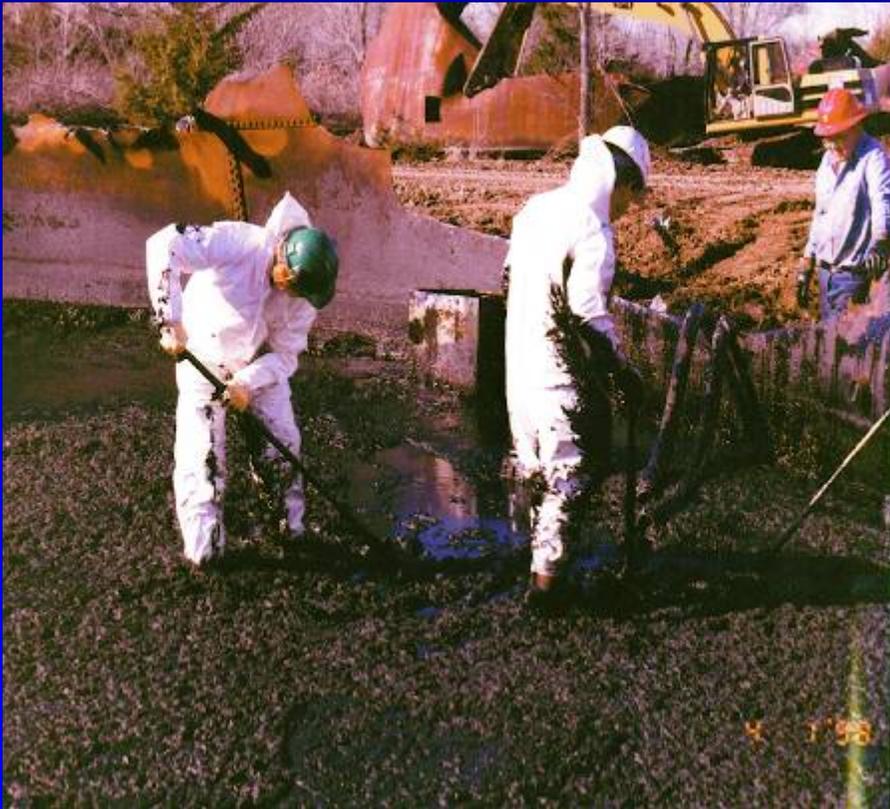
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- **Breakthrough time** - the time it takes a chemical to pass through the protective material from initial contact until it can be detected on the opposite side of the material by analytical instrumentation.
- Manufacturers provide breakthrough times



# Protective Clothing Breakthrough

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- Permeation - the process by which a chemical dissolves in and /or moves through the material on a molecular level.

# Protective Clothing Breakthrough

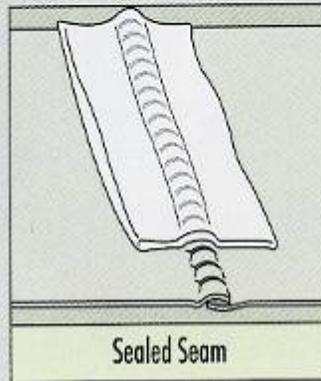
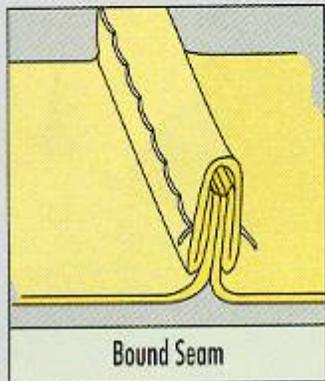
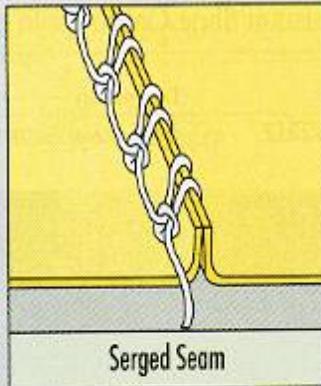
- **Degradation** - the loss of or change in a fabric's chemical resistance or physical properties due to exposure to chemicals, use, or ambient conditions (i.e., sunlight).



# Protective Clothing Breakthrough

## A QUICK GUIDE TO SEAM CONSTRUCTION IN LIMITED-USE CLOTHING

*Sealed seams give you the best all-around protection.*



- **Penetration** - the movement of chemicals through zippers, stitched seams or imperfections in the material.



# Protective Equipment and Accessories

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- Tyvek® - one-piece coverall that protects against dust, fibers, and contact with dry materials

- Inexpensive

- Not chemical resistant.

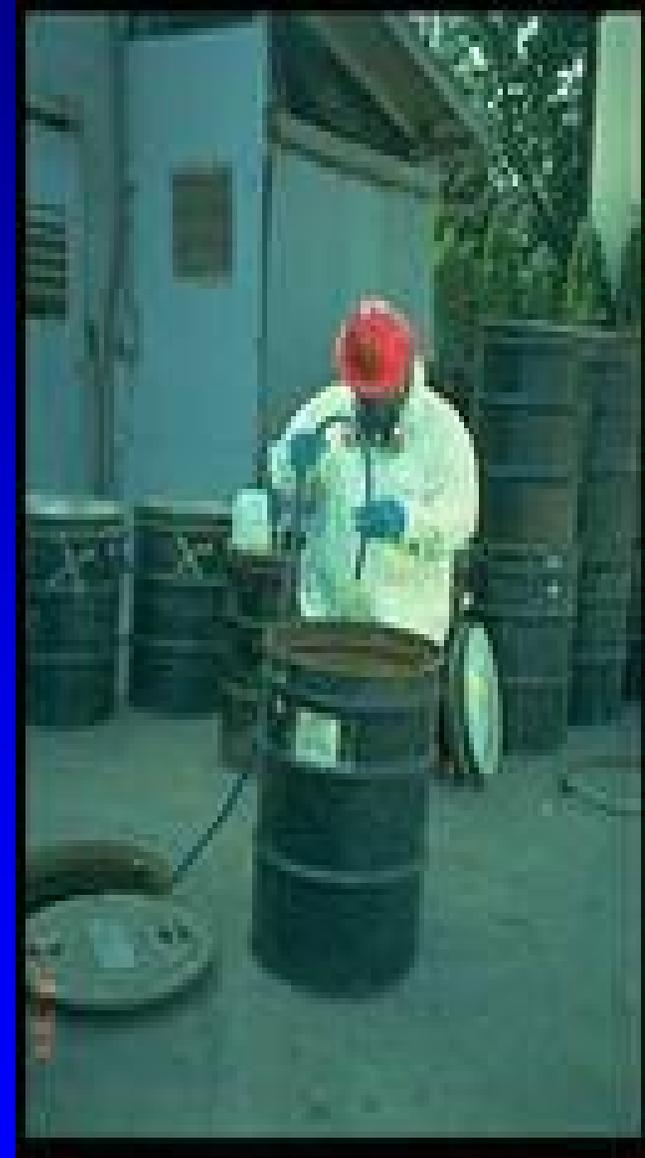
- Mainly used for keeping clean



# Glove Selection Considerations

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- Degree of dexterity needed
- Length of exposure
- Chemical concentration
- Temperature
- Cut and abrasion hazards



# Types of Gloves

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- Nitrile disposable
- Silvershield
- Leather gloves



# Safety and Disposable Boots



- Steel toe/steel shank (not required in all situations)
- Leather upper/oil resistant sole
- ANSI Z41.1
- Notched heel to prevent sliding thru ladder
- Disposable booties reduces decontamination needs



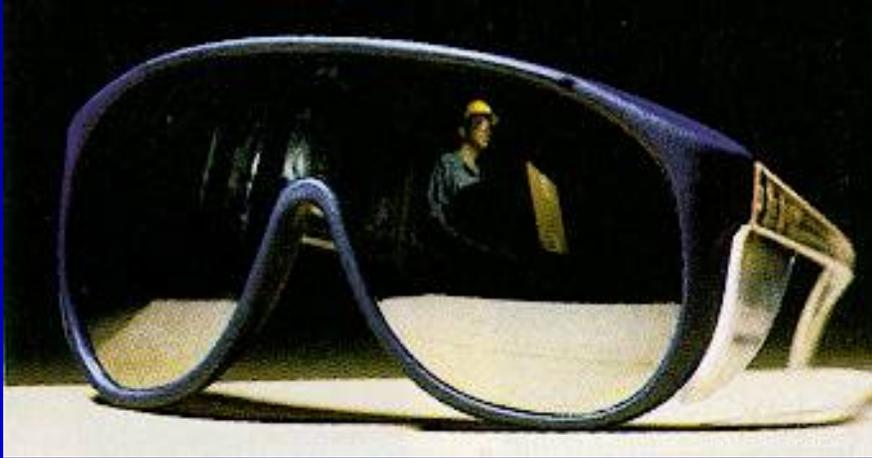
# Head Protection



- Hard hat
- ANSI Z89.1
- Inspect daily
  - ☒ Dents, cracks, penetration
  - ☒ Damage due to impact
  - ☒ Flex the hard hat - if it cracks or shatters, it has become embrittled by UV
  - ☒ Inspect the webbing for fraying or cuts
  - ☒ Inspect the anchor points

# Eye Protection

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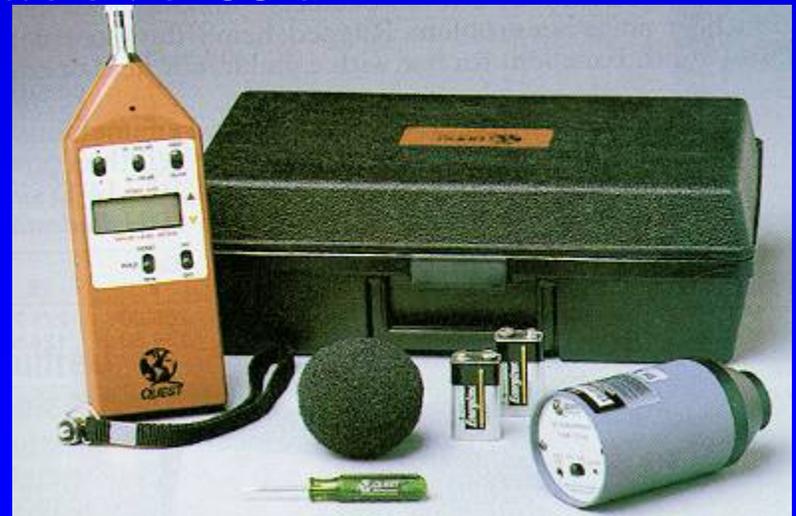
- ANSI Z87.1
- Spectacles with side shields



- Goggles
- Face shield
- Side shields

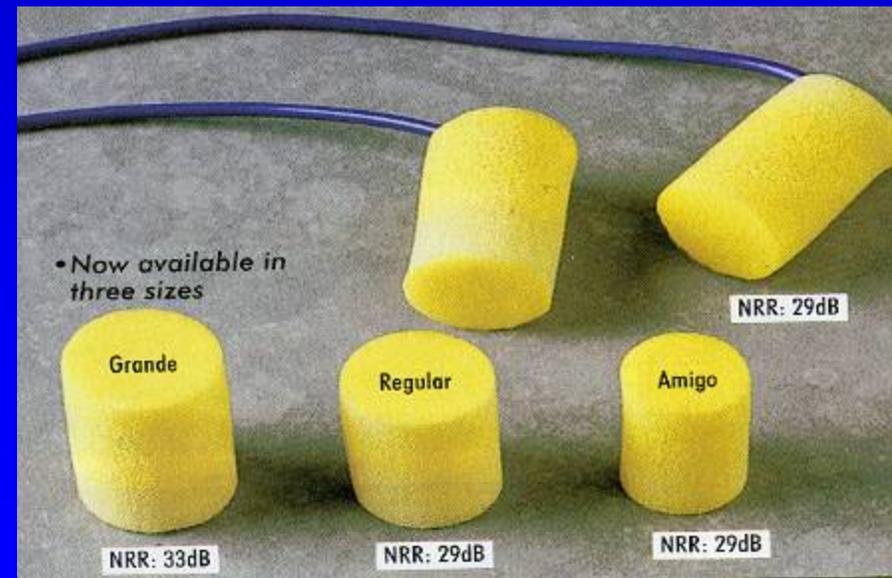
# Hearing Exposure

- OSHA PEL = 90 dB (if exceeded MUST use hearing protection)
- > 85 dB requires a Hearing Conservation Program (8 CCR, Article 105, Sections 5095 to 5100)
- Rule of Thumb: If you have to significantly raise your voice to talk with a person next to you, you are probably being exposed at or above 85dB
- Sound level meter
- Noise dosimeter



# Hearing Protection Controls

- Administrative & Engineering
- Ear plugs/ear muffs
- Noise Reduction Rating (NRR) - EPA hearing protection rating



# Selection Considerations

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- Durability:
  - ☐ Sufficient strength for task
  - ☐ Resists tears, punctures, and abrasions
  - ☐ Withstands repeated use
- Flexibility
  - ☐ Comfort to perform tasks
  - ☐ Size of person
- Temperature effects
  - ☐ Maintain protective integrity and flexibility
  - ☐ Heat stress



# Selection Considerations

---

- Ease of decontamination
- Compatibility with equipment
- Chemical resistance/breakthrough
- Disposable versus Reusable
- Which provides the best protection
- Cost



# Wear PPE Properly!

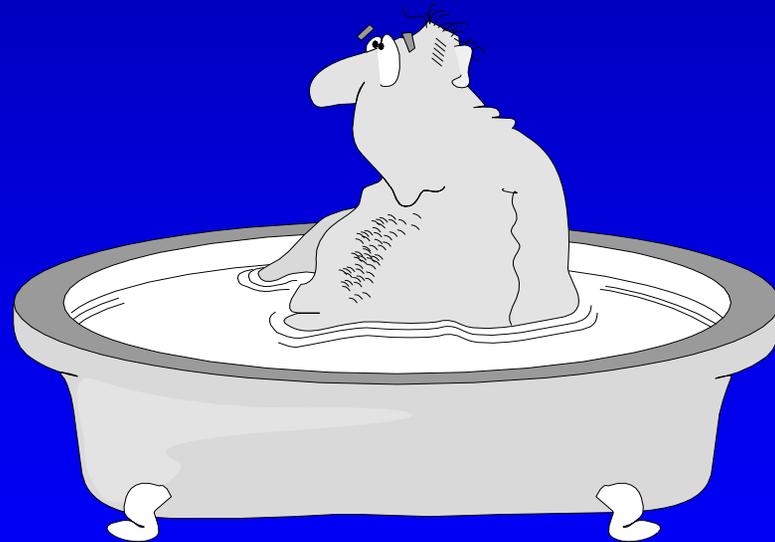
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# Decontamination

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- Definition: the process of physically removing contaminants or changing their chemical nature to innocuous substances



# Decontamination

---



- Why Decontaminate?
  - ☐ Protects local community
  - ☐ Protect workers
  - ☐ Minimizes the spread of contamination
  - ☐ Prevents the mixing of incompatible materials
- True fire fighter story

# Prevention of Contamination

- Separate workers and tasks
- Cover contamination with plastic
- Cover equipment with plastic
- Use of surfactants for dust suppression
- Limit access of personnel and equipment



# Objects of Decontamination

---

- Site workers
- Equipment
  - Tools
  - Instruments
  - Clip Boards
  - PPE
  - Vehicles
- Victims



# Types of Contamination

---

- Surface contamination
- Permeated contamination



# Decontamination Methods

---

- Dilution
  - ☐ Reduces concentration
  - ☐ Water is the best
  - ☐ Control run-off
  
- Chemical neutralization/degradation
  - ☐ Chemical structure is altered
  - ☐ Reduces the chemical harm
  - ☐ Bleach, baking soda, T.S.P., foam
  - ☐ Seek technical assistance

# Decon Methods (continued)

---

- Absorption
  - ☒ Picking up the material
  - ☒ Soil, clay, Speedi-dri™
  - ☒ Does not change the hazards
- Isolation and Disposal
  - ☒ Equipment that can not be decontaminated
  - ☒ Remove for later disposal

# Steps of Decontamination

---

- Identify hazards
- Organized decontamination operation
- Determine extent of decontamination
  - ☐ Nature of contaminant
  - ☐ Amount of contaminant
  - ☐ Level of worker protection
  - ☐ Nature of job function
  - ☐ Reason for leaving area

# Four Stage System

---

- Stage One: Tool drop, gross decon
- Stage Two: Wash and/or remove tape, outer boots/gloves
- Stage Three: Wash and/or remove suit, inner gloves
- Stage Four (optional)
  - ☐ Full body wash
  - ☐ Dry and dress
  - ☐ Medical exam

# Minimum Decon

---

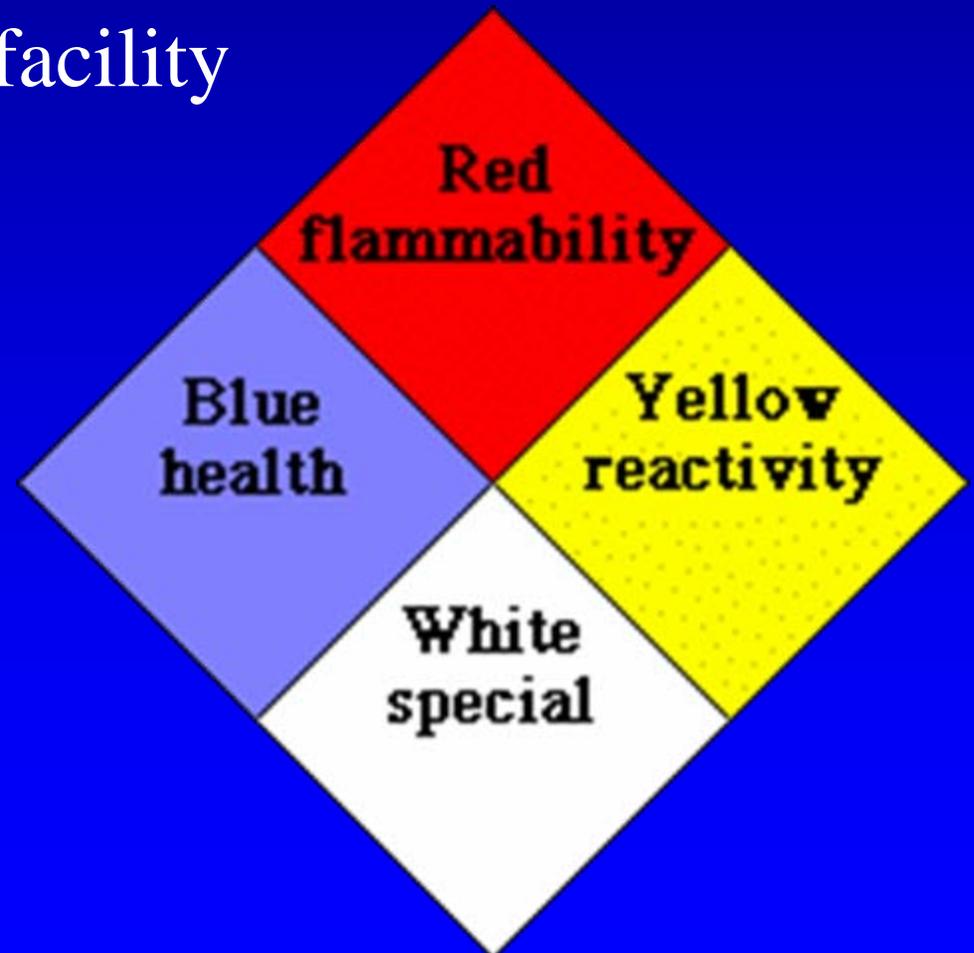
- Wash hands and face
- Wash boots or shoes
- Wipe down equipment



# NFPA 704 Label

---

- Required for facilities with hazardous materials
- Placed near entrances to facility
- Placed on containers



# Flammability Hazards

---

- 4 Flashpoint below 73°F & boiling point below 100°F
- 3 Flashpoint below 73°F and a boiling point above 100°F or flashpoint above 73°F but not exceeding 100°F and a boiling point below 100°F
- 2 Flashpoint above 100°F but not exceeding 200°F
- 1 Flashpoint above 200°F
- 0 Materials that will not burn

# Health Hazards

---

- 4 Very short exposure could cause death or major residual injury
- 3 Short exposure could cause serious temporary or residual injury
- 2 Intense or continued, but not chronic exposure could cause incapacitation or possible residual injury
- 1 Exposure would cause irritation but only minor residual injury
- 0 Exposure under fire conditions would offer no hazard beyond that of ordinary combustible material

# Reactivity Hazards

---

- 4 Readily capable of detonation, explosive decomposition, or reaction at normal temperatures and pressures
- 3 Capable of detonation, explosive decomposition, or reaction but require a strong initiating source, heated under confinement, or react explosively with water
- 2 Undergo violent chemical change at elevated temperatures and pressures, react violently with water, or may form explosive mixtures with water
- 1 Normally stable but can become unstable at elevated temperatures and pressures
- 0 Normally stable even under fire exposure conditions and which are not reactive with water

# Special Hazards

---

-  = Acid
-  = Alkali
-  = Corrosive
-  = Oxidizer
-  = Reacts with water
-  = Radioactive

# Placards, Labels, and Markings

- Placards are for
  - Outer containers
  - Trucks
  - Cylinders
  - Other vehicles used for transport



- Labels are for
  - Packages
  - Packagings
  - Overpacks



- Markings are additional identifiers that further describe the package

# DOT Placards and Labels

**TABLE OF PLACARDS AND INITIAL**  
USE THIS TABLE ONLY IF MATERIALS CANNOT BE SPECIFICALLY IDENTIFIED BY

Page 16

**RESPONSE GUIDES TO USE ON-SCENE**  
USING THE SHIPPING DOCUMENT, NUMBERED PLACARD, OR ORANGE PANEL NUMBER

Page 17

# Hazard Classification System

---

- Class 1 Explosives

 6 Divisions

- Class 2 Gasses

 4 Divisions

- Class 3 Flammable Liquids

- Class 4 Flammable Solids

 3 Divisions

- Class 5 Oxidizers

 2 Divisions

- Class 6 Toxics

 2 Divisions

- Class 7 Radioactive Material

- Class 8 Corrosives

- Class 9 Miscellaneous

 3 Divisions

# ERG 2004

## 2004 Emergency Response Guidebook



A GUIDEBOOK FOR  
FIRST RESPONDERS  
DURING THE INITIAL PHASE  
OF A DANGEROUS GOODS/  
HAZARDOUS MATERIALS  
INCIDENT

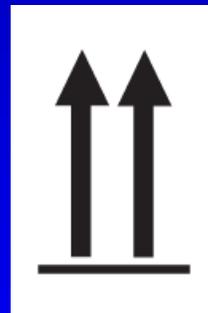
# Common Markings

- Proper Shipping Names and United Nation (UN) numbers

**2448**

- Reportable Quantities (RQ) and Marine Pollutant designations

- Orientation arrows



- Limited Quantity designations



- Exemption numbers

**DOT-E 8450**



# OSHA Signs

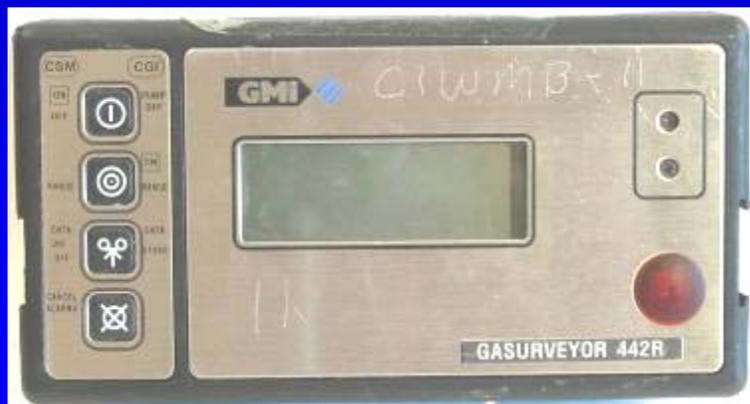
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- 29 CFR 1926.200
  - ☒ Accident prevention signs and tags
- 29 CFR 1910.145
  - ☒ Specifications for accident prevention signs and tags
- Many other sign regulations specific to various work environments

# OSHA Labels and Signs



# Air Monitoring Instrumentation



# Explosive Limits

---

- Lower Explosive Limit (LEL) = lowest concentration of a gas that will explode
- Upper Explosive Limit (UEL) = highest concentration of a gas that will explode
- Example - Methane
  - ☐ LEL = 5%
  - ☐ UEL = 15%

# Percent Conversion to ppm

---

| Percent | ppm       |
|---------|-----------|
| 100%    | 1,000,000 |
| 10%     | 100,000   |
| 1%      | 10,000    |
| 0.1%    | 1,000     |
| 0.01%   | 100       |
| 0.001%  | 10        |
| 0.0001% | 1         |

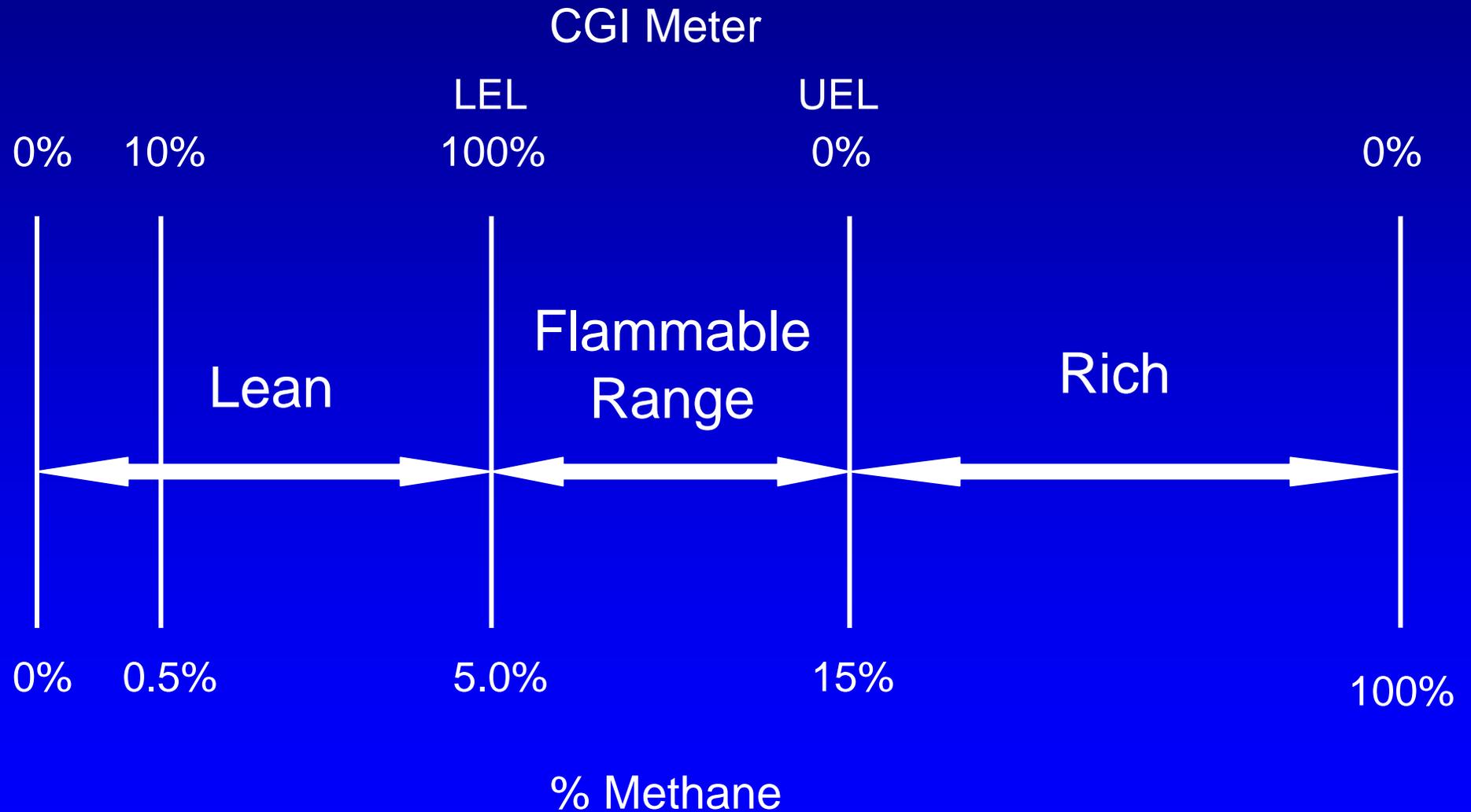
# LEL vs. % vs. ppm

---

Approximate equivalence for methane only

| LEL  | % Methane | ppm Methane |
|------|-----------|-------------|
| 100% | 5.0       | 50,000      |
| 10%  | 0.5       | 5,000       |
| 1%   | 0.05      | 500         |

# LEL, UEL, % Gas



# GMI Gasurveyor 442R

---

- Combustible Gas or LEL (% and ppm)
- Oxygen – O<sub>2</sub> (%)
- Carbon Monoxide – CO (ppm)
- Hydrogen Sulfide – H<sub>2</sub>S (ppm)
- Two Modes
  -  Confined space monitor (CGM)
  -  Combustible gas indicator (CGI)
- Data logging
- Alarms only in CGM mode

# Detector Operating Ranges

---

| <u>Parameter</u> | <u>Range</u>    | <u>Accuracy</u> |
|------------------|-----------------|-----------------|
| LEL              | 0% to 10%       | +/- 0.5%        |
| Methane          | 10% to 100% LEL | +/- 2.0%        |
|                  | 0 to 1,000 ppm  | +/- 50 ppm      |
|                  | 5% to 10%       | 0.5%            |
|                  | 10% to 100%     | 2.0%            |
| O <sub>2</sub>   | 0% to 30%       | +/- 0.5%        |
| H <sub>2</sub> S | 0 to 200 ppm    | +/- 2 ppm       |
| CO               | 0 to 1,000 ppm  | +/- 15 ppm      |

# Cautions

---

- Do not use in the presence of:
  - ☒ Silicones: lubricants, hydraulic oil
  - ☒ Free Halogens: chlorine, fluorine, bleach/pool chlorine
  - ☒ Halogenated hydrocarbons: Freon, refrigerants, dry cleaning fluid
  - ☒ Metallic oxides: Tetra Ethyl Lead (leaded gasoline), antimony
- Careful in low O<sub>2</sub> areas because LEL will not work
- Gases above certain concentrations will interfere with some of the detectors
- Response time
  - ☒ Flammable Gases = 15 seconds to 95% of reading
  - ☒ Toxic Gases = 30 seconds to 95% of reading

# Good Messages

---

- “SAMPLE” = pump is running
- “OFF” = instrument will turn off
- “STORE” = Auto data logging mode

# Uh Oh Messages

---

- “SAMPLE FAULT” = flow is not correct
- “ZERO FAULT” = Zero is out of calibration limits
- “CHECK ZERO” = Zero may have changed
- “BAT” = Low battery
- “10” after self test = minor memory error

# @\*%!\$# Message

---

- “01” = calibration error (requires major maintenance)

# Filters

---

- Probe has two filters
  - ☐ Particulate (cotton)
  - ☐ Hydrophobic
- Never turn instrument on without the probe attached!
- Replace filters if blocked or water ingress
- Hydrophobic filter can be dried and reused

# Calibration

---

- GMI Manual Calibration System – calibrate linked to a computer
- Recommend calibration once or more a day with methane
- Perform zero calibration in clean air

# On and Off

---

- Confined Space Mode (CSM) mode = press Switch One for one second (rarely used by CIWMB)
- Combustible Gas Indicator (CGI) mode = press Switch Two for one second
- Off = press Switch One twice; cancel by pressing Switch One once

# Scott Scout

---

- Sensors
  - ☐ Combustible Gas (% and ppm)
  - ☐ Oxygen – O<sub>2</sub> (%)
  - ☐ Carbon Monoxide – CO (ppm)
  - ☐ Hydrogen Sulfide – H<sub>2</sub>S (ppm)
- Warning and Alarm levels
- Passive and Active Monitoring
- Three modes
  - ☐ General user
  - ☐ Technical user (secret password)
  - ☐ Setup user (super top secret password)

# Detector Operating Ranges

---

| Parameter        | Range        |
|------------------|--------------|
| LEL              | 0% to 80%    |
| Gas              | 0% to 100%   |
| O <sub>2</sub>   | 0% to 25%    |
| H <sub>2</sub> S | 0 to 100 ppm |
| CO               | 0 to 500 ppm |

# Caution

---

- Do not use in the presence of:
  - ☒ Silicones: lubricants, hydraulic oil
  - ☒ Free Halogens: chlorine, fluorine, bleach/pool chlorine
  - ☒ Halogenated hydrocarbons: Freon, refrigerants, dry cleaning fluid, degreasers
  - ☒ Metallic oxides: Tetra Ethyl Lead (leaded gasoline), antimony
- Do not use in low O<sub>2</sub> areas (<10%) because LEL gives inaccurate readings
- Gases above certain concentrations will interfere with some of the detectors
- Response time is 15 – 30 seconds

# Warnings and Alarms

---

- Warning: Beeping tone and LED flashes once per two seconds
- Alarm: Whooping tone and LED strobing twice per second
- Warnings and Alarms programmable

# Negative Gas Readings

---

- Interferents can cause negative readings and/or zero drift
- Significant negative reading will give a warning (flash of red light)
- Display will blink slowly after acknowledgement

# Over Range Reading

---

- Over range = “+++”
- Display flashes
- Audible alarm
- Flashing LED

# Alarms

---

- “Low Flow Alarm”= blockage or pump failure
- “Shutter Alarm” = Shutter is not fully open or fully closed
- “Sensor Marginal” = Response is low

# Calibration

---

- Must be calibrated using appropriate calibration gas for the instrument detectors
- Recommend daily calibration (bump test)
  - ☐ Use gas mixture
  - ☐ Results within  $\pm 10\%$
- Perform zero calibration in clean air

# Monitoring Modes

---

- Passive mode (sensor shield open)
  - ▣ General surveying
- Active mode (probe attached)
  - ▣ Monitoring a single point or area

# On and Off

---

- On

- ☐ Press two buttons and hold

- ☐ “Hold” - hold for about 5 seconds

- ☐ “Release”

- Off

- ☐ Press two bottom buttons

- ☐ “Turn off”

- ☐ Press upper left button

# Landfill Gas

---

- Methane 38 - 58%
- Carbon dioxide 30 - 48%
- Nitrogen 2 - 10%
- Oxygen 0.2 - 1%
- Ammonia 0.1 - 1%
- Hydrogen 0 - 1%
- Trace gases 0 - 1%

# Trace Gases

---

- Water
- H<sub>2</sub>S
- CO
- NH<sub>3</sub>
- Benzene
- Toluene
- Vinyl Chloride
- Methylene Chloride
- Trichloroethylene (TCE)
- Perchloroethylene (PCE)
- Ethylbenzene
- Dichloroethylene

# Methane

---

- Typical Range of Concentration = 38% to 58%
- LEL = 5 % (50,000 ppm)
- UEL = 15 % (150,000 ppm)
- Specific gravity = 0.55
- PEL = none (explosive atmosphere and oxygen displacement hazards)
- Odorless

# Carbon Dioxide

---

- Typical Range of Concentration = 30% to 48%
- Nonflammable
- Specific gravity = 1.53
- PEL = 5,000 ppm (9,000 mg/m<sup>3</sup>) TWA
- IDLH = 40,000 ppm
- Odorless

# Nitrogen

---

- Typical Range of Concentration = 2% to 10%
- Nonflammable and inert
- Specific gravity = 0.97
- PEL = None
- Acts as an asphyxiant by displacement of air
- Odorless

# Hydrogen

---

- Typical Range of Concentration = 0% to 1%
- LEL = 4%
- UEL = 75%
- Specific gravity = 0.07
- PEL = None
- Odorless

# Hydrogen sulfide

---

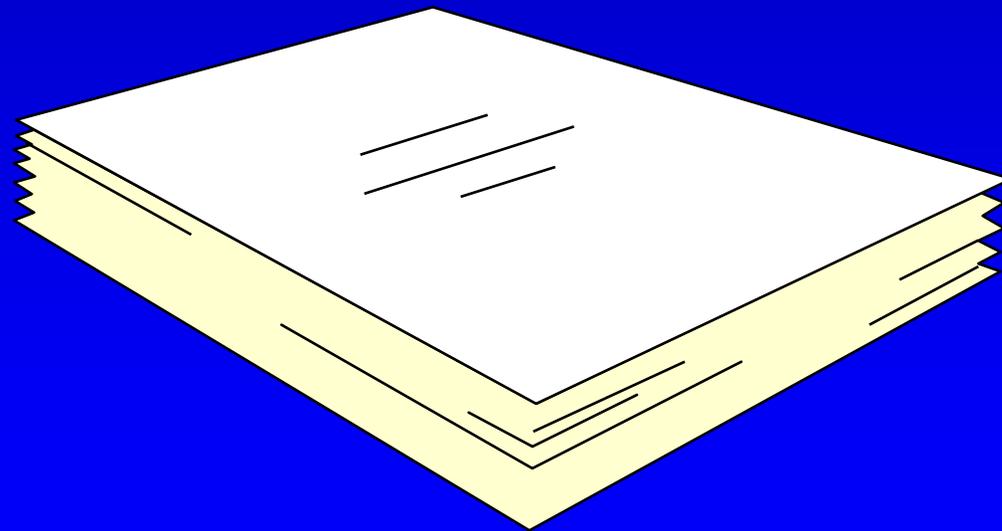
- Trace gas <1%
- LEL = 4%
- UEL = 44%
- Specific gravity = 1.19
- PEL = 10 ppm ceiling; 50 ppm 15-min max peak
- IDLH = 100 ppm
- Rotten egg odor (nose will quickly become desensitized)

# Carbon Monoxide

---

- Trace gas <1%
- LEL = 12.5%, UEL = 74%
- Specific gravity = 0.97
- Cal-OSHA = 25 ppm
- IDLH = 1,200 ppm
- Odorless

# Emergency Response Actions



# Emergency Response Plan

---

- Plan is required before working on a hazardous waste site
- *Written prior to commencement of emergency operations*
- Available to
  - 📁 Site workers
  - 📁 Visitors
  - 📁 OSHA personnel

# Emergency Response Actions

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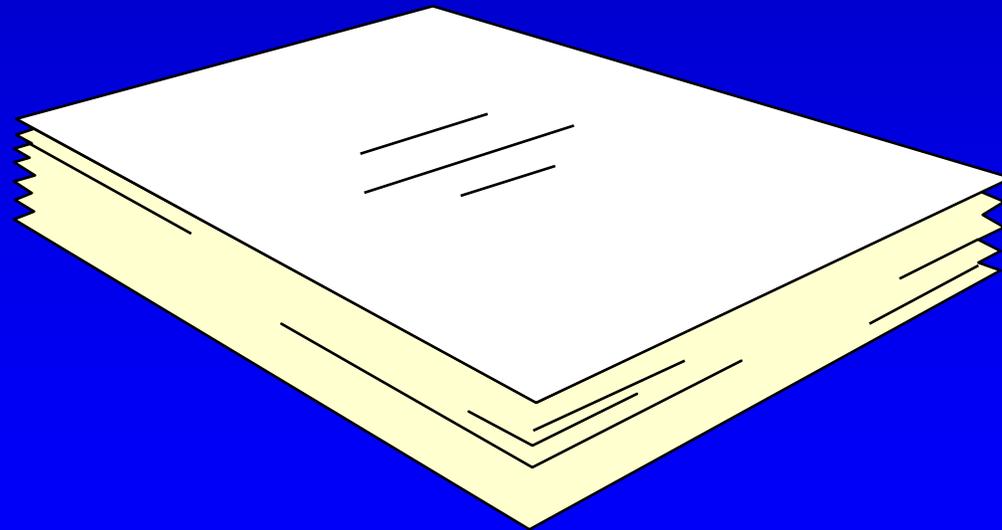
- Step 1: Protection priorities
  - ☐ First - protect yourself
  - ☐ Second – protect public
  - ☐ Third – protect environment
  - ☐ Forth – protect property
- Step 2: Make notifications
  - ☐ Facility
  - ☐ Employer
  - ☐ Local, state, federal

# More ER Actions

---

- Step 3: Isolate the incident
- Step 4: Perform actions, if properly trained!
  - ☐ Awareness level
  - ☐ Operational level
  - ☐ Technician level
- Step 5: Integrate into Incident Command System (ICS), if properly trained!

# Pre and Post Field Activities



# Field Activities

---

- Enforcement activities
- Closure activities
- Closed site investigation
- Asbestos containing waste (ACW) inspections
- Remediation activities
- Subsurface landfill fire investigation
- Permitting/inspecting solid waste facility

# Field Activities (cont.)

---

- Permitting and inspection of tire activities
- Field tours
- Facility reviews for grant purposes (used oil or household hazardous waste)
- Research and development
- CEQA review
- Waste characterization sorts
- Used Oil recycling facility inspection

# Pre-Field Planning

---

- Research site history
  - 📁 Review site files
  - 📁 Contact local regulatory authorities
  - 📁 On-line web search
  
- Conduct drive by
  - 📁 Look for obvious hazards
  - 📁 Find hospital route
  - 📁 Do not enter site

# Pre-Field Planning (continued)

---

- Prepare site safety and health plan
  - ☐ Work zones
  - ☐ Instruments
  - ☐ PPE
  - ☐ Decontamination
  - ☐ Action levels
  - ☐ Emergency plan
  - ☐ Make sure project team reads and signs
- Not required for all sites

# Pre-Field Planning (continued)

---

- Brief and organize project team
  - ☐ Assign individual duties
  - ☐ Review work plan
  - ☐ Determine schedule
  
- Obtain materials
  - ☐ Equipment
  - ☐ Instruments
  - ☐ PPE
  - ☐ Supplies (tape, first aid kit, sample containers, etc.)

# On-site Pre-Entry Planning

---

- Conduct site safety meeting
  - ☐ Review of hazards
  - ☐ Review of action levels
  - ☐ Establish exit routes
  - ☐ Establish emergency meeting location
- Calibrate instruments
- Review job duties
- Review work plan
- Drive hospital route

# On-Site Entry Actions

---

- Check that instruments are still working
- Establish work zones
  - ☐ Exclusion
  - ☐ Decontamination Reduction
  - ☐ Support
- Ensure complete decontamination
  - ☐ Personnel
  - ☐ Equipment
  - ☐ Tool
  - ☐ Samples
- Debrief team on any safety issues

# Post-Field Actions

---

- Report and record exposures, if necessary
- Report and record injuries, if necessary
- Amend site safety and health plan, if necessary

# Facility Accident

---

- You are conducting an inspection at a recycling facility with a new facility representative
- While walking in the area where the tires are stored, you witness a truck back into a worker
- The worker is laying on the ground face down, his hard hat has fallen off, and his left arm is severely twisted under his body
- What do you do?

# Chemical Spill

---

- During a routine inspection of a facility the facility is unloaded pallets of 55-gallon drums from a truck
- You recognize the drum labeled as:
- Suddenly a forklift pierces two drums near the bottom of each drum
- What do you do?



# Confined Space

---





# Confined Spaces Can Be Deadly

---

- In 39 workplace confined space fatalities:
  - 📁 95% of the entries were authorized by a supervisor
  - 📁 85% the supervisor was present
  - 📁 31% of the fatalities were at companies with written Confined Space Emergency (CSE) procedures
  - 📁 15% of the fatalities had completed CSE training

# Most Important . . .

---

43% of confined space fatalities were  
would-be rescuers

# Why Did These Fatalities Occur?

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- None of the fatalities followed written procedures
- None of the spaces were evaluated or tested prior to entry
- None of the spaces were ventilated
- None of the companies had a rescue plan

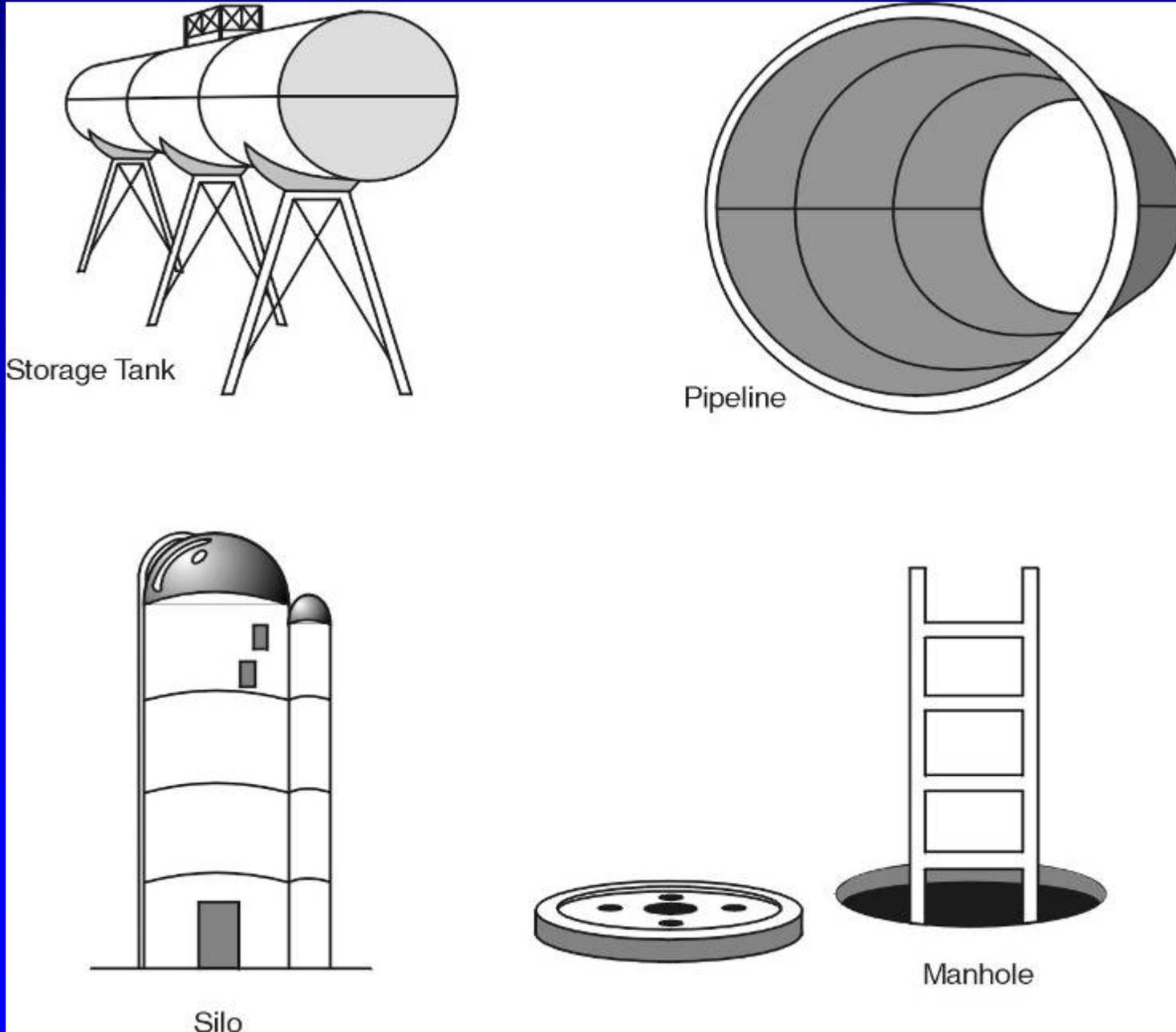
Source: NIOSH, Division of Safety Research

# Confined Space Definition

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- Confined space meets all three conditions:
  - ☐ Employee can enter area
  - ☐ Limited or restricted means of entry or exit
  - ☐ Not designed for continuous occupancy
- “Entry” - any part of the person’s body breaks the plane of an opening into the space
- OSHA Regulation: 8 CCR 5156-5158 (Requires a written procedures and specific training)

# Confined Space



# Confined Space Examples

---

- Storage tanks
- Process vessels
- Pits
- Silos
- Boilers
- Vats
- Degreasers
- Reaction vessels
- Vessels
- Storage bins
- Ventilation ducts
- Sewers
- Tunnels
- Underground vaults
- Tank cars
- Holes
- Large pipes
- Excavations
- Rooms in buildings
- Hoppers

# Two Types of Confined Space

---

- Permit required confined space
- Non-permit required confined space





# Permit Required Confined Space

---

- Contains or has a potential to contain a hazardous atmosphere.
- Contains a material with the potential for engulfment of an entrant.
- Has an internal configuration such that an entrant could be trapped or asphyxiated.



# Non-Permit Required Confined Space

---

- Does not contain hazards capable of causing death or serious physical harm.
- Does not contain atmospheric hazards which cannot be maintained at safe levels with engineering controls such as ventilation.

# Hazard Types

---

- Asphyxiating atmospheres
  - ☐ Oxygen less than 19.5 %
  - ☐ Chemical processes, biological activity
  - ☐ Simple asphyxiants
  - ☐ Chemical asphyxiants
  
- Toxic Atmospheres
  - ☐ Carbon monoxide
  - ☐ Hydrogen sulfide
  - ☐ PELs exceeded

# Hazard Types (continued)

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- Flammable/explosive atmospheres

- ☐ 10 % of LEL

- ☐ Oxygen more than 23.5 %

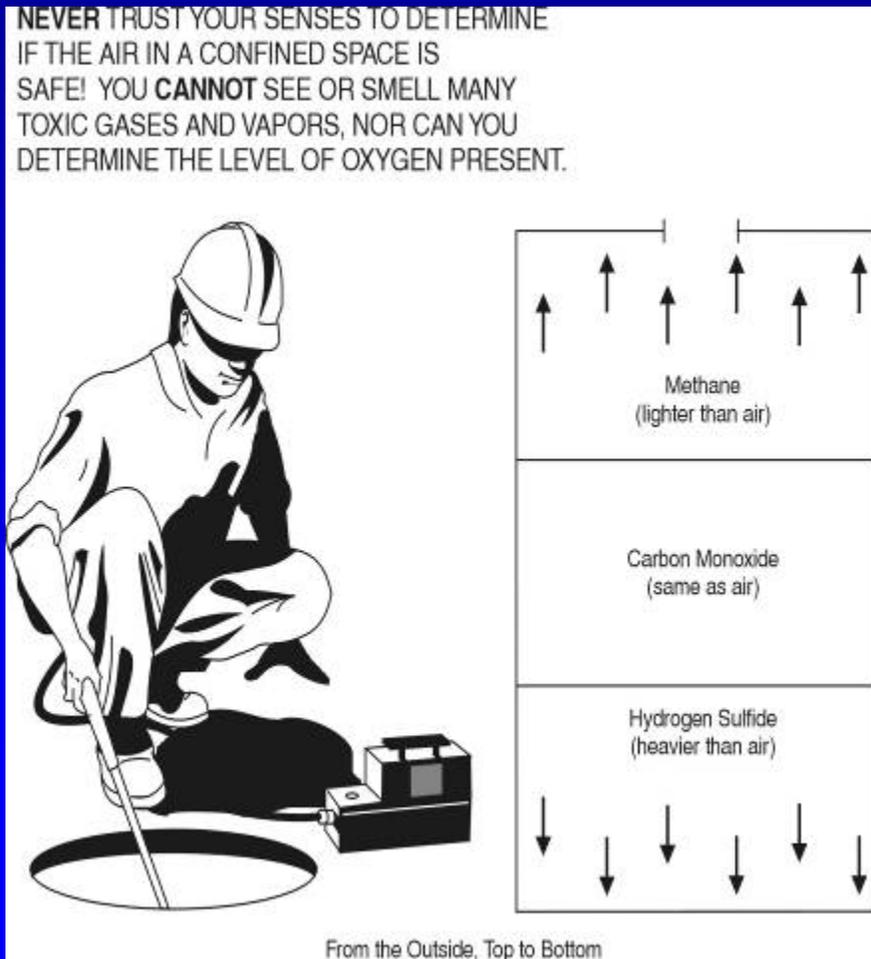
- Mechanical/Physical

- ☐ Entanglement

- ☐ Engulfment

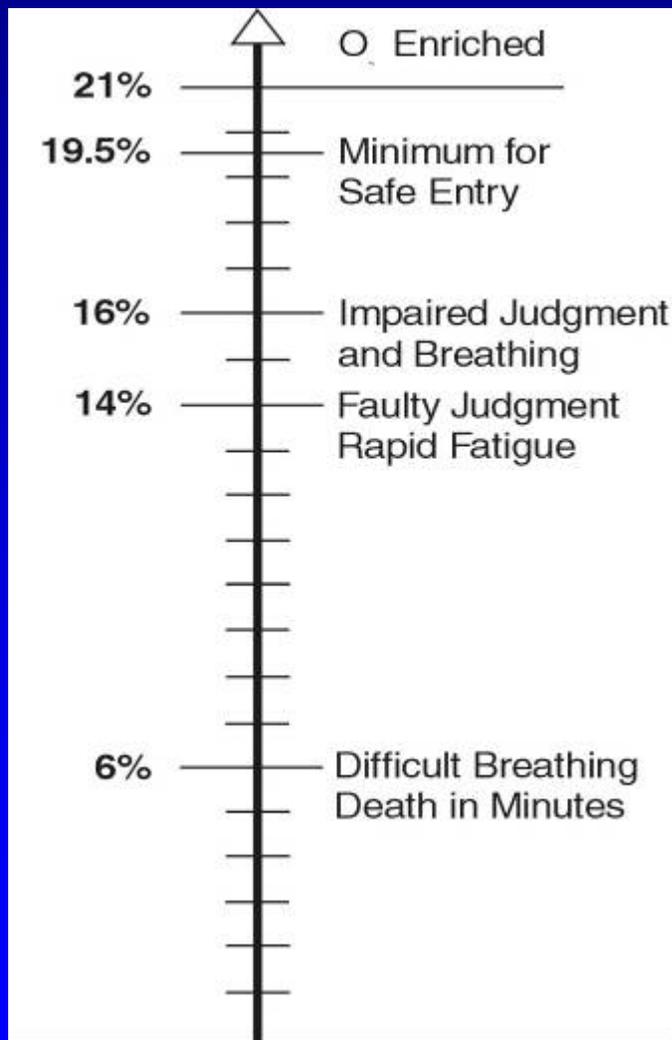
- ☐ General workplace hazards

# Initial Atmospheric Monitoring



- Before entering a permit required confined space, atmospheric monitoring must be conducted within the space using properly calibrated direct-reading instruments.
- Caution for manholes – test before opening (sparks can cause explosions)

# Initial Atmospheric Monitoring

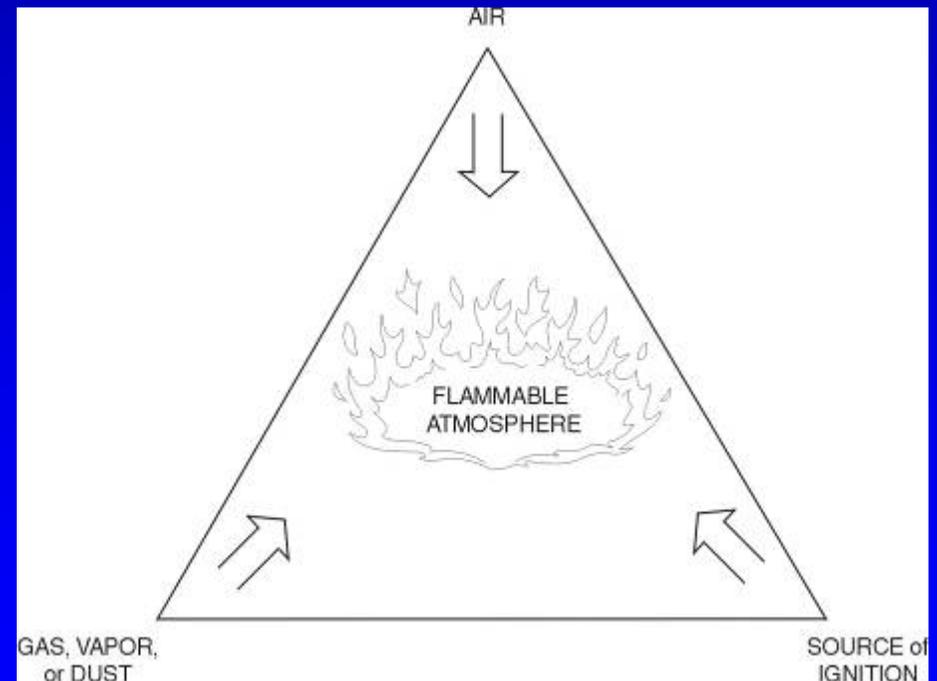
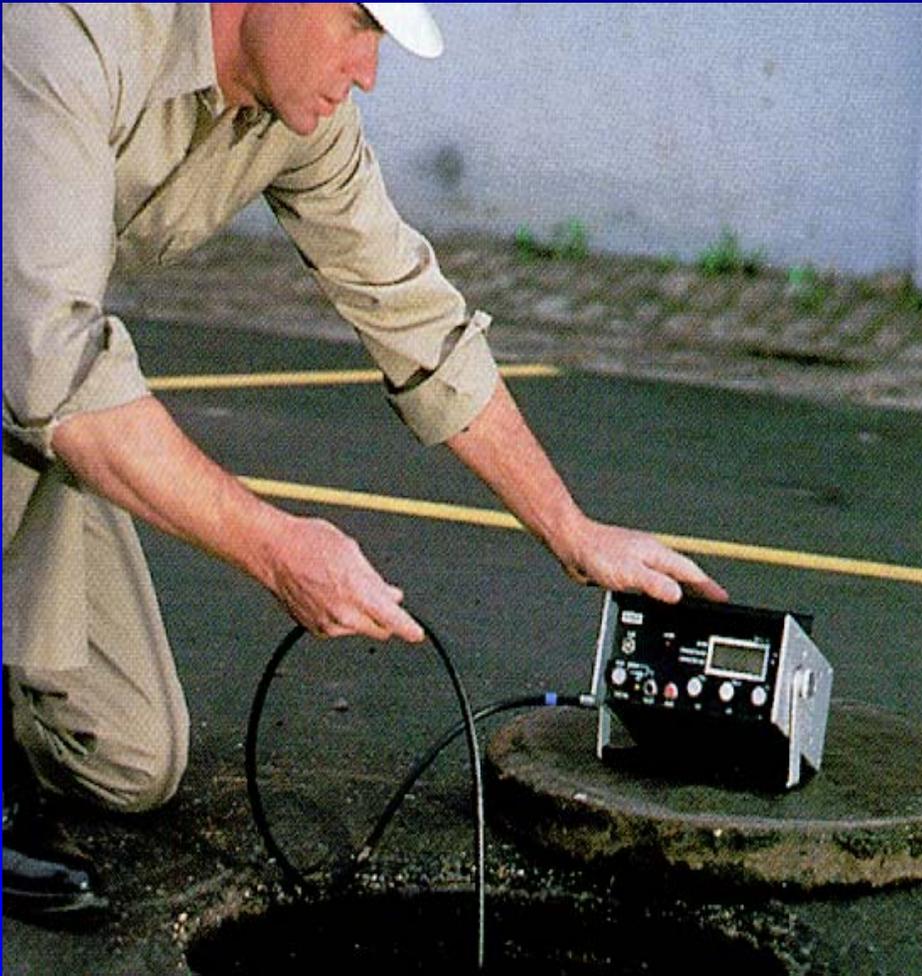


- Oxygen level



# Initial Atmospheric Monitoring

- Flammability and/or lower explosive limit <10% LEL



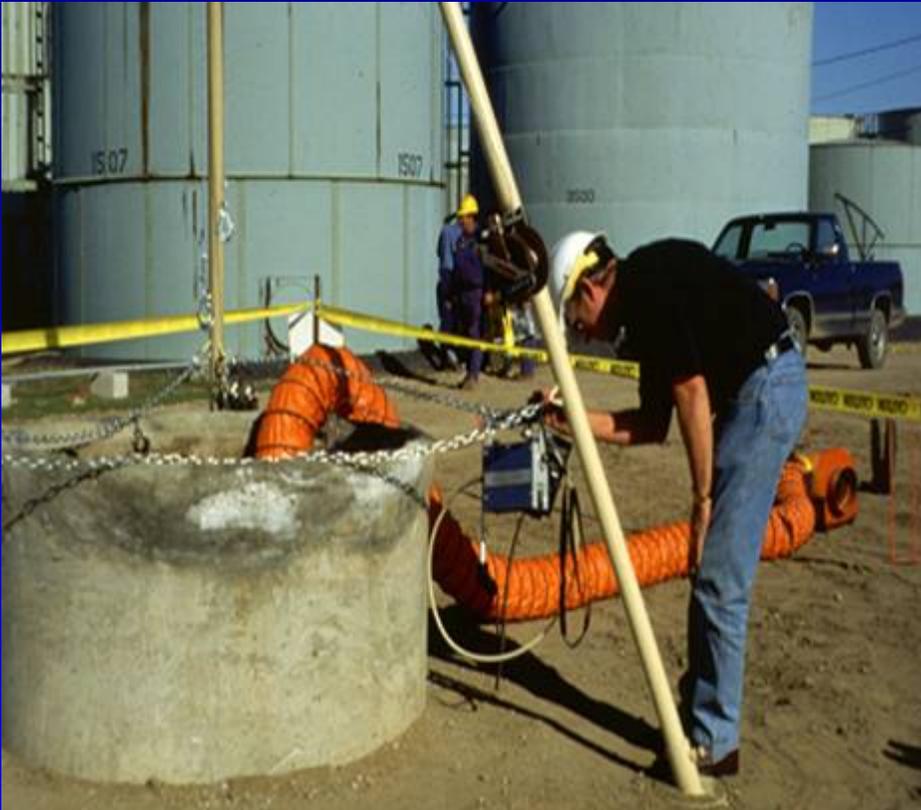
# Initial Atmospheric Monitoring

---



- Toxic substance levels

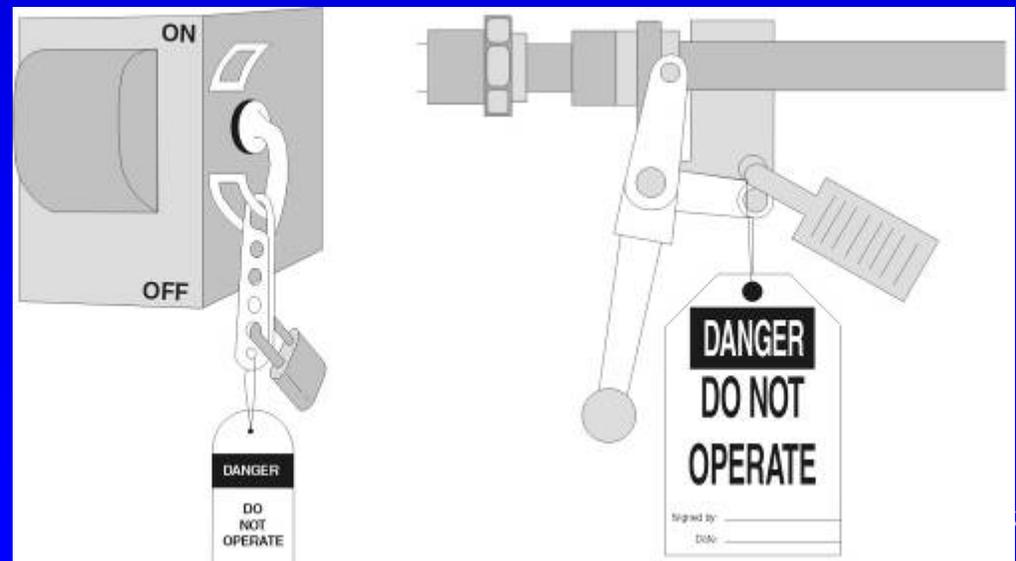
# Initial Atmospheric Monitoring



- **Continuously** monitoring during all phases of work in a permit space
- Sampling must be done at intervals from top to bottom of space if conditions for stratification may be present
- If an exposure or action level is exceeded, at any time, all entrants must immediately evacuate the space

# Isolation of the Space

- If confined space is within or part of an overall system, it must be isolated prior to entry by:
  - ☐ Blinding or blanking
  - ☐ Misaligning or removing sections of lines, pipes, or ducts
  - ☐ Double block and bleed system
  - ☐ Lockout or tagout of all sources of energy
  - ☐ Blocking or disconnecting all mechanical linkages





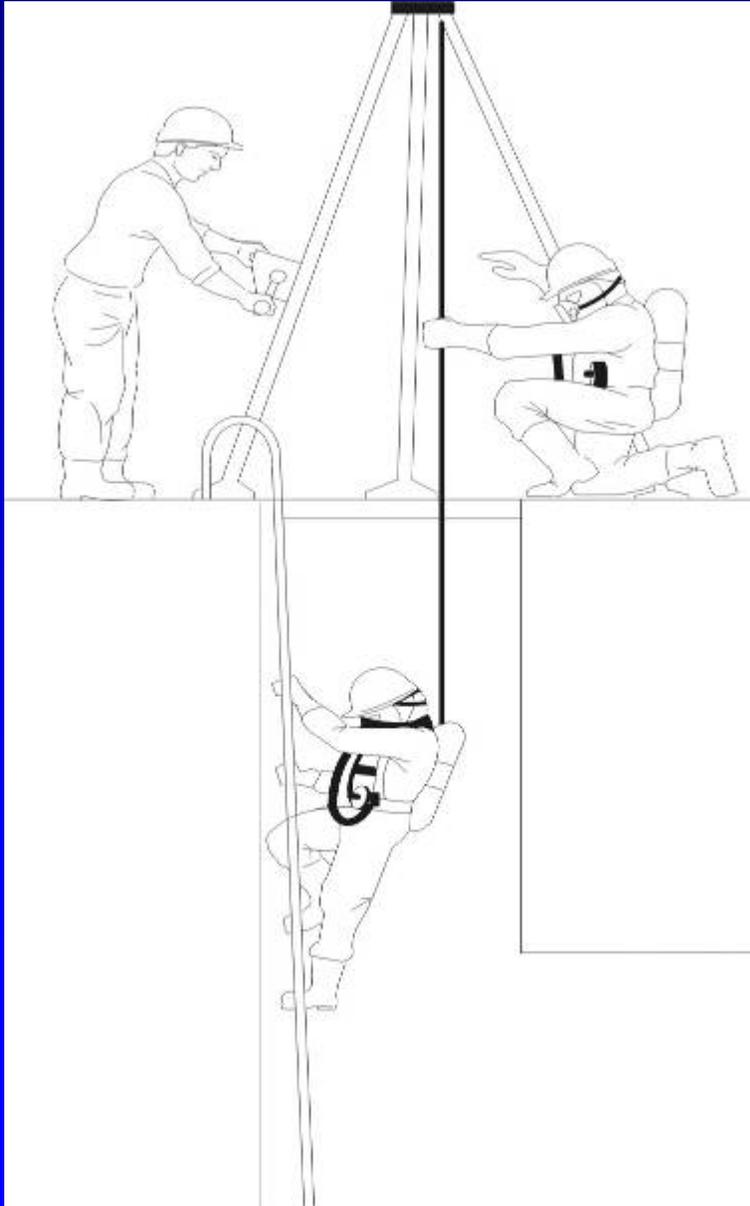
# Ventilation

---



- Maintain safe oxygen levels.
- Maintain toxic and flammable materials at safe levels.

# Confined Space Entry Team



- The Confined Space Entry team should consist of at least three members
  - ☑ Authorized entrant
  - ☑ Attendant
  - ☑ Entry supervisor

# Emergency Procedures

---

- Entry for rescue is a life-threatening activity attempted only as a last resort
- Rescue from outside the confined space using retrieval/lifelines





# Training

---

- All confined space entrants, attendants, supervisors and rescue personnel must receive training:
  - ☐ Prior to any confined space work
  - ☐ Prior to a change in the worker's confined space duties
  - ☐ Whenever inadequacies or changes in the program or environment occur

# Confined Space Permits





# Confined Space Permits

---

- Name of space
- Date of entry
- Names of entrants
- Entry supervisor
- Control measures
- Initial test results
- Name of tester
- Emergency numbers
- PPE required
- Purpose of entry
- Duration
- Hazards of the space
- Periodic test results
- Time of testing
- Communication
- Additional equipment

# Wise Grandfather

---

It is always better to be safe  
than Sorry!!

