



DEPARTMENT OF THE ARMY  
HEADQUARTERS  
U.S. ARMY MANEUVER SUPPORT CENTER AND FORT LEONARD WOOD  
FORT LEONARD WOOD, MISSOURI 65473-5000

FLW Regulation  
No 385-7

15 August 2002

Safety  
CONFINED SPACE ENTRY

Summary. The change to this regulation reflects transition to the United States Army Maneuver Support Center and Fort Leonard Wood, (MANSCEN & FLW).

Applicability. This regulation will apply to all persons who enter a confined space, as defined by current Occupational Safety and Health Administration regulations, on Fort Leonard Wood.

Supplementation. Supplementation of this regulation is prohibited unless specifically approved by Headquarters, MANSCEN.

Suggested Improvements. The proponent agency of this regulation is the Directorate of Public Works (DPW). Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications and Blank Forms) to DPW, ATTN: ATZT-DPW, 1334 First Street, Fort Leonard Wood, MO 65473-8944.

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Contents	Page
Paragraph 1. Purpose .....	2
Paragraph 2. References and Forms .....	2
Paragraph 3. Explanation of Acronyms and Definitions .....	2
Paragraph 4. General .....	2
Paragraph 5. Operating Requirements .....	2
Paragraph 6. Testing of Confined Space .....	2
Paragraph 7. Purging/Ventilation .....	3
Paragraph 8. Training .....	3
Paragraph 9. Emergency Response/Rescue .....	4
Appendix A. Entry Into Truck/Trailer Mounted Confined Spaces .....	4
Glossary .....	4

\*This regulation supersedes FLW Reg 385-7, dated 1 May 1995.

1. Purpose. This regulation ensures personnel, who must enter confined spaces, are protected from hazards dangerous to life or health, while performing assigned duties and to ensure specific hazards of confined space entry are identified and an effective personnel rescue/removal procedure is developed and tested to react in the event that an emergency develops which threatens life or health.

2. References and Forms.

a. Required Reference. 29 CFR 1910.146 (Occupational Safety and Health Standard, Permit-Required Confined Spaces). Cited in glossary, section II.

b. Related references.

(1) AR 11-34 (The Army Respiratory Program).

(2) Public Law 91.596, Occupational Safety and Health Act (OSHA) 1970.

(3) American National Standards Institute (ANSI) Z88.2, 1992, Practices for Respiratory Protection.

3. Explanation of Acronyms and Definitions. The acronyms and special terms used in this regulation are explained in the glossary.

4. General. This is a mandatory program and all U.S. Army personnel, civilian employees of the U.S. Army, other U.S. military services personnel performing a task on Fort Leonard Wood and civilian contractors hired to perform a specific task or series of tasks involving entry into confined space must comply.

5. Operating Requirements.

a. The Directorate of Public Works (DPW) shall locate, test, identify and establish a numbering system for all confined spaces located on Fort Leonard Wood with the exception of mobile trailer mounted tanks (see appendix A).

b. The DPW will be the authority for issuing entry permits. All permits will be accomplished in duplicate with the first copy posted at the entry site and the second copy retained at DPW. Upon completion of the task, or reissue of a permit, both copies of the permit will be over stamped "closed" or "reissued" as appropriate. The first copy will be retained by DPW and the second copy forwarded to MANSCEN Safety Office (MSO).

c. A confined entry permit properly issued for entry into an immediately dangerous to life and health (IDLH) space will be valid for no more than four hours per entrant per work day.

d. Occupancy of a confined space by more than one entrant at a time may be permitted if there is an attendant for each entrant and adequate rescue/removal resources are on the scene. Saving time should not be considered justification for allowing more than one entrant in an IDLH confined space at the same time. Co-occupancy of an IDLH confined space requires approval of a Brigade Commander/Director of the activity performing entry and notification to the fire department before entry takes place.

e. The area immediately surrounding an IDLH space shall be cordoned off and protected by suitable barriers and shall be posted with warning signs prohibiting entry into the area.

f. Other than the attendant(s), supervisor and rescue personnel, no other person(s) will be permitted inside the cordoned off area while entry is underway. The purpose of this restriction is to ensure those responsible for a specific task are not distracted from their responsibilities.

g. Immediately prior to entry into an IDLH space, the entrant, attendant, supervisor and rescue personnel, if on the scene, will examine the permit to ensure they are all totally knowledgeable of

the conditions expected, the method of communication and all signals to be used during entry.

h. Each entrant shall be instructed by the supervisor at the site that he/she shall immediately evacuate the space upon orders from the attendant, upon activation of an alarm or if the entrant perceives he/she is in danger.

i. Emergency alarms shall be thoroughly discussed among the parties at the site and evacuation signals/orders completely understood by the entrant, attendant and supervisor. These tasks should be accomplished just prior to entering the space.

j. Entry into an IDLH confined space will always require the use of a suitable, approved retrieving device, i.e., full body harness, lifeline and lifting device operable by the attendant. Under no circumstances will an attendant enter a confined space for rescue purposes. Many attendants who entered confined space to perform rescue ended up becoming victims themselves.

k. Attendant must maintain close effective contact with the entrant at all times while an entrant is in the space. The supervisor, entrant and attendant must agree on the type or method of communication to be used, verbal when noise does not limit or interfere, or radio, however, radio or other forms of electronic communications should not be used in an explosive atmosphere unless approved for use in explosive atmospheres or the atmosphere has been inerted or modified so explosive gas levels are less than 10% of lower explosive level (LEL).

l. It is recognized that in event of an emergency, particularly when the hazards of the confined space are unknown or not recognized and lifelines have not been deployed, the attendants first reaction may be to enter the space to help the entrant escape from the space or to attempt to perform rescue. The attendant must be strongly advised that if the entrant becomes incapacitated the attendant MUST NOT enter the space for rescue purposes. The attendant will very likely be overcome by the same hazard/condition that incapacitated the entrant and the attendant will become a victim.

m. Inability of an entrant to exit or escape a confined space under his/her own power shall be cause for the rescue team to be summoned. This shall be accomplished by persons other than the attendant who shall remain at the confined space until relieved by the rescue team chief. Any time the rescue team is summoned, medical authorities will be notified as well. NOTE: Medical personnel not trained to enter confined space will not enter confined space to perform medical treatment if the entrant has become incapacitated but will wait until the rescue team has removed the entrant from the confined space.

6. Testing of Confined Space. Every confined space located on Fort Leonard Wood, shall be tested prior to the first entry of the day and/or any time the entrant requests testing. Testing will be conducted by the supervisor at the site.

a. Testing of IDLH confined space will be on a continuous basis if an oxygen deficiency or explosive or toxic atmosphere was detected during the initial test. Any change in test values discovered during subsequent testing will be recorded on the permit.

b. Testing of non-hazardous confined space (NHCS) will be conducted at least every hour while an entrant is in the space, except as allowed under definition of entry permit. (See glossary.)

c. All tests, including tests for oxygen levels, explosive or combustible gases and/or toxic/hazardous substances, will be taken within one foot of the bottom of the space, midway to the top of the space and within one foot of the top of the space. All test results will be recorded.

d. Atmospheric tests will include, but not be limited to -

- (1) Oxygen level between 19.5% and 22%.
- (2) Methane gas below 10% of lower explosive limit (LEL)
- (3) Hydrogen Sulfide below 10 parts per million (ppm) and 10% of LEL.
- (4) Other explosive/flammable gases below 10% of LEL.

e. Atmospheric test results which exceed established limits, or in the case of oxygen concentration, are below limits, shall be sufficient reason to purge/ventilate the confined space until repeat test results fall within limits. Periodic tests will be conducted in accordance (IAW) paragraphs 13-4a and 13-4b above.

f. When atmospheric tests reveal either a contaminant in the atmosphere or an oxygen deficiency or enrichment, the cause(s) must be determined and corrected if at all possible. If the condition cannot be corrected by purging/ventilation and entry is determined to be necessary despite the hazards, intensive protective measures must be employed.

(1) An oxygen deficient atmosphere (less than 19.5%) as measured by a properly calibrated and operated instrument, will require the use of either a self-contained breathing apparatus (SCBA), or an airline supplied respirator with escape capabilities supplied by a known source of Class D breathing air.

(2) An oxygen enriched atmosphere, 22% or more, is rare and would only occur if pure breathing oxygen was vented into the space. The addition of normal air into the space, by an approved method, will bring the concentration of oxygen down to an acceptable level. NOTE: During the period in which the concentration of oxygen is 22% or greater, extreme care must be exercised to prevent fire since any organic materials including wood and textiles will ignite and burn violently.

(3) Methane gas concentrations greater than 10% of LEL pose multiple threats. Methane gas in concentrations between 5% and 15% of atmosphere are extremely explosive as well as being an oxygen displacing asphyxiant. Ventilation using the proper procedure, paragraph 13-5b(2), will reduce the concentration of methane to a level below 10% of LEL and at the same time bring the oxygen level up to at least 19.5%. Methane gas is a product of decaying organic material and may be found in landfills, sewage lines and treatment plants. Methane also occurs in natural gas and is lighter than air so it tends to collect at or near the top of a confined space. NOTE: If concentrations of methane gas cannot be lowered and kept below the established limit, and entry into the space is deemed necessary, all tools, parts and equipment introduced into the space must be non-sparking or static electrical charge producing.

(4) Hydrogen Sulfide is the result of decomposition of sulfur bearing organic material and may be found in swampy areas, landfills, sewage plants and in refineries/petroleum product lines and storage tanks. Hydrogen sulfide is both explosive and an asphyxiant in rather low concentrations. Between 4 and 44% of atmosphere hydrogen sulfide is explosive and in concentrations of 10 ppm or greater, an asphyxiant which paralyses the muscles which control the breathing process. Purging/ventilation using the proper procedure, paragraph 13-5b(1), will reduce the concentration of hydrogen sulfide to less than 10% of LEL and less than the OSHA limit value of 10 ppm. NOTE: If the concentration cannot be reduced as stated and entry is necessary despite the hazard, a SCBA, or an airline supplied respirator with escape capabilities and a source of Class D breathing air must be worn. Tools and equipment introduced into the confined space must be non-sparking and must be explosion proof and not over 12-volt. Hydrogen sulfide is heavier than air and tends to collect at the bottom of the space.

(5) Nitrogen dioxide is a product of diesel engine exhaust and high temperature welding. Nitrogen dioxide is non-combustible and is heavier than air so it collects in the low areas of the space. In concentrations above 5 ppm, nitrogen dioxide dissolves moisture in the lungs and forms nitrous and nitric acids. While being only slightly irritating to the respiratory system, dangerous concentrations can be encountered without immediate discomfort. However, 6 to 24 hours later the throat, bronchi and lungs suffer edema and congestion which leads to an accumulation of fluid in the lungs and suffocation. Proper purging/ventilation of a space in which nitrogen dioxide is found in concentrations of 5 ppm or greater, will reduce the level to a safe range.

(6) Carbon Monoxide is a product of internal combustion engines and is lighter than air so it tends to collect in the upper part of a confined space. In concentrations between 12% to 74% carbon monoxide is flammable and a concentration of 25 ppm is considered to be the maximum allowable for breathing. Carbon monoxide combines three times better with blood than oxygen does and it remains in the blood long after exposure has stopped. Carbon monoxide is the leading cause of deaths in fires. For detected concentrations above 12.5 ppm ventilation IAW paragraph 13-5b(1) will reduce the concentration to an acceptable level.

#### 7. Purging/Ventilation.

a. When a confined space is determined to contain a hazardous concentration of explosive or toxic gas, the supervisor must decide what form of purging/ventilation will be used.

b. Any one of three forms of purging/ventilation, or some combination, may be used, depending upon the type of gas and its weight.

(1) The suction method uses a pump which draws the fumes/gases out and is probably the most effective. All of the equipment used including the electrically driven pump, suction hoses, switches and extension cord must be explosion proof. The discharged fumes/gases will be concentrated at the outlet so a danger zone downwind of the outlet must be established, posted and cordoned off for the dispersal of the fumes/gases.

(2) The forced air method of purging/ventilating consists of an air supply under pressure, which is produced at the scene by a pump, and a hose or duct inserted into the confined space. The forced air method is best suited for fumes/gases which are lighter than air. Air under pressure is introduced at the bottom of the space and forces the fumes/gases up and out of the space. The discharged fumes/gases will not be as concentrated as those produced by the suction method, however, the fumes/gases in the space may be explosive so motors, switches, power cords and the hose or duct used must be explosion proof and non-spark producing.

(3) Steaming is the least desirable method of purging/ventilation of a confined space. The steam must be at least 170 degrees and should be introduced into the confined space near the bottom. The steam line must be bonded to the wall of the space to prevent the buildup of static electricity. The major drawbacks to using the steam method is an adequate supply of steam and disposal of the condensation formed when the steam cools.

(4) Both the suction and air pressure method are forms of dilution ventilation in which the fumes/gases are diluted until level is reached which is not hazardous to life and health.

#### 8. Training.

a. Individuals who authorize entry into a confined space must have knowledge of the contents and hazards associated with

entry. Knowledge may be acquired through extensive experience or formal training from a recognized source.

b. Every worker who performs the duties of an entrant, an attendant, a rescuer or a supporting task, must fully understand their duties. Training must include as a minimum, the following:

- (1) Hazard Recognition. The authorizing supervisor must ensure personnel are trained to recognize the hazards they may encounter in a confined space whether physical, mechanical or other hazards.
- (2) Personnel must be trained to recognize the symptoms of exposure/over-exposure and how to react accordingly.
- (3) Personnel must be trained to operate test equipment properly and how to interpret readings obtained.
- (4) Personnel must be trained to operate respiratory protective equipment including the SCBA, airline respirator and any other breathing device used during entry into confined space.
- (5) Personnel must be trained to operate systems used to supply breathing air.
- (6) Personnel must be trained in the use of emergency extraction equipment.
- (7) Personnel must be trained to operate communications equipment used at the site, and the limitations of the equipment.
- (8) Personnel must be trained in the operation of powered equipment used at the site.
- (9) Personnel must be trained in the need for, use of and availability of personal protective equipment (PPE), including the proper wear and maintenance of the PPE.
- (10) Personnel must be trained to react to emergency situations and to evacuate the confined space without delay when told to do so, when -
  - (a) The attendant orders an evacuation.
  - (b) A monitor alarm sounds.
  - (c) The entrant experiences symptoms of over exposure, i.e., headache, dizziness, blurred vision, shortness of breath, discomfort when breathing or other physical or mental reaction.
  - (d) Loss of communications with the attendant.
  - (e) Loss of illumination, if being used.
- (11) Required training will be conducted by an individual who has vast knowledge and experience in confined space entry, the characteristics of the hazards common to confined space entry and who is able to communicate effectively with employees.

#### 9. Emergency Response/Rescue.

- a. The Fort Leonard Wood Fire Department is the designated emergency responder/rescuer force in all instances where emergency rescue is necessary and is beyond the capabilities of the attendant at the scene.
- b. When entering a confined space in which an oxygen deficient or oxygen enriched atmosphere exists, or a toxic or flammable/explosive atmosphere exists, and the hazards cannot be negated prior to entry, the designated emergency responder will be notified by the on-site supervisor, before entry takes place. Notification may be made by telephone, radio or in person. The emergency response team will be furnished:

- (1) The identifying number and location of the confined space.
  - (2) The reason for entry into the confined space.
  - (3) The number of entrants and attendants.
  - (4) The hazard(s) known or expected to be encountered in the confined space.
  - (5) The type of rescue equipment already at the site.
  - (6) Estimated time of actual entry and duration of entry.
- Upon completion of work task, notification of exit will be made to the designated emergency responder. NOTE: Entry will not be accomplished until the designated emergency responder has been notified if an IDLH confined space cannot be made non-hazardous.

#### Appendix A ENTRY INTO TRUCK/TRAILER MOUNTED CONFINED SPACES.

- A-1. Truck and/or trailer mounted tanks, which are entered through a hatch or removable plate, are considered to be Type "M" (Mobile) confined space for the purpose of entry.
- A-2. Entry into a mobile or Type "M" confined space shall require the same basic action/precautions as entry into any other confined space. (See chapter 13 of this regulation.)
- A-3. Additional Operating Requirements for Type "M" confined space:
- a. Under "location of confined space" a description of the tank truck or trailer will be entered, i.e., Tank Trailer, Type MXXX, Serial Number XXX, and the location of the unit while entry is performed, i.e., Bldg XXX, XXX Transportation Co.
  - b. The remainder of the permit, completed by the entrants first level supervisor, will be completed the same as for any other confined space entry.
  - c. The entry will permit will be accomplished in duplicate with the original or first copy displayed on or near the tank and the second copy, or duplicate, maintained by the authorizing supervisor. Upon completion of the work task, or expiration of the permit, the duplicate copy of the permit shall be furnished to EBSO and the first copy of original, retained on file by the supervisor.
  - d. The FLW Form 1616-R, when completed, will be retained on file as long as the mobile unit is assigned to a military unit located on Fort Leonard Wood. If the mobile unit is transferred to another military unit the expired entry permits should be furnished to the gaining unit.

#### Glossary

##### Section 1. Acronyms and Abbreviations.

ANSI  
American National Standards Institute

AR  
army regulation

CFR  
Code of Federal Regulation

DPW  
Directorate of Public Works

FLW  
Fort Leonard Wood

IAW  
in accordance with

IDLH  
immediately dangerous to life and health

LEL  
lower explosive level

MANSCEN & FLW  
United States Army Maneuver Support Center  
and Fort Leonard Wood (same as MANSCEN)

MSO  
MANSCEN Safety Office

NHCS  
non-hazardous confined space

OSHA  
Occupational Safety and Health Act

PPE  
personal protective equipment

PPM  
parts per million

SCBA  
self-contained breathing apparatus

## Section II. Definitions.

**Attendant:** An attendant is an individual stationed outside of the confined space to monitor the entrant. An attendant is the entrant's link with rescue forces and activities outside of the space.

**Blanking or Binding.** Blanking or binding is the absolute closure of a pipeline or duct by fastening a solid plate or cap across and completely covering the bore and which extends at least to the outer edge of the flange to which it is attached, and which is capable of withstanding the maximum upstream pressure generated in the pipe or duct.

**Confined Space.** Confined space is any vessel, tank, including mobile tanks, cylinder, vault, bin, boiler, tunnel, pit, trench, vat, room, or other space which is not intended to be regularly occupied by personnel and which is entered via a hatch, lid or other opening smaller than a normal door and which is normally secured in a closed position. A confined space may be fixed in place, or may be mobile. Confined space may be vertical or horizontal, may be square or cylindrical in shape. Confined space may be identified as non-hazardous confined space (NHCS) or immediately dangerous to life and health (IDLH) confined space.

a. Non-hazardous confined space is space which has no potential for causing injury, has no hazardous fluids or granular materials in pipes or transported by other means through the space, has no form of energy in or through the space and has no potential for the generation or accumulation of toxic or explosive gases, vapors or fumes which might create an explosive atmospheric mixture or create an oxygen deficient or enriched atmosphere or the potential for engulfment.

(1) Type A NHCS is confined space which meets the basic definition of NHCS and which is entered on a routine basis (daily or more than once a month) for the purpose of reading meters or inspection of equipment. NOTE: Inspection does not include opening valves or other control devices, or the opening of

electrical distribution panels or any other activity which requires the use of tool beyond a source of illumination and a method of recording readings/inspection results.

(2) The confined space entry requirements for trailer mounted mobile tanks is contained in appendix A to this regulation.

b. Immediately dangerous to life or health (IDLH) is any confined space with the potential to generate or accumulate vapors, or fumes which may form an explosive/flammable or toxic atmosphere or an atmosphere deficient or enriched with oxygen. The minimum concentration of oxygen necessary to support human life is considered to be 19.5% and an oxygen concentration of 22% or greater, is considered to be an oxygen enriched atmosphere. In an enriched atmosphere, materials not considered to be highly combustible, will ignite easily and burn rapidly and violently. Once a space has been identified as being IDLH, it will always be considered to be IDLH space.

**Emergency.** An emergency is any condition or occurrence, including loss of communications, or monitoring equipment or events internal or external to the confined space, which could endanger the entrant.

**Entrant.** An entrant is an individual who has been properly trained IAW applicable directives and who, as part of assigned duties, enters a confined space as authorized by an Entry Permit.

**Entry.** Entry is the intentional act of passing through an opening into a confined space. An entrant is considered to have entered when any part of the entrant breaks the plane of the opening.

**Entry Permit.** Entry permit is a printed document generated by a qualified supervisor and which contains the following information:

- a. The location and identifying number of the confined space to be entered.
- b. The reason for entry into the confined space.
- c. The name of the supervisor authorizing entry.
- d. Start time and estimated completion time for the task.
- e. Person(s) authorized to be entrants. NOTE: Properly trained personnel may alternate between the duties of entrant and attendant.
- f. Date of the permit. A permit is normally only valid for the date originated, or for a single work shift. Change of personnel due to a shift change will require a new permit to be generated. However, when entry into a type A NHCS is performed on a recurring basis, for the purpose of reading meters or inspection of equipment, a blanket permit, valid for up to one calendar year may be issued. (See definition of Type A NHCS.)
- g. Name of attendant(s).
- h. Atmosphere testing/monitoring, including description of the test equipment, date of most recent calibration and serial number. Test/monitoring must include, as a minimum, oxygen level, explosive or flammable atmosphere, toxic atmosphere and any other test(s) deemed necessary by the entrant or the supervisor at the site.
- i. Name of the individual conducting test/monitoring.
- j. Protective clothing to be worn and equipment to be used in the space.
- k. The method to supply a source of suitable breathing air, i.e., SCBA, supplied airline with escape capabilities, with electrically driven pump or as appropriate.

l. The method of isolating any energy source(s) in the confined space.

m. Identity, location and telephone number(s) for emergency services, fire rescue, medical services.

n. The authorizing supervisor signs the permit form only when all the conditions for entry have been satisfied.

**Qualified Supervisor.** Qualified supervisor is a supervisor who successfully completes required training IAW Title 29, CFR 1910.146. Only a qualified supervisor may generate an entry permit. The supervisor must be familiar with the task to be performed and must certify the accuracy of atmospheric tests conducted prior to entry.

**Rescuer.** A rescuer is an individual who's sole responsibility is to perform rescue of an entrant should the need arise. Entry into an IDLH confined space by an entrant will always require the presence of a rescuer at the site in addition to the qualified supervisor and an attendant. However, a rescuer may also be the attendant providing a system is in place to allow the rescuer to remove the entrant from the space without the rescuer having to enter the space, i.e., a rescue tripod, winch, suitable cable and body harness worn by the entrant. If however, the rescuer must enter the space to perform the rescue, an attendant must be at the site as well, to monitor both the entrant and the rescuer.