Confined Space Rescue

Course Manual

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CONFINED SPACE RESCUE TRAINING

PURPOSE STATEMENT: This training is intended to familiarize participants with the requirements, procedures and equipment required to safely assist Entrants in exiting a permit required confined space during an emergency.

REGULATORY APPLICATION:
"Confined Space Rescue" complies with the following:
29 CFR 1910.146 (k) (1) states that: the requirements for employers who have employees, performing rescue services (i) the employer shall ensure that each member of the rescue service is provided with and is properly trained to use the personal protective equipment and rescue equipment necessary for making rescues and (ii) each member shall be trained to perform the assigned rescue duties

OBJECTIVES:
Staged emergencies in simulated permit required confined spaces and tabletop situations where participants must explain proposed actions to be taken to secure a situation inside a confmed space, will be used.

- Students will correctly explain rationale behind tabletop and actual actions taken during rescue
- Students will perform mock rescues from spaces they typically enter in the role they would normally take.
- Students will apply proper first aid techniques to injured victims.
- Students will properly decide and execute extraction of injured entrant(s) by deciding the following
  1) immediate action is needed
  2) form (entry versus non-entry rescue) is needed
  3) protocols to follow to extricate victim

I. BACKGROUND

There are approximately 2,000,000 confined space entries made in the United States each year Statistically, in general industry for every 14,000 accidents one fatality will result~ In comparison, for every 10 accidents in a confined space, one will be a fatality Also for every one person who dies in a confined space two more would-be rescuers will also become fatalities.

A. CONFINED SPACE ACCIDENTS

The following are examples of accidents that might have been avoided if safety guidelines has been followed:

A city worker was removing an inspection plate from a sewer line in a 50 ft. deep pump station, when the plate blew off allowing raw sewage to enter the room Two fellow workers and a police officer attempted to rescue the worker from the sludge filled room, all four were dead when removed from the pumping station.

A self-employed truck dnver died after entenng the top of a 22'x15' square sawdust bin He suffocated when the sawdust inside the bin collapsed and buned him.

A worker entered a septic tank to clean out the residue at the bottom and collapsed shortly afterwards. Two workers on the outside went in to rescue the downed worker. All three workers died.

A self-employed plumbing contractor entered an underground water line vault to inspect a back flow device. The contractor collapsed shortly after entering the vault. A supervisor noticed the man down, and entered the vault in a rescue attempt of the downed worker Both victim and rescuer die due to oxygen deficiency

B. PROFILE OF CONFINED SPACE ACCIDENTS

The following lists many of the physical and chemical hazards of confined space entry.

1. Hazardous atmospheric conditions : oxygen deficiency or enrichment, flammable or explosive gases or dusts, toxic vapors or gases
2. Electrocution or shock
3. Trapped in unstable material inside the confined space
4. Stress injuries from excess exertion
5. Restricted entry/egress from the confined space
6. Falls inside the space
7. Thermal burns while in the soace

C. CONFINED SPACE

OSHA defines a confmed space as a space with three characteristics

- a space that you can bodily enter
- a space that is not designed for continual human occupancy
- a space that has limited means for access and egress.

D. PERMIT REQUIRED CONFINED SPACE

A "permit required confined space" has one or more of the following characteristics:

- Contains or has a known potential to contain a hazardous atmosphere
- May contain a material that has the potential for engulfment of an Entrant
- Has an internal configuration such that an Entrant could be trapped or asphyxiated by inwardly converging walls or a floor, which slopes downward and tapers to a smaller cross-section

• Contains any other recognized serious safety or health hazards

TYPICAL PERMIT REQUIRED CONFINED SPACES

The following spaces could be considered permit required confined spaces if they contain one or more of the four hazards listed above.

storage tanks	excavations	boilers	shafts
septic tanks	vats	hoppers	cargo tanks
pipelines	tank trucks	trenches	furnaces
sewers	pipelines	vertical towers	manholes
ducts	shafts		

RESCUE PLANNING

OSHA has a requirement that the rescue team be capable of responding “in a timely manner”. The following should be considered in planning rescues for specific entries or assessing rescue capabilities overall.

Reaction time - The time in which it takes from the moment a problem arise for the entrant until it is recognized by the attendant. The method and frequency of the communications established between the entrant and the attendant will effect this.

Contact time - The time it takes for the attendant to notify the rescue personnel of a problem.

Response time - The time it takes for the rescue team to arrive at the scene.

Assessment time - The time taken by the rescue team to assess the situation and make determinations on the safest and most effective means to perform the rescue.

Preparation time - The time required by rescuers to set up and prepare for rescue.

Rescue time - The time required for the actual rescue.

There are many variables that can effect the length of time for each of these steps *Planning, preparation and practice* can only minimize the amount of time required in each of these steps.

AUTHORIZED ENTRANT’S RESPONSIBILITIES: SELF-RESCUE

The Entrant must exit the permit space when the Attendant orders the evacuation The Entrant must exit the permit space when perceived dangers exist or evacuation alarms are activated signaling dangers exist.

ATTENDANT’S RESPONSIBILITIES: RESCUE SITUATIONS

During rescue operation the Attendant must not enter the permit space to attempt rescue of Entrants. Once another person trained in the responsibilities of an Attendant, relieves them, they may act in the capacity of entry rescuer if trained to do so.

The attendants must be capable of using all rescue equipment provided for their use, and perform any other assigned rescue and emergency duties without entering the permit space.

Non-Entry -29 CFR 1910.146 states under Attendant’s responsibilities that the attendant shall: “Performs non-entry rescue as specified by the employer’s rescue procedures.”

It should be clear that a non-entry rescue should be the first consideration for rescue, but the Attendant must be capable and knowledgeable in the uses and limitations of mechanical extraction devices.

The use of a extraction device and/or retrieval lines are not always feasible for all confined space entries, especially those in which this equipment, “would increase overall risk of entry or would not contribute to the rescue of the Entrant”. Space configurations such as baffles, drop-offs, turns

and physical features may limit the use of these aids to non-entry rescue. Also, adequate space to construct a tripod or overhead support to accommodate the extraction device may be a limiting factor. As with every confined space, unless entry rescue can be excluded, planning for entry rescue must be developed before entry is allowed to begin.

ENTRY RESCUE - 29 CFR 1910.146 states under (k) rescue and emergency services:

The following requirements apply to employers who have employees enter into permit spaces to perform rescue services.

II. RESCUE TEAMS

The employer shall have either an in-plant rescue team or an arrangement under which an outside rescue team will respond to a request for rescue services.

A. IN-PLANT RESCUE TEAM DUTIES AND RESPONSIBILITIES:

- The employer shall ensure that the team has training on personnel protective equipment and rescue equipment necessary for making rescues from the employer's permit spaces.
- The team has received training up to the level of the Authorized Entrant.
- Rescue teams must practice rescues at least once every twelve months, by means of simulated rescue operations in which they remove dummies, mannequins or personnel through representative openings and portals whose size, configurations accessibility closely approximates those of the permit spaces from which rescues may be required.
- At least one member of each rescue team shall maintain current certification in basic first aid and cardiopulmonary resuscitation (CPR) skills.

B. OUTSIDE RESCUE TEAMS:

If the employer chooses to use an outside rescue service, the employer shall ensure that the designated rescuers are aware of the hazards they may confront when called on to perform rescues at the employer's facility, so that the outside rescue team can equip, train and conduct itself appropriately.

III. EMERGENCY PLANNING AND RESPONSE GUIDELINES

EMERGENCY ACTION DECISION MAKING

Prior to implementing emergency action, it is necessary to assess the nature of the emergency. Without a clear understanding of the hazard control system failure it is dangerous to reenter the space to take emergency action. Non-entry rescue poses less danger because exposure to the same conditions do not occur

Confined space accidents result in multiple fatalities approximately 60% of the time because rescuers enter before identifying and controlling the hazards that caused the initial accident.

To prevent rescuers from becoming victims and to extricate the Entrant as quickly as possible, the emergency must be quickly and thoroughly evaluated before appropriate action is initiated. Many decisions must be made. Some considerations are presented below. Answers to these questions will assist the emergency responder in evaluating the hazard control system failure, thereby permitting a rapid, appropriate response to each emergency.

The following questions refer to entry-required rescue However, difficulties experienced during non-entry rescue could result in the need to enter, to assist or effect rescue. Therefore, these

questions should for each emergency.

1. ***WHAT IS THE EMERGENCY?*** Does the injury/exposure require immediate action? Immediate action meaning that there is a serious threat to the victims life which requires fast and decisive actions.

Examples: Knee sprains (Immediate action not required.), Heart Attack (Immediate action needs to be taken, Disoriented yet responds to verbal communication (Immediate action not required).

2. ***IS THE CAUSE OF THE INJURY OR EXPOSURE KNOWN?*** The reason the injury or exposure occurred must be known before entry rescue can be initiated. Without this knowledge, rescuers could become victims.

Each emergency requires different action and constitutes a different level of urgency.

CHEMICAL EXPOSURE - A chemical bum to the skin may be urgent, but may not be life threatening. Immediate extrication from the space is warranted, but it is likely the employee can self-rescue.

Skin contact is not the only potential exposure source. Chemicals can affect the body through inhalation or through ingestion as well. Evaluate each situation for the appropriate actions. Use information from the MSDS for chemical exposure, knowledge of First Aid and CPR for more serious exposures.

ATMOSPHERIC - These situations represent potential inhalation exposures such as the case where air purifying cartridge respirators are worn and an unanticipated or uncontrolled gas such as hydrogen sulfide develops in the space. (What unique odor characteristics does hydrogen sulfide possess?)

Hydrogen sulfide affects the respiratory center of the brain and, elevated concentrations can cause cessation of breathing. In this example, the exposure could be life threatening and therefore removal should be initiated immediately.

PHYSICAL INJURY- Appropriate action depends on: Injury Site, Severity.

If the Entrant is conversant, an assessment of the severity and injury site can be identified from outside the space. However, if the Entrant is not conversant or the injury is severe, extrication must be rapid.

3. ***IS THE ENTRANT CONVERSANT?*** If the Entrant can communicate and appears rational, can the Entrant describe the injury? If urgency is not imminent and conditions won't deteriorate resulting in an increased hazard to the victim, then a thorough plan can be devised considering first aid and most appropriate removal method before imtiatmg extrication from the space.

4. ***WILL CONDITIONS CHANGE AND DETERIORATE SUCH THAT THE ENTRANT COULD BE INCAPACITATED OR RENDERED UNCONSCIOUS?*** If the answer is, yes, immediate victim assessment and extraction are required.

5. ***IS IMMEDIATE ACTION NECESSARY TO PREVENT FURTHER INJURY OR DETERIORATING CONDITIONS?*** Are there immediate actions that can be taken to reduce or eliminate the likelihood that conditions within the space will become more hazardous. Can these be accomplished from outside the space?

6. ***IS IT NECESSARY TO ENTER THE SPACE TO PERFORM RESCUE?*** Obviously, if removal of employees is possible without entering the space (i.e. employee is on a lifeline harness and tethered

to an extraction device or other acceptable means) and removal is appropriate, such as the injury or exposure is life threatening, and the Entrant can be moved, etc., this is the preferable method. This must be determined and known during initial planning Non-entry rescue can only be determined during initial operation planning The Entry Supervisor must assure that the physical space configuration will not present any impediments to the non- entry rescue.

7. ***WILL NON-ENTRY RESCUE INCREASE THE INJURY?*** Moving an individual with non-life threatening injuries may be urgent but could
increase the injury.
Example: Non-entry rescue will increase the injury Broken Bones or Spinal Injury
Example: Non-entry rescue will not increase injury Foot Sprain

Here again, a conversant Entrant and a knowledgeable Attendant are the key factors in determining the urgency of the situation. If the Entrant is non- conversant and if the injury is or may be life threatening, rapid removal is likely appropriate.

8. ***WILL ADDITIONAL CONTROL MEASURES MITIGATE THE HAZARD CAUSING THE EMERGENCY?***
Example: Mechanical equipment, electrical service, etc. not identified and controlled during hazard assessment and is activated, resulting in an injury. Will implementation of the controls (lockout/tagout) at this point to mitigate the hazard and permit safe reentry?
Example: A previously unanticipated gas is introduced to the space resulting in adverse health effects.

Will increased or localized ventilation mitigate the hazard and permit safe re-entry, or is immediate extraction required?

9. ***IS THE SPACE SAFE FOR AN ENTRY RESCUE?*** Unless all appropriate information has been gathered and evaluated (therefore the hazard is known), re-entry could result in additional victims.

10. ***ARE ALL ENTRANTS SIMILARLY AFFECTED BY THE EMERGENCY?*** For physical injuries, the answer to this question may be obvious. However, for atmospheric or chemical exposure, this is a critical decision point.
Example: If one or two employees in the space begins to show signs of exposure to the chemical being handled, it may be the result of a malfunctioning respirator, skin absorption of the chemical through a undetected breach of the PPE, or other causes.

If all individuals are affected similarly, unless the hazard is identified and controlled, emergency entry may also result in a similar exposure.
Example: Two Entrants on Level B (same air cylinder) enter a hazardous atmosphere storage tank. One Entrant begins experiencing dizziness, the other is unaffected. What could be the cause?

IV. HOW TO EVALUATE/ASSIST UNCONSCIOUS VICTIM WEARING RESP1UTORY EQUIPMENT

Evaluation of an unconscious victim within a confined space, who is wearing air supplied respiratory equipment, can pose significant problems.

Prior to a rescuer entering the space, the airline system being worn by the Entrant should first be checked. Hose connections at the cylinder regulator, cylinder pressure and gauges should all be evaluated. When an individual is breathing off an airline system, flow can usually be detected by looking at the discharge gauge, there will be a slight movement of the needle on inhalation. With

more than one individual on the system this is only an indication that someone, maybe not everyone, is still breathing.

The need to do a primary survey (A,B,Cs) remains the same. The evaluation of the victim breathing may require additional procedures beyond, the standard **LOOK, LISTEN, and FEEL**. Check responsiveness (tap and shout)

Is the victim breathing?

Establish an airway using the head tilt, chin lift method **(WITH THE FACE PIECE STILL ON VICTIM)**

LOOK, FEEL: Watch for the rise and fall of the victims chest. In poorly lit spaces, placing your hand on the victim's chest to feel for movement may be helpful. The common practice of trying to feel and hear air movement from the victims nose and mouth, with your cheek, will be hindered by both the victim's and rescuer's **PPE**.

LISTEN for the discharge of expired air at the exhalation valve.

Check pulse if possible (carotid artery) (The procedure to this point would also apply to Air-Purifying Respirators.) PPE can greatly binder your ability to check the pulse.

If victim does not appear to be breathing.

EXTRICATE IMMEDIATELY, IF THAT IS NOT POSSIBLE

Check airflow to victims face piece. By momentarily breaking the seal of the face piece you should be able to determine airflow to the mask. If air is being delivered, you should hear a discharge of air from the breach in the facepiece.

NO air being delivered. Turn on egress cylinder immediately if so equipped. Check for airflow again.

If possible, connect a new airline from a separate cylinder to the victim's regulator, or reconnect existing airline to a new cylinder. Check for airflow into facepiece.

NOTE: Regulator malfunction: An egress cylinder does not bypass the regulator on some airline systems. In the case of a regulator malfunction the introduction of a new airline from a separate cylinder will also feed air to the faulty regulator. This is a characteristic of MSA. Scott airline systems have a purge valve that would bypass the regulator assembly, but will greatly reduce the time allotted to the egress cylinder, since it would then become a constant flow through the face piece. (i.e. a 5 minute cylinder will not last 5 minutes).

Introduction of a separate breathing system for the victim must be considered but removal from the space is desired.

LAST RESORT: Remove the victims face piece. With the face piece in place and with no air being delivered, the victim cannot survive. Time now is most critical be aware of the oxygen and toxic levels. Immediate extraction of the victim is crucial. Begin rescue-breathing as soon as the victim is clear of the space.

Situations in inert spaces **(NO OXYGEN)** or highly corrosive **(ACIDIC, BASIC, OR ALKALINE)** atmospheres last resort measures may not be appropriate and possibly harmful **EXTRACT IMMEDIATELY.**

KNOW THE SPACE CHARACTERISTIC'S BEFORE ENTERING