

**SUBJECT: CONFINED SPACE EMERGENCIES - OPERATION RESCUE AND/OR  
CASUALTY RECOVERY**

**1. PURPOSE**

To provide an outline of operations, procedures, responsibilities and minimum safety requirements to be followed while entering, exiting and working in confined spaces at normal atmospheric pressure.

**2. DEFINITIONS**

**2.1 OSHA**

The Occupational Safety And Health Administration (OSHA), via the Code of Federal Regulations, has two (2) classifications for confined spaces based on life-threatening characteristics:

**2.2 CONFINED SPACE - GENERAL DEFINITION**

**2.2.1** The three significant characteristics of all confined spaces are:

- a. Large enough and so configured that a person can bodily enter and perform work.
- b. Limited or restricted means of entry or exit.
- c. Not designed for continuous human occupancy.

**2.3 PERMIT-REQUIRED CONFINED SPACE**

**2.3.1** Permit-Required Confined spaces have, or have the potential, for one or more of the following characteristics:

- a. A hazardous atmosphere.
- b. An engulfment hazard.

- c. An internal configuration that could trap or asphyxiate an entrant (such as inwardly converging walls or a downward sloping floor that tapers to a smaller cross-section).
- d. Any other recognized serious safety or health hazard.

**2.3.2** Prior to any entry, OSHA requires that these types of spaces are evaluated and all potential hazards are reduced before a written permit is issued.

## **2.4 ENTRY PERMIT**

A written form that addresses fifteen (15) specific areas of concern for an individual confined space. This document serves as a “check-list” that identifies unique characteristics for entry into a particular confined space at a given point in time. Issues such as hazards within the space, specialized equipment required, names (of individual attendants, entrants/rescuers, and supervisors), communications procedures, atmospheric monitoring procedures, etc. are addressed in this document. This form is required to be filled out before entry into a Permit-Required Confined Space (as defined in Section 2.3.1).

## **2.5 LOCKOUT / TAGOUT**

The placement of a lock/tag on the energy isolating device in accordance with an established procedure, indicating that the device shall not be operated until the removal of the lock/tag.

## **2.6 HAZARDOUS ATMOSPHERE**

**2.6.1** Any atmosphere which may cause immediate or delayed death, injury or disease and exposures are toxic, poisonous, corrosive, flammable or has the ability to be physically incapacitating or dangerous.

**2.6.2** Hazardous atmospheres include:

- a. Levels of flammability of 10% (or greater) of the lower explosive limit (L.E.L.).
- b. Oxygen-deficient atmospheres with levels below 19.5%.
- c. Oxygen-enriched atmospheres above 23.5%.

- d. Airborne combustible dust greater than its L.E.L.
- e. Any other toxic environment.

## **2.7 QUALIFIED PERSON(S)**

One who is capable of identifying hazards or working conditions in the work area that are hazardous or dangerous to personnel and is authorized to take corrective measures to eliminate them; one who is trained and familiar with accepted confined space standards and requirements.

## **3. RESPONSIBILITY**

It will be the responsibility of each member to exercise the appropriate control dictated by his/her rank in the implementation of this operational procedure.

### **3.1 MEMBERS WILL:**

When responding to a confined space incident, function in the capacity of one (or more) of the personnel categories (listed in Section 5.2) as directed, in accordance with their level of training.

### **3.2 COMPANY OFFICER WILL:**

**3.2.1** When arriving first at a confined space incident, make a determination if the space involved is a "Permit-Required Confined Space." He/She will initiate appropriate preliminary actions and will serve as the Incident Commander until properly relieved.

**3.2.2** When assigned to Rescue 1, assume the role of the Confined Space Supervisor. He/She will prepare the Entry Permit and ensure compliance with all listed safety considerations, including personnel assignments corresponding to the OSHA definitions and air supply system considerations.

### **3.3 BATTALION CHIEF WILL:**

The first arriving battalion chief will assume command of the incident and develop a clear, concise operational plan **including a contingency plan.**

**3.4 FIRE COMMUNICATIONS CENTER (FCC) WILL:**

Be responsible for the notification of the appropriate Division Chief whenever a confined space incident occurs.

**4. PROCEDURES**

**4.1 HAZARDS IDENTIFICATION**

Hazards shall be identified for each confined space. The hazard identification process shall include, but not be limited to, a review of the following:

- a. Past and current uses of the confined space which may adversely effect the atmosphere of the confined space.
- b. Physical characteristics, configuration and location of the confined space.
- c. Biological, mechanical or physical hazards.
- d. Existing or potential hazards in the confined space such as a FLAMMABLE AND TOXIC ENVIRONMENT (FATE).

**4.2 RESPONSE TO CONFIRMED CONFINED SPACE EMERGENCY**

**4.2.1** 1st due Engine Company.

**4.2.2** 1st due Ladder Company.

**4.2.3** 1st due Battalion Chief.

**4.2.4** Rescue 1.

**4.2.5** Rescue 101 (Collapse Unit).

**4.2.6** Engine 29.

**4.2.7** Medic Unit (ALS).

**4.2.8** EMCO

**4.3 SIZE-UP**

- 4.3.1** Recognize the emergency as a confined space incident.
- 4.3.2** Activate the PICS System to the degree necessary to control the scene. Plan operations and alternatives carefully and accumulate information required to conclude the operation safely.
- 4.3.3** Assign and/or have a Safety Officer respond to work in conjunction with the Operations Officer and entry crews to ensure the members' safety.
- 4.3.4** Consult with plant engineers and plant emergency responders (qualified personnel) as to the characteristics of the involved confined space.
- 4.3.5** Consult the designated company representative of a utility-owned confined space for pertinent information regarding same (i.e.: Verizon, PGW, PECO and Philadelphia Water Department).
  - a. The Philadelphia Water Department has trained and equipped "Sewer Inspectors" available for consultation or assistance.

**4.4 STABILIZE THE IMMEDIATE AREA**

- 4.4.1** Set up an operations perimeter.
- 4.4.2** Confirm "Lockout/Tagout" condition for the effected confined space.

**4.5 ELIMINATE IGNITION SOURCES**

- 4.5.1** Park apparatus outside the operations area.
- 4.5.2** Shut down plant operations in the immediate area, if necessary.
- 4.5.3** Do not take equipment that could serve as an ignition source into the area.

**4.6 USE ONLY EXPLOSION-PROOF EQUIPMENT**

- 4.6.1** Conventional flood and hand lights are not considered explosion-proof. Rescue 1 carries explosion-proof portable lighting.

- 4.6.2** DO NOT USE STANDARD ISSUE PFD PORTABLE RADIOS. Some types of portable radios can become an ignition source when the transmitter is keyed. Rescue 1 and Hazardous Materials Task Force 1 carry intrinsically safe communications systems.

**4.7 PROVIDE LIGHTING**

- 4.7.1** Keep floodlights outside of immediate area.

- 4.7.2** Hand lights may be used under limited and restricted conditions. Taping the light switch in the open position should eliminate the problem of ignition...AS LONG AS THE SWITCH REMAINS IN THIS POSITION.

**4.8 STANDARD OPERATING PROCEDURE**

- 4.8.1** Develop an operational plan and a contingency plan(s).

The operation should follow a clear and concise course of action with back-up plans in place.

- 4.8.2** Entry and Exit

Each entry and exit point shall be evaluated to determine the most effective method for entry and egress travel distances.

- 4.8.3** Equipment

Determine what types of equipment are required to enter, retrieve the individual(s) and exit the confined space in the safest manner possible.

- 4.8.4** Hazard Evaluation

Hazards identified shall be evaluated by a "qualified person."

- 4.8.5** Isolation and Lockout/Tagout

All energy sources which are potentially hazardous to the confined space entrant shall be secured, relieved, disconnected and/or restrained before personnel are permitted to enter the confined space. Lockout/Tagout of equipment, systems and processes shall be confirmed and secured prior to permitting entry into the confined space.

#### **4.9 PROTECTIVE CLOTHING**

- 4.9.1** Bunker gear, boots, helmet and gloves must be worn throughout if conditions dictate their use.
- 4.9.2** On occasion, protective clothing may not be practical due to an extremely limited working area, warm temperature, etc. This decision will be made by the Incident Commander.
- 4.9.3** On other occasions, bunker gear will not provide adequate protection and encapsulated suits shall be incorporated into the operation. This will also be determined by the Incident Commander.

#### **4.10 RESPIRATORY PROTECTION**

- 4.10.1** Respiratory protection must be worn by all personnel who enter the confined space....**UNDER NO CIRCUMSTANCES WILL ANY MEMBER REMOVE HIS/HER FACE MASK WITHIN THE CONFINED SPACE. REMOVING THE FACE MASK TO PROVIDE AIR TO THE VICTIM OR TO SHOUT A MESSAGE TO THE OUTSIDE FREQUENTLY RESULTS IN THE RESCUER'S DEATH.**
- 4.10.2** A confined space Supplied Air Respiratory Extension System (SAR) with ten-minute duration escape cylinders is carried by Rescue 1 and Hazardous Materials Task Force 1. This system is the preferred method of supplying air to a confined space operation. In limited situations, the use of standard SCBA is an option at the discretion of the Incident Commander.
- 4.10.3** Safety lines and harnesses should be attached to anyone entering the confined space. This equipment should be NFPA approved (1/2" lifesaving rope and related hardware and software is carried by Rescue 1).
- 4.10.4** A standby team will be fully suited and ready to go in at all times. One standby member for each member in the confined space is required.
- 4.10.5** Air Unit 1 will not use the remote supply line and manifold with the fusible link to directly supply the extension systems. Activation of the fusible link could terminate the external source of supplied air.
- 4.10.6** Members should not travel more than 300 ft. in a confined space when using extension hoses with external air supplies. If possible, an alternate entry/exit should be explored.

**4.10.7** SCBA's with 45-minute duration cylinders should be used as escape cylinders when the confined space permits adequate clearances. External air supply extensions can be used with these types of SCBA's by the use of "pigtails" designed to replace the Buddy Breathing Rescue Hoses. These "pigtails" are carried by Rescue 1.

NOTE: due to the possible interruption or failure of the external air supply, members should not exceed an internal travel distance that would preclude the ability of the attached 10-minute escape (self-rescue) bottle, or 45-minute scba (being utilized as escape bottle) to provide adequate reserve air to exit the confined space.

**4.10.8** Consideration should be given in the operational plan to provide respiratory protection for the victim(s). The standard issue oxygen resuscitator should be used cautiously due to the possibility of creating an oxygen-enriched atmosphere within the confined space. Rescue 1 carries a confined space resuscitator that operates with regular breathing air.

#### **4.11 ATMOSPHERIC MONITORING**

**4.11.1** The confined space must be monitored prior to entry and during the entire operation. Even if conditions were acceptable before entering, they may change.

**4.11.2** The atmosphere must be evaluated (at all levels of the confined space) for the following conditions:

- a. Oxygen
  - (1) 19.5% or less = oxygen-deficient; respiratory protection is mandatory.
  - (2) 23.5% or more = oxygen-enriched; respiratory protection needs should be carefully evaluated.
- b. Flammability (10% L.E.L. or greater); respiratory protection is mandatory.
- c. Carbon monoxide; respiratory protection needs should be carefully evaluated.
- d. Hydrogen sulfide; respiratory protection needs should be carefully evaluated.
- e. Toxicity; respiratory protection needs should be carefully evaluated.



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**4.11.3** Atmospheric monitoring readings should be taken and recorded approximately every ten-(10) minutes until the conclusion of the operation.

**4.11.4** The following atmospheric monitors are carried and may be utilized by qualified personnel:

- a. Battalion Chief vehicles: 3-Gas Monitor (combustible, oxygen and carbon monoxide)
- b. Rescue 1: 4-Gas Monitor (above 3 gases and hydrogen sulfide)
- c. Hazardous Materials Task Force 1: 5-Gas Monitor (above 4 gases and sulphur dioxide), Draeger/Tube system and other monitoring equipment.

**4.11.5** The use of other meters, depending on the oxygen content within the confined space, may give a false reading.

**4.11.6** For ongoing confined space rescue operations, 4-Gas or 5-Gas Monitors will be used.

#### **4.12 VENTILATION**

**4.12.1** The confined space should be ventilated before the entry team enters. Ventilation will be maintained during the operation as required. When ventilating a confined space, caution should be used not to place the atmosphere within the lower and upper explosive limits.

**4.12.2** Mechanical ventilation can be used to blow air into the confined space. **KEEP FANS AND VENTILATORS AWAY FROM APPARATUS EXHAUST.**

**4.12.3** Smoke ejectors with extension sleeves may be used.

**4.12.4** The confined space ventilator (carried by Rescue 1) may be used. It forces fresh air into a confined space. Caution must be used before making a decision to exhaust air from within a confined space to the exterior because exhausting may carry gases to an ignition source.

#### **4.13 COMMUNICATIONS**

**4.13.1** A communications plan (including primary and secondary methods) must be established prior to entry and indicated on the Entry Permit.

**4.13.2** Voice or eye contact is preferred, although in many cases this is not practical. Consider relay personnel if the distance is excessive.

**4.13.3** Standard issue PFD portable radios must not be used in explosive (or potentially explosive) atmospheres. Rescue 1 and Hazardous Materials Task Force 1 carry explosion-proof communications systems.

**4.13.4** Rope signals

a. Outside to Entry Team:

- (1) one pull - up or out
- (2) two pulls - down or in
- (3) three pulls - distress or help

b. Entry Team to Outside:

- (1) one pull - up or out
- (2) two pulls - moving down or going in
- (3) three pulls - distress or help

Note: three pulls indicates an emergency situation. At least one back-up member should be dispatched to ascertain the situation.

**4.13.5** Sound powered phones are carried by Field Com-1.

**4.14 VICTIM REMOVAL**

**4.14.1** Specialized equipment may be required to package and remove a victim from a confined space. Consideration should be given to utilize the SKED stretcher, confined space backboard, wristlets and rope rescue equipment carried by Rescue 1.

#### **4.14.2 Patient assessment**

- a. If a victim is injured, the entry team must evaluate taking the time to stabilize the injuries against permitting the victim to be further jeopardized by the conditions within the confined space.
- b. Only life threatening injuries should be treated and this treatment should be evaluated against remaining in the confined space.
- c. When a victim is ready to be removed, it may be necessary to rig a hauling system(s) to remove the victim either vertically or horizontally from the confined space. Rescue 1 has a pre-fabbed tripod and mechanical advantage hauling systems for this purpose. NFPA approved rescue ropes should be used for victim removal; they are carried by Rescue 1.

### **5. GUIDELINES**

#### **5.1 CONFINED SPACE INCIDENT**

- 5.1.1** A major cause of confined space injuries and/or fatalities is the failure to recognize the incident for what it is...A CONFINED SPACE INCIDENT. It must be kept in mind that the hazards of an open-topped enclosure, with depths that restrict the natural movement of air (for example: degreasers, pits, selected types of tanks and excavations) can be extremely deceiving.
- 5.1.2** Do not underestimate the seriousness of confined space incidents. More than half of the casualties of confined space incidents are RESCUERS. Enclosures with extremely limited opening(s) for entry or exit (for example: sewers, casings, tanks, manholes and silos) can significantly increase the risk inherent in rescue operations.

#### **5.2 TRAINING PROGRAM REQUIREMENTS**

Four personnel categories are identified by OSHA for confined space operations. The specific training requirements for each position are mandated:

- 5.2.1** Confined Space Supervisor - required to be trained in:
- a. Atmospheric monitoring
  - b. Hazard recognition

- c. Hazard abatement

**5.2.2** Confined Space Attendant - required to be trained in:

- a. Rescue management
- b. Rescue safety
- c. Rescue response

NOTE: Attendant cannot leave position until properly relieved by another attendant.

**5.2.3** Confined Space Entrant - required to be trained in:

- a. Hazard recognition
- b. Communications
- c. Personnel protective equipment

**5.2.4** Confined Space Rescuer:

Must be an authorized entrant in order to enter a confined space to perform a rescue, and must be trained in the same categories as an entrant.

**5.3 FOUR DISTINCT CATEGORIES OF HAZARDOUS ATMOSPHERES ARE:**

**5.3.1** Flammable.

**5.3.2** Toxic.

**5.3.3** Irritants and/or corrosives.

**5.3.4** Asphyxiating

**5.4 COMMON GASES FOUND IN BELOW GRADE OR CONFINED SPACE OPERATIONS ARE:**

**5.4.1** Carbon dioxide.

**5.3.2** Carbon monoxide.

**5.4.3** Hydrogen sulfide.

**5.4.4** Methane.

**5.4.5** Sulfur dioxide

## **5.5 STRATIFICATION OF GASES**

A group of gases may stratify within a confined space. This is one reason why one person may survive exposure to gas at one level, while another dies from exposure to the same (or a different gas) at another level. All levels of a confined space must be monitored for atmospheric conditions.

## **5.5 PHYSICAL/MECHANICAL HAZARDS**

Physical/mechanical hazards may also be encountered. Areas of concern are utility installations, areas having certain types of machinery and areas offering extremely limited working space.

## **5.6 REFERENCES**

OPERATIONAL PROCEDURE #02-HAZARDOUS CHEMICALS AND  
MATERIALS/SITE CONTROL

OPERATIONAL PROCEDURE #19-PHILADELPHIA INCIDENT COMMAND  
SYSTEM

OPERATIONAL PROCEDURE #24-RADIOLOGICAL INCIDENT PROCEDURE

OPERATIONAL PROCEDURE #28-ELECTRIC WIRES AND ELECTRICAL  
EQUIPMENT EMERGENCY PROCEDURES

OPERATIONAL PROCEDURE #29-CLANDESTINE DRUG LABORATORIES

OPERATIONAL PROCEDURE #31-PETROLEUM PROPERTIES AND CHEMICAL  
PLANTS

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OPERATIONAL PROCEDURE #34-LNG/LPG EMERGENCIES

DIRECTIVE #39-FIRE COMMUNICATIONS CENTER INITIAL DISPATCH

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION-CODE OF  
FEDERAL REGULATIONS

**BY ORDER OF THE FIRE COMMISSIONER**