

# Confined Space Manure Storage Emergencies

**This factsheet discusses the appropriate emergency actions when a person is discovered unresponsive in a manure storage pit; and the best management practices farmers can take to avoid a manure storage emergency on their farm.**

The purposes of this fact sheet are to discuss: a) appropriate emergency actions when a person is discovered unresponsive in a manure storage pit; and b) best management practices farmers can take to avoid a manure storage emergency on their farm. Many farms have under barn or outside manure storage's and various manure transfer and storage tanks that may need to be entered to perform a task such as unplug a pipe, retrieve a dropped tool, or recover an animal that has found its way into the structure. These structures and locations are not designed to be continuously occupied but are entered on occasion to perform various tasks. Often these particular spaces have limited entry and exit paths and contain or could potentially contain an atmosphere that is hazardous—either an atmosphere that is low in oxygen or high in toxic or explosive gases. The technical name for this type of space is called “confined space”. In most industries, the safety of confined spaces is regulated by the U.S. Department of Labor’s Occupational Safety and Health Administration (OSHA) Standard 1910.146, Permit-Required Confined Spaces. This standard is in place because deaths have taken place by workers entering and working in these spaces without adequate respiratory protection. To complement this standard, safety and health professionals have developed best safety practices to reduce the likelihood of death when someone has to enter these spaces. Although agriculture is exempt from OSHA’s permit-required confined spaces standard, the standard represents best safety practices for entry into confined spaces. Following these best safety practices will reduce entry risk for you, your family members and your employees.

## Consider This Scenario

During breakfast, you overhear a discussion that the pump in the manure transfer pit under the main barn has malfunctioned and needs repair. You know that this tank was pumped out yesterday. An hour after breakfast, you look for your husband and son to tell them that you are going to town. You want to ask if they need anything for the manure pump. You call out but hear nothing. You decide to check the farm shop and find no one around. You go back to the manure pit to look closer and you see that both your husband and son are laying face down on the floor of the manure pit.



What are your immediate thoughts and actions? Will you enter the space to render help? Will you call for help? Will you attempt to ventilate the space by forcing fresh air from a fan into the space? Many critical thoughts will go through your mind in only a few seconds.

An event like this happens all too often. Spaces such as manure pits, although not frequently entered are occasionally entered without consequence. Because of this, subsequent entries become easier to make. It is human nature to think that because you have entered previously without a bad consequence, the next time you enter it won't be any different.

## Responding Appropriately

Anyone in this situation could easily panic; if so this panic needs to be brought under control quickly. Your safety is of utmost importance. You are the lifeline to any chance of a successful rescue. If you enter the pit and are overcome by the hazardous atmosphere, you too will need to be found by someone else. First and foremost, call 911 and make sure you report that this emergency involves a person in a confined space manure pit. This information is critical so that emergency services sends specially trained responders to you. Not all emergency responders are equipped to rescue a person from a confined space; even fewer have been trained to perform rescues from a manure storage.

Once you call 911, you should attempt to ventilate the space. You can do this by blowing fresh air into the pit. This action will help to induce fresh air into the pit, move toxic gases away from the victims, and if they are still breathing, will enable them to breath fresher air than they can without ventilation. The most logical source of fresh air may be a barn or large house fan. Better still, provisions made as part of a safety plan should include a readily available ventilation fan for this purpose. The fan should be large enough to move fresh air from the opening to where the victim is located. NEVER lower the fan into the space to try to get the fan closer to the victim. Barn and home fans are not often intrinsically safe, meaning that they might give off an occasional spark due to static electricity or an electrical short. One particular hazard in a manure storage could be a buildup of highly flammable methane gas, which could ignite by such a spark.



Keeping the fan outside the space reduces this risk. Also be alert that gas that is being blown out of the space does not blow directly back toward you. If the confined space is a relatively small enclosed tank, the gas might be coming back out the opening where you are holding the fan. Make sure you are not exposing yourself to this potentially toxic air.

These two steps are your immediate emergency response actions. Even though you are ventilating the space, you cannot be sure this procedure is effective without testing the space with an oxygen and toxic gas detector. Most

emergency services personnel carry gas and oxygen detection equipment with them and know how to use it. This is why it is critical to accurately report the nature of the event when you call 911. Some rural emergency service responders that arrive first may not have gas and oxygen detection equipment—or the training to use the equipment—if they do have it. In this case, you and they must wait for more fully trained responders to arrive before anyone attempts to enter the space to retrieve the victims.

## Prevention Strategies: Best Safety Practices

Below are steps that can be taken on the farm to avoid situations like the one described in the previous section. These best safety practices are consistent with the OSHA 1910.146 standard on confined spaces and make sense to employ on farms. Following these 7 steps with all entries into a confined space can save your life and the lives of others.



1. Post signs that warn people of a potential hazardous atmosphere. This is a first step in educating everyone on the farm that certain hazards exist in a confined space. The more times the signage is seen, the more the message becomes engrained in the minds of potential entrants. Along with signage there should be the ability

to barricade the opening of the space while it is open. This can be done with a three-sided guard railing system or with saw horses, fence panels or other devices that may be on the farm. Remember, you are not only protecting yourself from entry hazards, but you are also assuring no one else goes into the space unknowingly.

2. Each farm should have a written entry plan for each space that is known to be hazardous. This is the second step in educating everyone on the farm about hazardous spaces. The plan should give details about the space, for example, what potential hazards exist inside that space, why entry would have to be made, and what specific procedures need to be followed if entry into that space is necessary. This information should be reviewed annually with all employees and family members. Items 3-7 below outline the specific entry plan procedures to be followed.

3. Do not enter the space without a minimum of two people at the site. The person going into the space must be knowledgeable about the space itself, the hazards that could exist within that space, and what to do if something goes wrong while inside that space. The second person will **always** remain OUTSIDE the space and be in clear view or in voice contact of the person inside. The second person's role is to summon help and operate a retrieval system (discussed more fully in Step 6 below). The second person should NEVER enter the space to assist with a job or to render help to a person that has collapsed. Even if the space seems to be fine at one moment, conditions inside the space could deteriorate and help may need to be called.

4. Before any entry is made into a potentially hazardous space, test that space for toxic or explosive gases and oxygen deficiency. A gas detection instrument that can test for oxygen, explosive gases and hydrogen sulfide (specific to manure storages) will be needed for this task. These devices can be purchased, leased, or borrowed for the specific task. In conducting a search on the internet, one finds that a multi-gas detection meter can be rented for around \$45/day or \$140 per week. This equipment can often be obtained within a few days. It is important to understand how to properly use and interpret these instruments. Renting them from a reputable source helps to ensure that they are properly calibrated and operating when it is sent to you. Selecting and using gas detection equipment is discussed in Fact Sheet E 51 *Confined Space Manure Gas Monitoring*.

5. Before any entry is made into a potentially hazardous space, ventilate the space to dilute toxic and flammable gases and to provide fresh air. Most manure pits can be adequately ventilated before a person enters the pit by following the ventilation recommendations that are provided in American Society of Agricultural and Biological Engineering (ASABE) Standard S607

(ANSI/ASABE S607), *Ventilating Manure Storages to Reduce Entry Risk*. Ventilation should continue while work is being performed in the pit. All ventilation parameters and calculations should be made well in advance of the entry, during the development of the written entry plan. Following this prepared protocol will greatly diminish the risk of oxygen deficiency or toxic gases. Properly ventilating manure storages is discussed in Fact Sheet E 53 *Confined Space Manure Storage Ventilation Systems*.

6. Any person that enters a hazardous area should wear a body harness that is attached to a fall arrest and retrieval system. Falling a significant distance is not the big issue in many agricultural manure pit emergencies. But the need to be safely retrieved is crucial. Common fall arrest and retrieval systems use a tripod device upon which a winch (or two winches) is attached. The important aspects of these winches are that a fall is limited (fall arrest) and it can be used to retrieve personnel if they become incapacitated (retrieval mechanism). Consider, for example, that you are descending into the manure pit and the concentration of toxic gas renders you unconscious. When this would happen, you would immediately start to fall. However, with a fall arrest device that is built into the winch (or in a separate winch that is attached to you) the device would lock when it senses a sudden drop of your weight, preventing you from falling the rest of the way (unless you land on the floor before it locks). The retrieval system built into the winch has a built in mechanical advantage system so a single person outside the space can crank the winch to lift you out of the space. Commercial tripod and winch units that are designed for confined space entry work are available and can be rented for around \$100 per day, or purchased for \$1,500-\$2,500. These offer the best protection because they are designed for this specific purpose. A tripod can be configured to fit squarely over the opening so that the cable that runs from the winch to the entrant is centered into the opening. The tripod design offers the greatest strength for lifting a person from the space quickly.

Farm operators may think they can easily construct their own emergency retrieval system. One idea a farm operator may have to save some cost is to construct his or her own tripod while purchasing the winching system. A farmer should employ the services of a certified welding shop to design and construct the tripod. An effective tripod system must be able to support the weight of the person that is being retrieved. Normally these systems will support in excess of 500 pounds. Anyone making their own system needs to use materials and a design to assure this weight can be supported. A block and tackle system (this is a system made up of two or more pulleys with rope or cable running through them to create a mechanical advantage for lifting a heavy load) attached to a suitable anchor (such as a tractor

bucket) that is attached to the person going in may be another option a farm operator would consider. The two important parts of this cost-saving option are that: a) a person is outside the space to operate the block and tackle; and b) the person going into the space is tied off so he/she can be hoisted to safety if it's necessary to do so. Inexpensive body harnesses are available at many farm supply outlets and this may be a third cost-saving option.

While using a homemade retrieval system may be possible in some instances, there can be several major problems to overcome:

1. You may lose the mechanical advantage for lifting built into commercial systems;
2. Emergency lifting may not be centered over the open space so the victim may become caught on the ladder or a corner of the space
3. There may not be adequate space around the entry point to set up the homemade system
4. The homemade system may not be as easy to set up, discouraging its use when needed; and
5. Operating the homemade system is more likely to introduce errors during an emergency than a commercial system. For example, the second person may not operate the tractor front-end loader smoothly, the tractor may move inadvertently, there may be a problem starting the tractor, or he/she may not understand how to properly operate a block and tackle system. For these reasons, commercial systems are much more desirable.
6. Another issue is the safety harness for the person entering the confined space. Some may think a rope tied around the waist of the individual in the pit would be sufficient, but this can be dangerous and cause serious harm to an incapacitated person. An appropriate body harness will loop around both legs and the person's shoulders, and have a lifting point centered between the shoulders on the back so there is no chance of bodily injury if a person has to be pulled to safety via a winch. A rope tied around an incapacitated person's waist may tighten and damage internal organs and cause severe nerve and tissue damage.
7. A final best safety practice for confined space entry is to lock out all power sources prior to the entry. For most manure pits, this is achieved by disconnecting the agitator PTO from the tractor, or removing the tractor or agitator from the manure pit. Another hidden danger of manure storages is stray electricity caused by a shorting motor on a sump pump or agitator. Or, that motor can be inadvertently started while you are in the space causing an entrapment. Assuring that the electrical circuit is off and locked-out will guarantee there will be no electrocutions or unwanted start-up of pumps or agitators.



Following these best safety practices will significantly reduce entry risks into on-farm manure pits. The overriding concept of any confined space entry is to reduce the risks for the people entering the space. By providing adequate ventilation prior to entry, the space will be no longer hazardous. The only way you can really assure that the space can be entered without undue risk is by testing and monitoring the space with a multi-gas detection instrument. Finally, having a mechanism attached to you that can retrieve you in the event you become incapacitated is an added safety feature for the person going into the space and for the person outside the space that would have to consider going in to perform a rescue.

See Fact Sheet E 51 *Confined Space Manure Storage Hazards* for information on manure gases and oxygen levels to reduce risk of entry into confined space manure storages. Additional details on monitoring for potentially hazardous atmospheres in manure storages can be reviewed in publication E 52 *Confined Space Manure Gas Monitoring*. More information about ventilating manure storages to reduce entry risk can be found in publication E 53, *Confined Space Manure Storage Ventilation Systems*. It is also recommended to consult with industrial hygiene consulting services that advertise expertise in confined space entry procedures. They can be found in the yellow pages or through a web search.

[Additional resources on manure storage safety.](#)

[Additional programs on Managing Agricultural Emergencies.](#)

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