Tempe Fire Department Policies and Procedures
Confined Space Operations
208.05
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PURPOSE

To establish guidelines for deployment of safe and effective confined space rescue operations.

POLICY

City of Tempe Fire Department members shall consider all operations within confined spaces to be immediately dangerous to life and health (IDLH). Operations within confined spaces shall be approached with extreme caution. Direct supervision is required and all safety precautions and procedures shall be rigidly enforced. Operations shall be conducted in a manner which avoids premature commitment to unknown risks.

INCIDENT ANALYSIS

Confined space rescue is one of the most difficult and dangerous tasks performed by emergency personnel. A confined space is any space that has limited or restricted means for entry or exit; is large enough and so configured that an employee can bodily enter and perform assigned work; and is not designed for continuous employee occupancy.

Some examples of confined spaces include trenches, excavations, deep shafts, tunnels, vaults, storm drains, sewers, piping, wells, water towers, storage tanks, silos, tank trucks, rail car tanks, collapsed structures, or any other location where ventilation and access are restricted by the configuration of the space. These factors may also apply to basements or attics.

Confined space incidents may involve injured persons, persons asphyxiated or overcome by toxic substances, cave-ins or fires occurring within the space. Pre-incident planning is an important factor to consider when dealing with these situations.

PROCEDURE

Phase 1 Arrive On-Scene. Take Command. Size-Up.

1. THE PRIMARY ASSESSMENT

   A. Command should attempt to secure a responsible party or witness to the accident to determine exactly what happened.

   B. An immediate assessment of the hazards present to rescuers must be done.

   C. Command should determine how many victims have been affected.

   D. A victim assessment should be performed to determine how long the victims have been down, the mechanism of injury, and the survivability profile of the victim.

   E. An early decision must be made as to whether the operation will be run in the rescue or recovery mode. Ask alarm times, from Dispatch to first on-scene companies, plus reaction time.

   F. Establish communications with the victim as soon as possible.

   G. Locate confined space permit and all other information about the space.

2. THE SECONDARY ASSESSMENT

A. The Confined Space
   1. Command should determine what type of confined space this is. This can be done by consulting with the R.P.
   2. What type of products are stored in this space.
   3. What known hazards are present; mechanical, electrical, etc.
   4. Location and number of victims affected.
   5. Diagram of confined space, including entry and egress locations.
   6. Structural stability of the confined space.
   7. Hazardous material size-up.
   8. Obtain copy of entry permit.

B. On-Scene Personnel and Equipment
   1. Command should determine if there is an adequate number of properly trained personnel on scene to do the rescue/recovery; a minimum of eight properly trained personnel are required.
   2. Command should consider the effect of temperature extremes on personnel, and consider early rotation of personnel operating on scene. For high humidity/high temperature conditions this rotation of personnel should take place every 15 to 20 minutes. For moderate to low humidity/temperature conditions the rotation of personnel should take place every 30 minutes.
   3. Command should consider the effects of rain on the hazard profile.

C. Command should consider if the proper equipment is on-scene to complete the operation. This includes, but is not limited to:

   1. Technical Rescue Team activation.
   2. Atmospheric monitoring equipment.
      * Command shall have at least one hazardous materials response unit to provide atmospheric monitoring.
   3. Intrinsically safe lighting.
   4. Intrinsically safe communications.
   5. Supplied air breathing apparatus or remote air.
   6. Cascade system with remote fill capability as found on SS274..
   7. Victim removal systems/equipment.
   8. Ventilation equipment with a CFM of 4000-5000 with necessary duct work.
   9. Rehab vehicle.

Phase II Pre-Entry Operations

1. MAKE THE GENERAL AREA SAFE

   A. Establish a perimeter. The size of the perimeter should be dictated by the atmospheric conditions, wind direction, structural stability, etc.

   B. Stop all unnecessary traffic in the area.

   C. Assure that vehicles park downwind from incident if vehicles are running.

2. CONSIDER ASSIGNING THE FOLLOWING SECTORS AS APPROPRIATE.

   A. **Hazard Sector**.
   B. **Lobby Sector** at perimeter entrance.
   C. **Accountability Sector.**
   D. **Safety Sector**.
   E. **Rescue Sector**.
   F. **Extrication Sector**.

G. **Ventilation Sector**.
H. **Treatment Sector.**
I. **Staging Area.**
J. **Resource Sector.**
K. **Rehab Sector.**
L. **Public Information Officer.** Consider the effect of the incident on family and friends, keep family informed.
M. Command should call for an OSHA representative if there has been a serious injury or death.

3. MAKE THE RESCUE AREA SAFE

A. Command should assign a **Hazard Sector** to determine exactly what hazards and products are within the confined space.

Many large industrial plant sites (Motorola, Allied Signal, Intel, etc.) have atmospheric monitoring equipment available for use by their Emergency Response Teams. Consider using their equipment and/or personnel to initiate atmospheric monitoring if this equipment is not available.

B. **Hazard sector shall** do atmospheric testing in the space to determine oxygen level, flammability, and toxicity. Based on readings, **Hazard Sector** should advise Command of the proper level of personal protective equipment. Any instruments used to monitor the confined space shall have:

1. An audio-alarm.
2. Calibration to 10% of the LEL of the calibrant gas.
3. Have the audio-alarm set at:
   - O_2 19.5%, low and O_2 enriched 23.5%
   - flammability 10% alarm set
   - toxicity carbon monoxide 35 ppm
   - hydrogen sulfide 10 ppm
4. Any O_2 readings below 12%, Command should recognize that the LEL reading will not be accurate.

5. **Hazard Sector** shall give Command atmosphere readings at least every 5 minutes with an announcement of rescue or recovery mode.

The **Hazard** and **Ventilation Sectors** are extremely important parts of a confined space operation. They should be staffed by personnel with a thorough knowledge of atmospheric monitoring and ventilation techniques.

C. Utilities, including electrical, gas and water should be secured and locked out. If it is not possible to lock/tagout/blankout, **Safety Sector shall** post a guard to assure the utilities are not turned on during the operation.

D. Any product that is in or flowing in the confined space must be secured and blanked off if possible. It may be determined that the space must be drained of any product prior to entry.

E. Any manufacturing or processing equipment must be shut down prior to entry. If possible, all equipment should be locked/tagged out and brought to a zero energy state.

F. The structural stability of the confined space should be evaluated. If there is a potential for collapse, appropriate measures must be taken to ensure the structural stability of the space.

4. VENTILATION

A. Command should assign a **Ventilation Sector** to establish the proper ventilation of the confined space.

B. **Ventilation Sector** should consult with **Safety Sector** and **Hazard Sector** to determine the proper type of ventilation for the space.

C. **Ventilation Sector** must consider the effects on the atmosphere that positive or negative pressure ventilation will have (i.e., increase or decrease flammability of atmosphere). It could require both positive and negative ventilation (pushing and pulling). This will be based on the vapor density or molecular weight of the product.

D. **Ventilation Sector** may consider negative pressure ventilation if there is only one entry point. Atmospheric monitoring will be required to ensure a non-explosive environment is present in the exhausted vapor area.

E. **Ventilation Sector** must also consider the effects the exhaust is having on the operation. Don't add CO to a confine space. If possible, use intrinsically safe electric fans.

Phase III Entry Operations. Victim Removal.

1. SELECTION OF PERSONNEL

A. The proper personnel shall be selected to make entry into the confined space. A minimum of two persons should be assigned to make entry. All personnel on the entry team shall have vital signs taken and recorded prior to entry.

B. Command shall assign a **Rescue Sector**. **Rescue Sector** shall provide a minimum 2:1 ratio of personnel outside the confined space to support personnel inside. This shall include a standby rescue team with a 1:1 ratio to provide immediate assistance to personnel in the confined space.

C. All entry and back-up personnel should be properly trained in confined space rescue procedures and capable of carrying out the rescue/recovery.

D. **Extrication Sector should be assigned to conduct the actual entry into the confined space.**

E. **Rescue Sector and Extrication Sector** should consider the size of entry and back-up personnel to make entry.

2. SELECTION OF PERSONAL PROTECTIVE EQUIPMENT

A. Protective clothing shall be worn as required by the situation, depending on an evaluation of the hazards and the products which may be inside the confined space. This may include helmet, gloves, proper footwear, goggles, turnouts, Nomex or PBI jumpsuits, and a Class II or Class III harness system.

B. **Rescue Sector** should determine the level of personal protective equipment by consultation with **Safety** and **Hazard Sectors**.

C. All entry and back-up personnel **shall** wear SABA or SCBA when making entry into the confined space. SABA (supplied air breathing apparatus) is recommended.

D. If entry personnel use an SCBA, they **shall** enter no farther than one half the amount of

supplied air minus 500 lbs. EXAMPLE: 3000 PSI tank gauge pressure -- 1/2 = 1500 PSI minus 500 PSI = 1000 PSI usage.

E. Entry personnel shall use personal air monitoring devices that monitor flammability and O_2 as a minimum.

F. Entry personnel shall have a Class II or III harness on prior to entry. Class III harness shall be used if inversion of the rescuer is possible.

3. COMMUNICATION AND LIGHTING

A. If the confined space has a flammable atmosphere, entry personnel should have intrinsically safe or explosion proof communication equipment. If this equipment is not available, **Rescue Sector** may decide to use a tag line for communication or a message relay person. Remember, these atmospheres are considered immediately dangerous to life and health (IDLH), until proven otherwise.

B. If the entry team is entering a dark confined space, **Rescue Sector** must ensure that the proper type of lighting is used. If explosion proof lighting is not available, then cyalume type lights must be used by the entry team.

C. The Thermal Imaging Camera is not intrinsically safe, but may prove useful for some situations.

4. ORIENTATION OF CONFINED SPACE

A. If available and prior to entry into the confined space, the **Rescue Sector**, with the help of the responsible party, should obtain a blue print or diagram of the space. All entry and backup personnel should be made aware of the layout of the space to be entered.

B. All entry and back-up personnel, Command and Safety shall be made aware of the action plan and the back-up plan prior to entry.

C. Rescuer tag lines may or may not be appropriate in the confined space, depending on the specific layout. Taglines could be an entanglement hazard.

5. VICTIM REMOVAL EQUIPMENT

A. Extrication sector should consider the necessary victim retrieval equipment prior to entry.

B. If possible, the entry team should bring a supply of breathable air for the victim.

C. Pure oxygen shall not be used in a confined space that has a potentially flammable atmosphere. Rescuers should not remove their breathing apparatus and give it to the victim.

6. ASSESSING CONDITION OF VICTIM

A. Upon reaching the victim, entry personnel should do an immediate primary survey of the victim. If appropriate, treatment should be started immediately.

B. A quick but thorough secondary assessment of the victim should be done. If time permits, entry personnel should attempt to treat serious injuries prior to removal.

C. If indicated, complete C-spine precautions should be administered. NOTE: Because of the difficulty removing the victim from the space, optimum C-spine precautions may not be

possible.

D. If the victim is conscious, he/she should be encouraged to wear the appropriate breathing apparatus.

7. PATIENT PACKAGING

A. After treatment of immediate life threatening injuries, the victim(s) should be properly packaged for removal from the space. This may include using a backboard, stokes basket, ked board, SKED, or some other similar device designed for extrication.

B. Prior to removal from the space, the entry team should secure any loose webbing, buckles, straps, or any other device that may hinder the extrication process.

8. VICTIM REMOVAL SYSTEM

A. Prior to removal of victim, the entry team should have determined the appropriate method of extrication. This may include a vertical or horizontal haul system constructed of ropes, pulleys, and other hardware, with a minimum of a 2:1 mechanical advantage.

B. As a general rule, entry personnel should never allow the victim between the rescuer an the point of egress, unless the situation dictates that one rescuer must pull the victim while the other rescuer pushes the victim in order to achieve rescue.

C. NOTE: IF the victim is a 901-H, **Extrication Sector** may want to leave the body and related equipment in place for investigative purposes.

9. TRANSFER TO TREATMENT SECTOR

A. Immediately after reaching the point of egress, entry personnel shall transfer the victim to treatment personnel.

B. If the victim is contaminated from product inside the space, a **Decontamination Sector** and corridor **shall** be set up and used prior to transport of victim.

Phase IV. Termination

1. PREPARATION FOR TERMINATION

A. Insure personnel accountability.

B. If there has been a fatality, **Extrication Sector** may consider leaving equipment in place and photographing the scene for investigative purposes.

C. If entry personnel and/or equipment have been contaminated during the rescue/recovery, proper decontamination procedures shall be followed prior to putting the equipment back in service.

D. Secure the scene. Prior to turning the property back over to the R.P., one final reading of atmospheres shall be taken and recorded. Command may consider activating the Critical Incident Stress Team if the situation dictatest.

E. If appropriate, conduct an on scene analysis with involved companies. Focus on lessons learned from incident.