Course Objectives

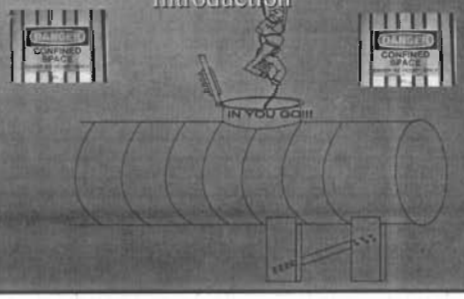
- Introduce fire service personnel to the ***codes*** that impact operations within confined spaces
- Provide fire service personnel with the information to ***identify*** confined spaces and permit required confined spaces
- Introduce fire service personnel to the ***hazards*** of confined spaces
- Introduce fire service personnel to the ***equipment*** and the ***procedures*** required to deal with a confined space rescue safely and legally
- Introduce fire service personnel to the basic ***operational positions***, and their responsibilities as set forth by Cal/OSHA
- Prepare fire service personnel for confined space entry/rescue training

Confined Space Awareness

- Fatality Stats
- Regulations/ Agencies
- Permit/Non-permit
- Hazardous Conditions
- Atmospheric Monitoring
- Entry Permits

Confined Space Awareness

Introduction



Confined Space Awareness

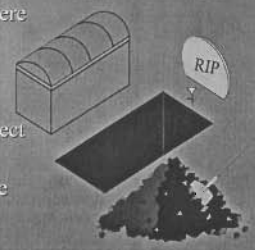
- Ventilation
- Communications Equipment
- PPE
- Space Isolation
- Retrieval Systems
- Positions/Functions
- First Responder Actions

FATALITY STATISTICS

- Approx. 67 / yr. preventable
- 60 % would-be rescuers

Causes of Death

- 65% Hazardous Atmosphere
- 13% Engulfment
- 7% Struck by Falling Object
- 6% Heat Stress / Exposure
- 4% Others



Statutes, Regulations and Standards

Fed/OSHA

CODE OF FEDERAL REGULATIONS

"Permit Required Confined Spaces"

Section 29 CFR 1910.146

- Effective April 1993
- Part 1910 GENERAL INDUSTRY "ONLY"
- Intent vs. "Letter of the Law"

REGULATIONS AFFECTING CONFINED SPACES

Statutes, Regulations and Standards

Fed/OSHA

- Covered by other regulations:
  - * shipyard employment (Part 1915)
  - * construction (Part 1926)
  - * agriculture (Part 1928)
- Performance-oriented, not specification-oriented
- States adopt federal regulations or draft their own
- At least as restrictive as the federal regulations

Regulatory Agencies

- Fed/OSHA - Code of Federal Regulations (CFR)
- Cal/OSHA - California Code of Regulations (CCR)
  - * A.N.S.I. - Safety Requirements for Working in Tanks and Other Confined Spaces
  - * N.I.O.S.H. - Working in Confined Spaces
  - * *Also set standards, compliance may be mandatory*

Statutes, Regulations and Standards

Cal/OSHA

CALIFORNIA CODE OF REGULATIONS

"General Industry Safety Orders"

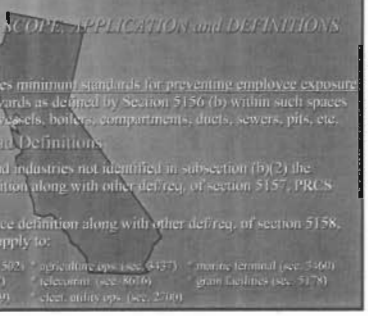
Title 8, Article 108,

Sections 5156, 5157, 5158

- Effective December 1993
- Fire departments <u>will</u> conform to the letter of the law

Statutes, Regulations and Standards

Cal/OSHA



Section 5156 SCOPE, APPLICATION and DEFINITIONS

(a) Scope

This Article prescribes minimum standards for preventing employee exposure to confined space hazards as defined by Section 5156 (b) within such spaces as silos, tanks, vats, vessels, boilers, compartments, ducts, sewers, pits, etc.

(b) Application and Definitions

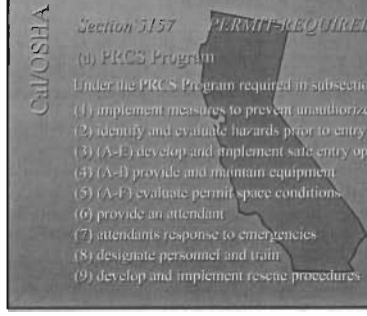
(1) For operations and industries not identified in subsection (b)(2) the confined space definition along with other def/req. of section 5157, PRCS shall apply.

(2) The confined space definition along with other def/req. of section 5158, "other" PRCS shall apply to:

* construction ops. (sec. 1502) * agriculture ops. (sec. 6437) * marine terminal (sec. 3360)
* shipyard ops. (sec. 8357) * telecomm. (sec. 8656) grain facilities (sec. 5178)
* nat. gas utilities (Title 49) * elect. utility ops. (sec. 2700)

Statutes, Regulations and Standards

Cal/OSHA



Section 5157 PERMIT-REQUIRED CONFINED SPACES

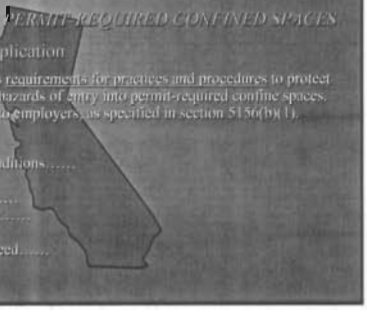
(d) PRCS Program

Under the PRCS Program required in subsection (d)(4), the employer shall:

(1) implement measures to prevent unauthorized entry
(2) identify and evaluate hazards prior to entry
(3) (A-E) develop and implement safe entry operations
(4) (A-I) provide and maintain equipment
(5) (A-F) evaluate permit space conditions
(6) provide an attendant
(7) attendants response to emergencies
(8) designate personnel and train
(9) develop and implement rescue procedures

Statutes, Regulations and Standards

Cal/OSHA



Section 5157 PERMIT-REQUIRED CONFINED SPACES

(a) Scope and Application

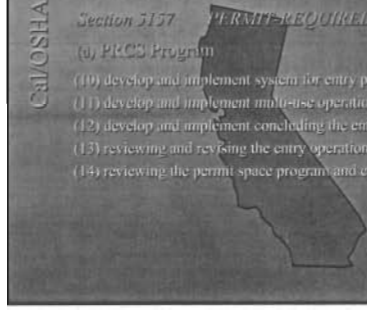
This section contains requirements for practices and procedures to protect employees from the hazards of entry into permit-required confine spaces. This section applies to employers, as specified in section 5156(b)(1).

(b) Definitions

Acceptable entry conditions……
Attendant……
Authorized entrant……
Blanking or blinding……
Confined space……
Double block and bleed……
Emergency……
Engulfment…

Statutes, Regulations and Standards

Cal/OSHA



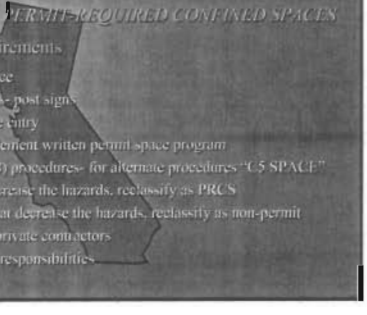
Section 5157 PERMIT-REQUIRED CONFINED SPACES

(d) PRCS Program

(10) develop and implement system for entry permits
(11) develop and implement multi-use operations system
(12) develop and implement concluding the entry
(13) reviewing and revising the entry operations
(14) reviewing the permit space program and cancelled permits

Statutes, Regulations and Standards

Cal/OSHA



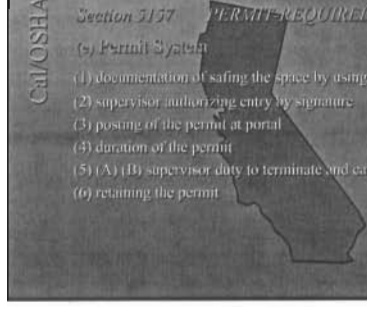
Section 5157 PERMIT-REQUIRED CONFINED SPACES

(c) General Requirements

(1) evaluate workplace
(2) inform employees- post signs
(3) prevent employee entry
(4) develop and implement written permit space program
(5) (A) conditions (B) procedures- for alternate procedures "C5 SPACE"
(6) when changes increase the hazards, reclassify as PRCS
(7) (A-D) changes that decrease the hazards, reclassify as non-permit
(8) (A-E) hosts and private contractors
(9) (A-C) contractor responsibilities

Statutes, Regulations and Standards

Cal/OSHA



Section 5157 PERMIT-REQUIRED CONFINED SPACES

(e) Permit System

(1) documentation of safing the space by using the permit
(2) supervisor authorizing entry by signature
(3) posting of the permit at portal
(4) duration of the permit
(5) (A) (B) supervisor duty to terminate and cancel entry permit
(6) retaining the permit

Statutes, Regulations and Standards

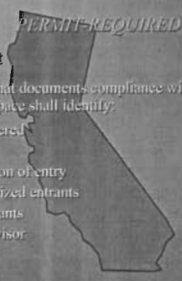
Cal/OSHA

Section 5157 *PERMIT-REQUIRED CONFINED SPACES*

(f) Entry Permit

The entry permit that documents compliance with this section and authorizes entry to a permit space shall identify:

(1) space to be entered
(2) purpose
(3) date and duration of entry
(4) name of authorized entrants
(5) name of attendants
(6) name of supervisor
(7) hazards
(8) space isolation
(9) acceptable entry conditions



Statutes, Regulations and Standards

Cal/OSHA

Section 5157 *PERMIT-REQUIRED CONFINED SPACES*

(h) Authorized Entrants Duties

The employer shall ensure that all authorized entrants:

(1) know the hazards
(2) properly use equipment
(3) communicate with attendant as necessary
(4) (A) (B) alert the attendant when…
(5) (A-D) exit the permit space when…

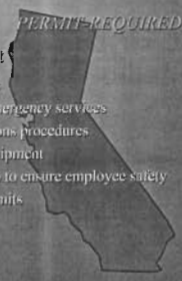
Statutes, Regulations and Standards

Cal/OSHA

Section 5157 *PERMIT-REQUIRED CONFINED SPACES*

(f) Entry Permit

(10) testing results
(11) rescue and emergency services
(12) communications procedures
(13) necessary equipment
(14) any other info to ensure employee safety
(15) any other permits



Statutes, Regulations and Standards

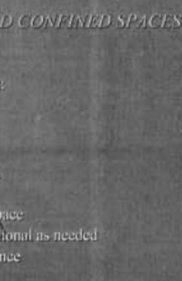
Cal/OSHA

Section 5157 *PERMIT-REQUIRED CONFINED SPACES*

(i) Attendants Duties

The employer shall ensure that each attendant:

(1) know the hazards
(2) aware of exposure
(3) maintains accurate count of entrants
(4) remains at portal until conclusion/relieved
(5) communicates as necessary
(6) (A-D) monitors activities outside/inside space
(7) initiates on-site rescue and summons additional as needed
(8) (A-C) secures safe perimeter around entrance
(9) performs non-entry rescue
(10) performs no duties that interfere with primary duties



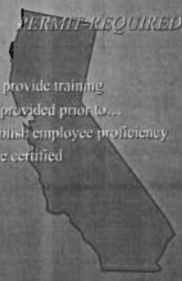
Statutes, Regulations and Standards

Cal/OSHA

Section 5157 *PERMIT-REQUIRED CONFINED SPACES*

(g) Training

(1) employer must provide training
(2) (A-D) training provided prior to…
(3) training to establish employee proficiency
(4) training must be certified



Statutes, Regulations and Standards

Cal/OSHA

Section 5157 *PERMIT-REQUIRED CONFINED SPACES*

(j) Entry Supervisor Duties

The employer shall ensure that each entry supervisor:

(1) know the hazards
(2) verifies permit is completed
(3) terminates/cancels the permit
(4) verifies rescue services are available
(5) secures safe perimeter
(6) verifies entry conditions remain constant

Statutes, Regulations and Standards

Cal/OSHA

Section 5157 PERMIT-REQUIRED CONFINED SPACES

(c) Rescue and Emergency Services

The employer shall ensure that at least one stand-by person at the site is trained and immediately available to perform rescue.

(1) requirements that apply to employers that employees enter permit spaces to perform rescue

(A) provided and trained with PPE and necessary equipment

(B) trained to perform assigned duties

(C) practice simulated rescue operations

(D) trained in first aid/CPR

Statutes, Regulations and Standards

Cal/OSHA

Section 5158 OTHER CONFINED SPACES OPERATIONS

(a) Scope

For industries and operations specified in section 5156 (b)(2) this section prescribes minimum standards for preventing employee exposure to dangerous air contamination, oxygen enrichment and/or deficiency in confined spaces as defined in subsection (b).

(b) Definitions

Confined space……

Dangerous air contamination……

(c) Operation Procedures and Employee Training

(d) Pre-entry

(e) Confined Space Operations

Statutes, Regulations and Standards

Cal/OSHA

Section 5157 PERMIT-REQUIRED CONFINED SPACES

(c) Rescue and Emergency Services

(2) (A) (B) inform rescue services and provide access for preplanning

(3) non-entry retrieval systems shall be used

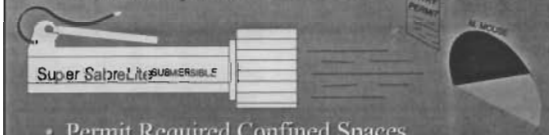
(A) attached for smallest possible profile

(B) attached to mechanical advantage type system

(4) exposure require MSDS to be shipped with patient to hospital

DEFINITIONS OF CONFINED SPACES

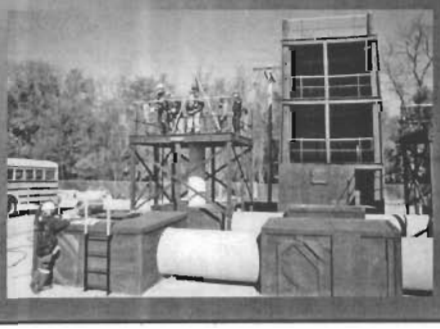
- Confined Spaces



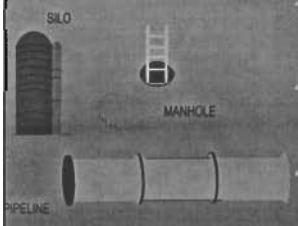
- Permit Required Confined Spaces

Statutes, Regulations and Standards

Cal/OSHA



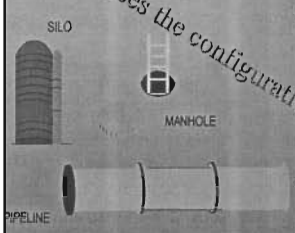
Confined Spaces



- Large enough to bodily enter; and
- Limited or restricted entry/exit; and
- Not designed for continuous occupancy

Confined Spaces

Addresses the configuration of the space ONLY!



- Large enough to bodily enter; and
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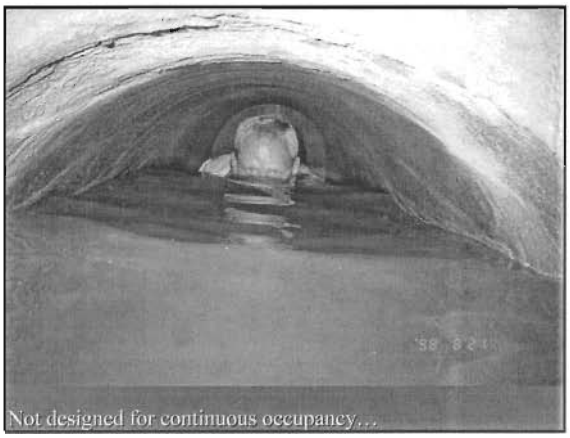
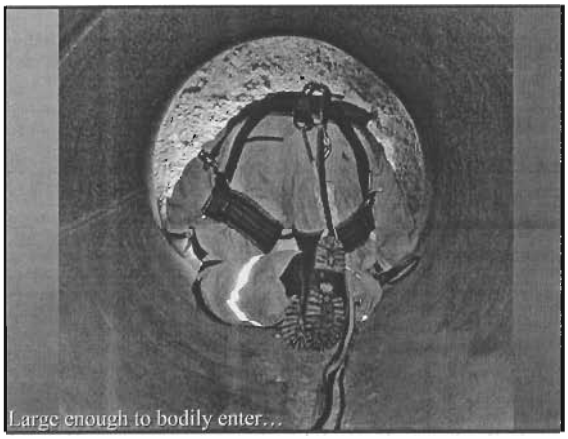


Not designed for continuous occupancy…



Large enough to bodily enter…

Potential Locations for Confined Spaces

Industrial, Commercial, Institutional Facilities

Agriculture

Marine

Public Service

Limited or restricted entry/exit…

Permit Required Confined Space

(A Confined Space that has one or more of the following:)

- Contains potential *hazardous atmosphere*
- Contains potential *engulfing material*
- Internal configuration that could trap or asphyxiate by *inwardly converging walls*, or a *floor that slopes and tapers* to a smaller cross section; or
- Contains any other recognized serious *safety/health hazard*

Permit Required Confined Space

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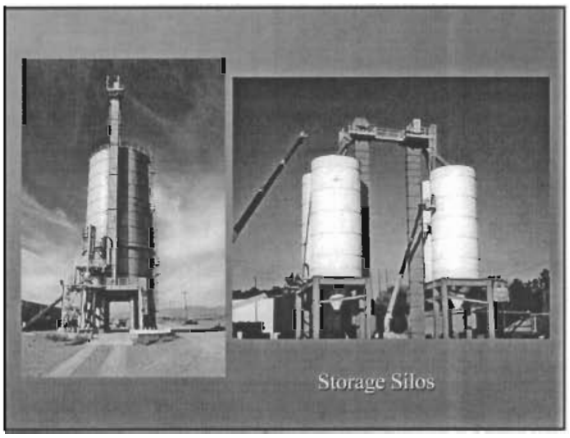
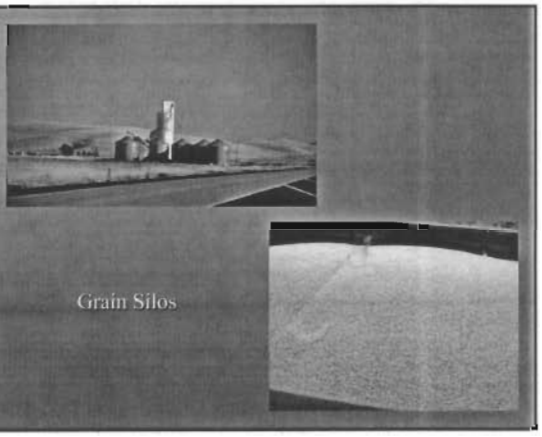
PERMIT REQUIRED = A HAZARD PRESENT !



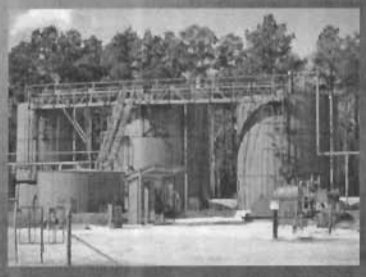
Storage Silos

Typical Permit Required Confined Spaces

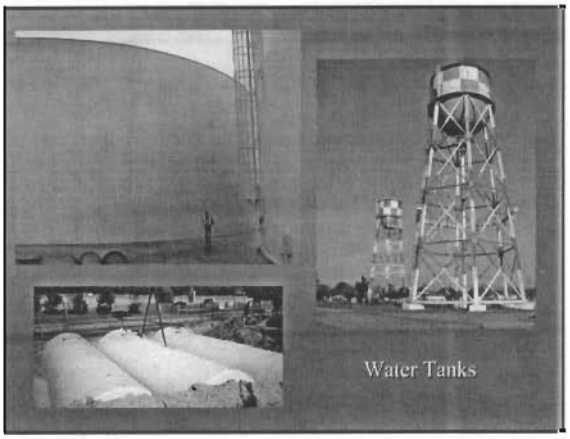
Degreasers	Pump Wet Wells	Boilers
Water Towers	Rail Tank Cars	Vessels
Man Holes	Grain Elevators	Tunnels
Mixers	Under Ground Vaults	Sewers
Open Topped Water Tanks	Enclosures w/ Bottom Access	



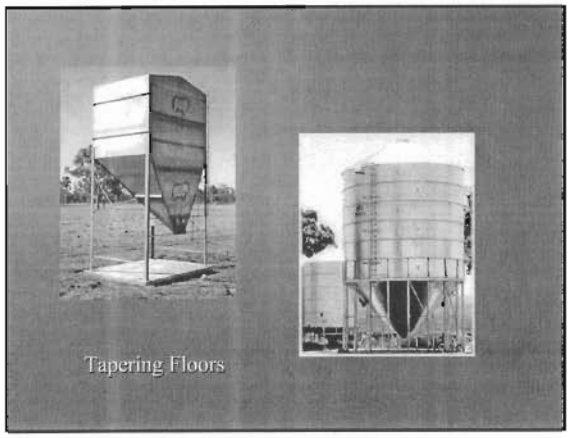
Grain Silos

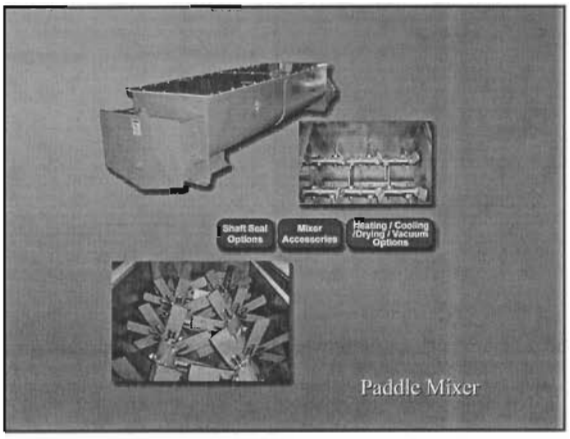


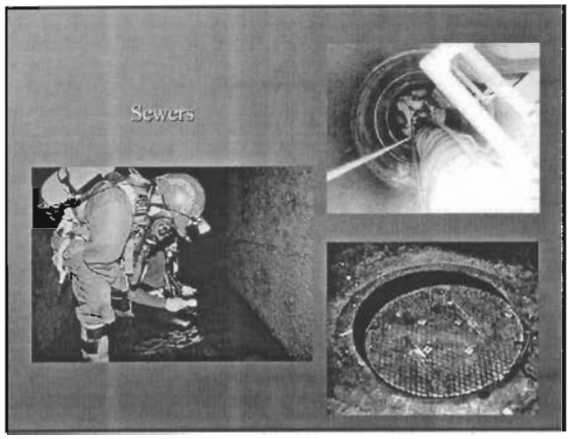
Storage Tanks

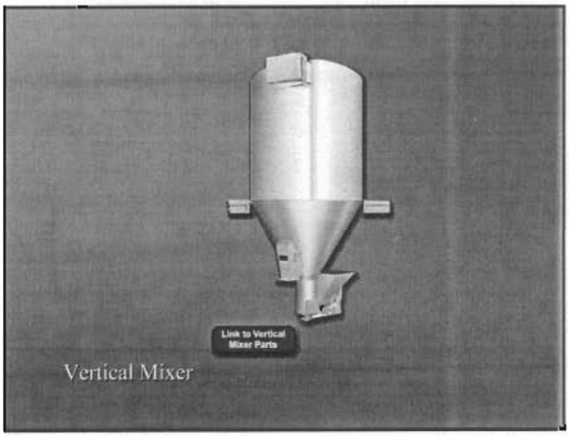


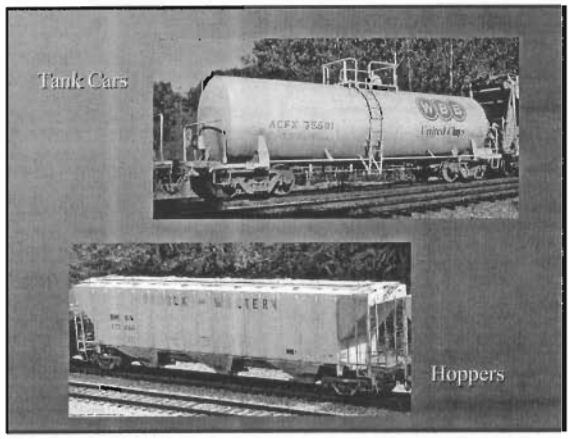
Water Tanks

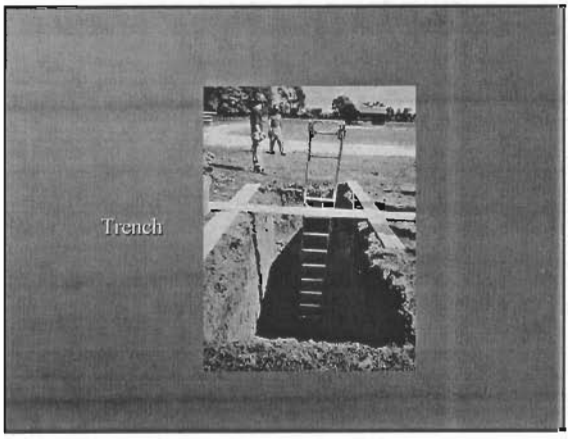

Tapering Floors


Shaft Seal Options
Mixer Accessories
Heating / Cooling /Drying / Vacuum Options
Paddle Mixer


Sewers


Link to Vertical Mixer Parts
Vertical Mixer


Tank Cars
Hoppers


Trench

Collapse

Ship Hull

Open Pit over a Sewer

DANGER !!!!!

ALWAYS PROCEED WITH CAUTION !!!

Empty swimming pool

Below grade loading dock

Large container with no bottom

Underground parking garage

Road Tanker

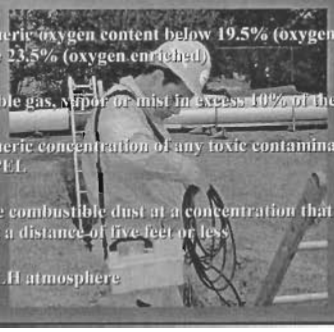
DANGERS OF CONFINED SPACES

- Oxygen Deficient
- By-Products of Previously Stored Material
  - residue
  - absorbed into tank walls
- Accidental Leaks or Spills
  - vapor release
  - slip, trip or fall hazard

DANGERS OF CONFINED SPACES

- Chemical Reactions
  - accidental mixing
  - drying paint
  - multiple use tanks
- Oxidation
  - rusting of metals
  - rotting or decomposing organic materials

Atmospheric Hazards



1. Atmospheric oxygen content below 19.5% (oxygen deficiency), or above 23.5% (oxygen enriched)
2. Flammable gas, vapor or mist in excess 10% of the LEL
3. Atmospheric concentration of any toxic contaminant above the OSHA PEL
4. Airborne combustible dust at a concentration that obscures vision at a distance of five feet or less
5. Any IDLH atmosphere

DANGERS OF CONFINED SPACES

- Mechanical Operations
  - welding, painting, cleaning
  - scraping or sandblasting
  - mixing/stirring operations
  - recharging of batteries
- Inerting Activities
  - carbon dioxide (CO_2)
  - helium (HE)
  - nitrogen (N)

Atmospheric Hazards

- Oxygen Deficient < 19.5 percent
  - consumption- which can be caused by:
    - combustion - welding or cutting torches
    - decomposition of organic matter - rotting foods or plant life
    - oxidation of metals - rusting
  - absorption- which can be caused by:
    - vessel itself or the product stored in the vessel
  - displacement- which can be caused by:
    - intentional purging with inert gases (CO_2, HE, N_2, steam) to remove residual chemicals, gases or vapors
    - unintentional purging with inert gases that do not support life, i.e..... engine exhaust

TYPES OF CONFINED SPACE HAZARDS

- Atmospheric Hazards
  - suffocation
  - asphyxiation
  - poisoning
- Physical Hazards
  - explosion/fire
  - entrap/crush/maim
  - electrocution
- Psychological Hazards
  - anxiety
  - phobia
  - panic

Atmospheric Hazards

- Oxygen Enriched > 23.5 percent
  - flammable
- Flammable
  - oxygen in the air and a flammable gas, vapor or dust in the proper mixture
  - be aware of the LEL
- Toxic
  - most "confined" substances should be considered hazardous
  - product stored, absorbed into walls, while cleaning, decomposing material, improper isolation procedures
  - absorption, ingestion, inhalation, injection

Atmospheric Hazards

Common Gases
- Carbon Monoxide
- Hydrogen Sulfide
- Sulfur Dioxide
- Ammonia
- Methane
- Carbon Dioxide
- Oxygen

✓ *Atmospheric hazards reduced below "flammable levels" may still be toxic !!!*

Physical Hazards

- Engulfment
  - means "surrounding and capture by a liquid or finely divided (flowable) solid substance"
  - materials
    - * grains * sand * gravel * cement
    - * clay * sawdust * coal * flour
  - containers
    - * storage bins * hoppers * silos * bottom dump

Atmospheric Hazards

Common Combustible Gases found in Confined Spaces

Carbon Monoxide
- colorless & odorless
- nearly equal to air in vapor density

Methane
- colorless & odorless
- lighter than air

Hydrogen Sulfide
- smells like rotten eggs
- heavier than air

Physical Hazards

- Engulfment
  - #2 cause of death
  - watch for "bridging"
  - block respiratory system or compress the upper body
    - * death occurs due to mechanical asphyxiation (suffocation)
  - 1980's Study: 227 deaths due to mechanical asphyxiation

Physical Hazards

- Engulfment
- Mechanical
- Temperature Extremes
- Biological
- Released Energy or Materials
- Corrosive
- Noise
- Radiation
- Slick/Wet Surfaces
- Falling Objects

Physical Hazards

- Mechanical
  - means "of or relating to machinery or tools"
  - equipment
    - * grinding * agitators * mulching * drive shafts
    - * gears * mixers * rams * presses
  - powered by
    - * gas/diesel * pneumatic * hydraulic * electric
    - * steam * heat (fire) * gravity

Physical Hazards

- Temperature Extremes
  - ambient air and surface temperatures
  - hampers rescuer efficiency and safety
  - medical monitoring and fluid replacement
- Biological
  - molds, mildews and spores
  - bacteria and viruses
  - insect and animal bites
  - bird, bat and animal feces

Psychological Hazards

- Claustrophobia
- Phobia
- Panic
- Anxiety
- Fatigue

Physical Hazards

- Released Energy or Materials
  - product
    - * electricity * steam * compressed gases
    - * liquids * hydraulic fluids and flowable solids
  - causes
    - * start-up of machinery in the space
    - * start-up of machinery outside the space
    - * opening of valves
    - * stored or residual kinetic energy
- Corrosive
  - by direct contact or contact with emitted fumes

Psychological Hazards

- Claustrophobia
  - is "an abnormal fear of a closed or confined space"
  - signs
    - * elevated pulse * increased respiration's
    - * sweating * clammy, cold palms
  - symptoms
    - * feeling of no air * feeling the walls are coming in
    - * feeling you are lost
- Phobia
  - is "a fear not proportional to its actual seriousness"
  - fear or anxiety of real hazards is not a phobia

Physical Hazards

- Noise
- Radiation
- Slick/Wet Surfaces
- Falling Objects

Psychological Hazards

- Panic
  - "sudden terror/unreasoning, infectious and uncontrollable fear"
  - symptoms
    - * accelerated anxiety
    - * difficulty breathing
    - * stress
- Anxiety
  - is "distress or uncasiness of the mind or a reaction when you feel danger
- Fatigue

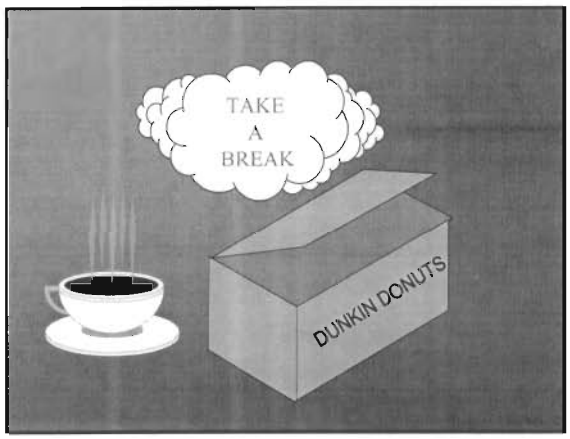
Psychological Hazards

- Causes (helps to control)
  - biological
    - * being physically fit reduces sodium lactate - anxiety attack chemical
  - psychological
    - * subconscious forces
    - * personality disorders, abnormal behaviors
- Control Techniques
  - recognition
  - training
  - psychological control techniques

ATMOSPHERIC MONITORING

- Four Categories of Monitoring

1. General Site Monitoring
2. Perimeter Monitoring
3. Confined Space Monitoring
4. Personal Monitoring



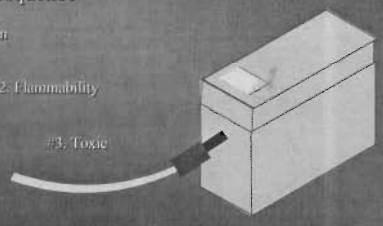
ATMOSPHERIC MONITORING

- Testing Sequence

#1. Oxygen

#2. Flammability

#3. Toxic



ATMOSPHERIC MONITORING

✓ WHY IS IT IMPORTANT ?
- Atmospheric conditions are leading cause of death in c.s.

✓ WHAT DO MONITOR READINGS TELL US ?
- Type, level of hazard

✓ HOW DO WE USE THE INFORMATION ?
- Selecting PPE, decon procedures, and delineates safe areas

ATMOSPHERIC MONITORING

- Monitoring
  - prior to lifting hatches
    - * most accurate reading
    - * eliminates potential hazard of explosion
  - accuracy of monitor readings assured by regular calibration
  - stratification
    - * wind currents
    - * temperature
    - * variation in vapor density
    - * test all levels

ATMOSPHERIC MONITORING

- Monitoring
  - continuously throughout incident
  - documentation
    - * name, location and reading
    - * if it was not documented, it didn't happen!
  - identify sources and control
  - OSHA regulation *"Testing Stratified Atmospheres"*
    - * 4 feet in direction of travel, and each side

ENTRY PERMITS

- Prior to entry
  - approve the permit
- Upon completion of entry
  - must be signed and canceled by the entry supervisor
  - must be filed and retained for at least one (1) year

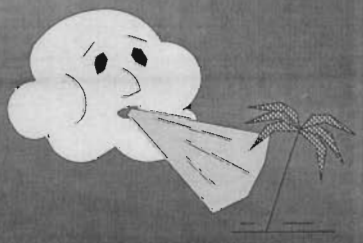
✓ *Entry permit is an excellent resource for first responders !!!*

ENTRY PERMITS

A FORM OR TACTICAL WORKSHEET REQUIRED BY CAL/OSHA THAT MUST BE COMPLETED FOR CONFINED SPACE ENTRIES

- Components
  - location of the C.S.
  - purpose of the entry
  - date of entry and duration
  - list of authorized entrants
  - list of attendants
  - entry supervisors name/sign.
  - acceptable entry conditions
  - necessary tools/equipment
  - special hazards
  - space isolation to be used
  - rescue/emergency services
  - communication procedures
  - results of atmospheric tests
  - additional permits (hot work)

VENTILATION



ENTRY PERMITS

- The Permit verifies completion of the items listed
- Shall be kept at the jobsite for the duration of the job
- Circumstances cause interruption in the work or conditions for which entry was approved, the permit shall be canceled and a new entry permit must be completed

VENTILATION

✓ *MOST EFFECTIVE MEANS OF CONTROLLING ATMOSPHERIC HAZARDS*

- Properly achieved:
  - replaces contaminated air with clean air
  - decreases chance of explosion by keeping the atmosphere below the LEL within the space
  - reduces/eliminates the toxicity within the space
  - increases chance of survivability of any victims
  - creates a more tenable environment (cooling)

VENTILATION

- Considerations
  - type of atmosphere
  - volume of air to move
  - access to the space
  - wind direction
  - location of openings
    - * vertical (top)
    - * horizontal (side)
    - * bottom
  - vapor density of suspected vapor
  - configuration of the space
  - number of openings
  - location of fresh air

VENTILATION

ATMOSPHERIC CONDITION		VENTILATION
oxygen deficient	dispersed in atmosph.	general supply-ppv
flamm. atmosph.	dispersed in atmosph.	general exhaust
flamm. atmosph.	single point of origin	local exhaust
toxic atmosph	dispersed in atmosph	general exhaust
toxic atmosph	single point of origin	local exhaust
hot work	single point of origin	local exhaust
grinding ops.	single point of origin	local exhaust

VENTILATION

✓ Prior to entry and continue throughout the operation

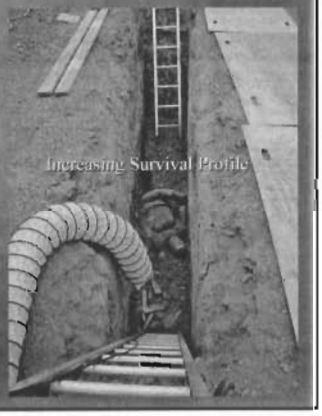
- Two Types

Natural

Mechanical

- Natural
  - * slow process
  - * not useful in rescue situations

Saddle Vent



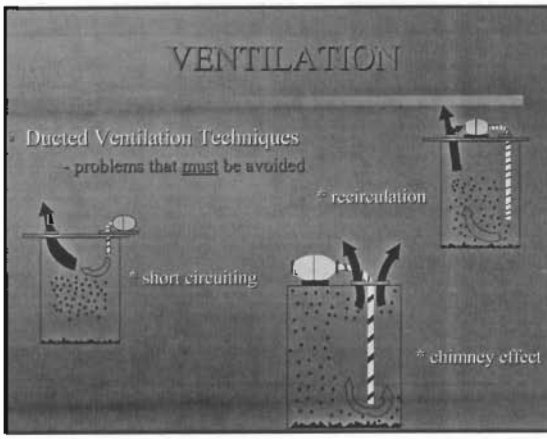
Increasing Survival Profile

VENTILATION

- Mechanical (forced)
  1. general supply/ppv
  2. general exhaust
  3. local exhaust
  4. Combination-supply and exhaust

VENTILATION

- Ducted Ventilation Techniques
  - problems that must be avoided
    - * recirculation
    - * short circuiting
    - * chimney effect



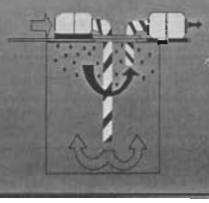
VENTILATION

- Ducted Ventilation Techniques *(cont.)*
  - specific procedures (*oxygen deficient*)

* openings at either end of a long space

VENTILATION

- Ducted Ventilation Techniques *(cont.)*
  - specific procedures (*flammable or toxic contaminants*)



* lighter than air

VENTILATION

- Ducted Ventilation Techniques *(cont.)*
  - specific procedures (*oxygen deficient*)

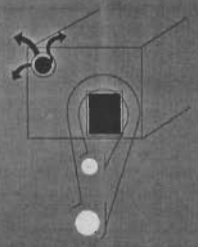
* deep confined spaces

* spaces with only one opening

VENTILATION

- Non-Ducted Ventilation Techniques
  - specific procedures

* spaces with one opening



* spaces with two openings

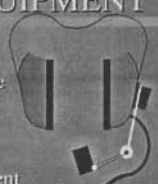
VENTILATION

- Ducted Ventilation Techniques *(cont.)*
  - specific procedures (*flammable or toxic contaminants*)

* heavier than air contaminant

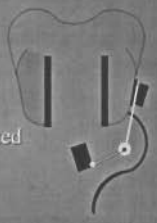
* long spaces with one opening at the end

COMMUNICATIONS EQUIPMENT



- Types
  - battery operated portable
  - hardwire systems
  - hand signals
  - rope signals
  - tapping/rapping codes
- Cal/OSHA Requirement
  - under normal operations must be maintained
  - continuos powered equipment required when
    - * dangerous/deficient conditions exist
    - * unsafe atmosphere may be expected to develop
    - * no quick exit from fire suppression protected area
    - * emergency rescue conditions

COMMUNICATIONS EQUIPMENT



- Communication Plan
  - back-up plans
  - type of communications
  - summoning rescue services
- Battery Operated/Voice Activated
  - freedom of movement
  - require no use of hands
- Hardwire Communications
  - clear
  - not effected by poor reception
  - cumbersome due to tag lines

RESPIRATORY EQUIPMENT and PPE

RESPIRATORY PROTECTION

- Air-Purifying Respirator
- Supplied Air Respirator
  w/ escape cylinder
- SCBA
- Combo-Type Dual-Purpose SCBA

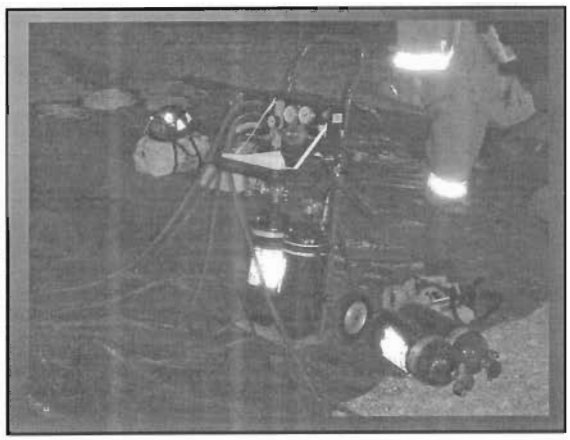
APR

RESPIRATORY EQUIPMENT and PPE

RESPIRATORY PROTECTION

- Requirements under CFR 29 1910.134
  - existence of dangerous or deficient conditions and additional ventilation cannot reduce concentrations to safe levels
  - atmosphere tests safe but unsafe conditions can be reasonably expected to develop
  - cannot readily exit from spaces equipped with auto. fire suppression systems and not practical to deactivate such
  - an emergency exists and it is not feasible to wait for pre-entry procedures to take effect

SAR



SPACE ISOLATION

- Procedures to Isolate Any Potential Energy Source to the Space

- electricity	- hydraulic	- steam
- drive mechanisms	- pneumatic	- gravity flow
- pressure	- momentum	- stored energy

- OSHA Definition
  - "Hazardous Energy Control"

"a program of an energy control procedure and employee training to ensure that before any person performs any service or maintenance on a machine or equipment they shall be isolated and rendered inoperable"

RESPIRATORY EQUIPMENT and PPE

PERSONAL PROTECTIVE EQUIPMENT

- Head Protection
  - firefighter helmet
  - hard hat
- Eye and Face Protection
  - safety glasses or goggles
  - SCBA face piece
- Foot Protection
  - firefighting boots
  - safety work boots/shoes
- Hearing and Elbow and Knee Protection

SPACE ISOLATION

- OSHA 6 Step Procedure
  - prepare for shutdown
  - shutdown the equipment
  - isolate the equipment
  - apply lockout/tagout or block/bleed devices
  - control stored energy
  - verify equipment isolation

/ Must be performed by an authorized employee

RESPIRATORY EQUIPMENT and PPE

PERSONAL PROTECTIVE EQUIPMENT

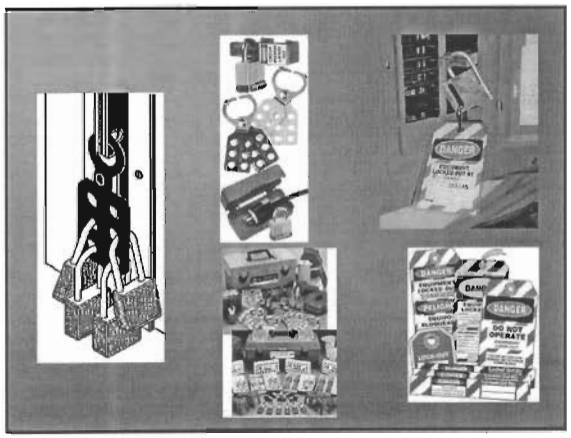
- Hand Protection
  - leather firefighting gloves
  - leather rappel gloves
  - latex gloves
- Body Protection
  - plain clothes
  - coveralls
  - chemical protective clothing

/ Situation, hazards, and atmospheric conditions dictate degree of protection !!!

SPACE ISOLATION

METHODS OF SPACE ISOLATION

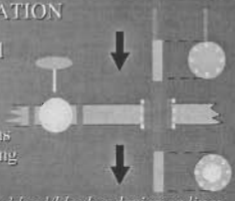
- Lockout / Tagout
  - prevents valves or switches from being opened
    - * chains
    - * ball valve lockouts
    - * valve covers
    - * warning tags
    - * lockout hasps
    - * plugs
    - * circuit breaker lockouts
  - Printed tags as well as locks warn employees of isolated energy sources



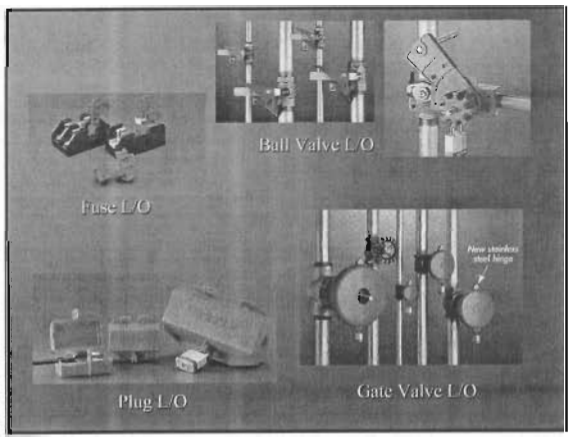
SPACE ISOLATION

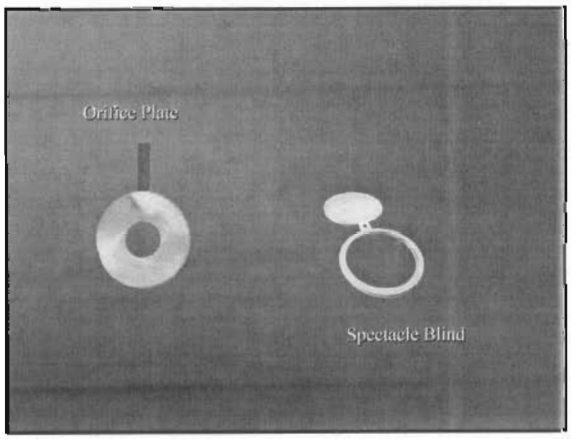
METHODS OF SPACE ISOLATION

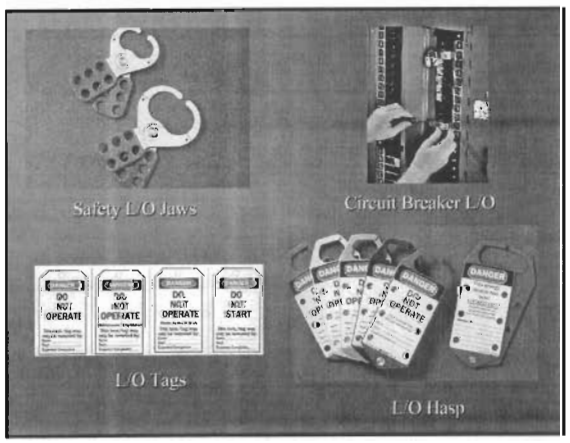
- Block/Bleed or Blank/Blind
  - piping that carries liquids, flowable solids, or gasses
    - * blind flanges
    - * removal of sections of pipe and bleeding



** Not possible to lockout/tagout or bleed/block a device or line: ✓ station a firefighter with a radio at the switches and/or valves !!!*

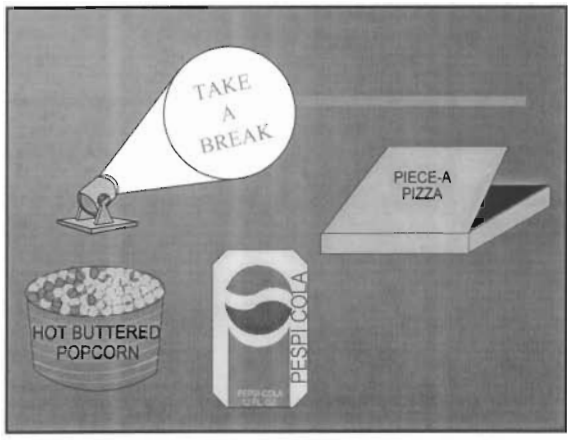


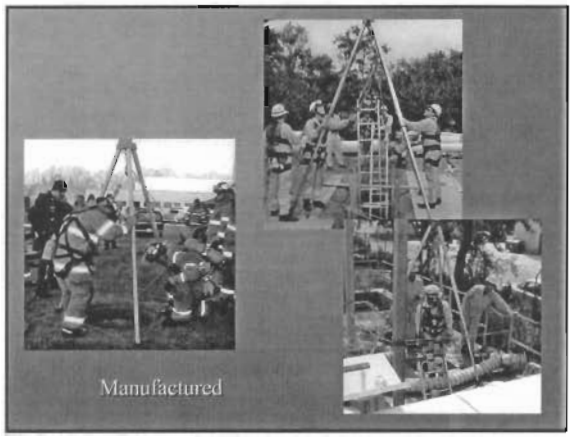




SPACE ISOLATION

- Off-Site Rescue Team Space Isolation Considerations
  - acquire knowledgeable plant personnel
  - back-up or redundant systems override one system and bring another on line
  - be aware of stored or residual energy still present in a locked out-system





RETRIEVAL EQUIPMENT

- OSHA Requirements
  - retrieval line and full restraint when vertical entry of 5 feet or more below grade is made
  - retrieval lines must be attached to a mechanical device (mechanical advantage) outside the space
  - entrants must stay "on line", unless it increases risk of injury or is impossible
    - * staying "on line" allows for non-entry rescue
    - * the increase risk is why we remove the safety line in trench rescue

RETRIEVAL EQUIPMENT

- Anchoring Devices
  - tripod
    - * manufactured
    - * fabricated (ladder 'A' frame)
  - ladder systems (jib, cantilever, etc.)
  - ladder gin
  - truck mounted systems
  - beam trolley

RETRIEVAL EQUIPMENT

- Anchoring Devices *(cont.)*
  - hand cranked mechanical winches and cables
  - rope and pulley systems

  ✓ *When lifting entrants, powered equipment is never used because resistance cannot be felt !!!*
- Fall Restraint Systems
  - inertia or centrifugal systems
    - * maximum 2 feet drop allowed
  - rope systems
    - * tandem prussiks

RETRIEVAL EQUIPMENT

- Entrant/Victim Harness
  - class 1
    - * waist only
  - class 2
    - * waist and thighs (or under buttocks)
  - class 3
    - * waist, thighs (or buttocks) shoulders



PRCS OPERATIONAL POSITIONS / FUNCTIONS

- Duties of Attendant
  - hazard knowledge to be faced
  - exposure consequences and behavioral effects
  - monitors entry personnel
  - positioned at entrance
  - maintains comm.
  - monitors activities inside and outside space
  - orders evacuation when conditions warrant
  - initiates rescue services
  - *secures safe perimeter*
  - performs no duties that interfere w/ primary duty to protect the entrant
  - performs non-entry rescues

RETRIEVAL EQUIPMENT

- Entrant/Victim Harness
  - wristlets
  - upper immobilization devices
    - * LSP Halfback
    - * Oregon Spine Splint

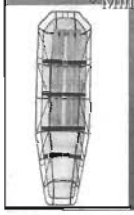


PRCS OPERATIONAL POSITIONS / FUNCTIONS

- Duties of Authorized Entrants
  - hazard knowledge to be faced
  - proper equipment use for safe entry
  - communicates with attendant as necessary for attendant to monitor entrants status
  - alerts attendant if situation warrants
  - exits the space immediately if situation warrants

RETRIEVAL EQUIPMENT

- Entrant/Victim Harness
  - full body immobilization
    - * stokes litter
    - * SKED
    - * Miller Board



PRCS OPERATIONAL POSITIONS / FUNCTIONS

- Duties of Entry Supervisor
  - knowledge of the hazards to be faced
  - verifies entry permit completed, tests conducted, needed equipment present before signing permit and approving entry
  - *confirms entry operations remain constant with the entry permit, and acceptable entry conditions are maintained*
  - *removes unauthorized persons* from the site
  - terminates the entry, cancels the permit

FIRST RESPONDER ACTIONS

ARRIVAL PHASE

- Scene Size-up - Quickly determine if the victim becomes a PRCS
  - hazard assessment upon approach
  - number trapped/injured
  - personnel unaccounted for
  - type of space
  - space purpose/currently being used?
  - is this a product storage area?
    - * storage hazards * residue hazard
    - * engulfment potential * other potential hazards
    - * viscous/heated/cryogenic

FIRST RESPONDER ACTIONS

RESCUE

- Rescue Entry by First Responders when...
  - completed risk assessment
    - * viable, salvageable victim(s)
    - * risk to rescuers minimized to acceptable level
    - * performed in a timely manner
  - *positive identification* of the atmosphere
    - * a monitored environment
  - AND no additional hazards

FIRST RESPONDER ACTIONS

ARRIVAL PHASE

- Establish Command
- Take Control of the Scene
  - * request police assistance
  - * remove unnecessary by-standers
  - * establish control lines
  - * hazard abatement

FIRST RESPONDER ACTIONS

RESCUE /RECOVERY

- Call for Resources
  - Technical Rescue Team / Hazmat
- Appoint Site Safety
  - monitor area for developing hazards

- Monitor Victim(s)
  - communicate and reassure

- Information
  - continue to gather

FIRST RESPONDER ACTIONS

ON-SCENE PHASE

- Energy Source to the Space
  - electrical, mechanical, stored energy, etc...
- Entry and Exit Points
  - multiple entry points
  - above/below grade
  - other access points

- Space Isolation
- Rescue/Recovery Mode