Managing slurry on farms

HSE Information Sheet

Agriculture Information Sheet No 9 (Revision 2)

Introduction

Incidents involving slurry occur regularly on farms in Great Britain. These incidents include people, not just farmers, being overcome by toxic gases, drowning as a result of a fall into slurry or liquid stores, or being injured from the collapse of structures containing slurry. This information sheet gives guidance on the precautions required to prevent these incidents, including practical advice on:

- avoiding exposure to slurry gases;
- standards of fencing etc needed to deter access by unauthorised people – particularly children – into areas used for storing slurry, other effluent, or water on farms;
- preventing vehicles entering slurry storage areas at scraping points;
- assessing the structural integrity of above-ground slurry storage facilities.

Slurry gases can and do cause deaths – remember this could happen to you.

Slurry gases

Slurry is broken down by bacterial action which produces gases. Slurry gas includes methane, carbon monoxide, ammonia and hydrogen sulphide, all of which can create a risk to human and animal health. Some gases are flammable, others are toxic and some will displace oxygen from the air, causing a risk of asphyxiation. Hydrogen sulphide can cause nausea, disorientation, unconsciousness or death. Any precautions taken to minimise exposure to hydrogen sulphide will help protect you from the effects of the other gases which might be present.

Avoiding exposure to slurry gases

Slurry gases are always present where slurry is stored. They are held within slurry in a similar way gases are contained in fizzy drinks. When they are disturbed, for instance by using an agitator or a pump or emptying a store, the slurry will release higher levels of gas in the right conditions. Each time you disturb the slurry, more gas will be released; gas may also be released much further up the storage system than where you are working, potentially exposing other people to harm.

Generation of slurry gases is spasmodic and unpredictable. Agitation of the slurry, for example to make pumping easier, can greatly increase the rate at which gas is given off, and suddenly release high concentrations of hydrogen sulphide,

Although at low levels hydrogen sulphide gives off a smell of rotten eggs, at high concentrations you cannot smell it and a fatal exposure can happen extremely quickly and without warning. It is heavier than air and will collect in poorly ventilated areas, possibly even in sheltered areas outdoors, as well as in enclosed spaces such as farm buildings, storage tanks, slurry pits and towers. Gas can be present for some time after being released from slurry – remember to leave the area ventilated for at least 30 minutes before you re-enter buildings or a workplace.

If you add other substances to slurry, such as silage effluent, or if gypsum, including plasterboard waste, comes into contact with slurry, it is likely that larger amounts of slurry gases will be released or the gas will be released more rapidly.

HSE recommends that gypsum products should not be used in animal bedding systems where bedding material might be scraped into slurry storage. Doing this increases the risk in an already potentially fatal situation.

Remember hydrogen sulphide is corrosive to metal; if you are considering slurry as feedstock for your anaerobic digester consider the effects of the addition of these substances and adjust your inspection and maintenance schedules accordingly.

Safety precautions

If you are going to mix, pump or disturb slurry in any way remember slurry gases, including hydrogen sulphide, will be released.

Always assume the gases will be released in high concentrations – **never** assume the gas levels will be safe for either humans or animals. Before starting work plan the job, assess the risks and decide on appropriate precautions to work safely. Make sure:

- you choose to work on a breezy day or have some other effective method of safely venting slurry gas away from the working area;
- everyone on the farm knows what you are doing and understands the dangers – take action to inform and protect those at risk, eg other workers, family members (including children), contractors or delivery drivers. Suitable warning signs can help;
- you have moved your livestock out of slatted buildings or buildings incorporating slurry storage facilities;
- you have checked no one is present in buildings connected to the slurry storage system;
- when the mixer is running, that you and others do not stand over mixing points, reception pits or other areas where gas may be emitted such as slats, even if they are outdoors. Cover mixing points and reception pits in case someone is overcome and falls in;
- you avoid creating naked flames, for example during welding, or by lighting a cigarette, as some slurry gases are flammable and may ignite causing a fire or explosion;
- you **never** enter a slurry tank or slurry storage system unless you are equipped, trained and competent to use air-fed respiratory protective equipment (RPE), specifically breathing apparatus. This must be suitable for the job, correctly fitted on the wearer, properly maintained and have its own clean air supply. Those using breathing apparatus should have a high level of specialised training;
- anyone who has to enter any part of a slurry storage system, such as a tank, pit or chamber, should wear a harness and lifeline. There should be a well planned and rehearsed emergency procedure to enable rescue of anyone unable to vacate the area unaided. Unless you can provide this high level of training, equipment and competence, this is a job for specialist contractors.

Gas monitoring and detection equipment

Gas monitors and detectors should not be used as the only means of providing an adequate level of safety in order to protect you from exposure to slurry gases, particularly hydrogen sulphide. Slurry gases are produced at fatal concentrations very quickly, often before a monitor could react. Gas detection systems also require expert maintenance, calibration and storage. The priority should always be to identify areas where slurry gases may be present and keep people away from these areas during mixing and for as long as possible afterwards.

Be gas aware

Many of the fatal accidents due to slurry gases involve multiple fatalities as rescuers are overcome as well. Key points to remember include:

- if someone is overcome try and get them away from the possible source of the exposure without endangering yourself;
- get help as quickly as possible, advising rescue services of the circumstances, so that they can bring the right equipment to protect themselves from any risk;
- if safe to do so, stop the pump or agitator.

If you are planning to build a new slurry storage facility, 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 easily removed if they become blocked to reduce the need for entry, eg removal remotely by mechanical means. Buildings above slatted storage areas must be adequately ventilated. Consider installing an aerator which disperses slurry gases slowly and safely.

See ‘Further reading’ for information on working in confined spaces.

Fencing of slurry lagoons and similar areas

Throughout the rest of this information sheet, areas such as lagoons, pits, tanks, weeping wall stores, blind ditches, sheep dips and man-made irrigation reservoirs are called ‘stores’.

Perimeter protection

Drowning in slurry lagoons and other similar areas has resulted in many fatal incidents. Children and the drivers of scraper tractors are particularly at risk. Simple precautions, such as surrounding these areas with child-deterrent fencing, gates or covers, or providing a tractor stop barrier on the scraping ramp, will help to control risks on most farms.

Steps should be taken to prevent unauthorised people, such as children, and livestock from accessing the store itself, for instance by surrounding the perimeter by a wall or fence. Access points such as gates or apertures for suction pipes should be protected to the same standard as the remainder of the fence or wall. You may wish to completely cover below-ground stores such as reception tanks or sheep dips when they are not in use (see ‘Below-ground stores’ below).

Check that fences:

- have been designed to deter access and are properly erected and maintained;
- are constructed of suitable material, such as small-mesh wire fencing or sheet material which do not offer hand or footholds, particularly for children;
- have an overall minimum height of at least 1.3 m (see Figure 1), including at least two strands of barbed wire spaced 100 to 150 mm apart at the top;
- will not be pushed up from the bottom by stock. Two strands of barbed wire at the bottom will help prevent this.

If your store includes a scraping ramp, consider whether it is best in your circumstances to:

- extend the fencing to the bottom of the ramp and provide a sheeted gate across the ramp at that point; or
- provide swinging flaps attached to the tractor stop rail. These provide good protection if they are properly designed, constructed and maintained.

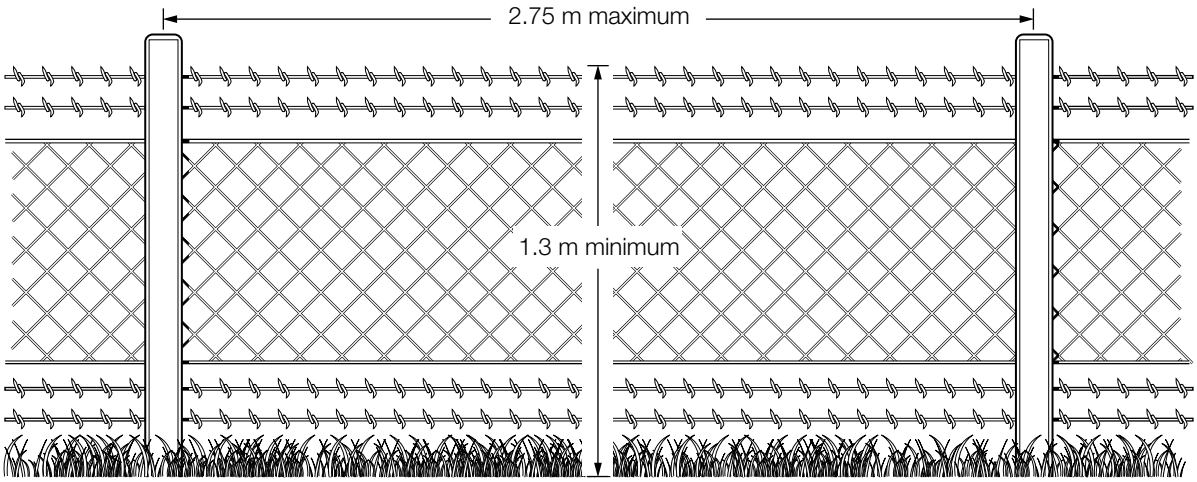

Figure 1

Check that access points such as gates and scraping points:

- provide a standard of deterrence equal to that provided by the fence if erected to the standard described above. For gates, this may be achieved by fitting metal sheeting or cladding to the outside so it is virtually impossible for children to climb them;
- are topped by two strands of barbed wire;
- are designed to prevent unauthorised opening. This could involve using a chains and padlocks, fitting latches designed so that children will be unable to open them, eg placed on the inside of the gate, or otherwise protecting against opening to an equivalent standard.

Below-ground stores

If you decide to use a cover to protect your below-ground store, check that:

- the cover can withstand any foreseeable traffic loads, eg cattle, humans or a tractor;
- there are no any gaps greater than 75 mm, eg between slats or mesh or alongside pumps;
- extraction pipes cannot fall into the pit. Consider securing them in position;
- there are suitable 'no access for unauthorised persons' prohibitory signs on, or close to, covers.

If covers have removable sections, check that they are:

- large enough to allow access for rescue purposes – bear in mind that this may need to accommodate a person wearing breathing apparatus;
- hinged or otherwise attached so that they will not fall into the store;
- closed or replaced when access is not needed;
- heavy enough to prevent children from opening them, or fitted with a padlock or other locking device.

Maintenance

Your precautions should normally include:

- checking the integrity, including the tension, of the fencing and gates regularly;
- checking the bottom of the gate and fence to ensure there are no gaps through which a child might crawl;
- checking that any fitted swinging flaps are still in good condition and securely attached;
- keeping gates securely closed with the child-resistant latch or lock in use except during scraping or emptying;
- not stacking materials against any fence, wall or above-ground storage tank in such a way that they provide a means of climbing over it;
- not leaning equipment such as a stirrer on a wire mesh fence so it deforms and offers easy access;
- removing ladders giving access to storage tanks when not in use.

Scraping points and ramps

If you scrape manure over a ramp into the lagoon or pit, your ramp will normally need a barrier to stop tractors or other vehicles used for scraping slurry from passing over the end. Check:

- whether your barrier is suitable. Suitable barriers, for a tractor of about 1 tonne weight and travelling at slow speed, would comprise vertical uprights of 150 mm x 75 mm rolled steel channel, with a horizontal barrier of similar material and size. If you use heavier vehicles you should consider what construction specification would be appropriate;
- the position of horizontal sections. Normally, they would be at a height to coincide with the top third of the rear tyres of the tractor normally used for scraping;
- the security of uprights, particularly whether they are connected to the ramp reinforcement by, for instance, long mild steel fishtailed plates welded to each upright. Avoid fixing uprights at the end of the ramp as they may break it away if hit by the tractor.

Materials other than steel and concrete are not likely to be strong enough or offer enough resilience to be suitable.

Detailed advice on constructing ramps etc is available from various agricultural advisory services.

Maintenance of slurry storage towers

Catastrophic collapse of both concrete and metal slurry towers have occurred both on farms and within the slurry storage facilities for anaerobic digesters. These can be avoided by planned maintenance of the plant and monitoring its condition.

Indications that your slurry tower needs replacement or repairs include:

- leaks;
- bowing or cracking to the outer skin;
- deterioration around joints;
- spalling or flaking of the concrete layer of a tower, caused by corrosion of the metal reinforcing bars. This may also show as rust staining on the concrete surface;
- corrosion on either on the surface or the underside of concrete slats and concrete covers to pits.

These are symptoms of a tower or slurry system in need of specialist attention. Contact the manufacturer, installer or a competent, experienced professional for advice.

Maintenance or inspection of slurry storage systems which involve exposure to slurry gases, eg by the removal of inspection pit covers or lids/membranes, should only be undertaken if you are wearing correctly fitted RPE as described above.

Never work alone on the maintenance of slurry systems.

Work on valves and pipework may lead to an inadvertent spillage of slurry which could result in exposure to slurry gases including hydrogen sulphide. You should ensure, wherever possible, that routine maintenance work is undertaken when the plant is empty of slurry, preferably after it has been washed through to ensure it is as clean as possible.

All work, including emergency work, **must** be planned carefully using the correct equipment, including appropriate RPE and trained, experienced workers.

If you cannot ensure a high level of training, supervision of workers and a robust emergency plan you should leave this work to specialist contractors.

Further reading

Confined spaces: A brief guide to working safely Leaflet INDG258(rev1) HSE Books 2013 www.hse.gov.uk/pubns/indg258.pdf

BS 5502-50:1993 + A2:2010 *Buildings and structures for agriculture* – Part 50: *Code of practice for design, construction and use of storage tanks and reception pits for livestock slurry* British Standards Institution

PH06265 (626) The Influence of gypsum in animal slurry systems on the generation of hydrogen sulphide – Research report from Health & Safety Laboratory (HSL) www.hse.gov.uk/research/rrpdf/rr1041.pdf

Storing silage, slurry and agricultural fuel oil www.gov.uk/storing-silage-slurry-and-agricultural-fuel-oil

Further information

For information about health and safety, or to report inconsistencies or inaccuracies in this guidance, visit www.hse.gov.uk/. You can view HSE guidance online and order priced publications from the website. HSE priced publications are also available from bookshops.

This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory, unless specifically stated, and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance.

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