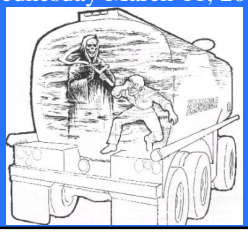
CONFINED SPACE SAFETY

OREGON GOVERNOR'S

SAFETY & HEALTH CONFERENCE

AL PARIS CIH

Wednesday March 11, 2009



AGENDA

- My Background
- Define Confined Space
- Why The Concern?
- Case Studies
- Type of Hazards
- An Approach To Managing Safety
- Confined Space Rules
- Program Implementation
- Program Enhancements
- Summary & Questions

AL PARIS

- Summary
  - M.S. Occupational Health
  - Board Certified in Industrial Hygiene
  - 28 Years of Safety & Health Experience
    - Government
    - Insurance / Consulting
    - Manufacturing
      - Program Development
      - Program Management
      - Employee Education

AL PARIS

- Boeing (Portland Site)
  - 1,000 to 2,000 Employees
  - More Than 500 Confined Spaces
  - 100 – 200 Confined Space Permits / Year
  - Program in Place More than Fifteen Years

WHAT IS A CONFINED SPACE

- OSHA'S DEFINITION
  - A Space That:
    - Is Large Enough To Enter
    - Has Limited or Restricted Means For Entry
    - Is Not Designed For Continuous Occupancy

DEFINITION

- Large Enough To Enter
- Limited or Restricted Means For Entry More Difficult Than
  - Walking Up A Flight of Stairs
  - Walking Through a Doorway
- Not Designed For Continuous Occupancy (Building codes)

EXAMPLES

- TANKS
- VESSELS
- REACTOR VESSELS
- RAIL TANK CARS
- GRAIN SILOS
- UTILITY MAN HOLES

EXAMPLES

- PITS
- TRENCHES
- TUNNELS
- VATS
- WELLS
- DEGREASERS
- BOILERS

WHY THE CONCERN ?

- Fatalities
- Injuries
- Rescue For Circumstances Not Related To The Confined Space
- Property Damage

WHY THE CONCERN ?

- FATALITIES
- Injuries
- Rescue For Circumstances Not Related To The Confined Space
- Property Damage

FATALITIES

- 1980'S National Data
  - –Average: 67 Deaths Per Year
  - –Range 47 TO 88

FATALITIES

- Annual Occupational Fatality Data
  - 6,000 to 6,600 Worker Fatalities / Year
    - 21% Highway Vehicle (Collision, Rollover, Jack-knife)
    - 16% Homicides (Tending Retail)
    - 10% Falls
    - 6% Electrocutions
    -
    -
    - 1% Confined Space Incidents

FATALITIES

- 1980's Data
  - 670 Victims
  - 585 Incidents
  - 12% Of The Incidents Involved Multiple Fatalities
    - 61 Incidents With 2 Fatalities
    - 9 Incidents With 3 Fatalities
    - 2 Incidents With 4 Fatalities

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FATALITIES

- 1980's — 67 FATALITIES / YEAR
- 1993 — CONFINED SPACE RULE
- 1994 – 2000 — 20 FATALITIES / YEAR 70 % IMPROVEMENT

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FATALITIES

- 1980'S Data

Industry	Fatality Rate Per 100,000 Workers
Mining / Oil / Gas	0.69
Agriculture	0.33
Construction	0.22
Transportation / Utilities	0.16
Manufacturing	0.08

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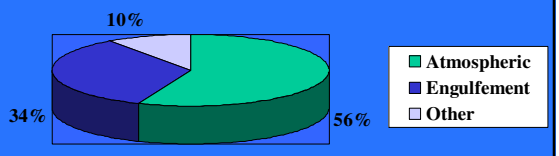
FATALITIES



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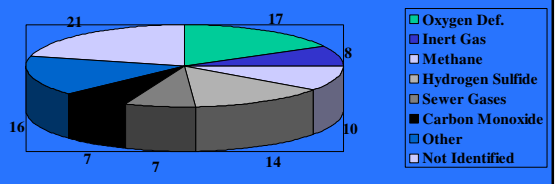
FATALATIES

ATMOSPHERIC



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Why the Concern ??

- Fatalities
- Injuries
- Circumstances Not Related to Confined Space
- Property Damage

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Why the Concern ??

Injuries

- 100's per year
- Injury Management in Confined Spaces Difficult

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Why the Concern ??

- Example: Ankle Injury

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Why the Concern ??

- Fatalities
- Injuries
- **Circumstances Not Related to Confined Space**
- Property Damage

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Why the Concern ??

Circumstances Not Related to The Confined Space

- Example: Heart Attack

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Why the Concern ??

- Fatalities
- Injuries
- Circumstances Not Related to Confined Space
- **Property Damage**

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CASE STUDIES

- Setting: Large Steel Evaporator Tank
- Sequence of Events:
  - Day One
    - Shut Down, Emptied, Washed
    - Atmosphere Tested: O. K. Work Initiated
  - Day Two
    - Tank Entered Without Testing
    - One Fatality, One Injury During Rescue

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CASE STUDIES

- Cause:
  - Oxygen Deficient Atmosphere
  - Rust Process
  - Situation Re-enacted
  - 24-Hour Period Oxygen Content
    20.9% to 1%
- Lesson: Things Change Over Time

CASE STUDIES

- A Small Vapor De-greaser (5' x 2.5' x 6' Deep)
- Sequence of Events:
  - Cleaning Using Perchloroethylene & Towel
  - Employee Used Respirator In Morning
  - Employee Did Not Use Respirator in Afternoon
  - One Fatality (Employee Rolled Out of De-greaser When Swing Shift Started)

CASE STUDIES

- De-Greaser Fatality
- Lessons:
  - Small vs. Large
  - "Heavier-than-Air"

CASE STUDIES

- Testing Case
- Setting:
  - Blocked Sewer
  - Loose Gravel Blockage with Back-up Water
  - Two Employees Assigned to Assess & Fix

CASE STUDIES

Sewer Incident (Continued)

- Sequence of Events
  - Employee #1 Stated, "I'll Test the Air" (with nose)
  - Climbed Down Man-hole Opening to "Check"
  - Employee #1 Collapses at bottom of ladder
  - Employee #2 Begins to Panic at Top of Opening as a Local County Employee is driving by
  - County Employee Recognizes Potential Hazard(s)

CASE STUDIES

Sewer Incident (continued)

- Employee #2 Insists on Helping Partner
- County Employee Convinces #2 to Tie Rope
- #2 Enters Sewer Man-hole Opening
- #2 Collapses on Top of #1
- County Employee Attempts Retrieval. Fails.
- County Employee Uses Mechanical Power

CASE STUDIES

- Sewer Incident (Continued)
- Results:
  - One Fatality
  - One Injury (Rescue Employee)
- Cause:
  - Oxygen Deficiency
- Lessons
  - Testing
  - Rescue

CASE STUDIES

- Tank Incident
  - Setting: Round Tank. 5' tall x 6' diameter with a 22" diameter Man-way Opening
  - Sequence of Events
    - Two Workers Assigned to Paint Interior of Tank
    - One In Tank w/ Air-less Sprayer / Air Line Resp.
    - One Stationed as a "Watch"
    - 500 Watt, Non-explosion-proof Halogen Lamp
    - Painted Bottom & Sides. Started to Paint top
    - Paint Gun Struck Lamp. Explosion

CASE STUDIES

- Tank Incident
  - Results
    - One Fatality (40% of Body 1st & 2nd Degree Burns) Died 5 Days after Incident
    - One Injury. "Watch" 1st & 2nd Degree Burns 12% of Body (face and neck)
  - Lessons
    - Explosive Atmospheres are More Easily Created in Confined Spaces

CASE STUDIES

- Setting:
  - 4 Foot Diameter Sewer Manhole. 15' Deep
  - Manhole not opened for 6 months
- Sequence of Events
  - Victim enters manhole alone, no attendant
  - Co-worker observers victim lying at bottom
  - Co-worker telephoned for help – Does Not Enter
  - 4 Firefighters arrive. One enters w/ no P.P.E.
    - Firefighter Dizzy, Rescued.
  - One Fatality

CASE STUDIES

- Manhole Incident
  - Manhole atmosphere by Depth

Depth	Oxygen Content Normal = 20.9%
5'	20.5 %
9'	14.0 %
11'	6.5 %
13'	4.0 %

CASE STUDIES

- Manhole Incident
  - Lesson
    - Atmosphere Hazards May Change Based upon Location

CASE STUDIES

- Engulfment
  - Sawdust Hopper. Sawdust accumulates on sides of Bin.
  - Pipe used to knock down the sawdust
  - Sometimes workers enter bin
  - Victim enters bin alone
  - Sawdust Surface Below "Gives Way"
  - Victim Buried Alive

CASE STUDIES

- Observations
  - Need to Test Air
  - Things Change Need to Test Periodically
  - Small Confined Spaces
    - Hazardous Atmosphere Easier to Create
  - Test Entire Area to Be Occupied

CASE STUDIES

- Observations
  - Rescue Operations Are Hazardous / Difficult
  - Many Spaces Entered In Past w/ No Trouble
  - Two Ways to Get Into Trouble (Atmosphere)
    - Hazardous Atmosphere Already There
    - Process Creates a Hazardous Atmosphere

Confined Space Hazards

- Atmospheric (Toxic / Oxygen Deficient)
- Engulfment
- Fire & Explosion
- Mechanical Hazards
- Electrical Hazards
- Gas or Liquid Line Hazards

Preventing Incidents

- Regulations as a Foundation or Minimum
- OSHA Rule for Confined Spaces 1910.146

OSHA Confined Space Rule

- Background: OSHA's Confined Space Rule
  - 1969 Nixon Signs OSH Act
  - 1970 OSHA Established
  - 1975 Advanced Notice for Proposed Rulemaking (ANPR) Confined Space Rule
  - 1979 Another ANPR
  - 1980 Public Meetings
  - 1989 Notice of Proposed rulemaking
  - 1993 Confined Space Regulation

OSHA Confined Space Rule

- Scope 1910.146
  - Covers General Industry
  - Does not cover:
    - Construction (Some Confined Space Rules)
    - Agriculture (Confined Space)
    - Maritime

OSHA Confined Space Rule

- 1st Survey the Site

OSHA Confined Space Rule

- Find a Place that Meets the Definition
  (Now the Hard Part)

  Decide What Kind of Confined Space

OSHA Confined Space Rule

- By OSHA
  - 3 Options
    - Permit Required Confined Space
    - Non-Permit Required Confined Space
    - Alternate Procedure Confined Space
  - Based Upon The Hazards (Existing / Potential)
  - Requirements for Entry Vary for Each Space

OSHA Confined Space Rule

- Beyond Compliance

The 1st Question to Ask is:

Can the Work Be Done From Outside the Space?

Relocate

Design & Purchasing

Tools, Etc.

OSHA Confined Space Rule

- Non-Permit Required Confined Space
  - Does the Space Have
    (or Have the Potential to Have)
    a Hazard?
    - Atmospheric ?
    - Engulfment ?
    - Configuration ?
    - Any Other Recognized Serious Hazard?

OSHA Confined Space Rule

- In Order to Answer…..Need to Know
  - What is in the Space
  - Shape of the Space
  - Why is it Entered
- Note: If entry into the space is required to answer these questions, it should be entered as a Permit Required Confined Space.

OSHA Confined Space Rule

- Non-Permit Required Space
  - If the Answer is, "NO Hazards"

  May be Designated a
  Non-Permit Required Confined Space

OSHA Confined Space Rule

- Requirements for a
  Non-Permit Required Confined Space

  –None

OSHA Confined Space Rule

- Non-Permit Spaces
  - Examples

OSHA Confined Space Rule

- Beyond Compliance
  May Want to Designate Non-Permit Required Spaces as Permit Required.

  Why?
  - Know Where Your People Are
  - Know What Work is Being Done
  - Safety Review

OSHA Confined Space Rule

- Permit Required Confined Space If It:
  - Contains a Hazardous Atmosphere, or
  - Potentially Contains a Hazardous Atmosphere
  - Poses a Potential for Engulfment
  - Could Entrap (Converging Walls)
  - Or Presents Any Other Serious Safety or Health Hazard (Mechanical, Electrical, Temperature)

OSHA Confined Space Rule

- Permit Required Confined Space
- Again……
  Need to Know
  1. What is in the Space
  2. The Shape of the Space
  3. What Work is Performed in the Space

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OSHA Confined Space Rule

- Permit Required Confined Space
  - Again.
    Can The Work Be Done Outside of the Space ?

    Note: OSHA Defines Entry as "breaking the plane of the space with any part of the body"

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OSHA Confined Space Rule

- Permit Required Confined Space Requirements (10)
  - Inform Employees
  - Develop & Implement a Written Program
  - Acquire Equipment
  - Develop Permit Documents
  - Provide Training
  - Identify and Evaluate Hazards Prior to Entry
  - Establish a Rescue Program
  - Establish Contractor Program
  - Establish an Audit Program
  - Involve Employees

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OSHA Confined Space Rule

Keep Out Option

- If Employer Decides Employees Will Not Enter:
  - Post Warning Signs
  - "Take Effective Measures to Prevent Entry"
  - Consider Impact of Changes in Use or Configuration
  - Establish a Contractor Plan (If Contractors Enter)

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OSHA Confined Space Rule

- Permit Required Confined Space
  - Have Them
  - Need to Enter
- Practical Information
  - 1st Task. Assign Responsibility for Confined Spaces Program to An Individual

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OSHA Confined Space Rule

- Permit Required Confined Space Requirements
  - Inform Employees
  - Develop & Implement a Written Program
  - Acquire Equipment
  - Develop Permit Documents
  - Provide Training
  - Identify and Evaluate Hazards Prior to Entry
  - Establish a Rescue Program
  - Establish Contractor Program
  - Establish an Audit Program
  - Involve Employees

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OSHA Confined Space Rule

- Permit Required Confined Space Requirements
  - Notify Employees
    - By Posting Danger Signs
    - Or By Any Other Equally Effective Means

OSHA Confined Space Rule

- Practical Information
  - Notify All Employees
    - Educate Everyone to a "Confined Space Awareness Level"
  - Educate Employees Who Hire Contractors - Contractor Obligations
    - Engineers
    - Maintenance
    - Purchasing

OSHA Confined Space Rule

- Permit Required Confined Space Requirements
  - Inform Employees
  - Develop & Implement a Written Program
  - Acquire Equipment
  - Develop Permit Documents
  - Provide Training
  - Identify and Evaluate Hazards Prior to Entry
  - Establish a Rescue Program
  - Establish Contractor Program
  - Establish an Audit Program
  - Employee Involvement

OSHA Confined Space Rule

- Permit Required Confined Space Requirements
  - Develop & Implement a Written Plan
    - Written Program Elements (Not Specified In The Rule)
      - Scope, Purpose, Definitions
      - Space Classification
      - Permits
      - Safe Operating Procedures
      - Training
      - Responsibilities

OSHA Confined Space Rule

- Permit Required Confined Space Requirements
  - Develop & Implement a Written Plan
    - Written Program Elements
      - Air Monitoring
      - Hot Work
      - Emergency Response & Rescue
      - Inventory of Confined Spaces
      - Contractor Confined Space Entry
      - Program Review

OSHA Confined Space Rule

- 1st Task For Written Program
  - Inventory & Review Every Space
    - Determine Potential Hazards of Space Prior to Entry
    - Determine Purpose(s) for Entry
      - Inspection
      - Cleaning
      - Repairs
    - Establish an Entry Procedure For Each Space Based Upon Information

OSHA Confined Space Rule

- Permit Required Confined Space
  - Written Plan
    - Details Dictated by Information Obtained During the Inventory Review

OSHA Confined Space Rule

- Permit Required Confined Space Requirements
  - Inform Employees
  - Develop & Implement a Written Program
  - Acquire Equipment
  - Require the Use of Appropriate Equipment
  - Provide Training
  - Develop Permit Documents
  - Identify and Evaluate Hazards Prior to Entry
  - Establish a Rescue Program
  - Establish Contractor Program
  - Establish an Audit Program
  - Employee Involvement

OSHA Confined Space Rule

- Equipment
  - Various Pieces Dictated by Information Obtained During Inventory Review

OSHA Confined Space Rule

- Permit Required Confined Space Requirements
  - Provide Appropriate Equipment
    - Atmospheric Testing & Monitoring Equipment
    - Ventilation Equipment
    - Communication Equipment
    - Lighting (To Perform Work & to Exit in Emergencies)
    - Barriers & Shields (Protect Entrants From External Hazards)
    - Ladders, Etc. (For Safe Access / Egress)

OSHA Confined Space Rule

- Permit Required Confined Space Requirements
  - Provide Appropriate Equipment
    - Personal Protective Equipment (Head to Toe)
      - Hard Hats
      - Eye Protection
      - Gloves
      - Foot / Boots
      - Respirator
      - Hearing Protection
      - Chemical Suits

OSHA Confined Space Rule

- Permit Required Confined Space Requirements
  - Provide Appropriate Equipment
    - Retrieval System

      Retrieval Systems Are Required Unless:

      Retrieval Equipment Increases Overall Risk And Would Not Contribute To Rescue

OSHA Confined Space Rule

- Permit Required Confined Space Requirements
  - Personal Protective Equipment
    - Retrieval Equipment (Vertical Spaces > 5' Deep)

  - Chest or Full Body Harness
  - Retrieval Line Attached
  - Attached to Mechanical Device or Fixed Point Outside Space
  - Wristlets May Be Used (Harness Not Feasible)

OSHA Confined Space Rule

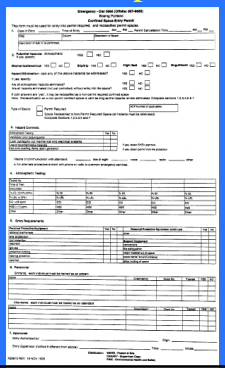
- Permit Required Confined Space Requirements
  - Provide Appropriate Equipment
    - Rescue Equipment
      - In House
      - Service Provider
    - "Any Other Equipment for Safe Entry"

OSHA Confined Space Rule

- Permit Required Confined Space Requirements
  - Inform Employees
  - Develop & Implement a Written Program
  - Acquire Equipment
  - Develop Permit Documents
  - Provide Training
  - Identify and Evaluate Hazards Prior to Entry
  - Establish a Rescue Program
  - Establish Contractor Program
  - Establish an Audit Program
  - Employee Involvement

OSHA Confined Space Rule

Permit
8.5 x 14



OSHA Confined Space Rule

Emergency - Dial 3666 (Offsite: 867-6666)
Boeing Portland
Confined Space Entry Permit

This form must be used for entry into permit required, and reclassified permit spaces.

1. Date of Entry _____ Time of Entry _____ AM ___ PM ___ Permit Cancelation Time _____ AM ___ PM ___

Bldg.	Column	Description of Space
Description of task to be performed.		

2. **Potential Hazards:** Atmospheric YES ☐ NO ☐ if yes, specify:

Mechanical/electrical YES ☐ NO ☐ **Slip/trip** YES ☐ NO ☐ **High Heat** YES ☐ NO ☐ **Engulfment** YES ☐ NO ☐

Hazard Elimination - can any of the above hazards be eliminated? YES ☐ NO ☐

If yes, specify:

Are all atmospheric hazards eliminated? YES ☐ NO ☐
Are all hazards eliminated (not just controlled) without entry into the space? YES ☐ NO ☐

If both answers are "yes", it may be reclassified as a non-permit required confined space
Note: Reclassification as a non-permit confined space is valid as long as the hazards remain eliminated. Complete sections 1,2,3,4,5 & 7

Type of Space: ☐ Permit Required ☐ Space Reclassified to Non Permit Required Space (all hazards must be eliminated) Complete Sections 1,2,3,4,5 and 7

SOP Number (if applicable)

OSHA Confined Space Rule

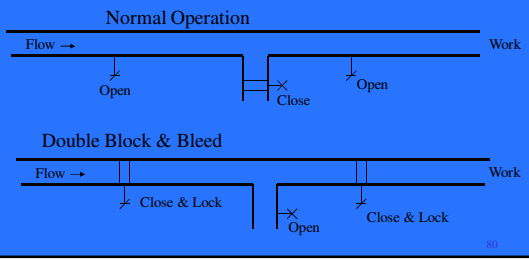
- Hazard Elimination
  - Lock out

OSHA Confined Space Rule

- Hazard Elimination
  - Blanking

OSHA Confined Space Rule

- Hazard Elimination
  - Double Block & Bleed



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Type of Space: ☐ Permit Required
☐ Space Reclassified to Non Permit Required Space (all hazards must be eliminated)
Complete Sections 1,2,3,4,5 and 7
SOP Number (if applicable)

OSHA Confined Space Rule

3. Hazard Controls:

	Yes	No
Atmospheric Testing		
Ventilation prior to/during entry		
Lock out/tag/try out mechanical and electrical systems		
Use of toxic/flammable materials		
Hot work (welding, flame, spark generation		

If yes, obtain SHEA approval
If yes, obtain permit from fire protection

Means of communication with attendant: _____ line of sight _____ voice _____ radio _____ other
or for alternate procedure entrant with phone or radio to summon emergency services.

4. Atmospheric Testing

Tested By					
Time of Test					
Instrument					
% O2 (19.5%-22%)	% O2	% O2	% O2	% O2	% O2
% LEL (<10%)	% LEL	% LEL	% LEL	% LEL	% LEL
CO (<25 ppm)	CO	CO	CO	CO	CO
H2S (<10 ppm)	H2S	H2S	H2S	H2S	H2S
Other	Other	Other	Other	Other	Other

OSHA Confined Space Rule

5. Entry Requirements

Personal Protective Equipment	Yes	No	Personal Protective Equipment continued	Yes	No
retrieval line/harness			other		
eye protection					
foot protection			**Support Equipment**		
respirator			radio/phone		
gloves			fire extinguisher		
protective clothing			clean material out of space		
hearing protection			place barrier around entrance		
hard hat			allow cooling of space		

OSHA Confined Space Rule

6. Personnel

Entrants: each individual must be trained as an entrant

Name	Organization	Clock No.	Trained	YES	NO

Attendants: each individual must be trained as an attendant

Name	Organization	Clock No.	Trained	YES	NO

7. Approvals

Entry Authorized by: _____ Orgn: _____

Entry Supervisor (notified if different from above): _____ Time _____ Initials _____

X29915 REV 18 NOV 1998

Distribution: **WHITE - Posted at Site**
CANARY - Supervisor Copy
PINK - Environmental Health and Safety

OSHA Confined Space Rule

- Permit Key Points
  - Permit Meets Requirements of Standard
  - Think When Writing

OSHA Confined Space Rule

- Permit Required Confined Space Requirements
  - Inform Employees
  - Develop & Implement a Written Program
  - Acquire Equipment
  - Develop Permit Documents
  - Provide Training
  - Identify and Evaluate Hazards Prior to Entry
  - Establish a Rescue Program
  - Establish Contractor Program
  - Establish an Audit Program
  - Employee Involvement

OSHA Confined Space Rule

- Training
  - Employer Provided
  - Employees
    - Understanding
    - Knowledge
    - Skills for the safe performance of their duties

OSHA Confined Space Rule

- Permit Required Confined Space
  - Training
    - Roles
    - Responsibilities
    - Proper Use of All Equipment

OSHA Confined Space Rule

- Training
  - Three Roles to Fulfill
    - Entrant(s)
    - Attendant
    - Entry Supervisor
  - Training Requirements Specified in the Rule
  - Need to Make Decisions
    - Who Will Perform Entry / Attendant Duties
    - Who Will Oversee Permit Process / Authorize Entry

OSHA Confined Space Rule

- Training
  - One Approach
    - Establish a Course for Entrants & Attendants
      - **Cover All Elements Required for Both Roles**
      - **Flexibility**

OSHA Confined Space Rule

- Training
  - One Approach
    - Establish Second Course for Entry Supervisors
      - **Cover All Elements of Entrant / Attendant Training**
      - **Cover Entry Supervisor Roles & Responsibilities**
      - **Provide More Detailed Instruction on Testing**
      - **Do a Permit Entry**
      - **Be Available to "Coach" at Future Permit Entries**

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OSHA Confined Space Rule

- Permit Required Confined Space Requirements
  - Inform Employees
  - Develop & Implement a Written Program
  - Acquire Equipment
  - Develop Permit Documents
  - Provide Training
  - Identify and Evaluate Hazards Prior to Entry
  - Establish a Rescue Program
  - Establish Contractor Program
  - Establish an Audit Program
  - Employee Involvement

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OSHA Confined Space Rule

- Identify and Evaluate Hazards Prior to Entry
  - Accomplished via Permit at Time of Entry
  - Survey S.O.P.'s & Annual Audit

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OSHA Confined Space Rule

- Permit Required Confined Space Requirements
  - Inform Employees
  - Develop & Implement a Written Program
  - Acquire Equipment
  - Develop Permit Documents
  - Provide Training
  - Identify and Evaluate Hazards Prior to Entry
  - Establish a Rescue Program
  - Establish Contractor Program
  - Establish an Audit Program
  - Employee Involvement

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OSHA Confined Space Rule

- Permit Required Confined Space
  - Establish a Rescue Program
    - Contract / Arrange
    - In House Team

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OSHA Confined Space Rule

- Permit Required Confined Space
  - Rescue Service
    - Employer Shall Evaluate a Rescuers Ability
    - Select One That
      - Has Capability to Reach Victims "within an appropriate time frame"
      - Is Equipped and Proficient

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OSHA Confined Space Rule

- Permit Required Confined Space
  - Rescue Service
    - Employer Inform Rescue Service of Hazards
    - Employer Provide Access to All Spaces
      - Service Provider May Develop Plans
      - Service Provider May Practice Rescue Operations

OSHA Confined Space Rule

- Permit Required Confined Space
  - In-House Rescue Team
    - Provide P. P. E. Needed to Conduct Rescue
    - Train – Proficient in Use of P. P. E.
    - Train to Perform Assigned Rescue Duties

OSHA Confined Space Rule

- Permit Required Confined Space
  - In-House Rescue Team
    - Train to Entrant Requirements
    - At Least One Member Available Current CPR/1st Aid
    - Practice Confined Space Rescue at Least Once/yr.

OSHA Confined Space Rule

- Permit Required Confined Space Requirements
  - Inform Employees
  - Develop & Implement a Written Program
  - Acquire Equipment
  - Develop Permit Documents
  - Provide Training
  - Identify and Evaluate Hazards Prior to Entry
  - Establish a Rescue Program
  - Establish Contractor Program
  - Establish an Audit Program
  - Employee Involvement

OSHA Confined Space Rule

- Permit Required Confined Spaces
  - Contractor Program
  - Employer (Host) Obligations
    - Inform Contractor of Confined Spaces
    - Inform Contractor They Must Have a Confined Space Program

OSHA Confined Space Rule

- Permit Required Confined Spaces
  - **Contractor Program**
  - **Employer (Host) Obligations**
    - **Appraise Contractor of Hazards**
    - **Appraise Contractor of Host's Experience w/ Space**
    - **Appraise Contractor of Precautions / Procedures of Host**
    - **Coordinate Work (Host / Contractor)**
    - **Debrief Contractor if Hazards Encountered**

OSHA Confined Space Rule

- Permit Required Confined Spaces
  - Contractor Program
  - Contractor Obligations
    - Comply with Confined Space Requirements
    - Obtain Information From Host (Procedures, History)
    - Coordinate W/ Others in Space
    - Inform Host of Contractor Confined Space Program
    - Debrief Host of Hazards Encountered

OSHA Confined Space Rule

- Permit Required Confined Spaces
  - Contractor Program

Practical Information

"Can You Write Us a Permit ?"

OSHA Confined Space Rule

- Permit Required Confined Space Requirements
  - Inform Employees
  - Develop & Implement a Written Program
  - Acquire Equipment
  - Develop Permit Documents
  - Provide Training
  - Identify and Evaluate Hazards Prior to Entry
  - Establish a Rescue Program
  - Establish Contractor Program
  - Establish an Audit Program
  - Employee Involvement

OSHA Confined Space Rule

- Permit Required Confined Spaces
  - Audit
    - May Use Cancelled Permits to Ensure Employees are Protected
    - Recommend
      - Walk the Site to Verify Signs & Modifications
      - Compare Employees on Permits vs. Training
      - Compare Permits to Entry Procedures

OSHA Confined Space Rule

- Permit Required Confined Space Requirements
  - Inform Employees
  - Develop & Implement a Written Program
  - Acquire Equipment
  - Develop Permit Documents
  - Provide Training
  - Identify and Evaluate Hazards Prior to Entry
  - Establish a Rescue Program
  - Establish Contractor Program
  - Establish an Audit Program
  - Employee Involvement

OSHA Confined Space Rule

- Employee Involvement
  - Consult With Affected Employees on Development & Implementation of the Permit Space Program
  - Make Available All Information

OSHA Confined Space Rule

- Permit Required Confined Space Requirements (10)
  - Inform Employees
  - Develop & Implement a Written Program
  - Acquire Equipment
  - Develop Permit Documents
  - Provide Training
  - Identify and Evaluate Hazards Prior to Entry
  - Establish a Rescue Program
  - Establish Contractor Program
  - Establish an Audit Program
  - Employee Involvement

OSHA Confined Space Rule

- 3rd Type of Space – Alternate Procedure
- Conditions for Alternate Procedure C. S.
  - The Only Potential Hazard is Atmospheric
  - The Work Performed Does Not Pose a Hazard
  - Ventilation Alone is Sufficient To Maintain the Space Safe for Entry

OSHA Confined Space Rule

- Conditions for Alternate Procedure C. S.
  - Monitoring Data Exists to Support Claim that Ventilation Controls Hazards (Previous permits)
  - Information (documentation) is Available to Employees
  - Entry is Performed Under Specific Procedures

OSHA Confined Space Rule

- Alternate Procedure C. S. Entry Requirements
  - Training
  - Cover Removal Hazards Controlled
  - Air Testing (Prior / Periodically)
  - Verify Acceptable Conditions Thru Duration
  - Ventilation (Directed at Entrants from Clean Source)
  - Evacuation if Hazard Detected, Check, Fix
  - Employer Verification via a Written Certificate

Program Implementation

1. Assign Responsibility (One Person, Program)
2. Survey Site
3. Determine Type(s) of Confined Spaces (OSHA)

Non-Permit → Post Signs, Document, Annual Review

Permit Required → Full Program

Permit Required → Employees will not Enter Option: Post Signs, Prevent Entry, Consider Changes, Contractors??

Program Implementation

- Full Program
  - Post Signs
  - Determine Routine Tasks
  - Determine Hazards
    - Potential Hazards of Space
    - Potential Hazards of Tasks
  - Establish Entry Procedures for Each Space

Program Implementation

Full Program

- Identify & Obtain Equipment (Based Upon Hazards)
- Identify Employees (Entrant & Attendant / Entry Sup.)
- Develop a Permit
- Establish Contractor Program
- Establish a Rescue Program

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Program Implementation

- Full Program
  - Establish a Training Program
    - Entrant / Attendant
    - Entry Supervisor
    - Confined Space Awareness (all others)

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Program Implementation

- Full Program
  - Write & Maintain Documentation
    - Written Program
    - Permit Retention
    - Audit Documentation
  - Establish an Audit Program
  - Consider Establishing Alternate Procedure Spaces After Documentation Established

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Program Enhancements

- Training
  - Entrants Required to Know Proper Use of Equipment
    - Testing & Monitoring Equipment
    - Ventilation Equipment
    - Rescue & Emergency Equipment
    - Personal Protective Equipment
    - "Any other Equipment"

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Program Enhancements

- Training
  - Attendants (Change from Original Rule)
    - Attendants May May Enter a Permit Space to Attempt Rescue If:
      - **They are Equipped & Trained for Rescue Operations, and**
      - **They are Relieved by a Replacement Attendant, and**
      - **This Practice is Included in the Employers Written Program**

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Program Enhancements

- Training
  - Entrants May Observe Pre-entry & Periodic Testing
  - Attendant May Monitor More Than One Space
    - Must Effectively Fulfill All Duties
  - Entry Supervisor May Serve as Attendant or Entrant

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Program Enhancements

- Training (Atmospheric Tests)
  - OSHA Designates Order of Testing
    - Oxygen, Flammable, Toxic
  - Explain Why: The Oxygen Content Effects the Flammables Test

Program Enhancements

- Training (Atmospheric Tests)
  - Oxygen Testing
    - Normal Air:
      - **Nitrogen 78 %**
      - **Oxygen 20.9 %**
      - **Argon 0.9 % (9,000 ppm)**
      - **Carbon Dioxide 350 ppm**

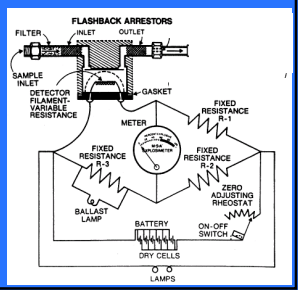
Program Enhancements

- OSHA Oxygen Criteria
  - Oxygen Enriched > 23.5%
  - Acceptable 19.5 – 23.5 %
  - Oxygen Deficient < 19.5 %

Program Enhancements

- Training (Atmospheric Tests)
  - Flammables Test
    - Wheatstone Bridge

Key: The Meter Measures Heat



Program Enhancements

- Training (Atmospheric Tests)
  - Flammables Test
    - Oxygen Content will Effect How Well it Burns
    - = How Much Heat is Generated
    - = Response of the Meter
  - Test for Oxygen 1st : Impact on Flammables

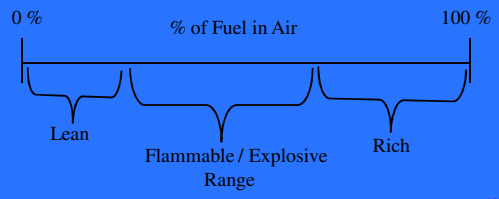
Program Enhancements

- Training (Atmospheric Tests)
  - Flammables Test
    - **Various Gases Burn Hotter or Cooler (Different BTU Values)**
    - **Heat is Generated at the Wire Effects Meter Response**
    - **Not Sure What Combustible Gas is Measured**
    - **Not Sure if a Combination is Present**

Program Enhancements

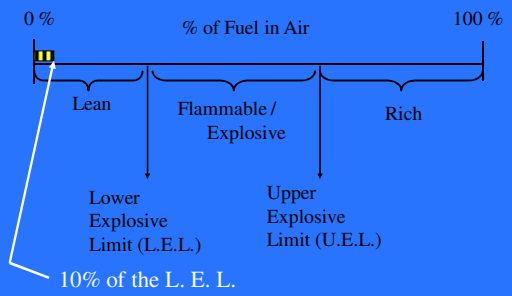
- Training Atmospheric Tests: Flammables
  - OSHA Criteria: 10% Lower Flammable Limit

Automobile Engine Example



10 % Lower Explosive Level

Automobile Engine Example

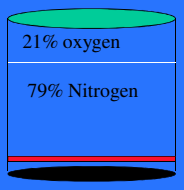


Program Enhancements

- Training Atmosphere Testing (OSHA)
  - Oxygen (19.5% to 23.5%)
  - Flammables (<10% L. E. L.)
  - Toxic Gases (Within P. E. L.'s)
    - Which Ones ?
      - What Was In The Space?
      - What Are You Going To Do?
      - What Might Be in the Space?

Program Enhancements

- Practical Information
  - Oxygen Content = 19.9%



Displace 1% of the Oxygen

Displace 4% of the Nitrogen

Mystery Gas is 5% of the Total

5% = 50,000 ppm

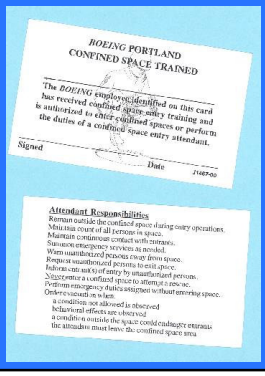
Program Enhancements

- Practical Stuff

  Air in Space = Air Outside Space

Program Enhancements

- I. D. Cards



Program Enhancements

- Inform Employees
  - Train Everyone to an Awareness Level
  - Train Departments Who Bring in Contractors
    - Obligations
    - Electrician Analogy
  - Train Departments Who Bring in Equipment
    - Avoid Buying / Building Confined Spaces
    - Or, Reduce Risk – Easy Entries

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Program Enhancements

- Written Program
  - Review Annually
  - Maintain
  - Communicate Audit Findings
  - Document Rationale for Classification (example)
  - Also Identify "Places that are Not Confined Spaces"
  - Post

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Program Enhancements

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Program Enhancements

- Equipment
  - Maintenance
  - Inspection
  - Calibration

  - Refresher Training

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Program Enhancements

- Training
  - Entrants / Attendants, Entry Supervisors
  - Practice an Entry
  - "Coach" the Entry Supervisors

  - Refresher Sessions

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SUMMARY

- Confined Space Incidents are Preventable
- Survey the Site – Inventory
- Determine Type of Confined Space
- A Permit Required Program is BIG (10 Elements)
- Identify a Single Program Manager
- Educate Everyone
- Think When Writing a Permit
- Go Beyond the Minimum Requirements

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Boeing

Confined Space Safety

Questions ??????????????