



## **Standard Operating Procedure (SOP) Confined Space**

### **I. Purpose**

The purpose of this procedure is to protect employees from the hazards of entry into confined spaces at Tennessee Tech. University.

### **II. Scope**

To establish requirements, practices and procedures for confined space for all Tennessee Tech University employees and contractors.

### **III. Definitions**

- **Authorized Entrant (Entrant):** An employee who is authorized by the employer to enter a permit space.
  - Know the hazards that may be faced during entry, including information of the signs or symptoms and consequences of the exposure.
  - Communicates with the attendant as necessary to enable the attendant to monitor entrant status and to enable the attendant to alert entrants of the need to evacuate the space.
- **Attendant:** An individual stationed outside one or more permit spaces who monitors the authorized entrants and who performs all attendant's duties assigned.
  - Know the hazards that may be faced during entry, including information of the signs or symptoms and consequences of the exposure.
  - Continuously maintains an accurate count of authorized entrants in the permit space.
  - Communicates with authorized entrants as necessary to monitor entrant status and to alert entrants of the need to evacuate the space if necessary.
  - Summon rescue and other emergency services as soon as the attendant determines that the authorized entrants may need assistance to escape from the permit space hazards.
  - Warns the unauthorized persons that they must stay away from the permit space.
- **Bump Test:** A method of verifying instrument accuracy. A bump test verifies calibration by exposing the instrument to a known concentration of test gas. The instrument reading is compared to the actual quantity of gas present (as indicated on the cylinder). If the instrument's response is within an acceptable tolerance range of the actual concentration, then its calibration is verified.

(Note: It is recommended that users check with the detection equipment manufacturer for the acceptable tolerance ranges.) Instruments should be "zeroed" before the bump test in order to give a more accurate picture of the bump test results. When performing a bump test, the test gas concentration should be high enough to trigger the instrument alarm.

- **Calibration:** A method design to make adjustments of the instrument's reading to coincide with a known concentration (generally a certified standard) of test gas. In most cases, a full calibration is only necessary when an instrument fails a bump test or after it has been serviced. The full calibration and bump test should be conducted in a clean fresh air environment. • **Confined Space:** A space that is large enough and so configured that an employee can bodily enter and perform assigned work and has limited or restricted means for entry or exit. A confined or enclosed space include, but are not limited to, tanks, vessels, storage bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels; and is not designed for continuous employee occupancy.
- **Confined Space Evaluation Form:** Form used to document the declassification of confined space.
- **Entry Permit:** A form that authorizes entry to a permit required confined-space.
- **Entry Supervisor:** The person (such as the employer, supervisor) responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations and for terminating entry as required.
  - Know the hazards that may be faced during entry, including information of the signs or symptoms and consequences of the exposure.
  - Verifies, by checking that the appropriate entries have been made on the permit, that all tests specified by the permit have been conducted and that all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin.
  - Terminates the entry and cancels the permit.
  - Verifies that rescue services are available and that the means for summoning them are operable.
  - Removes unauthorized individuals who enter or who attempt to enter the permit space during entry operations.
- **Hazardous Atmosphere:** An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue, injury or acute illness from one or more of the following causes:
  - Flammable gas, vapor or mist equal to or higher than 10 percent of its lower flammable limit (LFL)
  - Airborne combustible dust at a concentration that meets or exceeds its LEL.
  - Atmospheric oxygen concentration equal to or below 19.5 percent or above 23.5 percent.
  - Presence of toxic gases. (For example, equal to or more than 10 ppm hydrogen sulfide measured as an 8-hour time-weighted average). If the presence of other toxic contaminants is suspected, specific monitoring programs will be developed.
  - Atmospheric concentration of any substance for which a dose or a permissible exposure limit (PEL) is published in 29 CFR 1910 Subpart G or in Subpart Z and which could result in employee exposure in excess of its dose or PEL
  - Any other atmospheric condition that is immediately dangerous to life or health (IDLH).
- **Hot Work Permit** - A written authorization to perform hot work, received from an authorized supervisor or other site personnel authorized to write and issue hot work permits.

- **Isolation** - The process of blanking or blinding, removing a section of line, duct or pipe, a double block and bleed, lock-out / tag-out of all sources of energy as may be required to protect a permit space against the release of energy and material into the space.
- **Lockout / Tagout** - An established procedure for the placement of locking and tagging devices on energy isolating devices, ensuring that the energy isolating device and the equipment being controlled cannot be operated or started while work is being conducted.
- **Non-Permit Confined Space** - A confined space that does not contain, or with respect to atmospheric hazards, does not have the potential to contain any hazard(s) capable of causing death or physical harm.
- **Oxygen Deficient Atmosphere** - An atmosphere containing less than 19.5 percent or lower oxygen content by volume.
- **Oxygen Enriched Atmosphere** - An atmosphere that contains 23.5 percent or higher oxygen by volume.
- **Immediately Dangerous to Life or Health (IDLH)**: Any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a confined space.
- **Lower Flammable Limit (LFL) or Lower Explosive Limit (LEL)**: The minimum vapor concentration of flammable liquid in air, below which flame propagation does not occur on contact with an ignition source.
- **Permit-Required Confined Space (Permit Space)**: A confined space that has one or more of the following characteristics:
  - Contains or has potential to contain a hazardous atmosphere;
  - Contains a material that has the potential for engulfing an entrant;
  - Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
  - Contains any other recognized serious safety or health hazard.
- **Retrieval System**: The equipment (including a retrieval line, full-body harness, lifting device or anchor) used for non-entry rescue of persons from permit spaces.
- **Testing**: Process by which that hazards that may confront entrants of a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space.

#### IV. CONFINED SPACE ENTRY PROCEDURES

##### Space Evaluation

All permit required confined spaces are to be evaluated by an Entry Supervisor prior to authorizing an entry.

- **Permit Required Entry Procedures**

- As a minimum, an entry supervisor, entry attendant and entrant shall be designated to participate in each permit required confined space entry. Note: the entry supervisor may act as an entry attendant as well.
- Acquire, inspect and setup all safety equipment required by the permit including blowers, full body harness, rescue tripod, and rope or cables.
- The entry supervisor shall establish appropriate rescue procedures specific to the space entry and shall list these procedures on the Confined Space Entry Permit.
- All hazardous energy sources shall be locked and tagged out (Refer to the Lockout/Tagout Procedure)
- Testing - The confined space atmosphere shall be tested to determine whether dangerous air contamination and/or oxygen deficiency exists. A direct reading gas monitor shall be used. Testing shall be performed by the Entry Supervisor who has successfully completed the gas detector training for the monitor he will use. The minimum parameters to be monitored are oxygen deficiency, LFL and hydrogen sulfide concentration. A written record of the pre-entry test results shall be made and kept at the work site for the duration of the job. Affected employees shall be able to review the testing results.
- The Entry Supervisor shall complete and sign the Confined Space Entry Permit prior to space entry. The permit conditions, entry precautions, and rescue procedures shall be reviewed with the attendant and entrant (s) prior to entry.
- Prior to entry, the attendant shall verify that entry conditions are acceptable.
- The entrant must wear retrieval equipment during the entire entry operation.
- The attendant will continuously monitor the portable gas detector and record the readings every hour (minimum).
- Entry Supervisor and attendants must be in constant communication with the entrant at all times via radio and/or voice. This must be specified on the permit form.
- An immediate evacuation of the space shall be ordered if the safety equipment fails or if the space becomes, or has the potential to become, immediately hazardous.
- Upon completion of the job, the Entry Supervisor shall cancel the permit and ensure that the completed permit is returned to EHS department.

## V. HAZARD CONTROL

- Monitoring Confined Space Air Quality
- Prior to entering a confined space, a trained and authorized employee prepares the gas detector by ensuring the device is in good working order, and will follow the manufacturer instructions for calibration and maintenance requirements of the equipment.
- Conduct a “bump test”. Breathe into the gas detector probe and look for a decrease in oxygen concentration – the detector should alarm due to the lack of oxygen.
- Sample the air quality of the space by slightly moving the lid (horizontal entry), or by testing the space through a hole in the lid (if available) before completely opening the space (vertical entry).
- Lower the probe slowly into the space, allowing time for the instrument to detect atmospheric changes at different vertical heights within the space (vertical entry).
- Measure in the following order: ▪ Oxygen ▪ LFL ▪ H<sub>2</sub>S ▪ CO
- Record the results on the Confined Space Entry Permit.
- The gas detector shall remain on during the entire entry operation and shall be regularly inspected by the attendant. The attendant shall also record the gas readings on the record

sheet at a minimum of one hour intervals or after breaks (e.g. lunch, etc.) before re-entering the space.

- Cease entry operations and remove entry personnel if the following concentrations are exceeded any time:
  - Oxygen readings less than 19.5% or greater than 23.5%.
  - Combustible gas reading equal to or greater than 10% LFL.
  - H<sub>2</sub>S reading equal to or greater than 10 ppm.
  - CO reading greater than 25 ppm.

- **Ventilating a Confined Space**

- Set up one or more blowers to provide adequate ventilation for the space. Ventilation must be forced draft discharge of clean air into the space (not exhaust of the space).
- Ensure that ventilation air supply is from a clean source.
- Allow enough time for blowers to clear the space before entering.
- After a suitable ventilating period, repeat the testing. Entry may not begin until testing has demonstrated that the hazardous atmosphere has been eliminated.
- Ensure that the blowers remain on during the entire entry operation. If the blower fails, the entrant must leave the space immediately.

## **VI. EMERGENCY RESCUE FROM PERMIT REQUIRED CONFINED SPACES**

Only specifically designated, properly trained and protected Entry Attendants or Entry Supervisors may attempt to conduct a confined space rescue or retrieval. If at any time, rescue or retrieval of the confined space entrant is necessary, the Entry Attendant or Entry Supervisor **MUST CALL 911**.

Retrieval equipment is required for all permit required vertical entries greater than 5 ft. Retrieval equipment shall include (but not limited to) the following:

- Rescue harness
  - Rescue tripod
  - Rope or cable
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- Entry supervisor will notify EHS department immediately in an emergency.
  - All persons involved in the confined space entry must have received training.
  - At least one member of the rescue team must be certified in first aid and CPR.

## **VII. TRAINING**

Prior to performing confined space work, all Tennessee Tech University employees who participate in confined space entries including entry supervisor, entrants and attendants, must receive training.

Refresher training will be provided periodically.

The training records will be maintained in the EHS department.

## **VIII. CONTRACTORS**

Contractors that enter confined spaces on Tennessee Tech University must comply with this procedure and OSHA Standard 29 CFR 1910.146 Permit Required Confined Space.