

REGIONAL STANDARD OPERATING PROCEDURES

Confined Space Operations

#: 105.02

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SCOPE:

This procedure is designed to define the role of the Confined Space Rescue Team member.

PURPOSE:

The purpose of this procedure is to establish guidelines for the response of personnel and equipment to confined space rescue incidents. Because confined space rescue operations present a significant danger to fire department personnel, the safe and effective management of these operations require special considerations. This procedure identifies some of the critical issues which must be included in managing these incidents.

SAFETY:

Technical rescue operations provide situations that may easily overcome the well-intended rescuer who does not have discipline-specific training, and deteriorate the condition and/or status of the victim. In order to provide for the safety of rescuers and victims we must recognize our limitations and operate within our skill level as provided in NFPA 1670, *Standard on Operations and Training for Technical Search and Rescue Incidents*, NFPA 1006, *Standard for Technical Rescuer Professional Qualifications*, and OSHA Regulations Standard 29 CFR 1910.146, *Permit-Required Confined Spaces*.

POLICY:

Regional Technical Rescue Team 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. OSHA Regulations Standard 29 CFR 1910.146, *Permit-Required Confined Spaces* regulates entry into confined spaces for general industry and the rescue service and shall be considered the basis for confined space rescue operations. For the purpose of emergency response, a confined space is defined as:

- A space large enough for personnel to physically enter
- A space not designed for continuous employee occupancy
- An area with limited entry and egress

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.

- Confined space incidents will generally be dispatched as a First-Alarm Rescue, to include placing the Technical Rescue Team (TRT) on stand-by. Upon confirmation of a confined space rescue or recovery, the incident shall be balanced to a Second-Alarm Rescue which will include TRT call-out.
- Upon activation/call-out of the TRT, two team members should respond to the station housing the toter so that they can connect to the trailer and deliver it to the scene.
- All other team members should retrieve issued equipment and respond to the incident scene in a fire department vehicle. Responding team members shall make contact with the IC or other appropriate IMS functionary prior to arrival. Personal vehicles are not allowed at the scene.

Procedures

Phase I: Arrive On-Scene/Take Command/Size-Up

- I. Primary Assessment
 - a. First arriving company officer shall assume command and begin an immediate size-up of the situation, while isolating the immediate hazard area and denying entry to all non-rescue personnel
 - b. Command should attempt to secure a responsible party or witness to the accident to determine exactly what happened

- c. An immediate assessment of the hazards present to rescuers must be done
- d. Command should determine the number of victims
- e. A victim assessment should be performed to determine how long the victim(s) have been down, the mechanism of injury, and the survivability profile of the victim(s)
- f. An early decision must be made as to whether the operation will be run in the rescue or recovery mode
- g. Establish communications with the victim(s) as soon as possible
- h. Locate confined space permit if available and all other information about the space
- i. Refer to the "Confined Space Checklist " (located in all front line engines) for check off procedures

II. Secondary Assessment

a. The Confined Space

- i. Command should determine what type of confined space this is. This can be done by consulting with the responsible party.
- ii. What types of products are stored in this space?
- iii. What known hazards are present; mechanical, electrical, etc.?
- iv. Location and number of victims affected
- v. Diagram of confined space, including entry and egress locations
- vi. Structural stability of the confined space
- vii. Hazardous material size-up
- viii. Obtain copy of entry permit if available

b. On-Scene Personnel and Equipment

- i. Command should determine if there are an adequate number of properly trained personnel on scene to do the rescue/recovery. A simple rescue from a confined space requiring vertical access to the victim demands a team of 6-10 emergency responders. NFPA 1670 requires a rescue team to be made up of a minimum of six individuals who are able to work at the technician level, and a minimum of four individuals able to operate at operations level. Command should assign a currently certified Technical rescue Technician as Rescue Group Supervisor and shall also assign an Incident Safety Officer (ISO) to oversee the entire rescue mission.
- ii. Command should consider whether 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
 3. Intrinsically safe lighting
 4. Intrinsically safe communications
 5. Supplied air breathing apparatus or remote air
 6. Cascade system with remote fill capability
 7. Victim removal systems/equipment

8. Intrinsically safe ventilation equipment with necessary duct work
9. Rehab vehicle

Phase II: Pre-Entry Operations

- I. 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
- II. Make the Rescue Area Safe
 - a. Hazard Assessment / Atmospheric Monitoring
 - i. Determine exactly what hazards and products are present and conduct atmospheric testing for oxygen level, flammability, and toxicity within the confined space. The hazards identified and the results of atmospheric testing will determine the proper level of Personal Protective Equipment (PPE) to be worn by rescuers
 - ii. Atmospheric monitoring shall be done continuously, and readings shall be communicated to Command / Rescue Group Supervisor and ISO at least every 5 minutes. Readings must be obtained by personnel with a thorough knowledge of atmospheric monitoring
 - iii. Implement Lock-Out / Tag-Out procedure if applicable
 - iv. Take appropriate measures to ensure the structural stability of the confined space
 - v. Any product that is in, or is flowing into the confined space must be secured and blanked off if possible
 - b. Ventilation
 - i. Command / Rescue Group Supervisor should assign personnel to establish the proper type of mechanical ventilation of the confined space, considering the effects that positive and/or negative pressure ventilation will have on the atmosphere
 - ii. Consider positive and negative ventilation together in a push-pull configuration to obtain the greatest effect from ventilation. Consider negative pressure ventilation if there is only one entry point
 - iii. Ventilation personnel shall work closely with air monitoring personnel to ensure safe atmospheric conditions in the confined space, as well as the exhaust area and the general working area
 - c. Equipment
 - i. PPE shall include helmet, gloves, proper footwear, goggles/glasses, turnouts/Nomex/PBI jumpsuit, and a class III harness at a minimum. Additional PPE may be indicated by the hazard and atmospheric assessment
 - ii. Supplied Air Breathing Apparatus (SABA) or Self-Contained Breathing Apparatus (SCBA) shall be utilized by all entry and back-up personnel. SABA is the breathing apparatus of choice, however, if SCBA must be used, personnel shall maintain line of sight and

exit the confined space prior to low air alarm activation, following the ROAM SOP.

- iii. Air monitoring device (4 Gas Monitor) that monitors oxygen levels, flammability, and toxicity for the entry team
- iv. Intrinsically safe communication equipment shall be available for entry personnel. If this equipment is not available, entry personnel may use a tag-line for communication, or a message relay person
- v. Intrinsically safe lighting equipment shall be available for entry personnel. If this equipment is not available, entry personnel may use cyalume-type lighting sticks
- vi. A retrieval system with a back-up system shall be readied and in place. 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.

Phase III: Entry Operations

I. Make a Safe Entry

- a. Rescue Group shall be responsible for entry operations. The rescue plan will be discussed by Rescue Group Supervisor, ISO, and Command. Rescue Group and ISO shall ensure that all personnel operating in the confined space and the area immediately surrounding the confined space are accounted for and wearing appropriate PPE
- b. Conduct a system safety check prior to entry into the confined space (ISO)
- c. Prior to entry, Rescue Group and ISO shall ensure that an entry team and a back-up team are in place and have been briefed on:
 - i. Anticipated hazards within the confined space
 - ii. The space being entered including the configuration
 - iii. The rescue plan
 - iv. The back-up plan
 - v. Emergency procedures
 - vi. Time limits for the rescue operation
- d. Consider the use of rescuer tag-lines with the understanding that tag-lines may create an entanglement hazard
- e. Maintain constant communication with the entry team
- f. Entry personnel shall continually monitor atmospheric conditions inside the confined space in regards to oxygen level, flammability, and toxicity
- g. Locate victim(s)

II. Victim Removal

- a. Upon reaching victim, conduct a primary survey and initiate C-spine precautions, if warranted. NOTE: due to the configuration of the confined space, optimum C-spine precautions may not be possible and should be addressed as soon as possible
- b. When possible, provide respiratory protection for the victim(s). Rescuers shall not administer pure oxygen to a victim(s) in a confined space that has a potentially flammable atmosphere, and rescuers shall not remove their breathing apparatus and give it to the victim(s)

- c. Conduct a secondary survey of the victim(s) looking for immediate life threatening injuries. If conditions permit, entry personnel should attempt to treat serious injuries prior to removal, while considering that it may be more appropriate to remove the victim(s) from danger prior to treatment
- d. Properly package the patient for removal from the confined space. This may include using a backboard, stokes basket, KED board, Spec Pak, or similar device designed for extrication. Secure any loose webbing buckles, straps, or device that may hinder the extrication process
- e. Rescuers should not allow the victim between the rescuer and the point of egress except in situations where it is necessary for one rescuer to pull the victim while another rescuer pushes

III. Treatment

- a. Immediately upon egress, the victim(s) shall be transferred to treatment personnel for ALS level examination
- b. If the victim has been contaminated from product inside the confined space, a thorough decontamination of the victim should be conducted prior to transporting to the hospital
- c. Provide ALS level treatment and transportation to a hospital as indicated

Phase IV: Termination

- I. Ensure personnel accountability
- II. Remove all tools and equipment used in the rescue/recovery and return to proper apparatus. In cases of a fatality, consider leaving everything in place until the investigative process has been completed
- III. If entry personnel and/or equipment have been contaminated, proper decontamination procedures shall be followed prior to returning to service
- IV. Plan/schedule formal AAR/Critique
- V. Return to service after turning the scene over to the responsible party and ensuring the scene is secure

Other considerations

- A. Consider the effects of inclement weather on the hazard profile, the victim(s), and the rescuers
- B. Maintain awareness of the time of day and ensure sufficient lighting is available on the scene if operations extend into the night
- C. Confined Space rescue incidents attract the news media; consider assigning a PIO
- D. Request OSHA response if there has been a serious injury or death

4 Gas Monitor Alarm Thresholds

Sensor	LOW alarm	HIGH alarm	STEL	TWA
LEL	10 % LEL	20 % LEL	--	--
O2	19.5 %	23.0 %	--	--
CO	25 ppm	100 ppm	100	25
H2S	10 ppm	15 ppm	15	10

Definitions:

Confined Space Entry – any action that occurs if any part of an entrant's body breaks the plane of any opening to a confined space

Confined Space Incident – an incident in which a victim is trapped in an area with limited access and egress, and with the possible existence of hazards such as an oxygen deficient, flammable or toxic atmosphere or physical hazards. Confined spaces can be tanks, pipes, culverts, voids in a structural collapse, sewers, electrical vaults, manholes, or any area not intended for continuous human occupancy

Confined Space Entry Permit – the form required by OSHA to list all hazards inherent to a particular space; the procedures necessary to protect an entrant from such hazards; and the list of personnel in required positions

Confined Space Attendant – the person required to stand-by outside the space(s) and monitor the location and condition of authorized entrants, and perform the other duties listed in the employer's permit space program

Oxygen Deficiency – air containing 19.5% oxygen or less

Oxygen Enriched – air containing 23.5% oxygen or more

Lower Explosive Limit (LEL) – the lowest concentration (air/ fuel mixture) at which a gas will ignite

Upper Explosive Limit(UEL) – the highest concentration at which a gas will ignite

Permissible Exposure Limits (PEL) – the airborne concentration of a contaminant established by OSHA

Engulfment – the surrounding and capture of a person by a liquid or finely divided (flowable) solid substance

Immediately Dangerous to Life and Health (IDLH) – any condition that poses an immediate or delayed threat to life or would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from the permit space

Intrinsically Safe – a device that is not capable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture in its most easily ignited concentration

Part Per Million (PPM) – used to measure the concentration of toxic materials

Public Information Officer (PIO) – a person appointed by the Incident Commander to provide appropriate information to the public, through the media

Critical Incident Stress Debriefing – a confidential group discussion of a highly traumatic incident that usually occurs within 24 to 72 hours of the incident

Class III Body Harness – a body harness consisting of two sets of straps, one of which is secured around the rib cage, the other over the shoulders. The back of the harness is equipped with a D-ring to permit lifting or retrieval from a confined space

Lockout Device – a device that utilizes a positive means, such as a key or combination lock, to hold an energy-isolating device in the safe position, preventing energizing of equipment or machinery

Tagout Device – a prominent warning device, such as a tag, and means of attachment, which can be securely fastened to an energy-isolating device, in accordance with an established procedure, to indicate that the energy-isolating device and the equipment being controlled may not be operated until the tagout device is removed

CONFINED SPACE RESCUE

Emergency Response Checklist

Date: _____ Incident Number: _____ Time: _____ Location: _____

INCIDENT CHECKLIST

- Purpose Of Entry _____
- Secure Responsible Party
 - Secure Confined Space Entry Permit / M.S.D.S.
 - Determine Location / Number / Condition Of Victims
 - Rescue / Recovery Mode
- Type Of Confined Space
- Tank Manhole
 - Pipe Other: _____
- Assess Need For Additional Personnel / Equipment
- Hazards To Rescuers (Indicate specific hazards)
- Oxygen deficiency (less than 19.5%)
 - Oxygen enrichment (greater than 23.5%)
 - Flammable gases (greater than 10% of L.E.L.)
 - Airborne combustible dust (vision lees than 5 ft.)
 - Toxic gases or vapors (greater than P.E.L.)
 - Mechanical hazards
 - Electrical hazards
 - Engulfment
 - Other: _____
- Secure Area (Traffic Control Etc.)
 - Ventilation
 - Lock Out / Tag Out / Blank Out
 - Personal Protective Equipment
- Air Supply
- SCBA
 - SABA
- Communications and Lighting
 - Victim Retrieval Equipment
 - Pre Entry Briefing On Hazards
 - Pre Entry Briefing On Rescue Methods
 - Decontamination
 - CISD

SITE DIAGRAM

NOTES:

Products In Confined Space

ATMOSPHERIC MONITORING

	Acceptable Conditions	Results	Results	Results	Results
Time		_____ hrs.	_____ hrs.	_____ hrs.	_____ hrs.
pH	6.0 - 8.0	_____	_____	_____	_____
Oxygen	19.5% - 23.5%	_____	_____	_____	_____
Flammability	< 10% L.E.L.	_____	_____	_____	_____
Hydrogen Sulfide	< 10 ppm	_____	_____	_____	_____
Carbon Monoxide	< 35 ppm	_____	_____	_____	_____
Sulfur Dioxide	< 2 ppm	_____	_____	_____	_____
Toxic (Specify)	_____	_____	_____	_____	_____

Incident Commander

Entry Team

Safety Officer

Back Up Team

Ventilation Group

Air Supply

Medical Group

Haz Mat Group

Police Liaison

Public Info Officer

Staging Group

Extrication Group

Rescue Group

 Incident Commander Signature
Note: This checklist is to be implemented as part of the entry preparation phase.

Note:
This sample may be expanded or condensed depending on the extent or complexity of the Confined Space Incident.