

SHELBYVILLE FIRE & RESCUE STANDARD OPERATING PROCEDURES

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	SUBJECT: Confined Space	PAGE: 1 of 9
	Approved By:	Effective Date: December 1, 2012
		Revision Date:

Purpose:

To provide a standard guideline to be used during confined space rescues and entries within the limits of the City of Shelbyville, or any area in which Shelbyville Fire and Rescue provides mutual aid.

Scope:

This policy applies to all members, career and volunteer, of Shelbyville Fire and Rescue providing fire, rescue, or emergency medical care.

I. Procedure:

1. The Shelbyville Fire and Rescue shall perform confined space entry, utilizing members of the Shelbyville Water and Sewer Department, Shelbyville Public Works, or Shelby Task Force when necessary.
2. The Shelbyville Fire and Rescue shall perform confined space entry to the standards set forth under OSHA 29 1910.146, at a minimum. It is the intent of the Shelbyville Fire and Rescue to exceed the standards set forth by OSHA 29 1910.146.
3. The Shelbyville Fire and Rescue shall meet the standards set forth under OSHA 29 1910.120, 1910.134, and 1910.147 when applicable during confined space operations.
4. The Shelbyville Fire and Rescue shall function during the confined space operation utilizing the Incident Command System.
5. The Shelbyville Fire and Rescue shall institute a Safety Officer at all confined space incidents, this position is concerned directly with the confined space.
6. The Shelbyville Fire and Rescue shall provide all members of the department with the necessary training and personal protective equipment (PPE) needed for protection during confined space entries.

II. Training:

1. All entrants of the Shelbyville Fire and Rescue, Shall have current certification in CPR, and have their EMT certification. Additionally, there shall be Shelby County EMS personnel on site with the certification of Paramedic.
2. All attendants of the Shelbyville Fire and Rescue, Shall have a current certification in CPR, and have current certification in basic first-aid
3. All members of the Shelbyville Fire and Rescue, shall practice confined space rescue at a minimum once every 12 months as established by OSHA, and optimally at least every 4 months, as scheduling allows.

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4. Any industry in Shelbyville, which desires to name Shelbyville Fire and Rescue as its rescue agency, shall allow a representative from the Shelbyville Fire to visit the potential confined space rescue location to develop any specialized rescue plans for that location.
5. Shelbyville Fire and Rescue shall certify said member in Confined Space Rescue, after showing competency in the area of confined space rescue to the satisfaction of the chief of the department.
6. A copy of the Shelbyville Fire and Rescue members confined space rescue training verification will be kept in the members training file.

III. Definitions:

1. Confined Space
 - a. Large enough for a human to enter
 - b. Limited Entry / Egress
 - c. Not designated for continuous occupancy
2. Entry
 - a. Any break in the plane of the confined space entrance by any part of the body
3. Hazardous Atmosphere
 - a. Exposes worker to risk of death, incapacitation, impairment, and ability to self-rescue.
 - b. Flammable Gas or vapor with >10% LEL.
 - c. Dust atmosphere with > LEL concentration.
 - d. Oxygen level < 19.5% or > 23.5%.
 - e. Presence of a PEL chemical
 - f. Any immediately dangerous to life or health (IDLH) atmosphere.
4. Oxygen deficient atmosphere - <19.5%
5. Oxygen enriched atmosphere ->23.5%
6. Retrieval System
 - a. Equipment used for non-entry rescue
7. Tag line
 - a. Rope attached to entrant in confined space, normally not removed.
8. Umbilical Air Line
 - a. Air supply to SCBA supplied from a source located outside of the confined space
9. Haul Line
 - a. The main rope or cable line into the confined space, used to lower or raise entrants and patients in a vertical rescue.
10. Belay Line
 - a. The back-up rope or cable line into the confined space, used to provide a safety line for entrants and patients in a vertical rescue situation.

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IV. Roles & Responsibilities

Supervisor:

1. The Shelbyville Fire and Rescue shall function under the direction of the Incident Command System (ICS). Depending on the incident size, there may be a need to designate the position of Operations Officer (IC). These supervisory positions shall be filled by personnel who are capable of the following:
 - a. Able to recognize the hazards that may be faced during entry, including the mode, signs, symptoms, and consequences of exposure.
 - b. Completing the Shelbyville Fire and Rescue Confined Space Rescue checklist.
 - c. Remove unauthorized individuals from the area with the assistance of Law Enforcement.
 - d. Terminate the rescue/recovery operation.

Entrant:

1. The entry of the confined space shall be preformed by a member of the Shelbyville Fire and Rescue, and said member shall be referred to as the Entrant, and identified as "Entry". The Entrant shall be capable of the following:
 - a. Able to recognize the hazards that may be faced during entry, including the mode, signs, symptoms, and consequences of exposure.
 - b. Properly use the equipment provided, and rescue patients from the space.
 - c. Communicate with the attendant as necessary to enable the attendant to monitor entrant status and enable the attendant to alert entrants of the need to evacuate the space.
 - d. Alert the attendant whenever the entrant recognizes any warning signs or symptoms of exposure to a dangerous situation.
 - e. Exit the space as quickly as possible whenever an order to evacuate the space is given or the entrant recognizes signs or symptoms of exposure to a dangerous situation.

Attendant:

1. For each entry, an attendant shall be assigned to monitor the progress of the entrant. The attendant shall be referred to as "Support". The attendant shall be capable of the following:
 - a. Have knowledge of the hazards that may be present in the confined space, including information on the mode, signs, symptoms, and consequences of exposure to hazards in the confined space.
 - b. Be aware of possible behavior effects of hazards exposure to the entrant.
 - c. Maintain an accurate count of authorized entrants in the space and their names and radio identification number (one attendant may oversee multiple entrants in the same space).
 - d. Remain outside the space during entry operations until relieved by another attendant.

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- e. Communicate with the entrants as necessary to monitor entrant status, and alert the entrants of the need to evacuate the space. Communications shall be accomplished via radio, or tag line signals if conditions prohibit radio use. The signals are as follows:

# of tugs	Attendant	Entrant
1	Are you OK?	I am OK
2	Take more line	Give me more line
3	Taking up slack	Give me slack
4	Exit the space now	Help, unable to exit

- f. Monitors activities inside and outside the space to determine the safety of the entrants, and order the evacuation of the space if a hazardous condition develops, the entrants show signs or symptoms of exposure, a condition outside the space that endangers the entrants develops, or if the attendant cannot fulfill their duties.
- g. Monitors the entrant's air supply and feeds the entrants air/tag line as necessary, taking care to protect the line from damage or entanglement.
- h. Keep unauthorized personnel away from the space.
- i. Assist in non-entry rescues of entrants.
- j. Performs no duties that interfere with the ability to monitor and protect the entrants.

V. Equipment Requirements in the Confined Space

1. Supplied Air Breathing Apparatus shall be used by entrants into a confined space under normal conditions. Operations with a SABA shall be as follows:
 - a. Entrants shall wear self-contained breathing apparatus with a dual purpose airline attachment when possible. The purpose of the SCBA cylinder is to function as an escape device. The SCBA cylinder shall be of a capacity to allow a rated use time of thirty minutes at a minimum.
 - b. Entrants shall be connected to an air control device outside the confined space via an umbilical airline. The length of the airline is dictated by the situation, but under no circumstances may it extend further than 300 feet from the air control point: per NIOSH standards.
 - c. The status of the air control device shall be monitored by the attendant during the entry. Reserve air cylinder shall be kept on stand by near the air control device.
 - d. The umbilical airline is not to be depended upon as a rescue retrieval or tag line.
2. Self-Contained Breathing Apparatus- SCBA may be utilized for confined space entry without an outside air source under the following situations:
 - a. The entrant must travel further than 300 feet into the confined space. The entrant may continue on SCBA, but must remain on a rope tag line.
 - b. The entrant feels that the use of an umbilical airline will endanger the operation.
 - c. Any other situation where the use of SABA is impractical or will comprise the entry.
 - d. The entrant's time on air independent of an outside air source shall not exceed one half of the rated capacity of the air cylinder while in the confined space.

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- e. The attendant shall have available at or near the entry point, either an umbilical airline, or Quick Fill (R) line for the entrant to connect to in an emergency situation.
- f. SCBA should not be removed from the back under normal circumstances in the confined space, however if the entrant feels that the removal of the SCBA is necessary and can be performed safely, after notification to the attendant the entrant may remove the SCBA, and attach a safety strap from the SCBA to the entrant. Under no circumstances shall the SCBA be released from the hand hold of the entrant.

VI. Communication:

1. Radio communication- Radios shall be used in the confined space if at all possible, due to the tremendous coordination potential between the entrants and the exterior of the space. Normal radio communications are as follows:
 - a. Radios shall be provided to at least one of the entrants.
 - b. Voice amplification devices shall be used when possible in conjunction with the radio when available.
 - c. The attendant shall communicate with the entrant, unless advised otherwise by the Shelbyville Fire and Rescue operations officer.
2. Tag Line- In the event of radio failure, the tag line be utilized for communications within the confined space, utilizing the signals previously mentioned in Section C (1) (E) of this SOP.
3. Evacuation signals- The universal signal for evacuation of the confined space by the entrants is a continuous blast of all apparatus and hand held air horns on the entry site for a minimum of 15 seconds.

VII. Other Personal Protective Equipment:

- a. Hard Hats/Helmets
 - a. All entrants into the confined space shall wear head protection.
2. Boots
 - a. All entrants shall wear boots appropriate for the space being entered.
3. Gloves
 - a. All entrants in the confined space shall wear gloves appropriate for the space being entered.
4. Chemical Protective Clothing
 - a. All entrants shall wear CPC appropriate for the space being entered, if necessary, due to the presence of hazardous materials.
5. Full Body Harness
 - a. All entrants shall wear a full body harness, with lifting point located on the back between the shoulders unless the use of a harness would jeopardize the entrant, in which case wristlets may be used. Either the full body harness or the wristlets may be used.

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VIII. Hoisting Equipment:

Any entry into a confined space which requires a lift of more than five feet shall require the use of a mechanical device, as detailed below:

1. Under no circumstances will electric, hydraulic, air or otherwise powered hoisting devices be utilized to lower or raise personnel into or out of a confined spaces. Such devices may be utilized to provide a stationary anchor point for hand operated systems, but once positioned are not to be moved.
2. Rope advantage systems- The normal entry by the Shelbyville Fire and Rescue into a confined space shall utilize a rope advantage system for the main line, or Haul line, such systems shall normally have a self-braking mechanism as part of the system, as to allow for the safe retrieval of patients and entrants from the space.
3. Hand-operated Winch- The use of a mechanical winch in the confined space operation may take place in the following forms:
 - a. Belay Device- The winch may be utilized as a belay device if equipped with an inertia detection mechanism winch will halt the free fall of persons attached to it.
 - b. Hoist Device- The winch may be utilized as the main haul line, utilizing the hand crank.
 - c. Rope Belay System- The belay line for entrance and patients in the confined space may be rigged with rope and associated hardware. All persons being lowered or raised from a vertical confined space shall have a belay.
 - d. Tripod- A tripod may be utilized in a vertical rescue situation, provided that there is a stable surface for the tripod. Whenever possible the haul and belay lines should follow in line with the legs of the tripod for stability.

IX. Securing Hazards within the Confined Space

Air monitoring shall be performed prior to entry into the confined space. The following conditions shall be tested continuously throughout the operation:

1. **Oxygen**- conditions that register as oxygen deficient or oxygen enriched shall be corrected as possible throughout the entry with ventilation (see ventilation) Oxygen levels should be tested in all traveled areas of the same. Hypoxic atmospheres shall be treated with the respect, but the continued use of a positive pressure supplied air breathing apparatus shall allow the continuance of rescue efforts. The presents of an oxygen enriched atmosphere shall warrant the exit of entrants from the space.
2. **Flammable Vapors**- The presence of LEL concentrations above 10% of the LEL shall be considered as hazardous and if they cannot be corrected with ventilation shall warrant exit of the space by the entrant.
3. **Toxic Gasses**- The presence of a PEL level of a chemical with a PEL rating shall warrant the exit of the space by entrants, examples include:

Hydrogen Sulfide	10 ppm
Carbon Monoxide	35 ppm

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Hydrogen Sulfide and Carbon Monoxide are the two toxic gases most likely to be found in the confined space, and assuming that there are no clues pointing to the presence of other toxic gases in the confined space, these two gases will be the only two routinely monitored in the confined space. The presence of these toxic gases shall be noted and attempts to remove them shall be instituted. However the continued use of positive pressure supplied air-breathing apparatus shall allow the continuance of rescue efforts. It should be noted that the continued presence of these hazardous materials may invoke the standards presented under OSHA 1910.120 for emergency responders. In such a case the boundary of space shall become the Hot-Zone; and the buddy system, back-ups and other provisions of 1910.120 and Shelbyville Fire and Rescue Hazardous Materials Procedures may be instituted.

X. Airborne Combustibles Dusts

The presence of airborne combustible dust above the LEL shall warrant the exit of the space by the entrants. A general rule of thumb is that any concentration of dust that you cannot see approximately five feet through is above LEL.

XI. Engulfment

The presence of a material in the space with the ability to engulf shall warrant the exit of the entrants from the space until procedures are in place to control the hazard. Some specific materials are addressed in this section.

1. **Water-** The presence of water in the confined space shall require the use of Self-Contained Underwater Breathing Apparatus (SCUBA) or Self-Contained Breathing Apparatus (SCBA). The water in the confined space should be of a relatively static nature, as a current flow of such velocity as to carry the entrant against the tag line with such force as to prevent the safe return to the entry point by the entrant shall be a “no dive” situation and the space shall not be entered.
2. **Grain-** The presence of grain, such as found in a storage bin, shall require that the entrant utilize rope and other equipment such as ladders and tarps to ensure that the entrants do not go below the level of the product in the bin. If these safety measures cannot be instituted, the entrants shall not enter the space, and all efforts must be performed from the exterior of the bin.

XII. Mechanical/Electrical

The presence of a mechanical devices or open electrical contacts in the confined space shall require that these items be locked and tagged as being inoperable. The procedures for lockout/tagout shall be in accordance with OSHA 1910.147 and are as follows:

1. **Electrical Switchgear-** All breaker panels that control equipment in the confined space shall be switched to the “off” position, and a multi-hole locking hasp applied through the breaker box actuator arm. A minimum of two locks shall be inserted into the hasp. An exception to this procedure would involve electrical lighting which is housed in explosion proof fixtures, which may be utilized during rescue operations if their usage does not present a hazard.

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2. **Pipe Valves-** All pipe with entry into the confined space shall have control valves which would allow flow into the space shall be closed.
 - a. Quarter turn inline valves may be locked out with a chain or a device for that purpose. A minimum of two locks shall be placed on the device.
 - b. Hand wheel type valves may be locked out with a chain placed through the device or a device for that purpose.
3. Locks shall be placed on devices with the entrants placing at least one lock on the devices if possible.
4. Tags shall be filled out and attached to the devices with the names of the entrants on the tags.
5. **Materials Presenting Dermal Exposure Risks-** If the material inside the confined space presents the additional risk of exposure to the entrant via dermal transmission; the entrants shall protect themselves to the level necessary to prevent said exposure. It should be noted the entry into the sewer system should warrant at a minimum "Tyvek" style jumpsuit to prevent the entrant from exposure to bacterial organisms.

XIII. Ventilation

Ventilation shall be utilized whenever possible to eliminate present or possible hazardous atmospheres. Ventilation shall bring air from a clean source and shall take one of the following forms.

1. **Positive Pressure Ventilation (PPV)** - PPV is the process of introducing air under pressure onto the confined space by utilizing a mechanical fan, directed into an entrance in the space and blowing exhaust air out an exit in the space. Under ideal conditions, the exit should not be larger than the entrance as to allow the air pressure in the space to increase and maintain the flow of air out of the space. The lack of an obvious exit in the space should not preclude the use of PPV, as the pressurized air will find a way out of the space even if it is back through the fan location. The use of PPV in a sewer system is not an optimal ventilation option, as the introduction of positive pressure in the sewer system may force potentially explosive sewer gasses through dry drain traps into building connected to the sewer system.
2. **Negative Pressure Ventilation (NPV)** - NPV is the process of removing air from the confined space by using a mechanical fan blowing away from an opening in the space. NPV is to only be utilized if there is a separate, equally large opening in the space in another location from which fresh air will be pulled into the space; such as in a sewer system by opening several manholes on either side of the entry operation. NPV must be performed with an explosion proof fan.
3. **Venturi Ventilation (VV)** - VV is the process of removing air from a confined space by using a mechanical fan placed as to blow air under pressure across an opening in a confined space, as to create a lower air pressure just outside of the confined space opening, bringing air out of the confined space. As in NPV, VV must be performed only if a separate, equally large opening in the space is available to allow the ingress of fresh air into the space. The use of an explosion proof fan is desired but not required.

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- Care must be exercised during ventilation operations to avoid blowing excessive toxic or explosive gases out of the confined space into the support area outside the space.

XIV. Lighting

All lighting in the confined space must be explosion proof, and must allow the entrants to see, work safely, and to exit the space quickly in an emergency.

- Cyalume light sticks
- Explosion proof flashlights

XV. Patient Rescue / Recovery Equipment

The rescue of patients or recovery of victims from confined space incidents may involve specialized equipment.

- Special Situations-** Individual situations may dictate adaptation of patient handling devices to affect a rescue or recovery. The Shelbyville Fire Department personnel handling such an operation have the latitude to discuss options and improvise the equipment involved to safely perform the operation

XVI. Termination of the Incident

- Upon termination of the incident, the permit will be signed by the Supervisor and filed at Shelbyville Fire Station One for a period of not less than one year.
- A post incident critique will be scheduled after termination of the incident with an after action review to follow.

A critical incident stress debriefing may be scheduled if necessary depending on the nature of the incident.