CTC COMPLIANCE TRAINING ONLINE

Cal/OSHA, DOT HAZMAT, EEOC, EPA, HAZWOPER, HIPAA, IATA, IMDG, TDG, MSHA, OSHA, and Canada OHS Regulations and Safety Online Training

Since 2008

This document is provided as a training aid and may not reflect current laws and regulations.

Be sure and consult with the appropriate governing agencies or publication providers listed in the "Resources" section of our website.

www.ComplianceTrainingOnline.com

Zone Three Technical Rescue Manual

Confined Space Rescue

Confined Space Rescue Committee

FF Ed Marrs, North Highline Fire
Capt. Mark Hill, Seatac Fire Department
FF Gerry Maitland, Auburn Fire Department
Lt. Bill Howell, Port of Seattle Fire Department
Lt. David Michaels, South King Fire

Contents

Roles and Responsibilities

Rescue Group Supervisor (RGS):

- Reports directly to the on scene Incident Commander.
- Meets technician level standards for confined space rescue under NFPA 1670 and 1006.
- Is responsible for direct supervision of the rescue team operations. (1670)
- Determines RESCUE or RECOVERY mode. Performs a continuous hazard analysis and risk assessment. (1670)
- Provides passport accountability and maintains an ongoing awareness of the location and condition of all members. (1500)
- Provides and maintains safety and scene security. (1500)
- Makes key assignments of personnel:

    1. Technical Safety Officer
    2. Rigging Team Leader
    3. Entry Team Leader
    4. Support Team Leader
    5. Back-Up Team (as required)

- Determines an action plan, communicates the plan, and ensures that the plan is adhered to. Develops a back-up contingency plan. (1500)
- Ensures that the appropriate PPE is utilized and equipment to provide protection from those hazards to which personnel are exposed or could be exposed is provided. (1670)
- Initiates, maintains, and controls incident communications. (1500)
- Ensures that medical care at a minimum level of basic life support (BLS) is provided. (1670)
- Conducts pre-entry briefing with the entry team.
- Ensures that all rope systems have been safety checked by the Technical Safety Officer and Rigging Team Leader prior to operation.
- The RGS is the only person at a rope rescue incident who can initiate motion of the rope system *or* restart the rope system if stopped or re-set. (The RGS may delegate this function to the Entry Team Leader.)

Technical Safety Officer (TSO):

- Reports directly to the Rescue Group Supervisor.
- Meets NFPA 1521, Standard for Fire Department Safety Officer **and** meets technician level standards for confined space rescue under NFPA 1670 and 1006.

- Performs a continuous hazard analysis and risk assessment. Provides direction with respect to the overall safety of personnel. (1670)

- Ensures scene security.

- Ensures that the appropriate PPE is utilized and equipment to provide protection from those hazards to which personnel are exposed or could be exposed is provided. (1670)

- Ensures passport accountability and maintains an ongoing awareness of the location and condition of all members. (1500)

- Is aware of and approves the action plan and ensures that the plan is adhered to. Is aware of and approves the back-up contingency plan.

- Ensures that medical care at a minimum level of basic life support (BLS) is provided. (1670)

- Is present at the pre-entry briefing with the entry team.

- Ensures that all confined space systems and rope systems have been safety checked by the Rigging Team Leader then double-checked prior to operation by the TSO.

- Ensures that the Entry Team has been safety checked by the Entry Team Leader then double-checked by the TSO prior to deployment.

- Ensure that the Entry Team is properly equipped, properly secured, and all equipment and medical supplies necessary for the treatment and packaging of the patient(s) is present and secured.

Rigging Team Leader (Rigger):

- Reports directly to the Rescue Group Supervisor.

- Meets technician level standards for rope rescue under NFPA 1670 and 1006. The Rigging Team Leader should be the person on location who possesses the most experience and knowledge of rope based rescue systems.

- Assists the RGS in determining:

    1. The type of rope system(s) to be utilized.
    2. The location from which the rope system(s) are to be based from.
    3. Selecting the location and type of the anchor point(s).

- Responsible for direct supervision and safety of personnel assigned to the Rigging Team. (Main Line and Belay Line Team).

- Understands the action plan and communicates the plan to personnel assigned to the Rigging Team.

- Responsible for the engineering, construction, and operation of all rope based systems utilized during the operation. This responsibility includes “visualizing” the integrity of the rope system(s) in motion, and its effect or potential effect to all personnel who depend on the

rope system(s) for their safety as well as to personnel working on or around the rope system(s).

- Determines a contingency plan prior to the initial operation of the rope system(s) that addresses the utilization of additional rope systems in case of an emergency. This plan shall be worked out in advance with the RGS and approved by the TSO.

- Ensures that all rope systems have been safety checked then double-checked by the TSO prior to operation.

Entry Team Leader (ETL):

- Reports directly to the Rescue Group Supervisor.

- Meets technician level standards for confined space under NFPA 1670 and 1006.

- Responsible for direct supervision and safety of all personnel on the Entry Team and Backup Team.

- Understands the action plan and communicates the plan to personnel assigned to the Entry Team and Backup Team.

- Responsible for ensuring that all personnel on the Entry Team and Backup Team (if utilized) have proper PPE and have the ability to communicate with the Entry Team Leader or RGS.

- Responsible for ensuring that the Entry Team is properly secured to the system(s) prior to deployment.

- Ensures that any necessary PPE and/or medical equipment necessary for the patient is available and properly secured prior to deployment.
- Maintains an ongoing awareness of the location and condition of all Entry Team members.

- Ensures that the Entry Teams PPE and their attachment to the rope system has been safety checked and approved by the TSO prior to deployment.

- The properly secured Entry Team Leader should position himself/herself in such a manner as to have continuous line of sight (if at all possible) with the Entry Team as well as with the Main and Belay Line Teams to facilitate communicating the starting, stopping, re-setting, and speed of the rope systems.

- The Entry Team Leader (or RGS) is the only person at a rope rescue incident who can initiate motion of the rope system *or* restart the rope system if stopped or re-set.

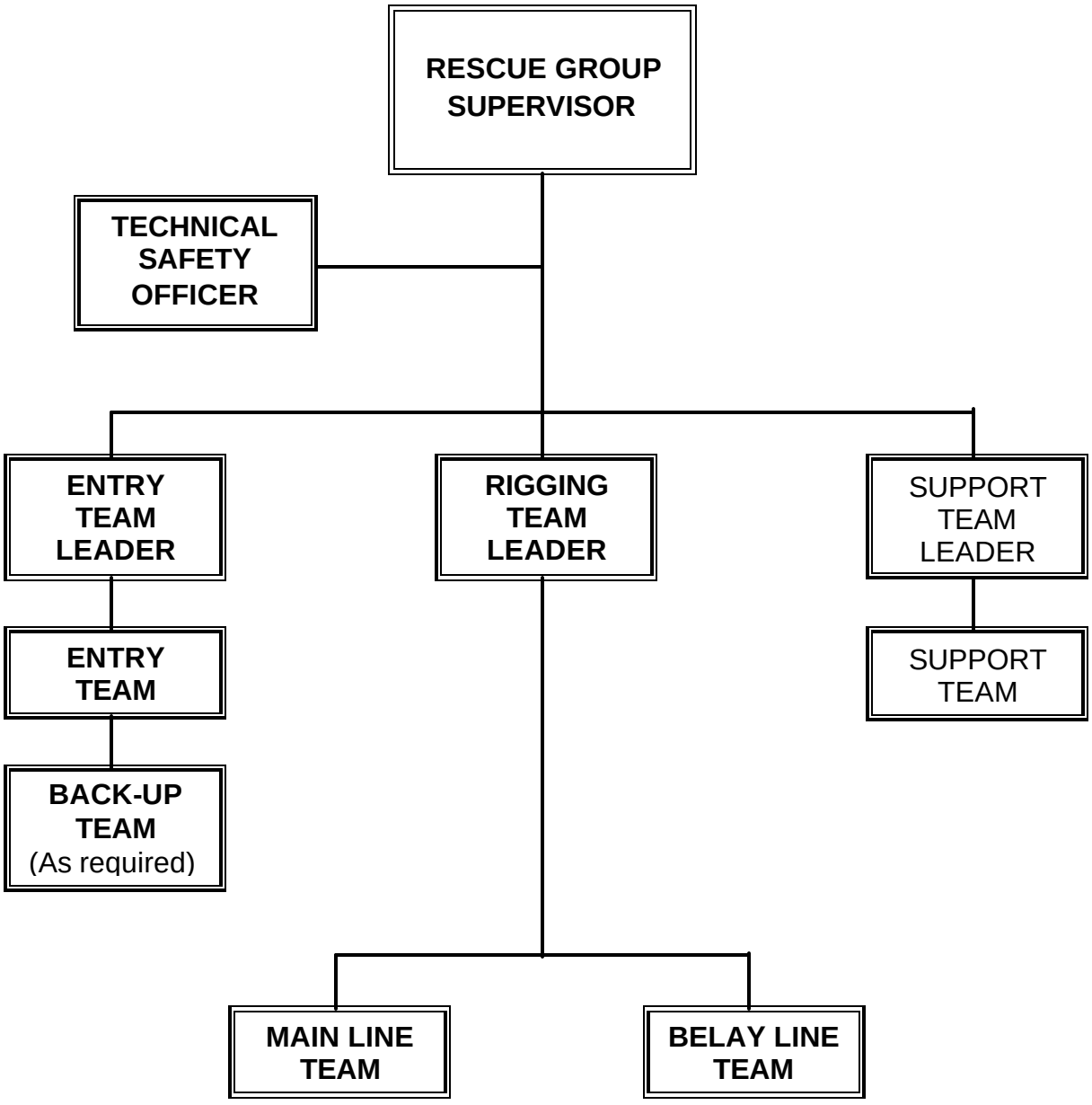
- The RGS may elect to perform the duties of Entry Team Leader in addition to the role of RGS. This may occur on a simplistic confined space rescue evolution *or* in the event that a sufficient number of confined space based, technician level personnel are not available to support all positions that require the presence of technician level personnel.

Support Team Leader:

- Reports directly to the Rescue Group Supervisor.
- Responsible for direct supervision and safety of all personnel on the Support Team.
- Responsible for completing assignments given by the RGS that supports the overall technical rescue incident. These assignments may include but are not limited to:

    1. Providing scene security.
    2. Removing brush, trees, or any obstacles that may hinder the SABA or rope systems.
    3. Securing utilities. (Lock out/ Tag out)
    4. Setting up an equipment staging area.
    5. Acquiring equipment from apparatus necessary to support the technical rescue incident. (Example: communication and SABA systems)
    6. Providing edge protection as required.
    7. Provide staffing for the Haul Team.

Zone 3 Confined Space Rescue Flow Chart



- **Bold type requires technician level personnel for the designated position or the leader of the designated team. Rigging team leader, Main Line, and Belay Line positions shall be filled by rope rescue technicians.**

Confined Space Definitions

air ejectors, or jet-air movers: blow air or steam through a tube, creating a low-pressure area, thereby causing large quantities of air to be drawn into the tube.

Air-purifying respirators: remove contaminants by passing the breathing air through a purifying element.

atmospheric supplying respirators: provide a source of clean breathing air from a remote location; the air is supplied to the worker from either a stationary or portable source.

atmospheric hazards: (contaminated air), including atmospheres that are asphyxiating, toxic, oxygen deficient or oxygen-enriched.

attendant: an individual stationed outside the confined space to monitor the authorized entrant.

authorized entrant: an employee who is authorized by an employer to enter a permit space.

axial flow fans: draw in air and discharge air along the path of the shaft. That is, the air flows in a straight line through the fan.

belly: the space between the lip and toe of trench.

belly in/wall slough: a collapse caused when a large mass of soil falls from the side of a trench and leaves a large overhang.

benching: relies on the maximum allowable slope principal but employs one or more vertical sided portions.

blanking or blinding: the absolute closure of a pipe, line, or duct by the fastening of a solid plate (such as a spectacle blind or a skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate.

block out: a process for isolating objects that can move or fall.

boiling point: the temperature at which a liquid turns into a vapor.

cave-in: the separation of material (rock or soil) from the side of the excavation into the excavation.

centrifugal flow fans: draw in air parallel to the shaft, but turn the air 90 degrees and discharge it perpendicular to the shaft.

closed-circuit SCBA: exhaled air is recycled by removing the carbon dioxide with an alkaline scrubber and by replenishing the consumed oxygen with oxygen from a solid, liquid, or gaseous source.

combustible gas indicators (CGI): measures the concentration of a flammable vapor or gas in air, indicating the results as a percentage of the lower explosive limit (LEL) of the calibration gas.

combustible liquids: a liquid that has a flash point of 100(F or more.

confined space entry permit: explains the hazards in the space and how these hazards will be controlled.

confined space supervisor: the responsible individual who authorizes entry; makes certain all work conditions are safe, only properly trained workers are doing appropriate tasks, and a confined space entry permit has been issued.

double block and bleed: the closure of a line, duct, or pipe, by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves.

duct work: contains the air stream and directs it where you want it to go. It may consist of rigid material or flexible hoses or tubing.

engulfment: occurs when a worker in a confined space is trapped or enveloped by solid or liquid material.

entrant: the individual who will actually enter the confined space.

entry permit: a written document provided by the employer that specifies the conditions of entry into a hazardous confined space.

entry: the action by which a person passes through an opening into a permit required confined space; occurs as soon as any part of the entrant's body breaks the plane of an opening into the space.

excavation: any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

finance: command function responsible for tracking all costs related to an incident.

flammable liquid: a liquid that has a flash point below 100(F (36(C).

flash point: the minimum temperature at which a liquid generates enough vapor to form an ignitable mixture with air.

hazardous atmosphere: an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a permit space), injury, or acute illness.

heat stress: results from a combination of temperature within the space, exertion, and use of personal protective equipment.

ignition temperature: the minimum temperature that a liquid must be raised to initiate or cause self-sustained combustion.

immediately dangerous to life or health (IDLH): any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse heath effects or that would interfere with an individual's ability to escape unaided from a permit space.

inerting: the displacement of the atmosphere in a permit space by a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible.

Intrinsically safe apparatus: "Apparatus in which all the circuits are intrinsically safe." (See UL 913)

Intrinsically safe circuit: "A circuit in which any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under prescribed test conditions." (See UL 913)

isolation: the process by which a permit required space is removed from service and protected against the release of energy and material into the space.

LC50: lethal concentration of a substance in air that will kill 50% of test animals when inhaled over a period of time, usually one hour.

LD50: the amount of substance that when fed to or applied on test animals, will kill half of the animals in the test. It is the lethal dose for 50% of the animals being tested under specific conditions.

Liaison Officer: responsible for coordinating all responding agencies.

liquid splash-protective suits: are designed to keep liquids off the wearer's skin.

line breaking: the intentional opening of a pipe, line, or duct that is or has been carrying flammable, corrosive, or toxic material, an inert gas, or any fluid at a volume, pressure, or temperature capable of causing injury.

lip: usually refers to the area at the top of both sides of a trench.

lip slide: often caused by piling the excavated spoil too close to the edge, thereby creating a load on the lip of the trench.

local negative pressure ventilation: a method of ventilation that places an exhaust intake close to the contaminant's point of origin.

lockout/tagout: the most common means of isolating an energy source.

logistics: command function responsible for providing facilities and services to support personnel at the incident, such as food, areas for rehabilitation and emergency medical treatment.

lower explosive limit (LEL): the lowest concentration at which flame will result given an ignition source.

mechanical hazards: could include uncontrolled electricity, unintentional activation of equipment, falling objects, inadequate footing, or releases of steam or compressed air.

mechanical ventilation: supplies air to the space (using positive pressure) or exhausts it from the space (using negative pressure).

miscibility: the ability of a gas or liquid to dissolve in another gas or liquid.

molecular weight: the atomic weight of all atoms in a specific molecule.

negative pressure/exhaust ventilation: pulls contaminated air out of a space.

negative-pressure respirators: also known as demand respirators, draw air into the face-piece via the negative pressure created by user inhalation.

operations section: responsible for most of the tactical planning and direct action.

open-circuit SCBA: air is exhaled directly into the ambient atmosphere.

oxygen deficient atmosphere: an atmosphere with an oxygen level below 19.5%.

oxygen enriched atmosphere: an atmosphere with an oxygen level greater than 21%.

oxygen meter: an instrument that detects the concentration of oxygen in air.

permissible exposure level (PEL): average concentration that must not be exceeded during 8-hour work shift of a 40-hour work week.

permit system: an employer's written procedure for preparing and issuing permits for entry.

permit-required confined space: a confined space with one or more of the following characteristics:
* Contains or may contain a hazardous atmosphere.
* Contains a material that may engulf a person inside.
* Has an internal shape that could allow a person to be trapped or asphyxiated, such as inwardly converging walls or a floor that slopes downward and tapers to a smaller cross-section.
* Contains any other recognized serious safety or health hazard.

permit-required confined space program (permit space program): an employer's overall program for controlling, and, where appropriate, for protecting employees from, permit space hazards and for regulating employee entry into permit spaces.

pH: a logarithmic scale which can measure the acidity or alkalinity of materials. The scale ranges from 0 to 14, with 7 considered neutral.

planning: command function responsible for collecting, evaluating, and disseminating information about the incident and available resources.

positive-negative/push-pull ventilation: flushes the atmosphere by supplying and exhausting large volumes of air. It doesn't reduce the total amount of contaminants released, but moves them out of the confined space into the atmosphere.

positive-pressure respirators: maintain a positive pressure in the face-piece during both inhalation and exhalation.

positive pressure/supply ventilation: pushes air into a space, causing contaminated air to exit through any available openings.

Public Information Officer: responsible for verifying, coordinating, and disseminating all media releases.

recommended exposure level (REL): average concentration limit recommended for up to a 10-hour workday during a 40-hour workweek.

rescue service: the personnel designated to rescue employees from a hazardous confined space.

Safety Officer: assesses hazardous and unsafe situations in an emergency incident.

self-contained breathing apparatus (SCBAs): a device which supplies grade D breathing air from a pressurized source carried by the user.

shield system: a structure or system that normally does not prevent a cave-in but is able to withstand the soil forces caused by a cave-in and thereby protect employees within the structure. Shields may be permanent structures or may be designed to be portable and moved along the trench. Shields used in trenches are usually referred to as "trench boxes" or "trench shields".

shoring: a system of uprights (vertical members of a trench shoring system) which bear against the soil, whalers (horizontal members of a trench shoring system) which- hold the uprights against the soil, and braces (cross members of a trench shoring system) which force the whalers tightly against the uprights. Whalers are also called stringers or rangers.

short-term exposure level (STEL): 15-minute exposure limit that must not be exceeded during the workday.

side wall shear: a collapse caused when an entire wall of earth shears-away from the side.

sloping: a method of protecting employees against cave-ins by cutting back the sides of an excavation to a safe slope.

solubility: the ability of one substance to mix with another.

specific gravity: refers to the weight of a liquid or solid in comparison to an equal volume of water.

spoil: the soil, rocks, or other materials removed from a trench.

supplied-air respirators/supplied air breathing apparatus (SAR/SABAs) : respirators connected to a remote source of grade D breathing air by an airline hose.

testing: the process by which the hazards that may confront entrants of a permit space are identified and evaluated.

trench: a narrow excavation (in relation to its length) made below the surface of the ground.

threshold limit value-ceiling (TLV-C): concentration that should never be exceeded.

threshold limit value-short-term exposure limit TLV-STEL): 15-minute exposure limit that should not occur more than 4 times during the workday.

threshold limit value-time weighted average (TLV/TWA): average concentration limit for a normal 8-hour workday and a 40-hour workweek that should not cause adverse effects.

toe: the area on both sides of the floor of a trench.

upper explosive limit (UEL): the highest concentration of flammable vapors which will result in flame given an ignition source.

vapor density: the tendency of a gas or vapor to rise or fall in air. Air has a vapor density of 1.0; gases and vapors with vapor densities less than 1.0 will rise in air; those with vapor densities greater than 1.0 will sink in air.

vapor protective suits: should be used when the chemical(s) encountered are volatile, particularly hazardous, and have known skin toxicity.

vapor pressure: the ability of a liquid to move from the liquid state to the gas state (a vapor). Vapor pressure is often measured in millimeters (mm) of mercury (Hg).

ventilator: a high powered fan which forces large amounts of air into a work area.

Response and Operation Phase

General information:

- The successful outcome of a confined space incident is dependent upon all personnel working within the Incident Management System (IMS) under direction of the Rescue Group Supervisor who in turn reports to the on scene Incident Commander (IC). The Incident Management System provides safety, accountability of personnel, communications, direction, an action plan and set roles, each with delegated responsibilities.

- This section, “Response and Operations Phase”, details actions and responsibilities during a response to confined space rescue incident, from the role of the first arriving unit, through single and multiple rope system evolutions.

First arriving unit:

- The role of the first arriving unit to a confined space rescue based incident includes:

    1. Perform a scene size up to determine exactly what the incident entails.
    2. Stabilize the incident by providing site control and scene management to prevent additional accidents.
    3. Establish command in order to initiate incident organization ***or***
    4. Pass command in the event immediate action is required commensurate with your level of training.
    5. Declare on air that the incident involves confined space rescue.
    6. Determine if operations will commence under a Rescue or Recovery Mode.
    7. Perform a Risk/Benefit Analysis.
    8. Call for internal assistance appropriate to your jurisdictions policies.
    9. Request dispatch of a Zone 3 Rescue Response.

Scene size up:

- Performing a scene size up will help determine the scope and magnitude of the incident and provide direction on the best approach for formulating an action plan. Many factors may impact the simplicity or complexity of a technical rescue involving confined space, and information gathered during the scene size up may include but is not limited to:

    1. Contacting facility manager/foreman/boss and keeping that person nearby for further questions.
    2. Determine the number and location of patients.
    3. Determine how best to provide scene security.
    4. Determine the stability of the ground relative to the area surrounding and above the patients’ location.
    5. Determine the impact of environmental factors.
    6. Determine any impact from exposure to utilities.
    7. Determine access points to the patient(s).
    8. Determine location and type of anchors available to be utilized if needed.
    9. Determine if on site equipment is usable.
    10. Determine how best to meet the needs of the patient(s).

11. Determine Rescue or Recovery Mode.
12. Perform a Risk/Benefit Analysis.
13. Determine equipment required/ equipment available.
14. Determine resources required/ resources available.

Awareness level operations:

- Jurisdictions operating under awareness level training for confined space rescue should limit operations at a technical rescue requiring rope rescue to functions as outlined above under the heading of “First arriving unit”. The exception to this statement is that the first arriving unit must establish command only and not pass it to perform immediate rescue unless they are trained to do so.

Determining patient needs:

- Determination of patient needs begins by making contact with the patient and/or witnesses. This contact will provide crucial information necessary in order to formulate an action plan. The immediate needs of a patient are two fold; first determine if the patient is injured or not and second, determine if the patient is in a stable position.

- If a patient is injured, try to ascertain the extent and severity of the injuries. This information is vital not only in dictating the course of patient care; it also starts the clock for weighing out how rapid of a retrieval is required.

Rescue/Recovery Mode:

- Making a determination if operations will commence under Rescue or Recovery Mode **shall** be ascertained prior to initiating operations. This determination will affect the urgency and pace of the incident. If a determination is made to operate in the Rescue Mode, it is based on the belief that there is a viable patient that must be retrieved, but only at a pace reflective of the ability of the rescuers to safely perform the operation proportionate to the level of training that they have received.

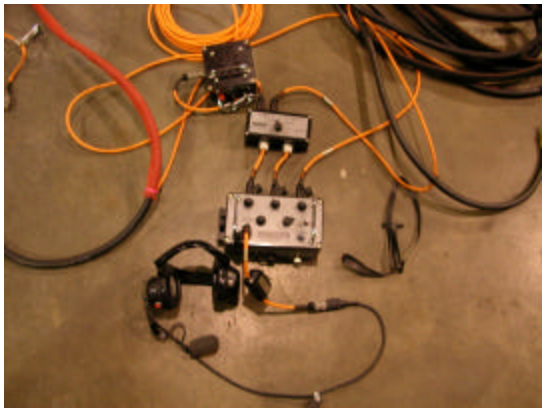
- A Recovery operation is based on the recognition that the patient is not viable. A recovery operation is a more calculated event conducted at a slower pace when a sufficient number of trained personnel are available to safely mitigate the event. The safety of all rescuers is of paramount importance; therefore no undue exposure of risk to rescuers is acceptable at any time for the recovery of a body.

Risk/Benefit Analysis:

- Determination to operate in the Rescue Mode **shall** be accompanied by a Risk/Benefit Analysis. A Risk/Benefit Analysis is based on weighing the degree of risk that rescuers will be exposed to vs. the benefits to be gained for taking those risks. A Risk/Benefit Analysis therefore measures the ability of the rescuers to resolve the exposure to danger that the patient faces, but only at a pace that balances the safety of the rescuers to the necessity to limit the amount of time that the patient is exposed to danger.

Confined Space Communications

Zone three generally uses a hard wire communication system made by Con-Space Communications Ltd. It offers clear communications between the entry team leader, entrants, and the patient. It is fairly simple to set up and use. It employs a hard wire to carry the signal. This wire may be married up with the SABA system airline to form an umbilical line to facilitate ease of movement. The system is intrinsically safe for use in hazardous environments. Consult the owner's manual for set up, operations, and maintenance.



General information:

- Clear verbal communication consisting of defined, understandable terminology is required in any rope rescue evolution to ensure safety and efficiency. To avoid confusion and the possibility of conflicting verbal orders, all verbal communication relative to movement of a rope system involving live loads shall come from only one designated person.

- The Rescue Group Supervisor (RGS) is ultimately responsible for initiating, maintaining, and controlling incident communications. During rope rescue evolutions, the Entry Team Leader who is properly secured and has a visual connection (if physically possible) with the Entry Team, Main Line Team, and Belay Line Team controls the verbal initiation, operation, resetting, and conclusion of movement of the rope systems. The Rescue Group Supervisor may choose to retain the role of Entry Team Leader as far as controlling the movement of any rope system, if it is either a simplistic operation, **or** if a sufficient number of technician level personnel are not readily available to fill all required positions thus prompting multi-tasking by the RGS.

System readiness verification:

- **"Ready":** Command given and acknowledgement received prior to any movement of a live load to ensure that personnel assigned to the Main Line, Belay Line, and the Entry Team are prepared. Example: From Entry Team Leader, "Main Line ready to raise?" reply from Main Line Team, "Main Line ready".

Verbal communication regulating the movement of rope systems:

- **"Raise":** Command given that places a rope system into motion that will bring the load towards the anchors. This evolution most typically is performed with a haul system providing mechanical advantage to ease raising the load.
- **"Lower":** Command given that places a rope system into motion that will lower the load away from the anchors. This is accomplished with a lowering system that protects the load from falling out of control.
- **"Stop":** Command given to halt movement of the rope systems. This command is unique to verbal communications impacting movement of rope systems as **anyone** can give the "stop" command at any time. Once a "stop" command has been issued, only the person designated to control rope movement (RGS or ETL) can place the rope system back in motion.
- **"Stop – Set":** Command given when a haul system is ready to be reset. This command will stop movement on the raise and prompt the Belay Line Team to set their prussiks in anticipation of the Main Line resetting.
- **"Reset":** Command given for the Main Line Team to reset their hauling system and the Belay Line Team to ensure the load is held static during the reset.
- **"Slow":** Command given to slow the speed that the rope system is moving either in a raise or lower.
- **"Up":** This command is utilized to remove slack from a rope system. This command most often is given to the operators of a belay line due to the nature of a belay line not being tensioned while the rope system is in motion. The rope that is required to be brought "up" may be identified verbally by the ropes color as opposed to its function, to aid simplicity. Example: From ETL to Belay Line Team, "Up on blue". Using voice inflection or saying "up" multiple times indicates a faster speed for removing slack is required. Example: From ETL, "UP, UP, UP On Blue".
- **"Down":** This command is typically used to create slack in a rope system. The "down" command functions as an opposite to the "up" command. Using voice inflection or saying "down" multiple times indicates a faster speed for adding slack is required. Example: From Entry Team to ETL, "Down on red", or "Down, Down, Down on Red".

Verbal communication between a climber (or rappeller) and belayer:

- **"On Belay?":** Question directed from the climber to the belay person prior to the climber moving, asking if the belayer is ready.
- **"Belay On":** Answer by belayer to climber indicating the belayer is ready to provide a belay.

- **“Climbing”:** Statement from climber indicating he/she is now moving.
- **“On Rappel”:** Statement from rappeller indicating he/she is now rappelling away.
- **“Rappel Away”:** Statement from belayer or ETL to rappeller acknowledging that the rappel has begun.

Alternate Communication Systems:

Radios: Radios, by their nature are considered ‘’line of sight’’ devices. They don’t always provide reliable communication in the confined space arena. Concrete, steel, and other features of the space often render radios unreliable.

It is important to understand that the higher the frequency of the radio wave, the shorter the distance it will travel unaided, (repeaters). That being said, a VHF radio will tend to work better than an 800 MHz. radio. If available, a VHF radio system would be preferred. However, any radio system must be intrinsically safe.

Tag Lines: Rope tag lines may be used to convey signals between rescuers, and the outside of the space. The ‘’OATH’’, or dive rescue rope signal system may be employed. It is important to note that familiarity with the chosen system must be mastered by all personnel involved. Rope signals often diminish over distance. That, coupled with the inherent friction encountered within the space tends to limit the usefulness of these systems.

Line-Hand signals to be used in the event of an emergency shall include use of the “OATH” line signal technique:

1. One tug on the tag line by the entrant to indicate they are Okay. If used by the attendant, it takes the form of a question. “Are you okay?”
2. Two tugs on the tag line by the entrant to indicate they wish to Advance or be given some slack. If used by the attendant, it takes the form of a question. “Do you need slack?”
3. Three tugs on the tag line by the entrant to indicate they wish slack Taken up. If used by the attendant, it takes the form of a question. “Do you need me to take up slack?”
4. Four tugs on the tag line by the entrant to indicate they need Help. If used by the attendant, it takes the form of a question. “Do you need help?” If sending or receiving four tugs on the tag line, be prepared to be pulled out of the space, or to pull the entrant out.
5. To confirm a Line-Hand signal, either the entrant or attendant will tug on the tag line with the same number of tugs. If a response is different, the entrant or attendant will use the number of tugs that correspond with their response.

   Example 1: An attendant asks if the entrant is okay using one tug of the line. The entrant confirms with one tug that they are okay. This procedure can also be used from the entrant to the attendant.

   Example 2: An attendant asks if the entrant needs help using four tugs of the line. The entrant responds with one tug of the line to indicate they are okay. This procedure can also be used from the entrant to the attendant.

Hand Signals: Hand signals offer an alternate means of communicating. The hand signals used in swift water rescue may be useful. Hand signals are *truly* line of sight. Additionally, there must be adequate light in order to convey messages.

Conclusion: Whichever means of communications are implemented, it is imperative that all personnel be familiar, and proficient in their use. This takes practice. As in rope systems, if you don't use it, you lose it.

The most efficient means of communication available within Zone 3 remains a well maintained and protected hard wire system.

PERSONAL PROTECTIVE EQUIPMENT(P.P.E)

- Helmet: small and durable yet protective. Must have some form of restraint system such as a chinstrap to prevent loss.

- Flash protection: Flame resistant long sleeve coveralls or wildland fire type clothing made of Nomex or PBI, should include a hood of same material.

- Boots: High top, steel shank and steel toe, with a slip resistant sole. Chemical resistant rubber type boots may be needed if chemical residue is present.

- Gloves: Quality leather construction, structural firefighting gloves offer good abrasion and thermal protection but lack dexterity. Nomex flight gloves offer good dexterity and flash protection, but are less abrasion resistant. Chemical resistant gloves may be needed for certain hazardous products.

- Personal alarm device: Can help to locate and identify trapped or incapacitated personnel.

- Lighting: Three environmentally safe sources should accompany each team member into confined spaces. Ideal combinations may be of headlamp, hand held flashlight, and a chemical snap activated light. Hardwire portable lights with the appropriate rating can be invaluable for prolonged operations or large area lighting needs.

- Full body harness and retrieval system: Required by OSHA for entry into hazardous atmospheres or where slip, trip, or fall hazards exist. This can be modified if the retrieval line itself creates a hazard, or encumbers the worker so as to make work impossible.
  The retrieval system must be attached both to the worker in the space, and to an anchor or hauling device outside the space.

  - Communication: Effective and constant communication must be maintained with entry personnel. High noise levels in the space may require things like eye contact, hand signals, or chalkboards. Radios may be ineffective in the space, if used they must intrinsically safe. (Most 800 MHz radios are not intrinsically safe and are not to be used unless marked by manufacturer)
- Atmospheric monitor: Must accompany the entry personnel into the space.

- Structural firefighting gear may be worn over lighter weight flash protection if the situation deems it necessary.

- If hazardous materials are present, level “A” or “B” entry protection may be required and worn over lighter weight flash protection.
- SABA covered in next section

Air Management
Supplied Air Breathing Apparatus (SABA)

Due to the nature of Confined Spaces and the length of time needed to be inside you may not be able to wear a full SCBA. The preferred equipment for these operations is a SABA unit.

Components

There are 4 major components to a SABA system:

The Face Mask

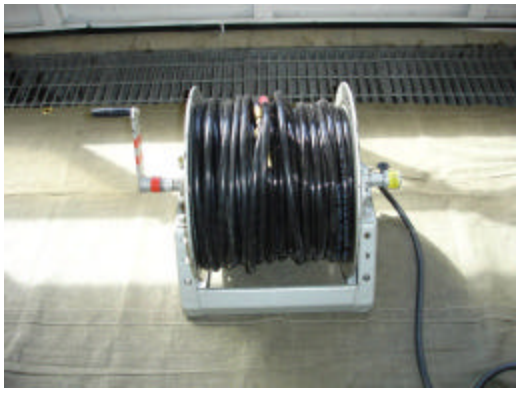
The Face Mask is typically the employees own SCBA mask from the Firefighting side of the job. These masks should not need any special equipment to be used with the SABA system.

The Escape Bottle with Regulator

The bottle is a 5, 10, or 15 minute escape bottle. The bottle is typically attached to a waist strap and also has a shoulder strap. The bottle will also have a regulator attached to attach to face mask. The regulator will also have a connection for the Air Supply Hose.

The Air Supply Hose

The Air Supply Hose is typically 300 feet in length. It may not be any longer than 300 feet. The hose can be on a reel or coiled in a bundle. In either case it will need an attendant to help pay out the line to avoid kinking and or knotting up. The 300 foot limit is due to the length of the tether rope line. These are limited by regulation to 300 feet.



Some Departments will have the air hose and the hard line communications system all in one cover.

The Air Manifold with Air Bottle

This device is designed to supply air to up to 4 hose lines. It can be hooked up to 2 supply cylinders to supply air and have a redundant back up.

South King Fire Air Manifold

Port Of Seattle Air Manifold

System Set Up

Once assigned, the air management officer should confer with I/C and the Entry Team Leader as to where to place the Air Management station. This should be a location close to the entry site because of the 300 foot limit, but also out of the way of entry operations.

After locating a suitable site the Air Management Team needs to place a tarp down to protect the equipment.

The Air Manifold then needs to be connected to two (2) SCBA bottles. One of these is the primary and one is the back up. You should also consider having 1 or more spares located in close proximity to the station for when you need to change bottles. After the first bottle goes empty the back up will become the primary and then the spare can be changed in to become the back up, this is a process that can go on indefinitely as long as you have bottle filling capability or an infinite number of bottles.

Primary entry system

Primary and back up system all set up (the RIT team should be on a separate system)

The Air Manager should have a radio to communicate with I/C in case of air problems. This person should also never leave the Air Station as the Air Bottle pressure needs to be constantly monitored.

Confined Space Rope Systems

Introduction:

The following shall serve as guidelines for the use of rope systems in confined space rescue incidents.
Some of the contents of this document were taken directly from the King County Zone Three Rope Rescue Manual.

Confined Space, by its nature requires specialized equipment, and techniques to insure the safety of rescue personnel, as well as the patient. The rope systems are generally the same as in high angle rescue, and are simply adapted to the confined space rescue environment in which they will be employed.

At all times, the safety standards set forth in NFPA 1670 shall be adhered to, as well as the standards contained in the Zone Three Rope Rescue Manual.

Rope Systems:

Tripods are generally considered to be the most efficient means of providing an overhead pick point. They are easily set up and rigged for mainline raising or lowering systems. They must however, be positioned in such a manor as to assure that they are level, that is to say that you may have to adjust the individual legs in order to make the top cap of the tripod level. Once the tripod is in position, and level, it must be secured to prevent accidental movement or toppling. (See owner's manual for additional information).

The main line is used to raise and lower the load. It must provide adequate mechanical advantage to easily control the movement of the load. Usually a MA factor of 4:1 will provide the necessary control. Some departments carry in their inventory a pre rigged 4:1 setup using a 200 foot rope that is made in such a way as to change color if the rope becomes chemically contaminated. This pre rigged system also features a mechanical brake system which saves time, and is an efficient and safe means of providing the mechanical advantage to accomplish the task. The pre rigged 4:1 system may also be inverted to provide a MA of 5:1. A change of direction must be attached at the overhead pick point to facilitate hauling as in the 4:1 system.
In situations where the vertical access is extremely deep the 4:1 system may need to be dismantled and re reeved with a 300 foot rope to provide for the extra depth.

The belay line is a separate system, and provides fall protection in the event of a failure of either the main line or the tripod.

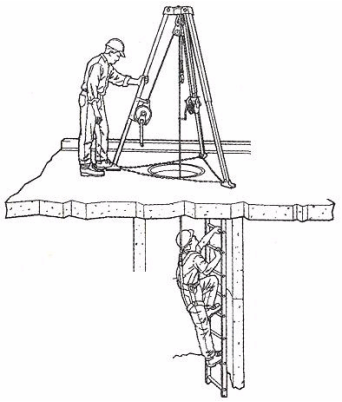
The belay line must have its own anchor point. It must not be suspended from the tripod used for the main line. It is usually run along the ground, and into the access point using edge protection to protect the rope.

Alternative Anchor Points:

Confined space incidents often require the use of alternative anchor points in order to assure the vertical alignment of the rope systems over the entry point.

Tripods:

Tripods designed for confined space rescue are available within zone three. These devices come in various sizes, and usually provide multiple pick points. The main line with appropriate mechanical advantage is attached to the top of the tripod, which is then set up directly over the access point. It is imperative that the tripod be secured in such a manor as to prevent toppling. A change of direction in the mainline to a low point such as an internal fixed ladder rung inside the manhole, or other suitable anchor point will assist in the prevention of toppling of the tripod when hauling the load vertically.



In the above photos, white line is main line, red line is belay.
Red bag represents load.

Winch Systems:

Winch systems are available from various vendors. These systems are usually attached to the tripod, and afford a simple means of lowering and raising the rescuers, and or victims. In the event that a winch system is to be used, it must be backed up by a belay line as in rope systems. It must be noted that the winch must be compatible with the tripod or davit system with which it will be used.

Winches must be inspected periodically, and re-certified by the manufacturer.

Davits:

Davits are used in place of tripods for vertical pick points. A davit is similar in design to an engine hoist. They are assembled on site, and then rolled into position over the entry point. The davit incorporates devices that prevent movement once in position. Several units are available, some with built in fall protection, some have built in manual winch devices with a clutch mechanism for safely lowering or raising personnel. However, a suitable belay setup shall be employed whenever *any* entry is to be made.

Davits have an additional advantage in that they provide a large open area for access to the space. See photo below.

Aerial Ladder pick points:

Aerial ladder devices may be employed as pick points in certain instances. However, always follow the manufacturer's recommendations in regards to loading, torque, lift angle, etc. Guidelines must be followed for stabilizing the apparatus on the ground.

It is important to understand that when using an aerial device as a vertical pick point that the load to be raised or lowered will require at least that amount of force to move the load. In other words, if the load to be lifted weighs 250 lbs, you must exert more than 250 lbs in order to move the load. These weights are added together plus the additional force necessary to actually *move* the load. Therefore, the haul line of the mainline system should be run back down the aerial ladder and a change of direction be anchored to a suitable anchor point on the apparatus, thereby causing the force of pull to parallel the ladder, and thus avoid excess loading of the ladder tip.

Main Line:

- The Main Line provides the rescuer and/or litter team with access to a patient, provides both the rescuers and patient with protection from a fall, as well as assistance in regaining the top in an angled or vertical environment.

- The Main Line bears the weight of the load imparted by the rescuers, the patient, and all equipment used as part of the patient extraction.

- The actual set up and operation of a Main Line rope system for raising and lowering a rescuer and/or litter team shall be performed by a technician level person. The exception to this is for low angle Main Line rope systems, where in such cases an operations level person may be utilized. (See NFPA 1670 for details).

Belay Line:

- The Belay Line provides a back up safety line to the Main Line. The Belay Line is not loaded unless there is a Main Line failure and as such, slack in the Belay Line has to always be at a minimum to prevent shock loading in the event of a Main Line failure.

- The actual set up and operation of a Belay Line rope system shall be performed by a technician level person.

Vertical rescue:

- A vertical angle slope can be defined by angle as a slope greater than 60 degrees to completely vertical. In rope rescue, this is an environment in which a two-rope system protects the rescuer and patient from a fall certain to cause injury or death, and the rope system is the only way possible for the rescuer and patient to regain the top of the slope. In vertical rescue, the weight of the rescuer and patient is completely reliant upon the rope system.

Use of in place systems:

Confined space incidents are often in industrial settings. Workers must enter confined spaces in order to perform maintenance, cleaning, and other tasks. These individuals should be trained in con space operations; however their knowledge of rescue techniques is often limited or non existent.

The first in company officer must evaluate any on site equipment to determine whether or not it may be used in a rescue operation. This evaluation must be based upon several factors. The overall integrity of its components, ease of use, (remember, every system or device has its own unique learning curve), patient needs, and above all risk benefit. If it is determined that any component of a system is questionable, then it must be ruled out in the rescue environment, safely removed (if possible), and replaced with an approved system.

Many systems used in con space entry in the industrial setting are essentially the same as those used in rescue. If it is determined that a system is viable, and meets industry standards in regards to setup, application, currency of inspection, etc, then it may be used. In any case a redundant belay system shall be employed, to eliminate the possibility of a fall.

Atmospheric Monitoring

BACKGROUND

The deaths of workers in confined spaces constitute a recurring occupational tragedy; approximately 60% of these fatalities have involved would-be rescuers. If you are required to work in a:

SEPTIC TANK SILO REACTION VESSEL
SEWAGE DIGESTER VAT BOILER
PUMPING/LIFT STATION DUCT PIPELINE
SEWAGE DISTRIBUTION UTILITY VAULT PIT
HOLDING TANK or AIRCRAFT WING TANKS

or similar type of structure or enclosure, you are working in a CONFINED SPACE. The Occupational Safety and Health Administration (OSHA) defines a confined space in 29 CFR 1926.21 as "any space having a limited means of egress, which is subject to the accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere." The NIOSH ***Criteria for a Recommended Standard .... Working in Confined Spaces*** dated December, 1979, defines a confined space as:

...a space which by design has limited openings for entry and exit; unfavorable natural ventilation which could contain or produce dangerous air contaminants, and which is not intended for continuous employee occupancy. Confined spaces include but are not limited to storage tanks, compartments of ships, process vessels, pits, silos, vats, degreasers, reaction vessels, boilers, ventilation and exhaust ducts, sewers, tunnels, underground utility vaults, and pipelines.

Confined spaces often contain ‘’invisible’’ hazards. Most notably are bad atmospheres.

The air that we breathe is generally considered to contain 21% oxygen, 78% nitrogen, and 1% of all the other gasses combined. These characteristics often change in confined spaces. These changes are often imperceptible. Therefore It is important know what the atmosphere actually contains, and why it has changed. This is accomplished through the use of atmospheric monitoring equipment, and techniques.

In today’s fire service, it’s common to find air monitoring equipment available on first line apparatus. These units are usually of the four gas type. They are considered to be our first line of defense against a bad atmosphere. Typically a four gas instrument will be set up to monitor the following gasses.

Oxygen (O2)
Lower explosive limit (LEL)
Hydrogen Sulfide (H2S)
Carbon Monoxide (CO)

Oxygen

Oxygen is considered to be in the normal range when it measures between 19.5 % and 23.5 %. O2 lower than 19.5 % is an oxygen deficient atmosphere. Above 23.5 % is an oxygen enriched atmosphere.

When the O2 falls below 21% it usually means that some other gas has taken its place. The four gas monitor in the hands of someone familiar with the instrument and interpretation of its readings is helpful. A Haz-Mat tech should be doing the monitoring, as these units are frequently used in hazardous materials incidents.

Oxygen readings are the most important in that the rest of the gas sensors depend upon the accuracy of the O2 reading.

LEL

Lower explosive limit, expressed in % LEL is the measurement of flammable gases present in the atmosphere. When the meter reads 10% of the LEL an alarm will sound warning of a potentially dangerous condition. This 10% is a built in safety factor, as there is 90% left to go before reaching 100% of the LEL. At 100% of the LEL, conditions are critical for an explosion.

H2S

Hydrogen Sulfide, also known as ‘’sewer gas’’ forms from the decomposition of organic matter. It is common in sewers, storm drains, and other subterranean locations. It is colorless and has a ‘’rotten egg’’ odor. H2S is heavier than air and will tend to settle to the lower areas of confined spaces. It is highly poisonous. Inhalation is the means of entering the body. H2S has toxicity similar to cyanide. It is detectable to the human sense of smell as low as 10 ppb. At concentrations of 50-100 ppm it may cause the sense of smell to fail, fooling the entrant into believing that the H2S has gone. At high exposures (usually greater than 300 ppm) the sense of smell will fail after a few breaths. Death may occur at 600 ppm concentrations. H2S is also flammable; its auto ignition temperature is 500 degrees Fahrenheit. The LEL is 4.0% and the UEL is 44.0%.

Carbon Monoxide

CO is a colorless, odorless, poisonous gas. It is slightly lighter than air (almost neutral). It has an auto ignition temperature of 1166 degrees F. its LEL is 12.5%, and an UEL of 74.0%.

When carbon monoxide is inhaled, it takes the place of oxygen in hemoglobin, the red blood pigment that normally carries oxygen to all parts of the body. Because carbon monoxide binds to hemoglobin several hundred times as strongly as does oxygen, its effects are cumulative and long-lasting, causing oxygen starvation throughout the body. Prolonged exposure to fresh air (or pure oxygen) is required for the CO-tainted hemoglobin (carboxyhemoglobin) to clear.
CO poisoning is often treated with hyperbaric medicine.

The effects of carbon monoxide in parts per million are listed below:

100 ppm (0.01%) Slight headache in two to three hours
200 ppm (0.02%) Slight headache within two to three hours
400 ppm (0.04%) Frontal headache within one to two hours
800 ppm (0.08%) Dizziness, nausea, and convulsions within 45 minutes. Insensible within two hours.
1,600 ppm (0.16%) Headache, dizziness, and nausea within 20 minutes. Death in less than two hours.
3,200 ppm (0.32%) Headache, dizziness and nausea in five to ten minutes. Death within 30 minutes.
6,400 ppm (0.64%) Headache and dizziness in one to two minutes. Death in less than 20 minutes.
12,800 ppm (1.28%) Death in less than three minutes.

Other toxic gasses are often present in confined spaces. Specialized monitoring equipment and methods may be required in order to detect these gases.

Monitoring

To begin with, the space to be entered shall be monitored prior to ventilation to determine atmospheric conditions.

Monitoring shall be done at the opening, then at four foot increments throughout its depth and along its length. The sample tube must be moved around at each depth in order to accurately measure the overall atmosphere.

The monitoring instrument to be used should be current in inspection, and fitted with a pump to draw the subject atmosphere into the sensor ports. It is important to note that there will be significant ‘’lag time’’ in obtaining readings. A sample tube or wand is attached to the pump that has been fitted to the monitor. Consult the operations manual of the instrument/pump to be used. If none is available, a good rule of thumb is to allow at least one second per foot of the hose or wand.

Once the initial monitoring has been completed, ventilation can commence. Subsequent monitoring shall be repeated at least every ten minutes. Record all monitoring results on the entry permit giving times and locations.

Be certain that the batteries for both the monitor and the pump are fully charged, or fresh batteries are installed. It is advisable to use clean sample tubing. Previously used tubing may contain contaminants that could render readings inaccurate. Proper tubing is available in rolls. This allows for making up a custom length sample tube. However, it is important to measure the tube prior to use. This will assist in determining the lag time of the instrument/pump combination. Consult the operations manual, or contact the manufacturer for details as to tubing type, inside diameter, and maximum length.

It takes hands on practice with the equipment to become proficient in its use.

VENTILATION

Ventilation should be one of the rescuers ***first*** priorities. Ventilation should be started as soon as the first air monitoring is completed and it is decided what type of ventilation is needed (positive pressure or exhausting). All fans should be rated as intrinsically safe. This means that these fans have devices that have all potentially arcing components encased in an insulating material, have operational voltages below the level needed for ignition or are incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture.

Positive pressure ventilation, when done properly, is designed to decrease atmospheric hazards. It does this by replacing the environment with good air. This will, in turn, decrease the chance of fire, explosion, and atmospheric toxicity by lowering the level of contaminants, or eliminating them altogether. Ventilation can also help regulate the temperature within the space. The use of built in ventilation systems within the space is appropriate if they are available and can be used safely.

Air streams should create continuous turbulence throughout the space. This will help assure proper air exchange, as long as the appropriate cubic feet per minute is attained. Cubic feet per minute flow is directly related to air changes per hour, and is based in part upon the cubic volume of space.

Depending on the space and type of work to be performed, it may necessary to exhaust air from the space. This may be done independently of, or in conjunction with positive pressure ventilation. Generally, if toxins or flammables are present, exhausting is preferred.

Proper placement of the ventilation system is crucial for effective and safe ventilation. This includes considerations of the type of gasses to be removed from the space. Consider whether the toxins are heavier or lighter than air. Hoses which blow in fresh air should normally hang within two feet of the floor. By ducting, airflow can be directed at a wall or floor to enhance circulation. When ventilation is performed properly, recirculation and short circuiting will not occur.

At times, two blowers located at opposite ends of the space may be needed to create a good air pocket around the subject. The use of a single blower to push good air toward the subject may continue to draw bad air from the source. This is called recirculation. Keep all vehicles and other combustion engines at least 50 feet down wind in order to prevent exhaust gasses from being drawn into the space by your ventilation efforts. Continually assess your ventilation efforts to assure that you are not increasing the chance of a flammable or explosive atmosphere by introducing good air into an environment which is too rich to burn.

Lock out Tag Out, [LOTO]

In rescue situations we are in a mode of needing to control potentially harmful energy. This energy can take the form of; electrical, hydraulic, pneumatic, free flowing solids, mechanical and gravity. Some ways of doing this will be obvious, [built in places to affix a lock], and others will be conceptual, [respect for what may come down a storm drain while you are packaging a patient]. Assume the worst, until your resources and/or level of trust proves otherwise.

The need to pre-plan what is in your response area cannot be emphasized enough! Determine what the potential hazards are and is there a way to isolate the space or control the potential hazard. Does the agency or business already have a LOTO program in place, and if so, how would we as rescuers interface with it? Do you have a commercially made device set, complete with a key operated lock, or will you be relying on a fire fighter equipped with a radio and an axe? These are questions that are better addressed prior to the event and if nothing else, a good excuse for a company/team drills.

LOCK OUT
"Placing a lockout on an energy-isolating device using an established procedure to make sure the machine or equipment can't be operated until the lockout device is removed."

This is the preferred method for controlling the scene and would be accomplished by the use of a key operated lock unique to the rescue agency and the key in the control of the individual making entry or the designated Safety Officer.

TAG OUT
"Placing a tagout device on an energy-isolating-device using an established procedure to indicate that the energy-isolating device and the machine or equipment being controlled may not be operated until the lockout/ tagout device is removed"

Tag out is more common in industry and is often used in conjunction with lockout. By itself it is not as secure of a way to control potential hazards. It can be a simple indicator sign to more elaborate tags that include the name and picture of the person making entry.

In Zone 3 operations we should use the highest level that is practical for the situation. Turn off the power to the item when possible and checked for stored energy. Isolate other potential energy sources. Attach lock/s and tag/s as feasible. If a lock is used, give the key to the Safety Officer for control until the end of the incident.

Victim Support

This portion of the manual is not a specific how to do things section, rather it is a list of items you need to consider for the safety and comfort of the victim.

Water Removal: This can be accomplished using a sump pump, water vac, bucket or any other means to remove water. Remember to try and find the source of the water (i.e. Broken pipe, water cooled cutting tools, rain etc.) and shut off, divert, or cover the patient so you can make the surroundings as comfortable as possible.

Patient Protection: You're wearing a helmet to keep things from hitting you in the head, be sure to protect your patient also! This can also be extended to safety glasses. In addition you might consider wrapping your patient in a blanket or using other PPE to protect your patient from falling/flying debris. Hearing protection is also important if you are going to be operating loud tools/ machinery next to the patient. (Be sure to check the patient for possible head injuries before plugging ears.)

Clean Air: Although ventilation of the working space is covered in another area of this manual you still need to consider additional protection depending on the atmosphere were the patient is located. This could be as simple as a dust mask or could include providing the patient with a SCBA or SABA system

Patient Warmth: In many instances providing a blanket to your patient is adequate but if this will be an extended operation you might consider heating the ventilated air. Be sure that any device used is not raising the CO levels of space you are working in. Another option is using hotpacks in the patient's armpits and hands.

Patient Packaging

Removing a patient from a confined space can be very challenging especially when the patient is injured or unconscious. There are several devices for this purpose that are used by the Zone 3 Rescue Teams. Following is a list of each and how to use them. Be sure to understand how to use *all* of them because you may not be using the one you have at your department when you arrive at a confined space rescue.

LSP Halfback: The LSP is carried by South King Fire and is applied in the following sequence.

1. The bottom chest strap is applied first.
2. The top chest strap is applied snuggly but not to restrict breathing.
3. The shoulder straps are attached next.
4. Finally the leg straps are applied being sure not to over tighten.

Yates Spec Pack:

The Yates Spec pack is carried and used by North Highline. Like the LSP Halfback it is a rated harness and no other harness is needed for the patient. The attachment point is by the hand in the top picture.

It is applied to the patient very similar to the way the LSP is applied with the difference being it has only one waist strap. It also has wrist straps as you can see from this picture.

As you can see in this last picture the back is slick plastic for dragging the patient.

SKED: CONTENTS OF SKED BASIC RESCUE SYSTEM

Backpack/Towing Harness – Constructed with Cordura fabric. Backpack has shoulder straps, waist strap and pockets for storing remainder of Sked system**. Backpack doubles as a towing harness** by connecting the stretcher to the backpack using the tow strap and 1 of the 2 "D" rings sewn into the backpack.

Vertical Lift Sling – 30' length of 3/8" PMI kern mantle rescue rope with 5,265 lbs. breaking strength.

Tow Strap – 6' strap with bronze snap hooks on each end. Can be used by attaching both ends to stretcher or one end to backpack and one end to stretcher.

Horizontal Lift Slings – a pair of nylon slings with 9,000 lbs. breaking strength.

Removable Webbing Handles – four webbing loops can be threaded through grommets to create handles, allowing Sked to be carried by up to eight rescuers.

Steel Locking "D" Carabiner – 9,000 lbs. breaking strength used to attach stretcher to hoisting system.

CONSIDERATIONS

• *The Sked is not a spinal immobilization device*; however, it will accommodate most long and short boards. Follow all spinal immobilization protocols prior to placing suspected spinal injury patients in the Sked.

• A backboard must be used on patients with injuries to the shoulder area prior to placing the patient into the Sked.
• Always use a tag line when hoisting the Sked in the horizontal position to keep the litter from spinning.
• Keep the Sked in the Cordura pack to minimize UV damage.

B. PATIENT LOADING: There are three basic ways to get a patient into the Sked; the log roll, the slide, and on an approved spinal immobilization device.

1. Log Roll
    a. Place stretcher next to patient with straps under Sked.
    b. Log roll patient and slide Sked as far under patient as possible.
    c. Slide patient to center of stretcher.
    d. Pull straps from under stretcher and fasten to buckle ends.
2. Slide
    a. Position foot end of Sked at head of patient.
    b. Have one rescuer straddle Sked and support patient's head, neck, and shoulders.
    c. Grasp foot straps of Sked and slide stretcher under patient.
    d. Center patient on stretcher and fasten straps.

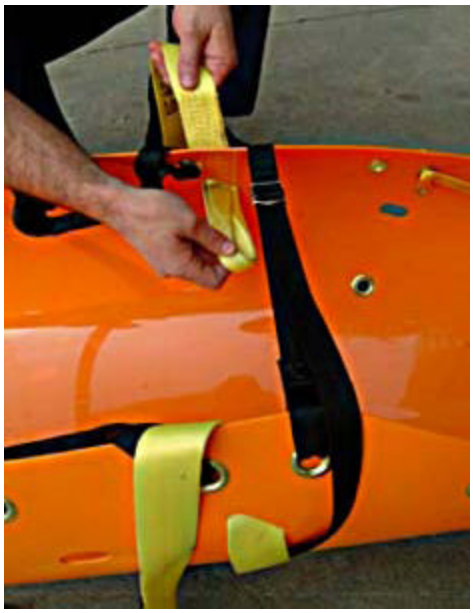
3. Spinal Immobilization
    a. Immobilize patient in accordance with current policy.
    b. Patients secured to long board devices may be placed in Sked using any technique available.
    c. Patients secured to short board devices should be placed into the Sked using the "Slide" technique. Center patient and fasten straps.

C. PATIENT PACKAGING

After patient is properly centered on the stretcher:
1. Lift sides of Sked and fasten the four cross straps to buckles directly opposite the straps. Tighten straps enough to hold patient in place but not so tight that the patient's ability to breathe is affected.

2. Feed foot straps through their respective grommets at foot of Sked and to buckles. At this point the patient is packaged correctly for towing evolutions. The Sked can be towed using the pre-attached handle or the tow strap. If the patient is going to be lifted using the horizontal or vertical evolution refer to the additional steps listed below.

D. HORIZONTAL HOIST SET-UP



1. Secure the head end of the stretcher up and over the patient's head by tying the pre-attached handle to a convenient cross strap.

2. Do not secure so tight that patient's cervical spine or airway is compromised.

3. Use the shorter of the lifting straps at the head end of Sked. Insert one end of head strap through angled slot at head end of stretcher.

4. Bring strap under Sked and through lift slot on opposite side.

5. Repeat procedure with other strap at foot end.

6. Equalize all four straps and secure to two steel locking carabiners.

7. Connect carabiners to hoist system.

8. Adhere to approved two line rope system requirements for hoist operations.

E. VERTICAL HOIST SET-UP

1. Secure the head end of the stretcher up and over the patient's head by tying the pre-attached handle to a convenient cross strap.

2. Tie a figure 8 with a bight in the middle of the 30' by 3/8" kernmantle rope.

3. Pass each end of the rope through grommets at the head end of stretcher from the outside inward.

4. Pull the knot up against the stretcher.

5. Feed rope through unused grommets and each carrying handle all the way to the foot end of the Sked.

6. Pass rope ends through grommets at the foot end of stretcher from the inside outward.

7. Tie the ends of the rope together with a square knot.

8. Bring ends of rope up over end of Sked and pass through carrying handles and tie ends together with a square knot.

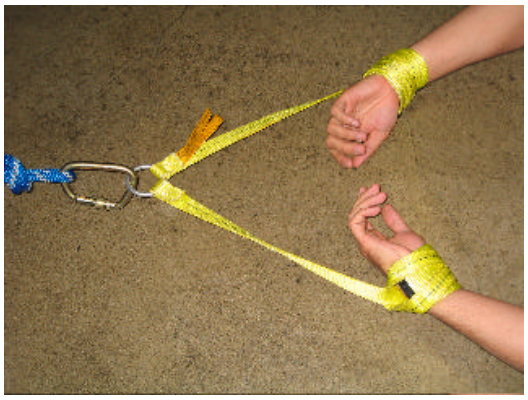
9. Tie a safety overhand knot with each bitter end.

Do not lift the Sked from the horizontal position to the vertical position with the hoist system. This will force the patient's chin into their chest and compromise the cervical spine. Two rescuers should lift the Sked from the horizontal to the vertical position using the carrying straps located at the head end. Once in the vertical position tension can be applied to the hoist system.

MAINTENANCE

All components of the Sked Rescue System can be washed in a mild detergent solution and air-dried out of the direct sun.

Wristlets: The wristlets are placed on the victim as shown in the picture. Keep in mind that these are mainly for body recovery. Removing a patient vertically out of a hole with little clearance or quick removal of a patient in a hazardous setting are other reasons you may have to use them. Further injury to a patient is possible so if possible use one of the other devices listed above. If you plan to use them to drag the patient you will want to be sure to protect the victims head from banging on the ground.



Stokes: See Patient Packaging on pages 35 and 36 of the Rope Rescue Manual.

Reeves Sleeve: As you can see the Reeves has a vertical attachment point sewn into the head of the litter. A backboard is placed inside the sleeve so there is no need for an additional back board. There are four horizontal attachment points on each corner allowing any litter spider type assembly to be in place. The patient is secured to the sleeve via large orange wraps with velcro enclosure and additional seat belt type straps in place outside of it. The head of the litter has pre set Velcro to accommodate the Ferno style head blocks and adjustable forehead and C-collar stabilizing straps. At the foot of the Reeves Sleeve are three buckles designed to hold an O2 cylinder in place.

Appendix A

Zone 3 Confined Space Permit

1. LOCATION:	2. DATE:
3. INCIDENT COMMANDER:	OPERATIONS OFFICER:
SAFETY OFFICER:	ATTENDANT:
ENTRY TEAM:	
BACK-UP TEAM:	
4. TIME PERMIT ISSUED:	5. TIME PERMIT EXPIRED:

6. JOB DESCRIPTION: ☐ RESCUE ☐ RECOVERY ☐ OTHER

7. HOT WORK PERMIT REQUIRED? ☐ YES ☐ NO

8. HAVE THE FOLLOWING PRECAUTIONS BEEN TAKEN?		9. SAFETY EQUIPMENT USED AT THE SCENE:	
AIR TESTED AT ALL LEVELS	☐ YES ☐ NO ☐ N/A	S.A.B.A.	☐
VENTILATION	☐ YES ☐ NO ☐ N/A	S.C.B.A.	☐
LIFELINES WORN BY RESCUERS	☐ YES ☐ NO ☐ N/A	AIR MONITOR	☐
RESCUE EQUIPMENT TESTED & READY	☐ YES ☐ NO ☐ N/A	VICTIM HARNESS	☐
ENTRY TEAM READY	☐ YES ☐ NO ☐ N/A	ROPE SYSTEM	☐
BACK-UP TEAM READY	☐ YES ☐ NO ☐ N/A	VENTILATION	☐
CONTINUOUS AIR TESTING IN PROGRESS	☐ YES ☐ NO ☐ N/A	TRIPOD	☐
COMMUN. SYSTEM OPERATIONAL	☐ YES ☐ NO ☐ N/A	PROTECTIVE CLOTHING	☐
S.A.B.A. READY	☐ YES ☐ NO ☐ N/A	COMMUNICATION SYSTEM	☐
ALL SYSTEMS SAFETY CHECKED	☐ YES ☐ NO ☐ N/A	OTHER	☐
HAZARDS POSSIBLE IN SPACE?			
ENGULFMENT	☐ YES ☐ NO ☐ N/A		
TOXIC ATMOSPHERE	☐ YES ☐ NO ☐ N/A		
FLAMMABLE ATMOSPHERE	☐ YES ☐ NO ☐ N/A		
OXYGEN DEFICIENT OR EXCESS	☐ YES ☐ NO ☐ N/A		
MECHANICAL	☐ YES ☐ NO ☐ N/A		
ELECTRICAL	☐ YES ☐ NO ☐ N/A		
COLLAPSE	☐ YES ☐ NO ☐ N/A		
LOCK-OUT/TAG-OUT	☐ YES ☐ NO ☐ N/A		
OTHER _____	☐ YES ☐ NO ☐ N/A		

10. INITIAL AIR TESTS CONDUCTED: M.S.A. PASSPORT UNIT # _____ OTHER DETECTOR:

	TIME	O2	LEL	CO	H2S	OPERATOR	PERMISSIBLE LIMITS
BEFORE OPENING							OXYGEN 19 TO 23%
INSIDE OPENING							LEL < 10%
4 FEET INSIDE							CO < 5%
8 FEET INSIDE							
12 FEET INSIDE							

11. COMMUNICATIONS SYSTEM: ☐ VOICE ☐ HARDWARE ☐ RADIO ☐ ROPE

NO ONE SHALL ENTER ANY CONFINED SPACE UNTIL THE ATMOSPHERE HAS BEEN TESTED AND ALL APPROPRIATE SAFETY PROCEDURES HAVE BEEN FOLLOWED

12. SIGNATURES:	SAFETY OFFICER:
	OPERATIONS OFFICER:

Zone 3 Air Monitoring Worksheet

1. LOCATION OF INCIDENT:						
2. DATE:						
3. INCIDENT COMMANDER:						
4. SAFETY OFFICER:						
5. ENTRY TEAM:						
6. AIR MONITOR:						
7. GAS DETECTOR USED:						
UNIT 1 _____						
UNIT 2 _____						
OTHER DETECTOR _____						
8. ATMOSPHERE TO BE MONITORED AT LEAST EVERY (minutes): _____						
AIR MONITORING CONDUCTED.						
TIME	DEPTH	OXYGEN	LEL	CO	H2S	OPERATOR
(ADDITIONAL MONITORING LOG ON REVERSE)						

NO ONE SHALL ENTER ANY CONFINED SPACE UNTIL ALL APPROPRIATE SAFETY MEASURES AND EQUIPMENT ARE IN PLACE AND STAFFED, AND INITIAL AIR MONITORING HAS BEEN COMPLETED AND APPROVED BY THE SCENE SAFETY OFFICER AND THE INCIDENT COMMANDER

APPROVED	SAFETY OFFICER:
	INCIDENT COMMANDER:

Air Monitoring Worksheet Continued

AIR MONITORING CONDUCTED.						
TIME	DEPTH	OXYGEN	LEL	CO	H2S	OPERATOR

Zone 3 Entry Team Leader Worksheet

ENTRY TEAM NAMES	COLOR OF AIR CORD
#1	
#2	
BACK-UP TEAM NAMES	
#3	
#4	
AIR PRESSURE, MAIN SYSTEM	PONY BOTTLE
#1	
#2	
#3	
#4	
COMMUNICATION CONNECTION PORT	
#1	
#2	
#3	
#4	

MEDICAL CHECK	PULSE	B/P	RESP	MENTAL STATUS
#1				
#2				
#3				
#4				

SAFETY EQUIPMENT CHECK	HELMET	GOGGLES	LIGHTx3	GLOVES	HARNESS	AIR SUPPLY
#1						
#2						
#3						
#4						

PERSONNEL STATUS CHECK (EVERY 15 MINUTES) TIME							
#1							
#2							
#3							
#4							
DEPTH OF ENTRY							

Appendix B

Definitions of commonly used hazardous locations terminology

For complete details, reference the National Electrical Code (NEC®), NFPA 70 or the appropriate NFPA or UL Standard.

Class I, Division 1

A Class I, Division 1 location is a location where ignitable concentrations of flammable gases, vapors or liquids:

- can exist under normal operating conditions;
- may exist frequently because of repair or maintenance operations or because of leakage; or
- may exist because of equipment breakdown that simultaneously causes the equipment to become a source of ignition

Equipment intended for use in a Class I , Division 1 area is usually of the explosionproof, intrinsically safe, or purged/pressurized type.

Explosionproof apparatus: "Apparatus enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor that may occur within it and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosion of the gas or vapor within and that operates at such an external temperature that a surrounding flammable atmosphere will not be ignited thereby." (See NFPA 70)

Intrinsically safe apparatus: "Apparatus in which all the circuits are intrinsically safe." (See UL 913)

Intrinsically safe circuit: "A circuit in which any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under prescribed test conditions." (See UL 913)

Purging: "The process of supplying an enclosure with a protective gas at a sufficient flow and positive pressure to reduce the concentration of any flammable gas or vapor initially present to an acceptable level." (See NFPA 496)

Pressurization: "The process of supplying an enclosure with a protective gas with or without continuous flow at sufficient pressure to prevent the entrance of a flammable gas or vapor, a combustible dust, or an ignitable fiber." (See NFPA 496)

Class I, Division 2

A Class I, Division 2 location is a location:

- where volatile flammable liquids or flammable gases or vapors exist, but are normally confined within closed containers;
- where ignitable concentrations of gases, vapors or liquids are normally prevented by positive mechanical ventilation; or
- adjacent to a Class I, Division 1 location, where ignitable concentrations might be occasionally communicated.

Equipment intended for use in a Class I, Division 2 area is usually of the nonincendive, non-sparking, purged/pressurized, hermetically sealed, or sealed device type.

Nonincendive circuit: "A circuit in which any arc or thermal effect produced under intended operating conditions of the equipment is not capable, under the test conditions specified, of igniting the specified flammable gas- or vapor- air mixture."(See UL 1604)

Nonincendive component: "A component having contacts for making or breaking an incendive circuit and the contacting mechanism shall be constructed so that the component is incapable of igniting the specified flammable gas- or vapor-air mixture. The housing of a nonincendive component is not intended to:

- exclude the flammable atmosphere, or
- contain an explosion." (See UL 1604)

Nonincendive field circuit: "A circuit that enters or leaves the equipment enclosure and that under intended operating conditions is not capable, under the test conditions specified, of igniting the specified flammable gas- or vapor-air mixture or combustible dust." (See UL 1604)

Non-sparking apparatus: "Apparatus that has no normally arcing parts or thermal effects capable of ignition. Examples of normally arcing parts are relays, circuit breakers, servo-potentiometers adjustable resistors, switches, non-latching type connectors and motor brushes. (See UL 1604)

Purging: See definition under Class I, Division 1

Pressurization: See definition under Class I, Division 1

Hermetically sealed component: "A component that is sealed against entrance of an external atmosphere and in which the seal is made by fusion, such as soldering, brazing, welding, or the fusion of glass to metal." (See UL 1604)

Sealed device: "A device that is constructed so that it cannot be opened, has no external operating mechanisms, and is sealed to restrict entry of an external atmosphere without relying on gaskets. The device may contain arcing parts or internal hot surfaces." (See UL 1604)

Class I, Zone 0

A Class I, Zone 0 location is a location where ignitable concentrations of flammable gases, vapors or liquids:

- are present continuously; or
- are present for long periods of time.

Equipment intended for use in a Class I, Zone 0 area is usually of the intrinsically safe, "ia," type.

Intrinsically safe: See definitions under Class I, Division 1

Class I, Zone 1

A Class I, Zone 1 location is a location where ignitable concentrations of flammable gases, vapors or liquids:

- are likely to exist under normal operating conditions;
- may exist frequently because of repair or maintenance operations or leakage; or
- may exist because of equipment breakdown that simultaneously causes the equipment to become a source of ignition; or
- are adjacent to a Class I, Zone 0 location from which ignitable concentrations could be communicated.

Equipment intended for use in a Class I, Zone 1 area is usually of the flameproof, purged/pressurized, oil immersed, increased safety, encapsulated or powder filled type.

Flameproof: "The enclosure of the equipment will withstand an internal explosion, and prevent passage of flame to the surrounding atmosphere. Care must be taken to maintain the length and clearance (gap) of flameproof joints in service." (See UL 2279)

Purged/pressurized: See definitions under Class I, Division I.

Oil immersion: "Arcing contacts are immersed in a protective liquid." (See UL 2279)

Increased safety: "The equipment contains no normally arcing parts, and additional measures (such as larger spacings among wiring connections) are taken to prevent the possibility of high temperatures or sparks. A minimum IP rating of IP 54 is required." (See UL 2279)

Encapsulation: "Arcing contacts are completely surrounded by an encapsulating material." (See UL 2279)

Powder filling: "Arcing contacts are surrounded by a filling material (glass or quartz powder)." (See UL 2279)

Class I, Zone 2

A Class I, Zone 2 location is a location:

- where ignitable concentrations of flammable gases, vapors or liquids are not likely to occur in normal operation or, if they do occur, will exist only for a short period;
- where volatile flammable liquids, or flammable gases or vapors exist, but are normally confined within closed containers
- where ignitable concentrations of gases, vapors, or liquids are normally prevented by positive mechanical ventilation;
- adjacent to a Class I, Zone 1 location from which ignitable concentrations could be communicated.

Equipment that is intended for use in a Class I, Zone 2 area is usually of the nonincendive, non-sparking, restricted breathing, hermetically sealed or sealed device type.

Nonincendive: See definitions under Class I, Division 2

Non-sparking: See definition under Class I, Division 2

Restricted breathing: "The enclosure relies on tight seals and gaskets to prevent diffusion of the explosive atmosphere into the equipment enclosure. Provision for checking that the restricted breathing properties of the enclosure are maintained is provided." (See UL 2279)

Hermetically sealed: See definition under Class I, Division 2

Sealed device: "A device that is constructed so that it cannot be opened and is sealed to restrict entry of an external atmosphere. The device may contain arcing parts or internal hot surfaces." (See UL 2279)

Class II, Division 1

A Class II, Division 1 location is a location where:

- ignitable concentrations of combustible dust can exist in the air under normal operating conditions;
- ignitable concentrations of combustible dust may exist because of equipment breakdown that simultaneously causes the equipment to become a source of ignition; or
- electrically conductive combustible dusts may be present in hazardous quantities.

Equipment intended for use in a Class II, Division 1 area is usually of the dust-ignition-proof, intrinsically safe, or pressurized type.

Dust-ignition-proof : "Enclosed in a manner that will exclude dusts and, where installed and protected in accordance with the NEC, will not permit arcs, sparks or heat otherwise generated or liberated inside of the enclosure to cause ignition of exterior accumulations or atmospheric suspensions of a specified dust on or in the vicinity of the enclosure." (See NFPA 70)

Intrinsically safe: See definitions under Class I, Division 1.

Pressurization: See definition under Class I, Division 1.

Class II, Division 2

A Class II, Division 2 location is a location where:

- combustible dust is not normally in the air in ignitable concentrations;
- dust accumulations are normally insufficient to interfere with normal operation of electrical equipment;
- dust may be in suspension in the air as the result of infrequent malfunctioning of equipment; or
- dust accumulation may be sufficient to interfere with safe dissipation of heat or may be ignitable by abnormal operation.

Equipment intended for use in a Class II, Division 2 area is usually of the dusttight, nonincendive, non-sparking, or pressurized types.

Dusttight: "Constructed so that dust will not enter the enclosing case under specified test conditions. An example of such conditions would be a UL Type 12 enclosure." (See NFPA 70)

Nonincendive: See definitions under Class I, Division 2

Non-sparking: See definition under Class I, Division 2

Pressurization: See definition under Class I, Division 1.

Class III, Division 1

A Class III, Division 1 location is a location where easily ignitable fibers or materials producing combustible flyings are handled, manufactured or used.

Equipment intended for use in a Class III, Division 1 area is usually of the dusttight or intrinsically safe type (both previously defined).

Class III, Division 2

A Class III, Division 2 location is a location where easily ignitable fibers are stored or handled.

Equipment intended for use in a Class III, Division 1 area is usually of the dusttight or intrinsically safe type (both previously defined).

NFPA Standards for Confined Space Rescue

7.1 General Requirements.

7.1.1 Organizations operating at confined space incidents shall meet the requirements specified in Chapter 4.

7.1.2 * The requirements of this chapter shall apply to organizations that provide varying degrees of response to confined space emergencies.

7.1.3 All confined space rescue services shall meet the requirements defined in 7.1.3.1 through 7.1.3.12.

7.1.3.1 Each member of the rescue service shall be provided with, and trained to use properly, the personal protective equipment and rescue equipment necessary for making rescues from confined spaces according to his or her designated level of competency.

7.1.3.2 Each member of the rescue service shall be trained to perform the assigned rescue duties corresponding to his or her designated level of competency.

7.1.3.3 Each member of the rescue service shall also receive the training required of authorized rescue entrants.

7.1.3.4 Each member of the rescue service shall practice making confined space rescues , in accordance with the requirements of 4.1.7 of NFPA, by means of simulated rescue operation in which he or she removed dummies, mannequins or persons from actual confined spaces or from representative confined spaces.

7.1.3.5 Representative confined space should-with respect to opening size, configuration, and accessibility-simulate the types of confined spaces from which rescue is to be performed.

7.1.3.6 Each member of the rescue service shall be certified to the level of first responder or equivalent according to U.S. Department of Transportation *First Responder Guidelines*.

7.1.3.7 Each member of the rescue service shall successfully complete a course in cardiopulmonary resuscitation.

7.1.3.8 The rescue service shall be capable of responding in a timely manner to rescue summons.

7.1.3.9 Each member of the rescue service shall be equipped, trained, and capable of functioning to perform confined space rescues within the area for which they are responsible at their designated level of competency.

7.1.3.10 The requirements of 7.1.3.9 shall be confirmed by an annual evaluation of the rescue service's capabilities to perform confined space rescues in terms of overall timelines, training types and equipment and to perform safe and effective rescue in those types of spaces to which the team must respond.

7.1.3.11 Each member of the rescue service shall be aware of the hazards he or she could confront when called on to perform rescue within confined spaces fro which the service is responsible.

7.1.3.12 If required to provide confined space rescue within U.S. federally regulated industrial facilities, the rescue service shall have access to al confined spaces from which rescue could be necessary so that they can develop rescue plans and practice rescue operations according to their designated level of competency.

7.1.4 A confined space rescue team shall be make up of a minimum of six individuals for organizations operating at the technician level, and a minimum of four individuals for organizations operating at the operations level.

7.2 Awareness Level.

7.2.1 Organizations operating at the awareness level for confined space search and rescue incidents shall meet the requirements specified in Section 7.2 and 6.2 (awareness level for rope rescue).

7.2.2 All members of the organization shall meet the requirements of Chapter 4 of NFPA 472, *Standard for Professional Competence of Responders to Hazardous Material Incidents*.

7.2.3 Organizations at the awareness level shall be responsible for performing certain non-entry rescue operations.

7.2.4 Organizations operating at the awareness level for confined space search and rescue incidents shall implement procedures for the following:

(1) Recognizing the need for confined space search and rescue
(2) Initiating contact and establishing communications with victims where possible
(3) Recognizing and identifying the hazards associated with non-entry confined space emergencies
(4) Recognizing confined spaces
(5) Performing a non-entry retrieval
(6) Implementing the emergency response system for confined space emergencies
(7) Implementing site control and scene management

7.3 Operations Level.

7.3.1 Organizations operating at the operations level for confined space search and rescue incidents shall meet the requirements specified in Sections 7.2 and 7.3, as well as in the following sections:

(1) Section 6.3 (0perations level for rope rescue)
(2) Section 11.2 (awareness level for trench and excavation search and rescue)

7.3.2 The organization operating at this level shall be responsible for the development and training of a confined space rescue team of at least four individuals who are trained, equipped, and available to respond to confined space emergencies of a type and complexity that requires an operations level organization.

7.3.3 Organizations operating at the operations level shall develop and implement procedures for the following:

(1) Sizing up existing and potential conditions at confined space emergencies
(2) Protecting personnel from hazards within the confined space
(3) Ensuring that personnel are capable of managing the physical and psychological challenges that affect rescuers entering confined spaces

(4) Identifying the duties of the recur entrant(s) and backup rescue entrant, rescue attendant, and rescue tem leader as defined herein

(5) Monitoring continuously, or at frequent intervals, the atmosphere in all parts of the space to be entered for oxygen content, flammability (LEL/LFL), and toxicity, in that order

(6) Performing entry-type rescues into confined space meeting all of the following specific qualifying characteristics:

(a) The internal configuration of the space is clear and unobstructed so retrieval system can be utilized for rescuers without possibility of entanglement.

(b) The victim can be easily seen from the outside of the space's primary access opening.

(c) Rescuers can pass easily through the access/egress opening with room to spare when PPE is worn in the manner recommended by the manufacturer.

(d) The space can accommodate two or more rescuers in addition to the victim.

(e) All hazards in and around the confined space have been identified, isolated, and controlled.

(7) Using victim packaging devices that could be employed in confined space rescue

(8) Transferring victim information including location, surroundings, condition when found, present condition, and other pertinent information to emergency medical serves personnel

(9) Planning and implementing a confined space rescue operation

(10) Selecting, constructing, and using a rope lowering and raising system in the high-angle environment

7.4 Technician Level.

7.4.1 Organizations operating at the technician level for confined space search and rescue emergencies shall meet the requirements of this chapter and Section 8.4 (technician level for vehicle and machinery search and rescue).

7.4.2 Te organization operating at this level shall be responsible for the development of a confined space rescue team of at least six individuals who are trained, equipped, and available to respond t confined space emergencies of a type and complexity that requires a technician level organization.

7.4.3 Organizations operating at the technician level for confined space search and rescue emergencies shall develop and implement procedures for the following:

(1) Evaluating existing and potential conditions at confined space emergencies

(2) Ensuring that rescue team members take part in a medical surveillance program

(3) Planning response for entry-type confined space rescues I hazardous environments

(4) Implementing the planned response