



Managing confined spaces on farms

Agriculture Information Sheet No 26

Introduction

This information sheet gives advice on managing the risks from confined spaces like moist grain silos, slurry pits or silage clamps and will help you to meet the requirements of the Confined Spaces Regulations 1997.

Why is this information sheet necessary?

Fatal accidents have occurred during work in confined spaces when people have entered, for example to make a repair, to retrieve something or to deal with a blockage without realising that the space contained a dangerous atmosphere. Some accidents claimed more than one person when would-be rescuers who were not properly trained or did not have proper rescue equipment also died. Deaths in confined spaces on farms have included members of the public and children.

What is a confined space?

A confined space is any place which is completely or partly enclosed and where it is foreseeable that hazardous substances or conditions either inside it or nearby may cause a risk of:

- loss of consciousness from poisonous gases or lack of oxygen;
- asphyxiation by free-flowing solids;
- drowning in an increasing level of liquid; or
- serious injury by fire or explosion.

Examples of confined spaces where there is a danger from gases include slurry pits, dirty water-treatment tanks, inspection chambers associated with weeping wall systems, forage tower silos, areas where rapid composting is encouraged, and moist grain silos.

Asphyxiation by free-flowing solids can occur in feed silos, grain reception pits or storage bins when they are being emptied.

Areas such as vehicle inspection pits contaminated with flammable substances may be confined spaces because of the risks if there is a fire or explosion.

Some confined spaces may occur temporarily in the course of work, for example: indoor enclosed silage clamps; fruit and vegetable stores where carbon dioxide is used to aid storage; glasshouses where carbon dioxide is introduced to

improve plant growth; and poultry houses which are closed and heated in preparation for new stock.

Managing the risks

If you have confined spaces on your farm you must follow these rules for safe working:

- avoid working in a confined space whenever possible, for example by doing the work outside;
- follow a safe system of work if working inside; and
- make appropriate arrangements for rescue in an emergency.

If you do follow these rules, you will also meet your main obligations under the Confined Spaces Regulations 1997.

Avoid working in confined spaces

The first rule for preventing these accidents is always to **aim to work outside a confined space and design it so that there is no need for anyone to enter**. For example, you might avoid the need to enter grain silos to deal with bridged material by using rotating flails operated from outside. Similarly, removable pumps eliminate the need for entry into slurry stores to clear blockages.

Where you can achieve this aim you should close off and secure the area and put up signs to warn of the danger. This is particularly important where children or others who do not understand the danger might otherwise enter.

Follow a safe system of work

If entry into a confined space is unavoidable you must make sure that everyone working in the danger area is thoroughly familiar with, and follows, your safe system of work and emergency procedures. Your safe system will depend on the type of confined space, the associated risks and the work that you intend to do. To be most effective it should be written down.

Here are some of the factors to consider, but there may be others.

- *Supervision* - you should appoint someone to be responsible for seeing that the necessary precautions are taken and to check safety at each stage. The supervisor may need to be in contact with the person inside the confined space throughout the work.

- *Competence* - only people who have adequate training and experience in the particular work can be considered competent.
- *Communication* - there should be clear communication between those inside the confined space and those outside. In most situations normal speech will be adequate, but where it is necessary to use breathing apparatus you should consider other methods such as tugs on a rope. You should also take into account how to summon help in an emergency.
- *Testing the atmosphere* - confined spaces on farms may contain hazardous gases or insufficient oxygen to support life. The concentration of oxygen in the air should not be less than 19%. Lower concentrations may impair awareness of any danger, cause rapid unconsciousness or lead to death. The level of carbon dioxide should be less than 0.5%. Retesting during the work may be necessary, for example when ventilation with an air blower is needed to maintain a safe atmosphere.

Testing may be done with suitably calibrated chemical detector tubes or portable electronic meters. The test results should be recorded.
- *Flammable gases* - if a risk from flammable gases may be present, all test and other equipment must be suitable for use in a flammable atmosphere.
- *Ventilation* - whenever possible, confined spaces should be ventilated to maintain a safe atmosphere while people are working in them. It may be sufficient to leave the top and bottom hatches of silos open for 24 hours before entry, but in other cases ventilation with a blower may be necessary.
- *Personal protective equipment (PPE)* - you should take reasonable measures to ensure that it is safe to work in a confined space without the need for PPE, but you should also consider hazards which might arise and the need for emergency evacuation. PPE could include breathing apparatus, harnesses and safety lines secured to a point outside the confined space.
- *Entry and exit* - openings should be large enough to allow unobstructed access by people, including rescuers, wearing protective clothing and equipment such as breathing apparatus. You should put up a safety sign next to these openings to prohibit unauthorised entry.

Emergencies

You should make arrangements for emergency rescue before anyone enters the confined space. These arrangements will depend on the type of confined space, the risks and the likely nature of an emergency rescue.

Emergencies may arise from slips and falls as well as the nature of the danger area. You need to consider the following:

- *The number of people involved* - it will rarely, if ever, be appropriate for anyone to enter a confined space without someone remaining outside to carry out the emergency arrangements.
- *Communications* - make sure someone outside the danger area will know if there is an emergency inside.
- *Rescue and resuscitation equipment* - rescue equipment will usually include harnesses, lifelines and lifting equipment. It will be almost impossible to haul an unconscious person upwards through the entrance of a tower silo or tank without lifting equipment or to pull them through small openings if the lifeline is tied around their waist.

Resuscitation equipment, operated by someone with specialist training, may be needed after exposure to toxic gases, for example at slurry storage systems or recently filled silage clamps.
- *Protection of rescuers* - rescuers may worsen the emergency if they are untrained or poorly equipped. Multiple fatalities have occurred when rescuers have been overcome by the same conditions that have affected the people they have tried to rescue. Rescuers should be properly trained, sufficiently fit to carry out their task, readily available and capable of using any equipment that you provide for rescue, such as breathing apparatus, lifelines and fire-fighting equipment. These measures should be in place before anyone enters the danger area.
- *First aid* - first aiders should be trained to deal with foreseeable injuries and to make proper use of any first-aid equipment provided.
- *Public emergency services* - you must decide how you will let local services know that there has been an incident and what information you need to give them when they arrive.

Several areas on farms can be confined spaces. The hazards and safe working practices may be different in each of them. Here are some common examples.

Sealed moist grain tower silos

Risks occur when people enter a moist grain silo, eg to deal with bridged grain without realising that dangerous gases are present. There is also the risk of becoming engulfed if bridged grain suddenly clears.

The main hazards are:

- oxygen deficiency;

- high concentrations of carbon dioxide;
(These conditions are necessary for good storage and must be expected.)
- asphyxiation if trapped in grain.

Safe systems of work

Your system for dealing with bridging in the grain must exclude entry into the silo for any reason because of the danger of asphyxiation if the blockage clears. Bridging can be reduced by proper management and following manufacturers' instructions. Where it does occur and it cannot be cleared with remotely operated flails, augers or other unloading systems you should seek advice from the silo manufacturer or other suitably qualified person.

For work other than clearing bridged grain, entry should only be made when absolutely essential.

- 1 Entry should be made through the bottom door when the grain in the silo has been extracted to below the door and the authorised person has checked that the grain in the silo has not bridged. No entry should be made through the top access door which should be permanently obstructed by welding or bolting in a grid or bars.
- 2 Both the top and bottom doors must be fully opened to allow changes of air before entry. The silo must be either naturally ventilated for at least 24 hours or ventilated with an air blower for a period which achieves the same effect.
- 3 Where there is any doubt that the atmosphere inside the silo will support human life, air testing should be done at levels down to the lowest point inside the silo to ensure that the oxygen and carbon dioxide concentrations are harmless. Tests should take place through the open bottom door at grain level before entry. If the atmosphere fails this test, further ventilation and monitoring should take place until it is safe.

Indoor silage clamps

Cases of permanent human lung damage, death and injury to livestock have been reported after exposure to gases in poorly ventilated indoor silage clamps.

The main hazards below the sheeting are:

- oxygen deficiency;
- high carbon dioxide or nitrogen dioxide concentrations.

Oxygen deficiency should always be expected so **under no circumstances should anyone crawl under the sheeting.**

The main hazard above the sheeting/outside the clamp is:

- nitrogen dioxide.

Nitrogen dioxide is a brown gas produced from excess nitrogen in the clamped grass. It is slightly denser than air so it may collect in depressions, beside clamp walls and around the edges of the clamp. If the gas is inhaled it forms a corrosive acid in the throat and lungs which causes permanent damage and can kill. Dead birds or rodents, the yellowing of grass around the clamp and coughing livestock may warn of the presence of this gas.

Nitrogen dioxide is produced up to 72 hours after ensiling. After that levels fall as the gas dissolves in the clamp moisture. The risk is transient, but during the risk period the clamp is a confined space.

Safe systems of work

You can reduce the risk of releasing nitrogen dioxide by careful consolidation of the grass to remove air and by effective sheeting.

- 1 Control the risk of exposure to nitrogen dioxide above the sheeting at indoor, enclosed clamps by providing extra ventilation, for example by leaving sheeted gates open, removing some side cladding or by installing Yorkshire boarding.
- 2 You may need to prevent unauthorised access and display warning signs. Move any livestock housed in enclosed areas beside the clamp to avoid the need for people to enter the danger area.

Slurry storage systems

All tanks above and below ground, sumps, reception pits and spaces under slatted floors present a high risk.

The main hazards are:

- carbon dioxide, ammonia, methane and hydrogen sulphide produced by bacterial decomposition of the slurry;
- oxygen deficiency.

Hydrogen sulphide is highly toxic and can cause unconsciousness after taking a single breath at high concentration. Some of these slurry gases are flammable and potentially explosive.

Generation of slurry gases is spasmodic and unpredictable. Agitation of the slurry, for example to make pumping out easier, can greatly enhance the rate at which gas is given off and suddenly release high concentrations of hydrogen sulphide. As a result, atmospheric monitoring devices may not give adequate warning of the danger so do not rely on them.

Safe systems of work

Aim for a slurry storage system designed to operate without the need to enter any part of it at any time. Use pumps

which can be removed if they become blocked to reduce the need for entry. Other waste, such as silage effluent, must not be mixed with slurry as it can liberate slurry gases. Buildings above slatted storage areas must be adequately ventilated.

If entry is absolutely necessary it should only be made by an appropriately supervised competent person. Anyone who has to enter should wear a harness and lifeline. They should also wear breathing apparatus which is matched to the job and the wearer.

Forage tower silos

Risks occur in both silos and discharge chutes.

The main hazards are:

- an oxygen-deficient atmosphere;
- high concentrations of gases like carbon dioxide or nitrogen dioxide.

Dangerous concentrations of gases can occur just above the silage within an hour of filling. The danger remains even during emptying.

Safe systems of work

Try to design or modify the silo so that it can be used without the need to enter it at any time. It may be feasible to fit bottom unloaders in place of top unloaders with discharge chutes. Consider replacing tower silos with silage clamps.

If entry into a forage tower silo is absolutely necessary, the following procedure should ensure that the silo is well ventilated so that it is safe to enter without the use of breathing apparatus.

- 1 Authorised persons should not enter a silo or discharge chute until it has been effectively ventilated and the air inside tested at all levels to ensure that it will support life.
- 2 A competent person should test the atmosphere inside the silo before every entry. Testing should only be done through the filler-blower roof hatch by lowering the detection probe down to 300 mm above the lowest level of the silage. Never test through any access hatch inside a discharge chute.
- 3 If the air is found to be unsafe, the silo should be ventilated, either naturally or by forced air, and retested. Repeat the cycle until the atmosphere is safe.
- 4 Prohibit entry into a discharge chute to open hatches unless the air inside the silo has been tested and found to be safe. Carbon dioxide is denser than air

and may be expected to flow down the chute if one of the hatches is opened, but in practice no part of the chute can be considered safe.

5 Gases build up quickly so any entry to level the silage or sheet down should be made IMMEDIATELY after filling, while maintaining adequate ventilation.

6 When silage is being levelled or other work is carried out inside the silo, the roof filling hatch and any discharge chute hatches down to silage level should remain open and forced air or adequate natural ventilation maintained.

7 Anyone working in the silo who experiences unusual breathing difficulties, headache or light-headedness should leave immediately.

8 The air in the silo should be tested regularly and anyone who is inside should leave immediately if the results indicate any danger.

Further reading

Safe work in confined spaces INDG258 HSE Books 1997

Safe work in confined spaces. Confined Spaces Regulations 1997. Approved Code of Practice, Regulations and Guidance L101 HSE Books 1997 ISBN 0 7176 1405 0

The future availability and accuracy of the references listed in this publication cannot be guaranteed.

Further information

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