

How to comply with your environmental permit for intensive farming

Appendix 9

Producing a proposal for covering slurry stores

Version 3

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Record of changes

Version	Date	Change
1	August 2008	Version 1
2	January 2010	Guidance republished as an appendix to version 2 of How to comply with your environmental permit for intensive farming. Technical content of guidance is unchanged.
3	February 2012	Amended to reflect the need to submit proposal with application. Technical content of guidance is unchanged.

Introduction

All farms permitted under the Environmental Permitting Regulations (formerly the Pollution Prevention and Control Regulations) are required to work to achieve Best Available Techniques (BAT). BAT for slurry stores is for the store to be covered.

All new and substantially enlarged slurry stores must be covered **before** they're used.

Existing uncovered slurry stores can continue to be used but a written plan detailing proposals for replacing or covering them shall be submitted to the Environment Agency **with your permit application**. All existing slurry storage **must** be covered by 2020.

This plan may be included as an improvement programme within your permit.

The plan should take into account the appropriate measures in section [5.3.1] [6.3.1] of Technical Guidance Note (TGN) How to Comply, Version 1 (or Version 2), and shall include a timetable for the replacement and refurbishment work.

Plans which include covering stores at a future date will be assessed against the risks of pollution from the stores before a permit is issued.

- The plan should consider all slurry stores on an installation.
- The plan needs to take into account the wider site drainage review, which has to be submitted with your permit application.
- The proposals in the plan will need to consider the techniques that are available for a particular storage type and location. They will also be influenced by the physical properties of the slurry to be stored and how the store is filled and emptied.
- Size, location and construction quality of stores must comply with all relevant legislative requirements. For example, the Silage, Slurry and Agricultural Fuel Oil (SSAFO) regulations. In Nitrate Vulnerable Zones (NVZs), you must comply with the relevant storage requirements.

<http://archive.defra.gov.uk/environment/quality/water/waterquality/diffuse/nitrate/documents/leaflet4.pdf>

- This guidance sets out the following four steps you should take to produce your plan:
 - Step 1** - calculate the amount of storage required.
 - Step 2** - consider the factors that affect the suitability of the techniques available.
 - Step 3** - assess the options available.
 - Step 4** - write the plan and submit it to the Environment Agency.

What you need to do to produce a written plan – the four steps

Step 1 – calculate the amount of storage required

Follow these steps to establish whether your slurry storage capacity is sufficient to meet the current and foreseeable legislation:

- a. Calculate the maximum amount of slurry produced by your livestock at the site during whatever storage period is required. This will be at least four months under SSAFO and may be up to 26 weeks in NVZ. This can be done by using the standard annual excreta production figures in [NVZ Leaflet 3](#).
- b. Add all muck pad run-off and any rainfall from yards and buildings that drains to the stores. Include any wash water that is directed into the store. If you choose a store cover that doesn't exclude direct rainfall, then you should add this amount.
- c. Deduct any quantities of slurry exported during the storage period. This only applies if you export the same (or more) amount of slurry every year.
- d. Calculate the storage capacity of the existing slurry store/s on the farm. Note that you should allow for the necessary freeboard (750mm for an earth banked lagoon and 300mm for all other stores).

If the figure obtained from **d** is greater than the combined total from **a, b, and c** then your existing storage capacity is sufficient and you have the option of covering these facilities. If storage capacity is insufficient, you will need to either reduce the volume to be stored, add an additional store or replace or enlarge the existing store.

Note – Some farm systems produce a low dry matter (DM) slurry. This may be because the slurry is wash water or slurry is diluted by contaminated rainwater run-off. Where the DM is less than 1% the store may not need to be covered. The criteria for this to be acceptable is for regular analysis of the slurry store annually to confirm that the DM remains below 1%. Exceedence of this figure may mean that the store will have to have a cover installed. (There's a protocol for sampling slurry for analysis in Appendix 1 of this How to Comply document. You should make sure this protocol is followed to ensure that a representative slurry sample is taken).

Step 2 - consider the factors that affect the suitability of the techniques available

Follow the flowchart (Figure 1) on page 7. It will help you to identify factors that may affect the suitability of the available covering techniques. The following points should be borne in mind before considering the available options:

- Size of lagoon or store – several techniques are unsuitable for very large lagoons.
- Site location, accessibility, proximity to power lines and other utility services may limit the available options for covering stores and access may be impaired during adverse weather conditions.
- Agitation during stirring, filling and emptying may preclude covering with some floating materials. They may cause sedimentation or blockages in pumps.
- The decision making process should include a health and safety risk assessment for installing the cover, its operational use and its subsequent disposal.
- Filling lagoons via ramps and scrapers can cause problems with all types of covers.

- Some types of floating covers may need to be supported by floats and be anchored to lagoon banks or store sides. Are they engineered to allow this?
- The structural integrity of above ground tanks will need to be assessed by an engineer to confirm that they can withstand the pressures from the tensioning and loading of fixed covers.
- An interim solution may be to encourage and then maintain crust formation.
- The costs of a cover may be mitigated by the exclusion of rainfall. This will increase the effective capacity of the store, reduce odour, reduce ammonia loss and reduce the amount of slurry that will need to be spread (and its accompanying cost).

Step 3 – assess the options available

Take account of the limiting factors identified in step 2 and establish the most appropriate available technique to cover your store:

- A summary of some of the currently available techniques and their likely costs and benefits is available in the BPEX publication '[Covering slurry stores](#)'. It's reproduced in this guidance (Figure 2). Note that new techniques may be developed in the future and that this summary may not be exhaustive.
- If there's insufficient capacity because of the quantity of run-off identified in Step 1 then you may choose to install better clean and dirty water separation rather than construct new stores or enlarge existing ones.
- Retro-fit covers may be feasible on above ground tanks (in terms of ease, effectiveness and cost). Guidance is available from the following weblink - ADAS Construction guidance note [CGN 011](#).
- If new storage capacity is needed to meet legislation or is a preferred option to retro-fitting current facilities (albeit that they may be large enough) then they will need to be fitted with a cover at the time of their construction.

Note - If you have an improvement condition to reduce ammonia emissions to protect designated conservation sites then covering stores will need to be considered as part of your Ammonia Emission Reduction Plan.

Step 4 – write the plan and submit to the Environment Agency

There are two examples of proposals in Tables 1 and 2 (see pages 9 and 10). There's a template to help you complete your proposal in Table 3 (page 11).

- If it's decided to cover the existing facilities then the proposal should state this and a timescale for achieving this should be agreed with the Environment Agency inspector. Given the costs and possible difficulties it's accepted that in some cases this is a long term objective and may be achieved over several years.
- The costs of the various techniques can vary widely. It may be felt that a new store which can be covered at the time of construction is a better option than retro-fitting existing stores with less effective covers which may be more expensive to install, impossible to fit without compromising integrity, and/or difficult to maintain.

- New stores may be planned as either standalone structures or as part of a wider review of site manure management and drainage. This may involve considerable infrastructure replacement and construction may occur over a long period. The plan should be realistic as to the likely timescale.

Figure 1 - Covering slurry stores – factors to consider

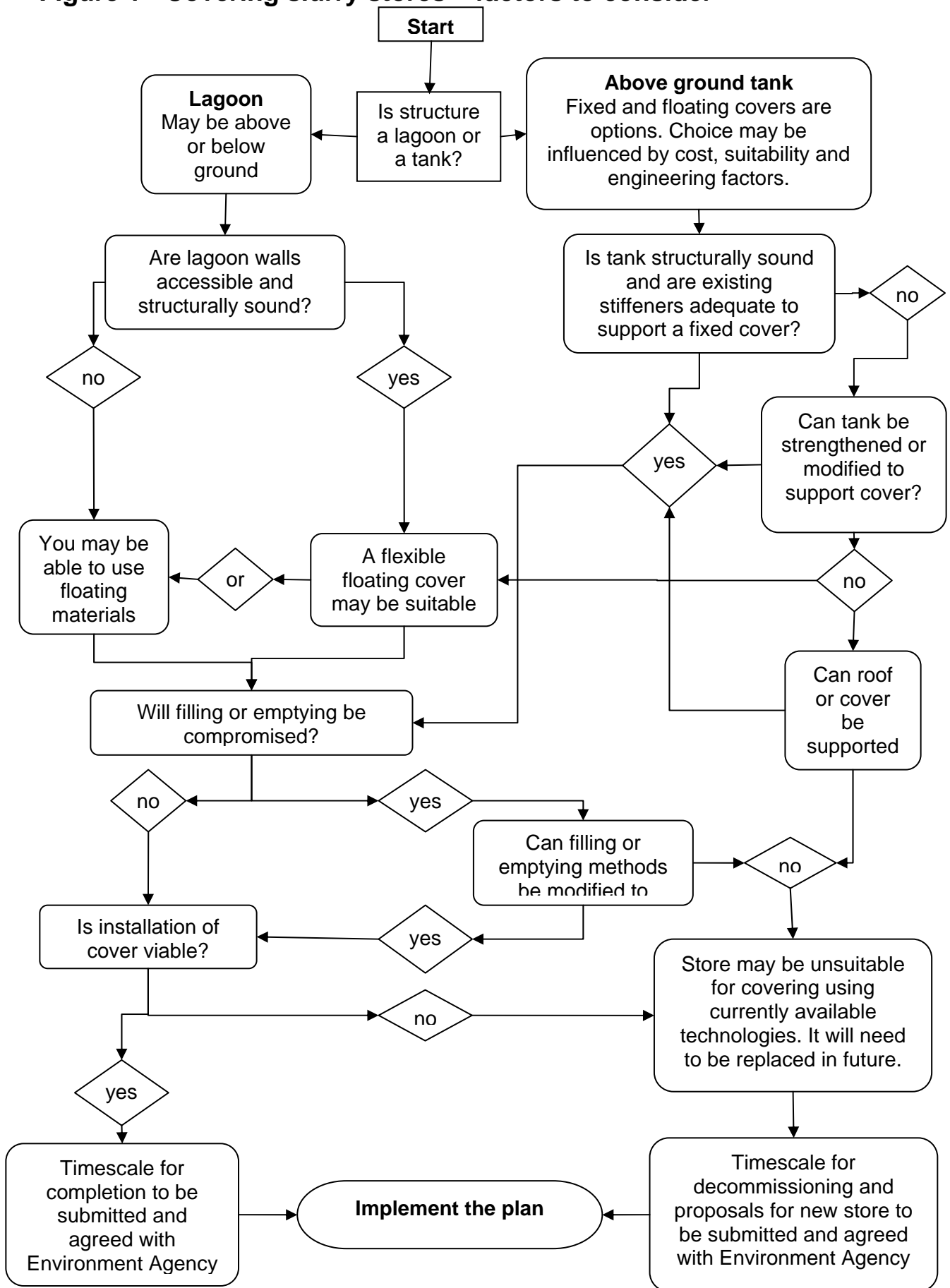








Figure 2 - Covering techniques – the available options

Permeable covers

Type	Description	Advantage	Disadvantage
Lightweight Expanded Clay Aggregate (LECA) or foam glass 	<ul style="list-style-type: none"> Applied in a layer 100 – 150 mm deep. Moderate capital cost. 	<ul style="list-style-type: none"> Easy to install on existing stores and lagoons regardless of shape and is effective. No problems reported with pumps etc. 	<ul style="list-style-type: none"> Approximately 10% of the cover needs to be replaced annually. These covers do not prevent rainfall from diluting the slurry.
Floating plastic plates 	<ul style="list-style-type: none"> Free floating plastic plates, generally hexagonal in shape Moderate cost, can be recovered and reused. 	<ul style="list-style-type: none"> Easy to install on existing stores and lagoons regardless of shape and is effective. Up to 95% reduction in gas emissions can be achieved. 	<ul style="list-style-type: none"> These covers do not prevent rainfall from diluting the slurry

Impermeable covers

Type	Description	Advantage	Disadvantage
Lagoons – fixed floating plastic membrane 	<ul style="list-style-type: none"> A large plastic sheet with integral floats and gas vents. The edges of the cover are buried into the lagoon banks to retain it Moderate to high cost 	<ul style="list-style-type: none"> Rainwater can be pumped off the top. Stirring is possible if design allows. 	<ul style="list-style-type: none"> Requires lagoon to be initially empty and embankments to be suitable for fixing. Access for de-sludging is difficult.
Tanks – free floating plastic cover 	<ul style="list-style-type: none"> A plastic sheet is stretched over and tensioned around a plastic hoop, which floats on the surface. Low to moderate cost. 	<ul style="list-style-type: none"> It requires no structural alteration to the store. Covers can be fitted with an agitation hatch. Rainwater can be pumped off the top. Suitable for retro-fitting. 	<ul style="list-style-type: none"> Access for de-sludging is difficult.
Tanks – fixed cover 	<ul style="list-style-type: none"> Reinforced PVC polyester-coated fabric cover. Normally these types of cover are attached to the sides of the tank with centre support pole and gas vents. High cost. 	<ul style="list-style-type: none"> Rainwater is shed from the surface. 	<ul style="list-style-type: none"> May not be suitable for retro-fitting. Requires store to be structurally suitable and may involve additional reinforcing.
Integral store and cover (bag) 	<ul style="list-style-type: none"> Reinforced PVC polyester-coated fabric bag sitting within an earth structure. Restrained at sides, fitted with gas vents. The cover forms part of the structural integrity of the store. Moderate cost. 	<ul style="list-style-type: none"> Smaller footprint than conventional lagoon cover. Rainwater is kept separate from slurry. Simpler earthworks than for lined and covered lagoons. Agitation can be facilitated. 	<ul style="list-style-type: none"> Site needs to be carefully selected. Secure safety fencing is required.



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Table 1 - Example of a proposal for covering a slurry lagoon

Slurry store type	Earth banked store. Slurry transferred to store by automatic pump from a reception pit. Reception pit is fed by under-slat storage tanks from three weaner houses. Also takes run-off from muck pad and scraped passageways in finishing sheds. Dirty water from roadways and hard standing areas also drains to reception pit. Banks are engineered and are 4m wide at the top of the lagoon.
Capacity and area to be covered	Estimated at 1 million gallons (4540m ³). 50m x 40m at top of lagoon and 4m deep. Surface area to be covered when full would be 2000m ² .
Months of storage available	Currently in excess of 6 months.
Methods available and their suitability	Floating covers – technically feasible but anchorage would need to be outside the lagoon walls to maintain their integrity. Light Clay Aggregates (LCEA) or floating plastic plates are possible.
Likely costs	Floating flexible cover – with cover, supporting grid and pump to remove rainwater could be approx £33m ² . 2000m ² x 33 = £66,000. LCEA is also £33m ² (20 year period with 10% annual replacement). Floating plastic plates are £25m ² 2000m ² x 25 = £50,000.
Payback period and annual cost	Over a 20 year payback period with interest costs and maintenance, the floating flexible cover could cost £5000 per annum (£3000 capital repayment + £1500 interest + £500 maintenance). The cost of spreading the rainfall that falls on an uncovered store is estimated at £1.40/m ³ . Rainwater collected on the top of a floating cover remains clean and can be pumped to ditches and watercourses. Every 500mm of rainfall on a 2000m ² store is 1000m ³ of water. Not having to spread it at a cost of £1.40 m ³ gives a saving of £1400 per annum. In high rainfall areas a cover could be almost cost neutral. Floating plastic plates would be 25% cheaper and cost £3750 per annum but they would not prevent rainfall from entering the store and thus it would have to be disposed off with the slurry so there would not be the same cost savings.
<p>Proposal and timescale for completion</p> <p>If installed the cover could be in place within 3 months and would not require any planning consents. However, currently 2500 pig places generate a rent of £25 per pig place per year (52 weeks at 50p/place/week). The cheapest cover option would be £1.50 per pig place which represents nearly 6% of gross income every year. This is currently not financially viable. I shall reassess the viability of the business in 2010 and if it's sufficiently profitable to finance the available techniques then I shall proceed with a cover. If not I shall have to consider other options such as alternative housing types.</p>	

Table 2 - Example of a proposal for covering an above ground slurry tank

<p>Slurry store type</p>	<p>Above ground circular steel tank. Filled and emptied by automatic pump from a reception pit which is fed by under-slat storage tanks from farrowing house and three weaner houses. Also takes run-off from muck pad and scraped passageways in finishing sheds. Clean water from site is diverted to ditch.</p> <p>Tank is 20m diameter, three rings tall (3.6m). Tank was installed in 1999 and appears in sound condition but out of warranty.</p>
<p>Capacity and area to be covered</p>	<p>1037m³ capacity. Surface area to be covered when full is 314m².</p>
<p>Months of storage available</p>	<p>Currently only 22 weeks (this includes up to 450mm rainfall). Average rainfall in the area is 800mm. New NVZ rules may require 26 weeks storage. During a 26 week winter this may be 500mm (15% of tank capacity).</p>
<p>Methods available and their suitability</p>	<p>Fixed flexible tent cover. This would increase the effective capacity by 15% and meet the new NVZ regulations, but will need an engineer to assess whether tank is suitable for a fixed cover.</p> <p>Flexible floating cover would also give benefits from rainfall saving and not impose any loadings on tank walls.</p>
<p>Likely costs</p>	<p>Fixed flexible tent cover, tank strengthening, central supporting pole, radial webbing straps etc would be approx £18840 (£60/m²).</p> <p>Floating disc cover would cost approximately £8000 (£25/m²).</p> <p>Both provide a rainfall saving of 157m³ per 500mm of rainfall. Not incurring the cost of spreading rainwater at £1.40/m³ would provide a saving of 157 x 1.4 = £220 per 500mm/yr.</p>
<p>Payback period and annual cost</p>	<p>Over a 20 year payback period the fixed flexible cover could cost £1800 per annum (£1000 capital repayment + £600 interest + £200 maintenance).</p> <p>Over 20 years the floating cover would cost £800 per annum (£400 capital repayment + £300 interest + £100 maintenance).</p>
<p>Proposal and timescale for completion</p> <p>If installed, either cover could be in place within 3 months and would not require any planning consents. However, due to the cost and the ability to install a cover without fully emptying the store I propose to install a floating cover which will cost £1 per sow place per annum (based on a 800 sow unit).</p> <p>Currently collecting 157 m³ of rainfall during a 26 week period (314m² x 0.5m = 157m³).</p> <p>£800/yr cost of the floating cover would create 157m³ of storage capacity at a cost of £5/m³/yr. After subtracting the saving from not having to spread rainfall (£1.40/m³/yr) the net cost of the storage is £3.60/m³/yr.</p> <p>The store doesn't need to be emptied completely prior to installation, but it's proposed to commence work immediately after harvest when stubbles are available to take slurry.</p> <p>Work to be completed before the end of September 2008.</p>	

Table 3 - Proposal template

Slurry store type	
Capacity and area to be covered	
Months of storage available	
Methods available and their suitability	
Likely costs	
Payback period and annual cost	
Proposal and timescale for completion	