

Fact sheet 5a: soil suitability and testing for earth lined slurry stores

Are you planning to build or substantially alter an earth bank slurry store?

This fact sheet outlines the necessary soil tests and characteristics needed for constructing an unlined earth bank slurry store or lagoon. It will help you meet the requirements of the Water Resources (Control of Pollution) (Silage, Slurry and Agricultural Fuel Oil) (England) Regulations 2010. These are commonly referred to as the SSAFO Regulations and apply in England. The importance of proper assessment cannot be overstressed.

The fact sheet should be read with fact sheet 5 which contains more information about earth banked slurry store construction.

Slurry must only be stored in a storage system that satisfies the requirements of the SSAFO Regulations.

We advise that you seek specialist advice on the siting, design, construction and installation of your slurry system. We recommend that you choose a contractor who fully understands the SSAFO Regulations and building standards who will provide you with written confirmation that the design, construction, and installation, will meet the legal requirements.

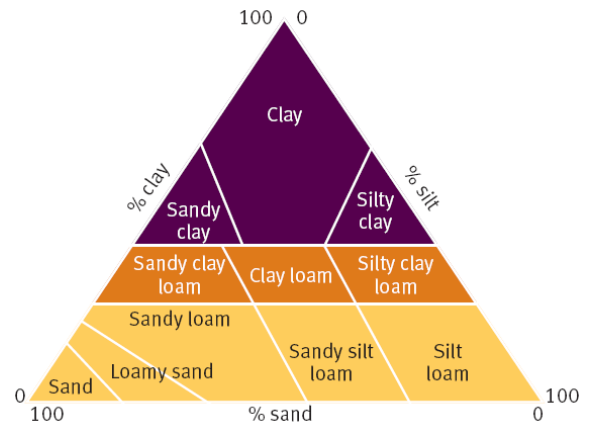
You may require planning permission. We recommend that you check with your Local Authority. CIRIA Report C759F, [Livestock manure and silage storage infrastructure for agriculture](#) also provides guidance on planning requirements.

You are legally required to notify us of your proposals at least 14 days before work constructing the new or improved store is to begin. We recommend that you notify us earlier than this to help ensure costly mistakes are avoided.

Is my soil suitable for an earth lined slurry store?

If either the soil in-situ or imported is not suitable for an unlined earth banked store, the store must be lined with a suitably engineered synthetic sheet liner. This would need to incorporate a single or a double skinned liner with or without leakage detection depending on the soil permeability and local factors. Guidance on selecting suitable synthetic liners can be found in CIRIA Report C759.

A site is only considered suitable for an unlined earth banked slurry store if the final permeability of the compacted soil is less than 0.000001 mm per second (1×10^{-9} metres per second) and the impermeable soil is at least one metre thick. These criteria also apply where an imported soil or clay lining is used in the construction.



The ideal mineral soil to use for embankments generally has between 20-30% clay content. These are the soil types shown in orange in the triangle diagram above. A lower clay content may not meet the required permeability, whilst a higher one may be difficult to form into a stable embankment and could tend to shrink and crack on drying. It should however be suitable for the base.

Initial soil assessment should be taken from four perimeter points and one at the centre of the site, to identify any variability in clay content and depth of impermeable soil.

This can be done by digging trial pits that extend down to a metre beyond where you expect the final store base to be. You can check and record soil texture class below the topsoil by hand texturing. You should note the percentage stone content in each layer in the pit and consider the soil that will be used for the base and the embankments. Where there is little variability across the site only samples from one pit need to be sent for detailed testing, otherwise send a range of samples. They need to be tested in an approved soils' laboratory to show whether the required level of impermeability can be achieved. As well as soil permeability, other soil characteristics should be tested for their suitability for embankment construction.



Testing should be to BS 1377 / BS EN 1997-2:2007 standard and will commonly involve methods such as 'Triaxial' testing. Laboratory tests costs vary depending on the range of tests performed.

Material that is to be re-compacted, for example the subsoil excavated to form the banks, and any imported clay, should be tested to determine natural moisture content, liquid and

plastic limits, particle size distribution, compaction characteristics and permeability. Where in-situ material can be used without replacement, this only needs to be tested for permeability and depth. Soil testing involves compression. You may need to compact the in-situ material to obtain the same permeability as the test results.

An outline of suitable tests and the acceptance criteria are given in CIRIA report C759.

In considering embankment design it is useful to determine the specific gravity and shear properties of the soil. The use of naturally occurring soils in construction can involve significant variability in the soil profile. It is therefore recommended that the structural design is carried out by a suitably experienced and qualified engineer and that an engineer supervises the site works.

Investigations should also be carried out to determine the depth of the water table. The water table should be below the level of the proposed base level of the store. This investigation should preferably be done during the wettest time of the year.

You are advised to discuss your plans with your local Environment Agency office at the earliest possible opportunity. You must notify the Environment Agency about any new, substantially enlarged or substantially reconstructed system at least 14 days before any construction begins. You should provide the results of soil testing along with site plans.

Where can I find further help?

You can find further information on GOV.UK at [Storing silage, slurry and agricultural fuel oil - GOV.UK \(www.gov.uk\)](http://www.gov.uk)

There is detailed guidance on the construction of slurry stores and other installations in CIRIA Report C759F, [Livestock manure and silage storage infrastructure for agriculture](#)

Further advice on assessment of soil properties can be found in our 'Think Soils' document: <http://www.ahdb.org.uk/projects/documents/ThinkSoils.pdf>

UKAS approved soil testing laboratory can be found at: [UKAS - The UK Accreditation Body - Creating Confidence](#)

To help identify any Source Protection Zones, look at [Groundwater source protection zones \(SPZs\) - GOV.UK \(www.gov.uk\)](#).

If you are unsure, please contact your local Environment Agency office via our general enquiries line. Telephone 03708 506 506