OSC | 11
Ohio Safety Congress & Expo

#105 – Identifying confined spaces

Warren Brown, CSP, ARM, CSHM

Wednesday, March 30, 2011
2:15 to 3:15 p.m.

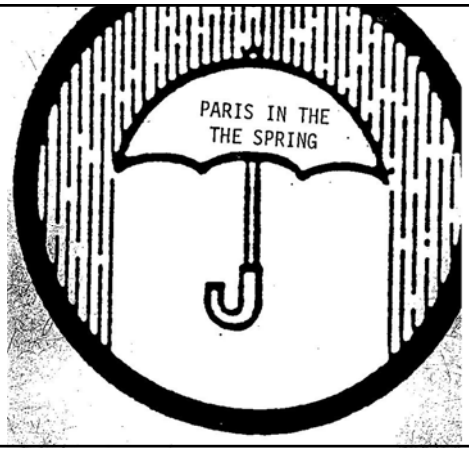
Ohio | Bureau of Workers' Compensation

IDENTIFYING CONFINED SPACES

WARREN K. BROWN, CSP, ARM, CSHM

W. Stewart, of Dupont --

"It ain't what you forget that hurts you, it's what you know for sure that just ain't so."



IDENTIFYING CONFINED SPACES

- PROOF OF THE NEED
- SOME DEFINITIONS
- THE PROCESS
- DOCUMENTING THE PROCESS

IDENTIFYING CONFINED SPACES

- PROOF OF NEED
  - Fatalities usually result from lack of procedure.
    - Unapproved lighting system results in fire
    - Flammable gas leaked into space
    - Failure to follow lockout procedure
    - Equipment failure or malfunction
    - No test for toxic or oxygen deficient atmosphere
    - Entry was made for no known reason
    - Failed to use safety harness and lifeline

WORKED KILLED IN STEEL MILL FURNANCE: A steel mill worker was accidentally locked in a 250-degree furnace and tried to claw his way out before he died, Lima police said. Sections of insulation around the door of the machine at the [redacted] plant had been ripped away, [redacted], 43, had been in the furnace about six hours before fellow employees found his body Sunday, Shawnee Twp. police said.

Man suffocates in corn bin

An Auglaize County man died Friday after he apparently fell into a corn bin at Auglaize Farmers in Uniopolis and suffocated, authorities said. Thomas [redacted], 62, of Cridersville was pronounced dead at the scene by the Auglaize County coroner. The Auglaize County sheriff's office said [redacted] body was found about 2:45 p.m.

ONE KILLED, ONE HURT AT LANDFILL: Robert [redacted], 25, of Dellroy was killed Monday when he fell from a ladder into a 35-foot shaft at a landfill near the Stark County-Carroll County line. A co-worker, Thomas [redacted], 26, climbed down the ladder but lost consciousness at the base of the shaft, Stark County Sheriff W. Bruce Umpleby said. It is unknown what overcame [redacted], the sheriff said. [redacted] of Malvern was in critical condition Tuesday at Aultman Hospital.

FUMES FATAL FOR RESCUER: Thomas [redacted], 26, of Malvern, died Thursday from injuries he received while trying to rescue a co-worker from a Sandy Twp. landfill well near Akron. Robert [redacted], 25, of Dellroy, died Monday when he fell about 30 feet into 4 to 5 feet of water at the base of a well shaft. [redacted] had gone down to rescue [redacted] when he was overcome by fumes and gases and had to be pulled up by other workers.

Sewer-line work fatal for 2 men

TWINSBURG — Two men suffocated Friday while they were working on a sewer line at a Summit County housing development.

The men were working for an engineering survey company that was a subcontractor on the sewer line at a new housing development between Akron and Cleveland, Twinsburg Fire Chief Richard Racine said.

One man entered the manhole but could not escape after he began to feel faint. The second man apparently tried to save him.

Racine said the victims were 26 and 53 years old.

Solvent kills worker

A 19-year-old Springfield man who died Friday in an industrial accident was overcome after he went into a vat of degreasing chemicals to retrieve a clipboard he'd dropped, a co-worker said. Dead is [redacted]. The accident occurred at [redacted] Industries in Springfield. The vat contained trichloroethylene, a cleaning solvent that can cause unconsciousness and death in high concentrations. A co-worker said [redacted] dropped a clipboard of papers into the vat and climbed into the vat to retrieve it.

Incident- 2/4/10- Minnesota

- After nearly 8 hours emergency workers rescued an elevator manager who was trapped inside a corn silo. At about 7:30 PM the manager was rescued from the 50 foot deep silo he fell into at 11:20 AM. When a truck was being loaded he went into the silo to loosen a clog-the corn shifted below him pinning him against the wall chest deep. Rescue workers built a plywood box around him and scooped the corn out. After nearly 8 hours he was lowered to the ground with a SCBA on his back placed there by rescue workers. He survived the ordeal.

Incident- 2/9/10- Wisconsin

- A man was freed from a grain bin after being trapped for 4 hours with no apparent injuries. Rescue workers used saws to cut through the sides of the metal grain bin to unload grain so they could reach the victim. They had to use front end loaders to move the grain that poured out. Grain bin entrapment can be deadly. According to Texas A&M university extension, more than 200 farmers in the US alone have died in grain bin suffocation incidents over the past three decades.

Incident-Texas- 11/2010

- 50 year old victim pulled into and under sorghum in elevator where he worked-took 8.5 hours to locate body-not using company issued safety harness-family members waited at the scene during the recovery operation.

Incident-2/9/10

- Construction worker dies inside unused sewer line attempting to pull out a valve. Likely he was exposed to hydrogen sulfide but not determined yet. Investigation to determine if procedures for entry were followed. Managers indicated that procedures for confined spaces should have been followed.

Incident-Kansas-4/2010

- 2 men died of asphyxiation from unknown gases in cane molasses storage tank they were cleaning—2 would be rescuers were overcome when they attempted to enter the tank without proper PPE. A hole was cut in the side of the tank and that rescuerer was overcome by the gases as well but survived.

Incident-12/31/09-Africa

- Four employees lost their lives in a steel mill oven. Initial information indicates that there may have been nitrogen gas at a high level in the oven. The oven had been idle for a week to allow maintenance work to be performed.

Incident- 1/7/10-Southeast Asia

- Four workers die cleaning sewer. Preliminary information indicated high water levels and the workers had no safety equipment other than a flashlight. An official indicated that equipment was available but evidently was not used. This type of work is generally not performed by regular employees and the workers may have not received significant safety training. Rain at the time caused higher than expected water levels.

Incident-China-12/2010

- 5 workers killed and 2 injured when they entered a pit at a fertilizer plant in the Gansu Province—2 workers entered the pit to perform task-5 other workers went looking for them in the pit—all were overcome by a toxic gas—gas still unknown.

Incident –India-11/2010

- 2 workers die cleaning 10 foot deep dye storage tank-2 would be rescuers also die—no ppe was in place

Incident-India-2/2011

- 2 men fell into resin tank while moving a barrel—the tank had to be cut open by rescuers –one of the men survived—vapors from the tank made rescue difficult.

IDENTIFYING CONFINED SPACES

- DEFINITIONS:
  - A confined space is an area that:
    - has limited or restricted means of entry or exit-**and**
    - is large enough for a worker to enter and perform an assigned task-**and**
    - is not designed for continuous employee occupancy.

  Any open top tank or pit more than four (4) feet deep that meets the above conditions is also considered a confined space.

IDENTIFYING CONFINED SPACES

- STORAGE TANKS
- DEGREASERS
- PITS
- VENTILATION DUCTS
- MACHINERY PITS
- VESSELS
- MANHOLES
- BOILERS
- FURNACES
- VATS
- SEWERS
- TUNNELS
- SILOS
- OPEN SURFACE TANKS

IDENTIFYING CONFINED SPACES

- **CAUTION:** There may be spaces that a worker cannot completely enter but may as a result of the work task requirements introduce an atmospheric hazard. Even though the space does not strictly meet the confined space requirements, some confined space procedures may need to be used.

IDENTIFYING CONFINED SPACES

- Entry into a confined space occurs when any part of the entrants body enters the opening into the space.
- What has previously been stored in a confined space must be considered.
- What is being taken into a confined space must be considered also.

IDENTIFYING CONFINED SPACES

- Classifying confined spaces:
  - All confined spaces must be evaluated and classified as :
    - non-permit confined space
    - permit-required confined space

  People are then informed by posted signs at each space and a confined space log should be maintained and updated as conditions warrant.

IDENTIFYING CONFINED SPACES

- Non-permit confined space:
  - A confined space that does not contain or have the potential to contain any hazard capable of causing death or serious physical harm. Examples would be areas with natural or permanent ventilation that will not allow accumulations of hazardous atmospheres. If there is a change in configuration the area must be re-evaluated.

IDENTIFYING CONFINED SPACES

- Permit-required confined space contains or has potential to contain one or more of:
  - Atmosphere hazard
  - Engulfment hazard
  - Configuration hazard
  - Any other recognized serious safety or health hazard

IDENTIFYING CONFINED SPACES

- Hazardous atmosphere may expose employee to serious risk of death, incapacitation, impairment, injury or acute illness.
- Hazardous atmosphere:
  - Oxygen concentration is below 19.5% or above 23.5%
  - Flammable gas, vapor or mist exceeds 10% of its lower flammable limit(LFL)

IDENTIFYING CONFINED SPACES

- Airborne dust concentration meeting or exceeding the LFL.
- Atmospheric concentration of a substance whose TLV exceeds acceptable standards.
- Any other atmospheric hazard that could impair an employees ability to escape or be IDLH.

IDENTIFYING CONFINED SPACES

- Engulfment hazard:
  - Surrounding and capture of a person by a liquid or finely divided flowable solid substance such as grain, salt, sand or plastic pellets. The substance can either plug the respiratory system or constrict breathing by exerting pressure on the outside of the body. Trenching cave-ins could fall into this category as well as bridged materials in a silo for example.

IDENTIFYING CONFINED SPACES

- Configuration hazards:
  - An internal configuration that could trap and or asphyxiate an employee. Examples could be inwardly converging walls or a chute that tapers to a smaller cross section. Mixing tanks, grain processing tanks, sand chutes and duct work could fall into this category.

IDENTIFYING CONFINED SPACES

- Other Hazards:
  - A hazard capable of causing death or serious physical harm. Examples could be high pressure gas lines, steam lines, footing problems, temperature extremes, electrical concerns, minimum work room and mechanical problems.

IDENTIFYING CONFINED SPACES

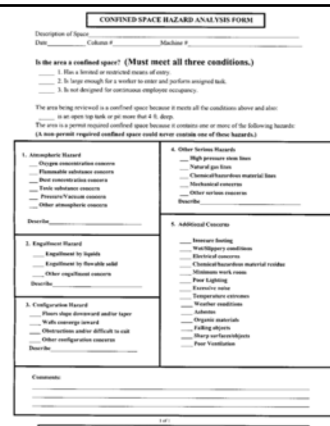
- The process:
  - Procure a confined space hazard analysis form
  - Analyze maps and drawings of your facilities-you will need at least three maps and drawings-one of the main floor, one of the underground environment and one of the roof. Additional floors, mezzanines, vaults and penthouses must be looked at as well. Don't forget the area around the perimeter of your facility.

IDENTIFYING CONFINED SPACES

- Document the process :
  - Complete a Confined Space Hazard Analysis Form for each suspected space.
  - All spaces that are considered confined spaces are then transferred to the confined space log.
  - Create a separate log for permit and non-permit confined spaces.
  - Have the spaces marked with an appropriate sign.

IDENTIFYING CONFINED SPACES

- The process (continued):
  - When looking at the maps and drawings be looking for manholes, pits, tanks, storm drains, furnaces, bins, hoppers, vaults, vessels, silos and ducts.
  - Make an all important walk through looking at potential sites identified in the preliminary evaluation as well as sites observed during the walk through.
  - Talk to maintenance employees, supervisors, security and engineers.



CONFINED SPACE HAZARD ANALYSIS FORM

Description of Space__________

Date______ Column #______ Machine #______

Is the area a confined space? (Must meet all three conditions.)

____ 1. Has a limited or restricted means of entry.
____ 2. Is large enough for a worker to enter and perform assigned task.
____ 3. Is not designed for continuous employee occupancy.

The area being reviewed is a confined space because it meets all the conditions above and also:
____ is an open top tank or pit more that 4 ft. deep.
The area is a permit required confined space because it contains one or more of the following hazards:
(A non-permit required confined space could never contain one of these hazards.)

1. Atmospheric Hazard
___ Oxygen concentration concern
___ Flammable substance concern
___ Dust concentration concern
___ Toxic substance concern
___ Pressure/Vacuum concern
___ Other atmospheric concern
Describe__________

2. Engulfment Hazard
___ Engulfment by liquids
___ Engulfment by flowable solid
___ Other engulfment concern
Describe__________

3. Configuration Hazard
___ Floors slope downward and/or taper
___ Walls converge inward
___ Obstructions and/or difficult to exit
___ Other configuration concerns
Describe__________

4. Other Serious Hazards
___ High pressure stem lines
___ Natural gas lines
___ Chemical/hazardous material lines
___ Mechanical concerns
___ Other serious concerns
Describe__________

5. Additional Concerns
___ Insecure footing
___ Wet/Slippery conditions
___ Electrical concerns
___ Chemical/hazardous material residue
___ Minimum work room
___ Poor Lighting
___ Excessive noise
___ Temperature extremes
___ Weather conditions
___ Asbestos
___ Organic materials
___ Falling objects
___ Sharp surfaces/objects
___ Poor Ventilation

Comments:

1 of 1

Hazard Analysis Form

and Description of Space _____ Date _____

_____ ID#_____ Bay/Column _____ Name _____
(Person completing form)

ise: Determine if the area is a confined space. Mark all boxes that apply.

a being reviewed is a confined space because it: ☐ has limited or restricted means of entry or exit ☐ is not designed for continuous employee occupancy (all must apply) ☐ is large enough for a worker to enter and perform the task assigned

a being reviewed is a confined space because it meets the conditions above and: ☐ is an open-top tank or pit more than 4 feet deep

ise: if the area is a confined space, determine if it is permit-required. Mark all boxes that apply.

is a permit-required confined space because it contains or has the potential to contain: ☐ an atmospheric hazard ☐ a configuration hazard ☐ an engulfment hazard ☐ a recognized serious safety or health hazard

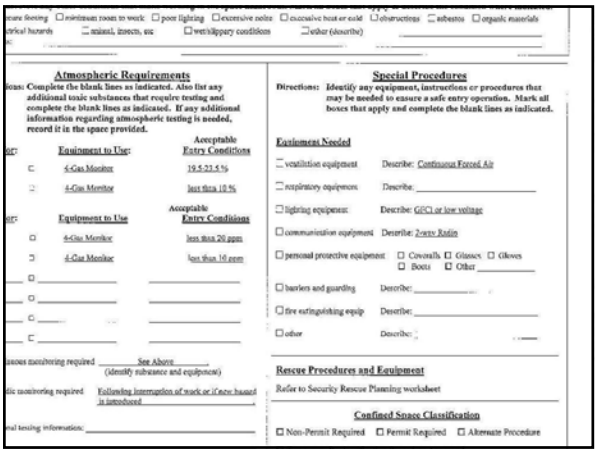
ise: For each hazard or potential hazard identified, mark the appropriate boxes and describe the conditions where indicated.

Atmospheric Hazard
Source:
☐ oxygen concentration below 19.5% or above 23.5%
☐ flammable substances at or above 10% LFL
☐ dust concentration at or above its LFL
☐ toxic substance exposure in excess of permissible limits
☐ other atmospheric conditions that may be IDLH
Describe:
ntrols: ☐ Ventilate space ☐ Remove Source ☐ Lockout ☐ Other _____
ditional Comments: _____

Engulfment Hazard
Source: _____
☐ engulfment by liquid
☐ engulfment by flowable solid substances
☐ other engulfment hazard
Describe: _____
ntrols: ☐ Lockout ☐ Blanking ☐ Cap ☐ Separate & Misalign ☐ Other _____
ditional Comments: _____

3. Configuration Hazard
Source: _____
☐ floors slope downward, and/or taper to small cross-section
☐ inwardly converging walls
☐ other configuration hazard
Describe: _____
Controls: ☐ Temporary platform ☐ Fall Hazard Equipment ☐ Other _____
Additional Comments: _____

4. Other Serious Hazards
Source: _____
☐ high pressure steam lines
☐ natural gas lines
☐ chemical/hazardous material lines
☐ mechanical hazards
☐ other serious hazards
Describe: _____
Controls: ☐ Lockout ☐ Blanking ☐ Cap ☐ Separate & Misalign ☐ Other _____
Additional Comments: _____



...reme freezing ☐ minimum room to work ☐ poor lighting ☐ excessive noise ☐ excessive heat or cold ☐ obstructions ☐ asbestos ☐ organic materials
...trical hazards ☐ animal, insects, etc ☐ wet/slippery conditions ☐ other (describe)

Atmospheric Requirements

...ions: Complete the blank lines as indicated. Also list any additional toxic substances that require testing and complete the blank lines as indicated. If any additional information regarding atmospheric testing is needed, record it in the space provided.

...er:
	Equipment to Use:	Acceptable Entry Conditions
☐	4-Gas Monitor	19.5-23.5 %
☐	4-Gas Monitor	less than 10 %

...er:
	Equipment to Use	Acceptable Entry Conditions
☐	4-Gas Monitor	less than 20 ppm
☐	4-Gas Monitor	less than 10 ppm
☐	_____	_____
☐	_____	_____
☐	_____	_____
☐	_____	_____

...ious monitoring required See Above
(identify substance and equipment)

...ic monitoring required Following interruption of work or if new hazard is introduced

...ual testing information: _____

Special Procedures

Directions: Identify any equipment, instructions or procedures that may be needed to ensure a safe entry operation. Mark all boxes that apply and complete the blank lines as indicated.

Equipment Needed

☐ ventilation equipment Describe: Continuous Forced Air
☐ respiratory equipment Describe: _____
☐ lighting equipment Describe: GFCI or low voltage
☐ communication equipment Describe: 2-way Radio
☐ personal protective equipment ☐ Coveralls ☐ Glasses ☐ Gloves ☐ Boots ☐ Other _____
☐ barriers and guarding Describe: _____
☐ fire extinguishing equip Describe: _____
☐ other Describe: _____

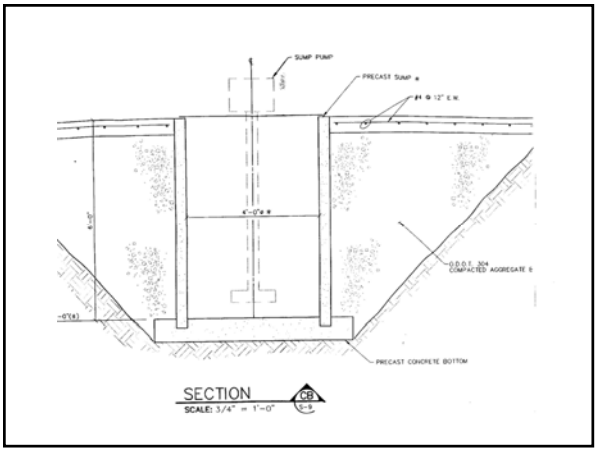
Rescue Procedures and Equipment

Refer to Security Rescue Planning worksheet

Confined Space Classification

☐ Non-Permit Required ☐ Permit Required ☐ Alternate Procedure

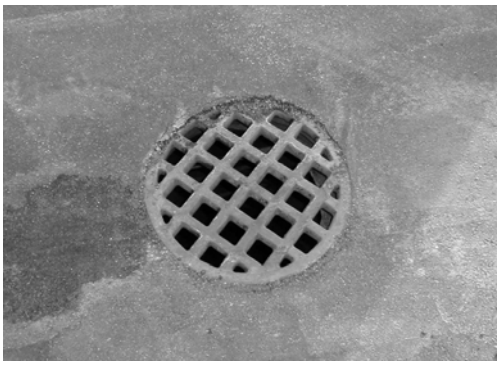
SUMP BASIN



IMPREGNATION TANK

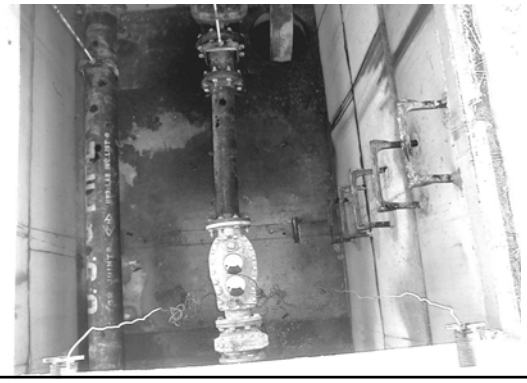
OPEN IMPREGNATION TANK

STORM DRAIN



WATER METER PIT

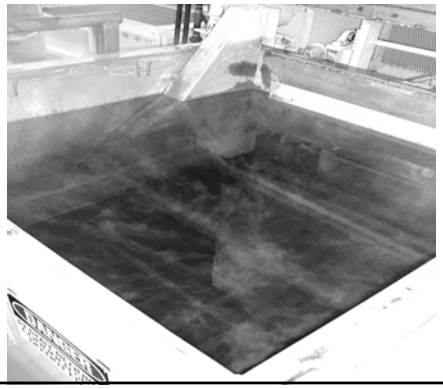
OPEN WATER METER PIT

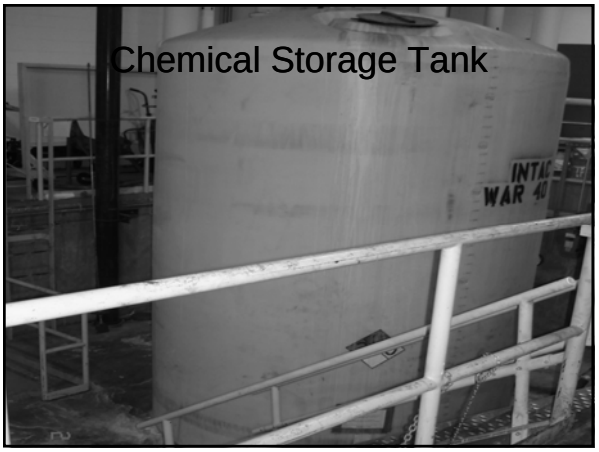


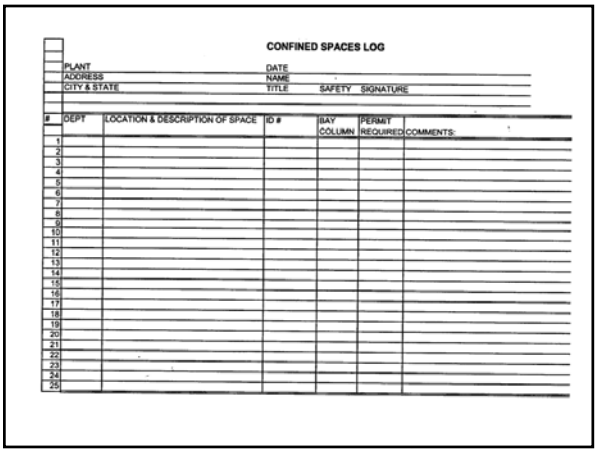
COOLING TOWER ACCESS

IMPREGNATION RINSE TANK

OPEN IMPREGNATION RINSE TANK







CONFINED SPACES LOG

PLANT
ADDRESS
CITY & STATE
DATE
NAME
TITLE
SAFETY SIGNATURE

#	DEPT	LOCATION & DESCRIPTION OF SPACE	ID #	BAY COLUMN	PERMIT REQUIRED	COMMENTS:
1						
2						
3						
4						
5						
6						
7						
8						
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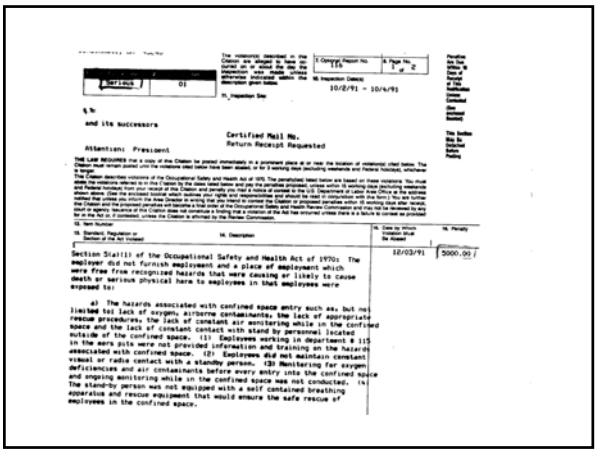


and its Successors

Certified Mail No.
Return Receipt Requested

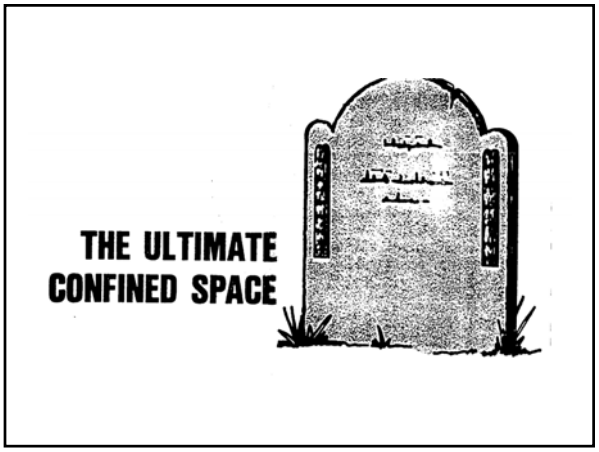
Attention: President

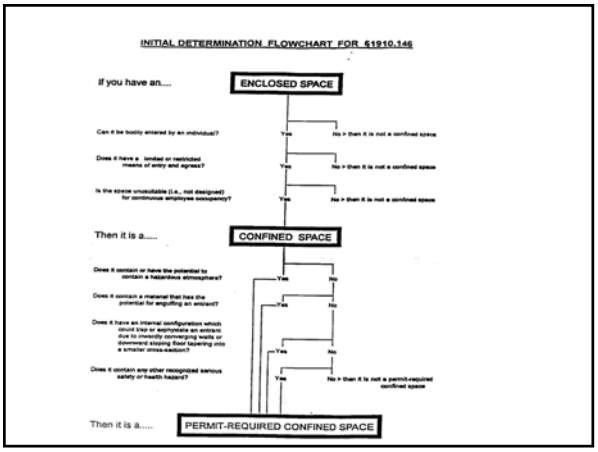
10/2/91 - 10/4/91

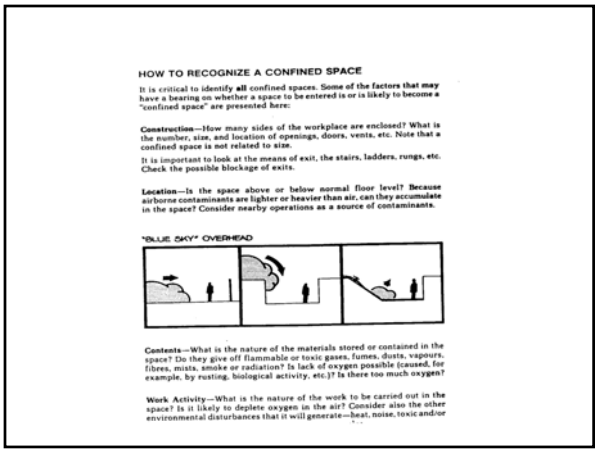
12/03/91 | 5000.00

Section 5(a)(1) of the Occupational Safety and Health Act of 1970: The employer did not furnish employment and a place of employment which were free from recognized hazards that were causing or likely to cause death or serious physical harm to employees in that employees were exposed to:

a) The hazards associated with confined space entry such as, but not limited to: lack of oxygen, airborne contaminants, the lack of appropriate rescue procedures, the lack of constant air monitoring while in the confined space and the lack of constant contact with stand by personnel located outside of the confined space. (1) Employees working in department # 115 in the mary pits were not provided information and training on the hazards associated with confined space. (2) Employees did not maintain constant visual or radio contact with a standby person. (3) Monitoring for oxygen deficiencies and air contaminants before every entry into the confined space and ongoing monitoring while in the confined space was not conducted. (4) The stand-by person was not equipped with a self contained breathing apparatus and rescue equipment that would ensure the safe rescue of employees in the confined space.







HOW TO RECOGNIZE A CONFINED SPACE

It is critical to identify **all** confined spaces. Some of the factors that may have a bearing on whether a space to be entered is or is likely to become a "confined space" are presented here:

Construction—How many sides of the workplace are enclosed? What is the number, size, and location of openings, doors, vents, etc. Note that a confined space is not related to size.

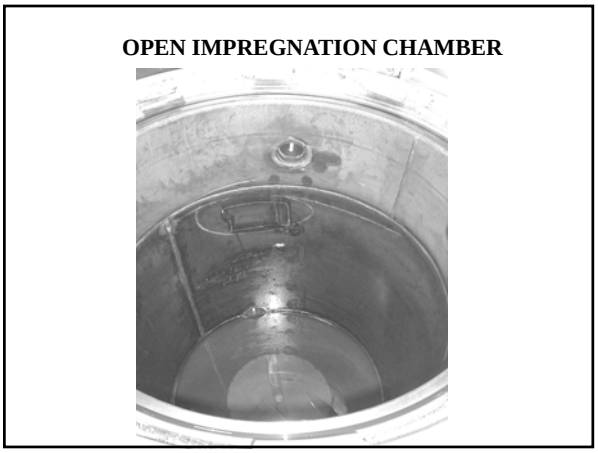
It is important to look at the means of exit, the stairs, ladders, rungs, etc. Check the possible blockage of exits.

Location—Is the space above or below normal floor level? Because airborne contaminants are lighter or heavier than air, can they accumulate in the space? Consider nearby operations as a source of contaminants.

"BLUE SKY" OVERHEAD

Contents—What is the nature of the materials stored or contained in the space? Do they give off flammable or toxic gases, fumes, dusts, vapours, fibres, mists, smoke or radiation? Is lack of oxygen possible (caused, for example, by rusting, biological activity, etc.)? Is there too much oxygen?

Work Activity—What is the nature of the work to be carried out in the space? Is it likely to deplete oxygen in the air? Consider also the other environmental disturbances that it will generate—heat, noise, toxic and/or



OPEN IMPREGNATION CHAMBER