

Identifying Confined Spaces

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Some facilities may not have confined spaces and are not concerned about confined space entry. However, all facilities should be assessed for the presence of confined spaces. This paper will discuss the proof of the need, some definitions, the identification process and the documentation of the process.

When there is no confined space entry procedure in place and something goes wrong, fatalities are many times the result. Some of the typical outcomes are: unapproved lighting was used resulting in a fire; a flammable gas leaked into the space; a lockout procedure was not followed; there was some type of equipment failure or malfunction; no test of the atmosphere was taken prior to entry; there was no known reason for the entry, or no harness or lifeline was used to aid rescue. A couple of examples of fatal incidents include an instance where a clipboard was dropped in a confined space and the person went after it. Due to the lack of oxygen in the space the person died. In another example an engineer went into a land-fill area where there was inadequate oxygen and was overcome. A companion tried to rescue him and was overcome also. Both people subsequently died. In one other case a farmer got caught in a grain silo and died as a result of suffocation by the material in the silo. As can be seen over and over, the results of entering confined spaces without following a procedure often results in death.

The first step is to have a good understanding of the definition of a confined space, so they can be isolated and marked for identification. The common definition of a confined space in the United States is an area that has limited or restricted means of entry or exit, and is large enough for a worker to enter and perform an assigned task, and is not designed for continuous employee occupancy. Any open top tank or pit more than four feet deep that meets the above conditions is also considered a confined space. Some examples of confined spaces are storage tanks, degreasers, pits, ventilation ducts, machinery pits, vessels, and man-holes. Also boilers, furnace vats, sewer tunnels, silos, and open surface tanks. There may be spaces that a worker cannot completely enter but may as a result of the work task requirements introduce an atmospheric hazard. Even though the space does not strictly meet the confined space requirements, some confined space procedures may need to be used. By definition, entry into a confined space occurs when any part of the entrant's body enters the opening into the space. Other considerations are what has been previously stored in the confined space and what is being taken into the confined space.

After the space has been identified it must be evaluated and a determination made whether it is a permit required confined space or a non-permit-required confined space. A sign must be posted at the space and a log of the spaces must be kept and updated as necessary. A non-permit-required confined space does not contain or have the potential to contain any hazard capable of causing death or serious physical harm.

Examples would be areas with natural or permanent ventilation that will not allow accumulations of hazardous atmospheres. If there is a change in configuration, the area must be re-evaluated. A permit-required confined space contains or has the potential to contain one or more of the following: atmosphere hazard, engulfment hazard, configuration hazard or any other recognized serious safety or health hazard.

A hazardous atmosphere may expose employees to serious risk of death, incapacitation, impairment, injury or acute illness. Examples of hazardous atmospheres are: oxygen concentration is below 19.5% or above 23.5%; a flammable gas, vapor or mist exceeds 10% of its lower flammable limit; there is an airborne dust concentration of a substance and the TLV exceeds acceptable standards, or any other atmosphere hazard that could impair an employee's ability to escape or be IDLH.

An engulfment hazard exists when the surrounding and capture of a person by a liquid or finely divided flowable solid substance such as grain, salt, sand or plastic pellets could occur. The substance can either plug the respiratory system or constrict breathing by exerting pressure on the outside of the body. Trenching cave-ins could fall into this category as well as bridged materials in a silo, for example.

Configuration hazards exist when an internal configuration that could trap and asphyxiate an employee. Examples could be inwardly converging walls or a chute that tapers to a smaller cross section. Mixing tanks, grain processing tanks, sand chutes and duct work could fall into this category.

Other hazards are capable of causing death or serious physical harm. Examples could be high pressure gas lines, steam lines, footing problems, temperature extremes, electrical concerns, sharp edges, minimum work room and mechanical problems.

The identification process requires a visual inspection of the facilities using a confined space hazard analysis form. A good start is to make a walk through of the facilities to get an idea of what exists in the way of confined spaces. Procure a plant layout of the facilities making sure that all floors of the facility are represented. These layouts should include the roof, out buildings, storm sewers, water systems and any tankage that might be above or below ground.

Manufacturing and plant engineering personnel should be consulted as well as maintenance personnel. Plant security personnel are another source of potential information.

At each potential site, complete the confined space hazard analysis form so you will have a documented assessment of all potential spaces. All spaces identified as confined spaces should be transferred to a confined space log for use by plant security and those who may have to enter the spaces. This log removes the chance that a space will not be properly categorized and entry could take place without proper precautions.

All spaces determined to be a confined space must have a sign indicating that they are either a non-permit confined space or a permit-required confined space. A communication program must be put in place to tell all employees that confined spaces exist in the facility and that they are not to enter them under any circumstances. Only employees who have attended a confined space entry training program will be allowed to enter the spaces and then only when following a very specific procedure.

Confined Space Hazard Analysis Form Annotations

The following is a step-by-step process to assist the PLANT NAME confined space team in the hazard analysis of a confined space. Each entry on the example Hazard Analysis Form is numbered for reference to the descriptions that follow. The Safe Entry Procedures will be established based on a combination of current and previous space evaluations and entry experience in the space. However, each entry supervisor must take into account the specific work activity and chemicals used in the each confined space entry. **Note: A notation must be made in each space on the analysis form. Mark “N/A” if not appropriate.**

1. Location and description of the confined space (i.e. Stamping B press slide lock)
2. Date hazard analysis is taking place.
3. Department where the confined space is located or department that “owns” the confined space.
4. Generate a confined space identification number; this number must coincide with confined space log numbering system. If it is a reevaluation of a space, utilize the number that is already assigned.
5. Enter the bay location of the confined space.
6. Name of person or persons completing the form.
7. Mark all boxes that apply to the area to determine if it is a confined space. For an area to be considered a confined space, all three boxes must be checked next to question #1 or the area must be an open-top pit as defined in question #2.
8. Once you have classified an area as a confined space, it must be determined if it is a permit-required-confined space. Mark all boxes that apply to the space—only one box needs to be checked for a space to meet the criteria of permit required. If the only hazard is atmospheric, the space may be classified as alternate-procedure permit required.
9. Identify the potential hazards and describe the conditions for each hazard category. It should be noted how each hazard will be abated prior to entry. A space cannot be classified as alternate-procedure permit-required if there is any other hazard besides atmospheric:
 - a. Atmospheric hazard
 - i. Identify source of atmospheric hazard (i.e. sludge)
 1. Oxygen levels are below 19.5% or above 23.5%
 2. The Lower Flammable Limit is at or above 10%
 3. Airborne combustible dust at a concentration that meets or exceeds its LFL
 4. Exposure to a toxic substance in excess of permissible limits
 5. Any other atmospheric condition that is immediately dangerous to life or health.
 - ii. Identify means of controlling the atmospheric hazard
 - iii. Enter any additional comments related to the atmospheric hazard or controls.
 - b. Engulfment hazard
 - i. Identify source of engulfment hazard (i.e. wastewater)
 1. The surrounding of a person by a liquid or flowable solid that can be inhaled to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.
 - ii. Identify means of controlling the engulfment hazard
 - iii. Enter any additional comments related to the engulfment hazard or controls.
 - c. Configuration hazard
 - i. Identify source of configuration hazard

1. Floors slope downward and/or taper
 2. Walls converge inward
 3. Obstructions and/or difficult to exit
 - ii. Identify means of controlling the configuration hazard
 - iii. Enter any additional comments related to the atmospheric hazard or controls.
 - d. Other serious hazards
 - i. Identify source of serious hazard
 1. High pressure steam lines
 2. Natural gas lines
 3. Chemical/Hazardous material lines
 4. Mechanical hazards
 5. Any other serious hazard not listed
 - ii. Identify means of controlling the serious hazard
 - iii. Enter any additional comments related to the serious hazard or control
10. "Other conditions" may exist that make working in a confined space hazardous. Typically these conditions do not cause a space to be classified as a permit-required confined space. It is up to the team that is performing the hazard analysis to decide.
 11. List the equipment that will be used to test for atmospheric conditions and or toxic substances. Also list what is acceptable by OSHA standards.
 12. Identify the atmospheric hazard that must be continuously monitored and the equipment to be used.
 13. Identify the atmospheric hazard that must be periodically monitored and the equipment to be used, include how often it must be checked. At a minimum, periodic monitoring should be done following interruption of work or if a new hazard is introduced.
 14. Enter any additional testing information or comments.
 15. Identify the equipment needed to enter the space and describe the equipment if appropriate.
 16. Mark the box that describes the classification of the confined space being analyzed.

CONFINED SPACE

Hazard Analysis Form

1. Location and Description of Space

2. Date _____

3. Dept. _____

4. ID# _____

5. Bay/Column _____

6. Name _____

(Person completing form)

7. Directions: Determine if the area is a confined space. Mark all boxes that apply.

1. The area being reviewed is a confined space because it (all must apply):

- has limited or restricted means of entry or exit
- is not designed for continuous employee occupancy
- is large enough for a worker to enter and perform the task assigned

2. The area being reviewed is a confined space because it meets the conditions above and: is an open-top tank or pit more than 4 feet deep

8. Directions: if the area is a confined space, determine if it is permit-required. Mark all boxes that apply.

This is a permit-required confined space because it contains or has the potential to contain:

- an atmospheric hazard
- a configuration hazard
- an engulfment hazard
- a recognized serious safety or health hazard

9. Directions: For each hazard or potential hazard identified, mark the appropriate boxes and describe the conditions where indicated.

<p>a. Atmospheric Hazard Source: _____</p> <p>i. _____</p> <p>A. <input type="checkbox"/> oxygen concentration below 19.5% or above 23.5%</p> <p>B. <input type="checkbox"/> flammable substances at or above 10% LFL</p> <p>C. <input type="checkbox"/> dust concentration at or above its LFL</p> <p>D. <input type="checkbox"/> toxic substance exposure in excess of permissible limits</p> <p>E. <input type="checkbox"/> other atmospheric conditions that may be IDLH</p> <p>Describe: . _____</p> <p>ii. Controls: <input type="checkbox"/> Ventilate space <input type="checkbox"/> Remove Source <input type="checkbox"/> Lockout <input type="checkbox"/> Other _____</p> <p>Additional Comments: _____</p> <p>iii. _____</p> <p>_____</p> <p>b. Engulfment Hazard Source: _____</p> <p>i. _____</p> <p>A. <input type="checkbox"/> engulfment by liquid</p> <p>B. <input type="checkbox"/> engulfment by flowable solid substances</p> <p>C. <input type="checkbox"/> other engulfment hazard</p> <p>Describe: . _____</p> <p>ii. Controls: <input type="checkbox"/> Lockout <input type="checkbox"/> Blanking <input type="checkbox"/> Cap <input type="checkbox"/> Separate & Misalign <input type="checkbox"/> Other _____</p> <p>Additional Comments _____</p> <p>_____</p> <p>_____</p>	<p>c. Configuration Hazard Source: _____</p> <p>i. _____</p> <p>A. <input type="checkbox"/> floors slope downward, an/or taper to small cross-section</p> <p>B. <input type="checkbox"/> inwardly converging walls</p> <p>C. <input type="checkbox"/> other configuration hazard</p> <p>Describe: . _____</p> <p>_____</p> <p>ii. Controls: <input type="checkbox"/> Temporary platform <input type="checkbox"/> Fall Hazard Equipment <input type="checkbox"/> Other _____</p> <p>Additional Comments: _____</p> <p>iii. _____</p> <p>_____</p> <p>_____</p> <p>d. Other Serious Hazards Source: _____</p> <p>i. _____</p> <p>A. <input type="checkbox"/> high pressure steam lines</p> <p>B. <input type="checkbox"/> natural gas lines</p> <p>C. <input type="checkbox"/> chemical/hazardous material lines</p> <p>D. <input type="checkbox"/> mechanical hazards</p> <p>E. <input type="checkbox"/> other serious hazards</p> <p>Describe: . _____</p> <p>_____</p> <p>ii. Controls: <input type="checkbox"/> Lockout <input type="checkbox"/> Blanking <input type="checkbox"/> Cap <input type="checkbox"/> Separate & Misalign <input type="checkbox"/> Other _____</p> <p>Additional Comments: _____</p> <p>iii. _____</p> <p>_____</p> <p>_____</p>
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10. Directions: Note any other conditions that make working in the space hazardous. Mark all boxes that apply & describe the condition where indicated.

- insecure footing minimum room to work poor lighting excessive noise excessive heat or cold
 obstructions asbestos organic materials
 electrical hazards animal, insects, etc wet/slippery conditions other
 (describe) _____

Comments: _____

11. Atmospheric Requirements

Directions: Complete the blank lines as indicated. Also list any additional toxic substances that require testing and complete the blank lines as indicated. If any additional information regarding atmospheric testing is needed, record it in the space provided.

Acceptable

Test For: **Equipment to Use:**
Entry Conditions

- O₂ _____
- LFL _____

Acceptable

Test For: **Equipment to Use**
Entry Conditions

- CO _____
- H₂S _____

12. Continuous monitoring required (see above) Identify substance and equipment

13. periodic monitoring required following interruption of work or if new hazard is introduced

14. Additional testing information:

Special Procedures

Directions: Identify any equipment, instructions or procedures that may be needed to ensure a safe entry operation. Mark all boxes that apply and complete the blank lines as indicated.

15. Equipment Needed

ventilation equipment Describe: _____

respiratory equipment Describe: _____

lighting equipment Describe: _____

communication equipment Describe: _____

personal protective equipment Coveralls

Glasses Gloves Boots

Other _____

barriers and guarding
Describe: _____

fire extinguishing equipment
Describe: _____

other
Describe: _____

16. Rescue Procedures and Equipment

Refer to Rescue Planning Worksheet

17. Confined Space Classification

- Non-Permit Required
- Permit Required Alternate Procedure
- Temporary Reclassification Procedure

Approved: _____

Date: _____

References

OSHA Standard 29 CFR 1910.146.

“Confined Space Entry—An AIHA Protocol Guide—Second Edition 2001.

ANSI/ASSE Z117.1-2003 Safety Requirements for Confined Spaces.